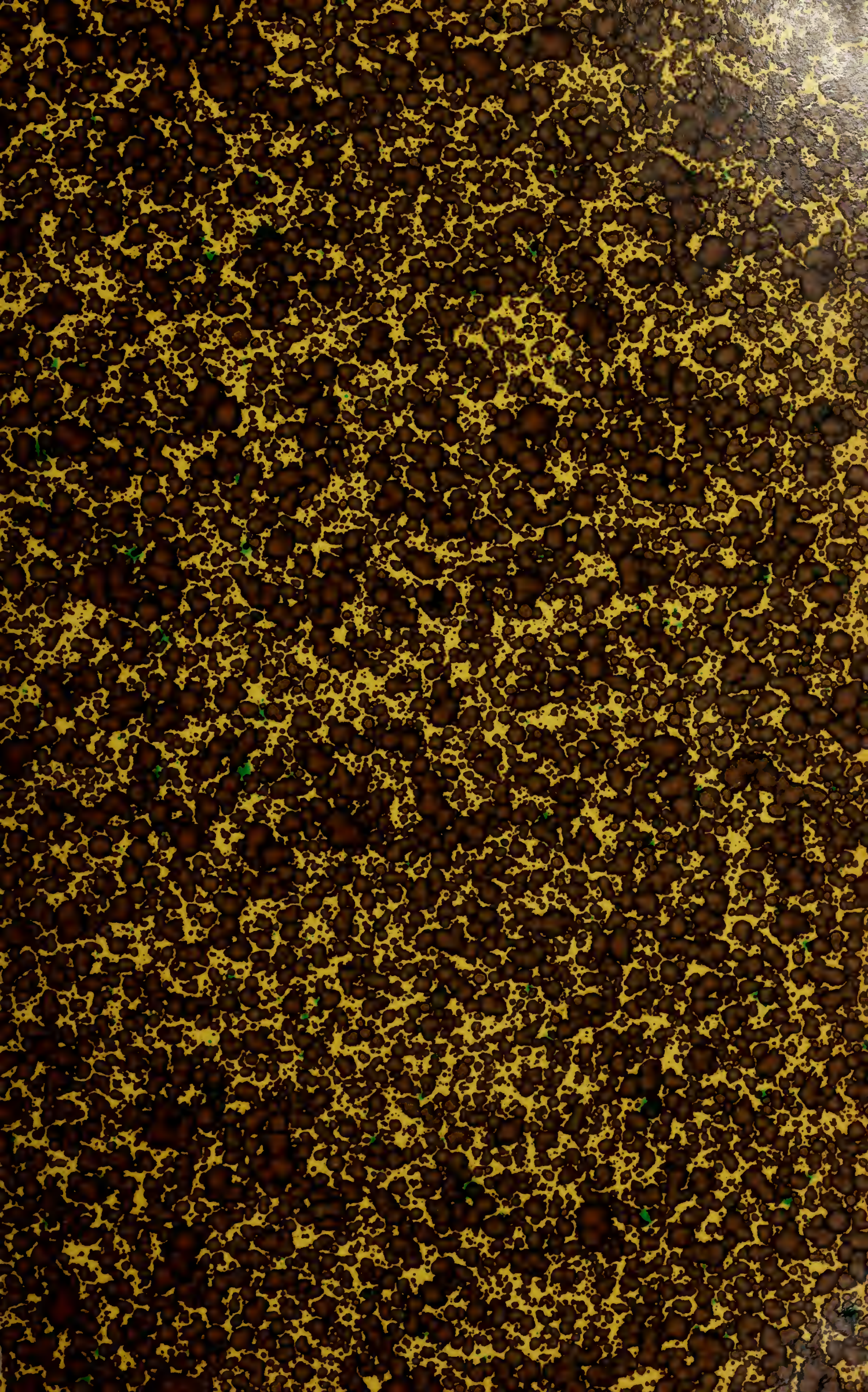
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Index Supplement to the Electrical Review,
January 5th, 1912.

THE

ELECTRICAL REVIEW.

VOL. LXIX.

JULY 7 – DECEMBER 29, 1911.

LONDON:

H. ALABASTER, GATEHOUSE & CO.

4, LUDGATE HILL, E.C.

REMOTE STORAGE

London:
Published by the Proprietors,
at 4, Ludgate Hill, E.C.

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Armstrong, Whitworth, Sir W. G., and Co., and F. Harlow (27,814), 1088
Arno, R. (9,580), 320
Arnold, W. W. (29,452), 636
Ashworth, R. (17,690), 200
Aubert, L. R., and A. E. F. Ferrand (20,948), 636

BACCI, R. (27,240), 320
Bailey, C. W. (24,858), 888
Ball, A. E. J., and J. H. Parsons (24,533), 888
Barber, H. C. (28,783), 320
Barlow, A., and A. Mather (27,711), 1088
Barnes, J. (26,282), 588
Bauer, A. (25,205), 40
Baxter, W. D., and H. B. Swift (29,747), 1048
Beck, C., and C. Wirth (28,973), 684
Beeton, S., and Morgan Crucible Co. (27,162), 764
Belle, C. S. du (13,910), 40
Berger, C., and E. Klupathy (27,144), 400
Berry, A. F. (18,115), 536; (21,943), 684
" G. (12,926), 40
" H. F. (12,355), 536
" J. H., and D. W. John (19,729), 160
Bevis, R. R., and M. G. Clayton (13,833), 40
Bidwill, W. E., L. L. McDermott, F. Castle and E. J. Riddiford (14,283), 120
Bicge, O., and H. Specht (19,033), 120
Billington, A. M., and W. H. Johnson (18,470), 440
Billiter, J. (11,695), 120
Daguerre, R. Billon (24,025), 1088
Blackall, A. T., and C. M. Jacobs (21,554), 536
Blackstone, R. D. (30,240), 968
Blasberg, R. (19,236), 80
Blondell, A. (27,949), 764
Bonhommc, J. (17,172), 320
Booker, H. J., A. Ogilvy-Webb and Reincckc (9,191), 320
Born, K. (27,857), 440
Bosch, Robert (19,241), 488
Bottone, A. E. R. (28,611), 1088
Boult, A. J. (28,368), 536
Bowman, E. (26,440), 888
Bresslauer, M. (26,187), 968
British Insulated and Helsby Cables, Ltd., and W. Aitken (25,502), 120
" Insulated and Helsby Cables, Ltd., and P. Bucher (26,478), 1048
" Thomson-Houston Co. (13,694), (19,359), 40; (21,041), 80; (13,946), 120; (8,031), 200; (30,233), 488; (18,868), (30,323), 636
" Thomson-Houston Co. and H. J. Martin (23,066), 400; (25,683), 536
" Thomson-Houston Co. and J. Whitcher (17,177), 888
" Thomson-Houston Co. and Wedmore (20,872), 636
Brockdorff, R. von (27,562), 1048
Brooks, B., and F. H. Alston (19,525), 200; (26,225), 1048
Brown, A. W. (24,183), 536
" Boveri & Co. (14,391), 80; (15,145), 200; (18,195), 360
" Boveri & Co. and A. C. Eborall (20,249), 536
" H. F., Vickers, Ltd., and A. D. Williamson (29,161), 440
Bruhn, J. H. (28,135), 120
Brush Electrical Engineering Co. and A. E. Salisbury (28,991), 764
" Electrical Engineering Co. and S. Leech (27,725), 488
Bucher, P., and British Insulated and Helsby Cables, Ltd., (26,478), 1048
Bullers, Ltd., and H. Dagnall (23,153), 400
Bunzli, R., and P. A. Juston (28,177), 200
Burge, H., and Crompton & Co. (29,726), 40
" Crompton & Co., Williams, and Macfarlane (29,727), 280
Burney, G., and Sterling Telephone and Electric Co. (26,854), 724

CABOT, S. (27,696), 724
Cambridge Scientific Instrument Co. and W. S. Peake (24,457), 888
Canning, T. F. (27,086), 1048
Capellano, O., E. Piacani and A. Pacini (24,524), 588
Castle, F., E. J. Riddiford, W. E. Bidwill and L. L. McDermott (14,383), 120
Catts, R. M., and D. J. L. O'Brien (25,404), 724
Cerebotani, L. (16,360), 200
Chapman, A. C., and H. E. Mason (26,909), 808
Cheadle, E. (29,425), 1088
Christian, A. R. (15,114), 160
City of London Electric Lighting Co. and Peard (19,795), 80
Clark, C. M. (20,095), 440
" E. J. (26,542), 968
" F. W., and Kelvin & James White, Ltd. (29,414), 488
Clarke, A. E., and H. R. Doel (26,124), 888
" Chapman & Co. and H. J. Moysey (16,559), 200
Clayton, M. G., and R. R. Bevis (13,883), 40
Cochrane, W. N. (26,696), 888
Collins, N., and Electric and Ordnance Accessories Co. (14,625), 160; (19,182), 200
Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz (30,297), 280
" de l'Industrie Electrique et Mecanique (14,766), 160
Copland, C. D. (25,897), 588
Cowper-Coles, S. O. (13,282), 80; (28,226), 724; (28,592), 764
Craven, A. (29,291), 968
Crawford, R. S., and J. Scott (13,716), 280
Crompton & Co. and H. Burge (29,726), 40
" & Co., Macfarlane, Burge and Williams (29,727), 280
Crossland, T. W., and A. (25,426), 588
Cunnington, R. (21,848), 280

DAGNALL, H., and Bullers, Ltd. (23,153), 400
Dale, A. E., and A. E. Fletcher (23,807), 400
Darker, A. H., and J. Stone & Co. (17,587), 536
Davies, G. A. G., W. H. Kent and D. Davies, Kent & Stewart, Ltd. (19,071), 488
Dickson, W. K. L. (18,359), 40; (26,248), 968; (26,627), (27,277), 1048
Doel, H. R., and A. E. Clarke (26,124), 888
Dowdell & Gilbert Arc Lamp Co. (21,157), 80
Drake, B. M., J. Waddell and D. P. Battery Co. (25,516), 588
Dudgeon, H. M. P. (23,536), 200
Dunn, D. P. (21,942), 40

EARLE, C. (13,052), 40
Eborall, A. C., and Brown, Boveri & Co. (20,249), 536
Eckstein, A., and A. C. Heap (23,525), (23,526), (23,894), 808
Eisener, F. (17,469), 320
Electric and Ordnance Accessories Co. and W. Collins (14,625), 160; (19,182), 200
" and Ordnance Accessories Co., and J. D. Morrison (21,468), 588
" and Ordnance Accessories Co. and M. R. H. Mueller (20,995), 400
" and Ordnance Accessories Co., J. R. Garner and M. H. Mueller (17,319), 360
Electrical Construction Co. and N. Pensabene (27,205), 1088
Ellis, R. M., F. Murphy and J. T. Morris (14,588), 160
Esser, J. W., and C. Hodgkinson (19,532), 80
Etablissements Paz and Silva (20,040), 440
Etchells, J. C. (22,355), 360
Evershed & Vignoles, Ltd., W. D. Kilroy and J. C. Needham (24,272), 808

FAWCUS, G. H. (25,036), 928
Ferguson, A., and J. A. Gardner (27,223), 40
" F., and Leeds Forge Co. (28,695), 40
Ferranti, Ltd., and M. B. Field (26,836), 200
" Ltd., and W. Hamilton (13,704), 200; (24,485) 400
Ferrand, A. E. F., and L. R. Aubert (20,948), 636
Ferreira, L. D. M. G., and Siemens Bros. & Co. (24,003), 724
Fessenden, R. H. (11,154), 440
Field, M. B., and Ferranti, Ltd. (26,836), 200; (24,485), 400
Fleming, E., and I. Frankenburg & Sons, Ltd. (28,724), 200
" J. A. (23,242), 764
Fletcher, A. E., and A. E. Dale (23,807), 400
" G. H., and E. A. Gatehouse (27,119), 808
Forster, G. (27,256), 968
Foster, H. F. (23,577), 808
Frankenburg, I., & Sons, Ltd., and E. Fleming (28,724), 200
Freeman, E. H., and R. G Tyler (21,876), 588
" E. R. (26,993), 1048
Friedmann, A. (12,931), 400
Frisby, W. (28,994), 160

GABREAU, E. (19,035), 400
Gardner, J. A., and A. Ferguson (27,223), 40
Garner, J. R., M. H. Mueller and Electric and Ordnance Accessories Co. (17,319), 360
Garrard, C. C., and M. J. Railing (26,009), 636
Gatehouse, E. A., and G. H. Fletcher (27,119), 808
Geissinger, H. G. (29,463), 40
Ges. für Chemische Industrie in Basel (18,800), 400
" für Elektrotechnische Industrie and S. Presser (22,198), 280
" für Maschinen and Metallindustrie (22,841), 968
Gilbert Arc Lamp Co., and Dowdell (21,157), 80
Giles, G. (28,179), 488
Gill, C. W., and H. G. Alther (25,368), 536
Girardelli, A., and P. Holzmann (20,696), 400
" R. (22,714), 764
Glover, A. W., and George Glover & Co. (25,172), 684
Golby, F. W. (30,166), (30,167), 440
Gray, J. (26,119), 636
" W. (28,246), 160
" W. E. (21,080), 400
Green, G. H., and W. R. Shaw (16,017), 80
Griesbach, R. C., and R. Venner (14,471), 636; (17,658), 724
Grote, E. R. (26,667), 968

HALL, R. F. (16,093), 440
Halliwell, J. R., and J. D. Jeremiah (14,429), 80
Hallstream, V. (18,012), 360
Hamilton, W., and Ferranti, Ltd. (13,704), 200
Hankin, R. (13,453), 80
Hardie, A. R., and W. Judd (17,523), 320
Harlow, F., and Sir W. G. Armstrong, Whitworth & Co. (27,814), 1088
Harris, J. W., and Alfred Wiseman, Ltd. (29,111), 536
" N. K. (12,047), 120
" R. D. (10,717), 80
Harrison, H. T. (22,775), 440
Hawley, James, Ltd., S. H. Saunders and Jones (17,126), 360
Heap, A. C., and A. Eckstein (23,525), (23,526), (23,894), 808
Heath, C. (27,508), 808
Heather, H. J. S. (11,336), 80
Helhronner, A., M. von Recklinghausen and V. Henri (18,768), 440; (20,436), 588; (23,078), 636; (23,077), 764
Helfenstein, A. (17,650), 360
Henri, V., A. Helbronner and M. von Recklinghausen (18,768), 440 (20,436), 588; (23,077), 764
Hering, C. (15,139), 40
Herrde, C. (19,199), 488
Herz, A. (25,539), 536
Higgins, H. (18,969), 160
Hirst, H., and C. H. Archer (24,238), 200 (23,902), 400
" H., and G. Maurice (14,349), 120
Hodgkinson, C., and J. W. Esse (19,532), 80
Höfle (23,757), 808
Hoge, F., and "Z" Electric Lam Manufacturing Co. (23,332), 724
Holbech, R. A. (15,587), 764
Holden, F. (14,126), 280
Holzmann, P., and A. Girardelli (20,696 400
Hope, V. (25,923), 120; (29,631), 1048
Horvath, S. (27,401), 808

INRIG, C., and Gavan Inrig, Lt (28,755), 636
Irwin, J. T. (29,206), 536

JACK, A. J. (22,120), 684
Jacobs, C. M., and A. T. Black (21,554), 536
James, H. V. (17,247), 320
" J. E. (14,181), 160
" T., and C. Jones (25,846), 808

Jeremiah, J. D., and J. R. Halliwell (14,429), 80
John, D. W., and J. H. Berry (19,729), 160
Johnson, A. H. (12,184), 160
" A. H., and L. W. Williams (16,800), 200
" H. J. (30,047), 636
" H. L., and Loxley & Co. (14,042), 280
" J. T. (30,194), 684
" W. H., and A. M. Billington (18,470), 440
Jones, C., and T. James (25,846), 808
" C. R. (14,484), 684
" S. H. Saunders, and James Hawley, Ltd. (17,126), 360
Joyce, V. E., and Spagnoletti, Ltd. (25,076), 888
Judd, W., and A. R. Hardie (17,523), 320
Justice, P. N. (27,701), 888
Juston, P. A., and R. Bunzli (28,177), 200

KAATZ and R. Smith (29,700), 120
Kallmann, M. (16,258), 280; (19,993), 536
Kelvin & James White, Ltd., and F. W. Clark (29,414), 488
Kent, W. H., D. Davies, Kent & Stewart, Ltd., and G. A. G. Davies (19,071), 488
Kessels, E. J. (17,322), 360
Kilroy, W. D., J. C. Needham and Evershed & Vignoles (24,272), 808
Klein, L. (16,763), 320
Klostermann, F. (15,143), 160
Knupathy, E., and C. Berger (27,144), 400
Knyne, C. H., and McCaffery (25,906), 968
Knowles, A. E. (27,264), 968
Knudsen, H. (13,917), 636
Köhnel and Dr. Paul Meyer Akt.-Ges. (28,657), 120
Koopman, E. B., and Pontelec Welding Patents, Ltd. (23,735), 808
Kronnichfeldt, J. (26,045), 160

LAMBOT, A. (15,619), 200
Lanchester, F. W. (18,631), 400
Law, A. H., and H. C. P. Parsons (14,680), 120
Leech, S., and Brush Electrical Engineering Co. (27,725), 488
Leeds Forge Co. and T. Ferguson (28,695), 40
Leitner, H. (20,257), 360; (27,037), 1048
Lenoz, T. (20,594), 588
Lewis, F. M. (22,803), 440
Lichtenfeld, S. (16,901), 320
Liddle, J. (22,760), 536
Lindsy, F., R. Ritzmann and M. Wolfke (27,163), 888
Littler, T. (16,485), 40
Lohay, C. G. (29,578), 120
Lomax, R. (14,057), 120
Lowne, A. M., and Lowne Electric Clock and Appliances Co. (27,293), 1088
Loxley & Co. and H. L. Johnson (14,042), 280
Lyon, T. H., and J. C. Smith (22,164), 440

MCCAFFERY and C. H. Klyne (25,906), 968
Macdermott, L. L., F. Castle, E. J. Riddiford and W. E. Bidwill (14,383), 120
Macdonogh, J. C. C. (21,557), 636
Macfarlane, Burge, Williams and Crompton & Co. (29,727), 280
Macfarlane, J. (27,825), 536
Macgeoch, W., and William McGeoch and Co. (13,476), 80
Maclean, D., C. Murray and B. R. Raggett (20,531), 320
MacLean, J. H., and W. L. Madgen (24,994), 536
Maldick, S. W. (25,371), 888
Malgen, W. L., and J. H. McLean (24,994), 536
Marconi's Wireless Telegraph Co. and H. J. Round (20,441), 536
Marks (25,092), 120
Martin, H. J., and British Thomson-Houston Co. (23,066), 400; (25,683), 536
" W. M. (19,449), 488
Mason, H. E., and A. C. Chapman (26,909), 808
Massip, G. (22,777), 200
Maurer, A., and R. Barlow (27,711), 1088
Mavhieson, J. (14,534), 160
Maurice, G., and H. Hirst (14,349), 120
Maxson, J. H. (20,917), 636
Mayes, F. C. (24,216), 120
Mark, G. T. (21,045), 588
Mayuin, Franz, & Co. (6,212), 120
Mech, C. (23,891), 440
Meryweather, J. C. (26,409), 440
Meyer, Dr. Paul, Akt.-Ges. and Kohnel (28,657), 120
Midgley, H. H., and C. A. Vandervell (25,588), 888
Mih (22,717), 200
Miller, L. B. (25,065), 808
Millelhansen, C., and A. R. Williams (22,735), 440
Mittelbridge, W. J., and Allen, West and Co. (20,107), 536
Mond, H. (23,404), 536
Montgomery, J. S. (25,885), 684
Morgan Crucible Co. and S. Beeton (27,162), 764
Morris, J. T., R. M. Ellis and F. Murphy (14,588), 160
Morrison, J. D., and Electric and Ordnance Accessories Co. (21,468), 588
" W. (25,315), 808
Mould, J. (28,307), 1088
Mueller, M. R. H., and Electric and Ordnance Accessories Co. (20,995), 400
" M. H., Electric and Ordnance Accessories Co. and J. R. Garner (17,319), 360
Muirhead, A., and F. E. Wilkins (26,077), 968
" & Co. and A. H. Smith (18,794), 280
Muller, G. (27,259), 588
" Prof. Dr. E., and Ampere Ges. (21,603), 684
Munro, F. M., and Railless Electric Traction Co. (24,475), 808; (29,706), 1088
Murphy, F., J. T. Morris and R. M. Ellis (14,588), 160
" T. J. (29,802), 320
Murray, C., B. R. Raggett and D. Maclean (20,531), 320

NEEDHAM, J. C., Evershed and Vignoles, Ltd., and W. D. Kilroy (24,272), 808
Neple, J. (24,818), 120
Neuhold, E. (22,959), 120; (22,669), 360
Nield, D. (21,408), 588
North, G. (15,170), 120

O'BRIEN, D. J. L., and R. M. Catts (25,401), 724
Ogilvy-Webb, A., Reinecke and H. J. Booker (9,191), 320
Oldham, O. (27,641), 1088
Olvis, J. E. (9,775), 360

PACINI, A., E. Piacani and O. Capellano (24,524), 588
Parker-Haigh, B. (26,984), 764
Parkes, E. T. (25,478), 888
Parsons, H. C. P., and A. H. Law (14,680), 120
" I. H., and A. E. J. Ball (24,533), 888
Paton, W. (16,486), 160
Peake, W. S., and Cambridge Scientific Instrument Co. (24,457), 888
Peard and City of London Electric Lighting Co. (19,795), 80
Pechin, J. E. F. C. (15,784), 200
Peck, S., and A. Rosenberg (17,010), 280
Penner, H. (23,947), 808
Pensabene, N., and Electrical Construction Co. (27,205), 1088
Perotti, P. (24,347), 320
Piacani, E., A. Pacini and O. Capellano (24,524), 588
Pipkin, W. G., and Veritys, Ltd. (18,136), 200
Polack, W. G. (28,138), 724
Pontelec Welding Patents, Ltd., and E. B. Koopman (23,735), 808
Popp, V. (30,390), 400
Presser, S., and Ges. fur Elektrotechnische Industrie (22,198), 280
Price, A. A. (28,501), 888
" W. A. (14,380), 80; (14,499), 120

QUERTIER, H. (19,701), 536
" N. (19,703), 536
Quint, B. (15,710), 160

RAGGETT, B. R., A. D. McLean and C. Murray (20,531), 320
Railing, M. J., and C. C. Garrard (26,009), 636
Railless Electric Traction Co. and F. M. Munro (24,475), 808; (29,706), 1088
Ramsbottom, H., and Adamson, Ramsbottom & Co. (27,299), 536
Rasmussen, H. P. (28,834), 40
Rosenberg, E. (24,511), 808
Ray, J. W. (28,320), 280
Read, H. J. (27,954), 1088
Recklinghausen, M. von, V. Henri and A. Helbronner (18,768), 440; (20,486), 588; (23,078), 636; (23,077), 764
Redrup, C. B. (15,134), 160
Reeve, H. E. (16,172), 440
Reinecke, H. J. Booker and A. Ogilvy-Webb (2,191), 320
Reiniger, Gebbert & Schall Akt.-Ges. (26,341), 968
Renton, C. A. M. (18,655), 400
Reyrolle, A. C., and Reyrolle & Co. (19,851), 360
Rideal, E. N. (18,680), 400
Riddiford, E. J., W. E. Bidwill, L. L. McDermott and F. Castle (14,383), 120
Ritzmann, R., M. Wolfke and F. Lissy (27,163), 888
Rogler, F. W. (21,235), 320
Romen, R. (28,840), 764
Rorke, T. G., & E. (22,397), 724
Rosenburg, A., and S. Peck (17,010), 280
Round, H. J., and Marconi's Wireless Telegraph Co. (20,441), 536
Royce, J. C. (23,445), 764
Rucker, B. P. R. (30,054), 684
Rumpler, C. (23,369), 400
Ruthenburg, M. (28,536), 440

SACEK, J. (21,311), 636
Salisbury, A. E., and Brush Electrical Engineering Co. (28,991), 764
Sanchez, M. (24,143), 808
Saul, P. (13,932), 40
Saunders, S. H., James Hawley, Ltd., and Jones (17,126), 360
Scheidemann, B. (29,125), 1088
Schiessler, J. (24,696), 808
Schilling, J. (23,639), 440
Schmidt, A. (25,634), 200
" R. (29,506), 120
Schultze, G. A. (29,465), 808
Scott, J., and R. S. Crawford (13,716), 280
" M. D. (25,756), 536
Sefton-Jones, H. (25,012), 160
Serpek, O. (29,299), 120; (29,715), 588
Sharpe and H. Smithson (29,314), 888
Shaw, W. R., and G. H. Green (16,017), 80
Siemens & Halske Akt.-Ges. (22,013), (27,860), 40; (27,026), 120
" Bros. & Co. (14,196), 120
" Bros. & Co. and L. D. M. G. Ferriera (24,003), 724
Sims, F. R. (1,893), 80
Smith, A. H., and Muirhead & Co. (18,794), 280
" J. C., and T. H. Lyon (22,164) 440
" K. K. (20,378), 588
" R., and Kaatz (29,700), 120
" W. O. (24,421), 160
Smithson, H., and Sharpe (29,314), 888
Sabotka, B. F. (24,316), 636
Soc. Anon. "Phi," (23,831), 536; (25,026), 888
Spagnoletti, Ltd., and V. E. Joyce (25,076), 888
Speakman, C. W. (27,804), 400
Specht, H., and O. Biege (19,033), 120
Speight, J. W., and H. R. Walmsley (21,522), 40
Staniland, C. N. (14,045), 120
Sterling Telephone and Electric Co. and G. Burney (26,854), 724
Stevenson, J., and O. R. Williams (18,217), 200; (24,294), 888
Stone, J., & Co., and A. H. Darker (17,637), 536
Strelow, M. (21,240), 636
Sutton, J., & C. J. (20,685), 360
Swift, H. B., and W. D. Baxter (29,747), 1048
Sykes, W. R., Interlocking Signal Co., J. C. Sykes and R. W. Tarrant (23,933), 536

TANNER, J. J. (30,176), 1048
Tarrant, R. W., W. R. Sykes, Interlocking Signal Co. and J. C. Sykes (23,933), 536
Tate, G. E. (25,858), 888
Taylor, A. M. (20,906), 636; (24,611), 808; (26,390), 1048
Telephon Apparat Fabrik E. Zwietusch and Co. Ges. (26,079), 968
Thomas, A. V. (28,069), 1088
Thompson, W. P. (24,808), 40
Thomson, W. (15,004), 160
Tucker, J. H. (20,900), 320
" T. H. (27,903), 808
Tyler, R. G., and E. H. Freeman (21,574), 588

UPTON, F. C. (17,873), 40
Urban, A. O. (22,697), 764

VANDERVELL, C. A., and H. H. Midgley (25,588), 888
Vedovelli, Priestley et Cie (27,174), 40
Venner, R., and R. C. Griesbach (14,471), 636; (17,658), 724
" R. F. (17,684), 320
Veritys, Ltd., and W. G. Pipkin (18,136), 200
Vickers, Ltd., A. D. Williamson and H. F. Brown (29,161), 440
" Sons and Maxim, Ltd., and R. Williamson (22,507), 280

WADDELL, D. P. Battery Co., and B. M. Drake (25,516), 588
Walker, H. C., and R. Waygood & Co. (20,118), 536
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Printed by WILLIAM CATE, LTD., Hogarth House, Bouverie Street, E.C., and Published by the Proprietors, H. ALABASTER, GATEHOUSE & Co., 4, Ludgate Hill, E

THE

ELECTRICAL REVIEW.

VOL. LXIX. JULY 7, 1911. No. 1,754.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE EDUCATION AND TRAINING OF ENGINEERS.

THE important Conference held at the premises of the Institution of Civil Engineers last week, necessary and valuable though it was, suffered much through lack of time, and also by reason of the fact that different sections sat simultaneously. Thus, on the first day, Sections I and II (respectively labelled "General Education" and "Scientific Training") sat together, while Section III ("Practical Training") sat by itself. On the second day, Sections II and III sat together for half the time, and afterwards separately. If the object of the Conference was to blend the views of these three sections into some sort of coherent homogeneity, Section III should have participated with Sections I and II in the joint discussion on the first day. The consideration of the problems of practical training cannot be divorced from general education, and many times Section III had to be called to order by its chairman for its reference to subjects under discussion elsewhere.

Important though the Conference has been, we see the opinions of the engineering community grouped more or less in three divisions. There is the sandwich system of alternately six months at college and six months at works, possible only where college courses permit it, *i.e.*, in Scotland. Then we have for English conditions, first, those who favour a boy going straight from school into the works and then going to college, and, secondly, those who, on the other hand, prefer that the college course should follow immediately on the school course, the works training coming last. We return later to a discussion of the relative merits of the respective orders in which education and training should be taken. But at this juncture we feel bound to express our doubts as to whether a successful engineering education for a community can ever adequately be covered by any set programme or syllabus. Within certain limits, the man of superior ability and requisite common sense, who essays to earn his livelihood in one branch or other of the engineering industry, will do so, no matter how poor or how unorthodox his preliminary training may have been. Given sufficient incentive, the world will always produce its Stephensons, Watts, Trevithicks or Kelvins. Granted that the man of transcendent genius is rare, it is not inconceivable that if some such had, in their youth, been the bond-slaves of the examination-mongers, the letter of a standardised training would perchance have killed the spirit of originality which makes progress possible. We do not wish to be misunderstood by either school, for we know of engineers doing excellent work who are not mathematicians, and mathematicians whose work is equally valuable who are not engineers.

Obviously we cannot go back to the practical (or was it sandwich ?) educational system of the late and unlamented

Mr. Squeers. "C-l-e-a-n, clean, verb active, to make bright, to scour. W-i-n, win, d-e-r, der, winder, a casement. When a boy knows this out of the book he goes and does it." It might, perhaps, be urged that the methods satirized by Dickens had some points of superiority over a course of study comprising lectures upon the chemistry of soaps, the coefficient of friction of elbow-grease, and the refractive index of plate-glass, without any practical reference to the utility of windows in domestic architecture. But, after all, it seems a fair question whether we are as far removed as we think from the crude educational methods of Mr. Squeers, or from their equally reprehensible antithesis. Hence it is that we have, on the one hand, a college training which teaches the student who has never ground a valve in its seat or seen a gland packed, the whole science of thermo-dynamics, and, on the other hand, the practice of putting a boy of 16 fresh down from a public school with all its healthy environment and mental and physical stimulus, into the shops for a period of months or years, because, forsooth, the discipline of 6 a.m. and the hard work may disgust some boys of engineering, and thus weed them out at an early age.

The immediate fruits of the present Conference will probably be that the new fashion will enforce one year in the shops, which is to intervene between school and college, that the college course should be of six-monthly periods of alternation with the works, and that where this is impossible, the long vacation should be spent in the shops, and a shop course follow upon the obtaining of a degree. There are, however, some very apparent drawbacks to this sudden taking of a boy straight from a public school to put him into works for about a year or more. It means an interruption in his course of studies at a time of greatest mental receptivity, an abrupt change of environment, no real opportunity of attaining to mechanical skill. The advantages of a year's roughing it seem none too certain. Four or five years would turn out a fair artisan; one year means acting as a sort of fitter's mate's mate, or being set to work at a turret lathe very much as half-timers are employed in Lancashire cotton mills. What insight can a boy of 16 get which will be helpful to him at college, and which will compensate for the interruption in the consecutiveness of his studies? We know, of course, that some will say, "Oh, make the boy attend evening classes." It is true that many possess the physique to work from 6 a.m. to 5 p.m. on a 9½-hour day, and to put in the evenings at a local technical college; but in all sections of the community, there are some who are not capable of doing so. Physical recreation and general culture, too, make claims which must not be neglected.

The subject is undoubtedly one of great interest, and of the utmost importance not only to the youths themselves, but also to the future well-being of the whole engineering profession. It is also of great complexity, and strong arguments can be advanced in favour of either of the leading theories. Further comments upon it must be deferred to a later occasion, but in the meantime we strongly recommend our readers—especially those whose sons are destined to become engineers—to read the report of the Conference which we commence elsewhere in this issue, and if possible to obtain copies of the introductory notes *in extenso*.

THE SEARCH FOR CHEAP POWER.

The Presidential Address which Mr. Percy Rosling, M.I.E.E., delivered on May 11th to the Victorian Institute of Electrical Engineers, is interesting on account of the emphasis laid on the need for providing cheap power as a primary essential of commercial prosperity. It points to the two Australian cities, Melbourne—where the address was delivered—and Sydney, the capital of the neighbouring State. In Melbourne, for reasons which are detailed in the address, electrical energy is dearer than in Sydney. What is the result:—

> Melbourne used to be considered the leading business and manufacturing town in Australia, but as far as the use of electricity is concerned, it is content to take second place to Sydney, and as it is the most energetic and up-to-date people who appreciate the advantages of electricity, we must infer that there are more of this class in Sydney than in Melbourne; and therefore, generally, Melbourne is losing, or has lost, her pride of place.

Leading up to this question, Mr. Rosling discusses two problems as having, in his opinion, an important bearing on the subject. The first is the advisability of the general employment of a consulting engineer for public works, and the other is the policy which should be followed in the early stages of the development of an electricity supply undertaking.

These are old friends here, and much thought has been expended and a large amount of ink used in the search for correct solutions.

Dealing with the position of consultants, Mr. Rosling points out the disadvantages of entrusting the design of large works to individual contractors, who cannot help having a bias towards utilising plant in which they are interested, and with whose good points they are most conversant. He shows that in a new country, during the early stages of its development, matters must be left in the hands of contracting firms; the man on the spot gets the best results he can from the material at his disposal. When, however, progress has reached a certain point, final success, rather than immediate results, becomes the important factor, and to attain this, the wider outlook and more general experience of the independent engineer are often sought.

Whether a contracting engineer is suited thus to act impartially is considered in the address, and practically answered in the negative, though Mr. Rosling considers that the least objectionable manner in which he can so act is to prepare a specification, stand aside from personal tendering, and adjudicate on offers received only from his competitors. Methods by which a contracting engineer prepares a specification, personally tenders either directly or indirectly, and afterwards adjudicates on offers received and supervises the execution of the work, are rightly condemned. The personal opinion is given that the present condition of electrical engineering work in Australia affords an opportunity for the establishment of a consulting practice based on the high standards of British engineering work.

It is usual in Australian public contracts to insist on the engineering representative of the purchasing body being the sole arbiter in case of disputes, and one direction in which the advent of a strong independent engineer would be warmly welcomed, would be in insisting that the British plan of appointing an independent and impartial arbitrator should be followed. Another need is stated in the address

to be the development of the function of the true consultant to specify distinctly the results he requires, and to leave manufacturers and contractors to determine how they will obtain those results with their standard apparatus.

Having shown how the wise employment of independent engineers might help towards the cheapening of the cost of power by securing that the most suitable plant purchased under fair conditions should be used, Mr. Rosling proceeded to consider the right policy to be followed in the early stages of an electricity supply undertaking. Naturally, Melbourne, with its high rates for power, and its separate electricity authorities for different areas, afforded the text of how not to do it.

So far as the City itself was concerned, where the Town Council owned the plant, the policy—which had apparently been followed—of using the electricity undertaking as a constant feeder towards the reduction of general rates was severely condemned. It was shown that to expect profits during the early stages of the undertaking was distinctly detrimental to its rapid development. The plan adopted by some of the British power companies of fixing at the start on an output which would pay, and arranging the power rates on the basis of this output, irrespective of early losses in working, was referred to as the safest and soundest plan of operation, as this ensured the advantages of electricity being placed within the reach of all, and offered a real inducement towards its being employed for industrial purposes. Unless electrical energy were actually obtainable at low rates when industries were being started, other forms of power would be tried, and the load which might have helped to reduce standing charges would be lost. It was far harder to induce manufacturers to discard an already installed source of power than to persuade them to adopt electricity when it was obtainable at rates which compared favourably with the cost of its rivals.

It was felt that one way in which the Victorian Institute could most effectively help towards the consummation of the moderate hopes expressed in the address, was by the education of public opinion, more particularly as represented by the members of the Town Council. This is a direction in which much has been done, but more might be attempted even in this country. It is only when those who have the direct control of undertakings involving such technical questions as that of electricity supply, have the requisite knowledge of the true economics of supply that they can be expected to make them a success.

Mr. Rosling has done well to probe so fearlessly the reasons for the slow progress of electrical work in Victoria, and to show that if the State is to hold its own among its Sister States, it must consider more carefully than it has hitherto done, the problems which determine the cost at which power can be supplied within its borders for the development of industrial undertakings.

The Telephone Appeal.

The uncertainties and eccentricities of British law were admirably illustrated by the verdict of the Court of Appeal in the action between the National Telephone Co. and the Post Office last week. The question turned upon the meaning of the word "unsuitable," together with its context. We always supposed that "unsuitable" meant "unfitted," or "inappropriate," for a specified purpose, relating only to quality; we now learn, however, that it relates to quantity, at least in the Postmaster-General's usage of the word, for on the ground that he has enough apparatus without that of the company, he alleges that the latter is "unsuitable" for his purpose, and therefore refuses to discuss its purchase. The fact that with the said apparatus the company is giving at least as good a service as that of the Post Office does not appear to have come into consideration at all, though to the ordinary person it would seem to settle the question at once. Truly, the ways of lawyers are mysterious and inscrutable. Unfortunately, we understand, the decision of the Court of Appeal in this instance was final—otherwise, no doubt, the case might have had a different issue.

As regards the attitude adopted by the Post Office towards the suitability of the plant in question, here using the word in its customary sense, we cannot say much on this point without trenching upon questions now *sub judice*; but we may be allowed to point out that the wholesale scrapping of large and costly plant, in efficient working order, and capable of being easily adapted at trifling cost for use with the system favoured by the Post Office, in order to substitute entirely new apparatus at a correspondingly greater price, is a proceeding which can hardly be justified from a business point of view.

Copper.

The recent hardening in the price of standard copper is a little difficult to account for, in the face of visible supplies which, though decreasing, are still equal to about one-fifth of the annual production. A writer in the *Financial News* for June 26th, commenting on the fact that the price has risen during two months from £53 10s. per ton to the neighbourhood of £58, attributes this to a better market position in the States, which apparently means that the organising of the industry by the Amalgamated Copper Co. is beginning to bear fruit. Comparing production and consumption for the past 12 months (June, 1910, to May, 1911), the writer of the article gives a table showing that the quantity of copper consumed in the States during August, September and October amounted to more than 50 per cent. of the production, while in December and January this was less than 40 per cent., increasing to 50 per cent. in March, April and May of this year. This goes to show that the market is becoming brisker on a gradual improvement in the trades affected. Curtailment of production does not show up particularly on this table, the average per month being 54,433 tons, and the months of March, April and May this year registering 58,273, 52,717 and 56,679 tons respectively. Certainly, February only showed 49,080 tons. It is recorded, in this connection, that the Anaconda Co. has reduced its output in the past five months from 113 million lb. to 107 million lb., a reduction of something like 6 per cent. In the report of the Amalgamated Copper Co. for the year ending April 30th last, it is stated that the Anaconda Copper Mining Co. has acquired all the properties of the mining companies and timber and coal undertakings doing business in Montana and Wyoming in which the present company had any interest, and the stock of the United Metals Selling Co. At the same time, as the article remarks, the return made on copper shares at present prices is very small. Amalgamateds stand to return about $2\frac{3}{4}$ per cent., and Rio Tintos roughly $3\frac{5}{8}$.

Messrs. Merton's circular for mid-month gave stock in Europe and afloat at 70,416 tons, and total stocks for the end of May as 146,718 tons. American supplies had slightly increased from April-May, while European had dropped over 5,000 tons, and bids fair to be decreased by as much in the present month. This may have something to do with increased prices.

D

DISTRIBUTION AND EFFICIENCY TESTS ON LAMP SHADES AND REFLECTORS.

By LEONARD MURPHY, A.M.I.E.E., and H. L. MORGAN, East London College.

Since the advent of the high-efficiency lamps now in general use, more attention has been paid than formerly to the design of shades and reflectors, as a badly arranged fitting may easily nullify the advantage gained by the use of the high-efficiency lamp.

It is, however, quite impossible to obtain a simple photometric test on any shade or reflector which will immediately express the merit of the particular arrangement for the class

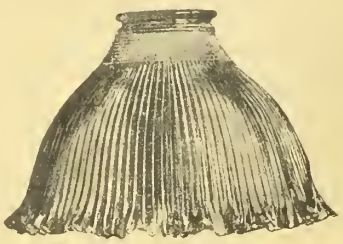


Fig. 1.—Holophane Shade, No. 9673. (Combination II.)

of work for which it is required, but it is believed that if the figures for the efficiency and the polar curves of shades in common use are available, it will be possible to make a fairly accurate estimate of the qualities of any other arrangement.

In this direction much valuable work has been done by Messrs. The Holophane Glass Co. in connection with their well-known fittings, but this work is, of course, confined to that particular form of shade.

It is not easy to draw a line of distinction between shades and reflectors. No doubt some will fall distinctly into one



Fig. 2.—Holophane Shade, No. 6046. (Combination III.)

class and some into the other, but in many cases the object aimed at is both to prevent the eyes being dazzled and at the same time to concentrate the light in one direction. Thus the authors use the term "shade" indiscriminately, though in some of the arrangements described, the term "reflector" would, undoubtedly, be more accurate.

The work naturally falls under two heads :—

(*a*) The consideration of the polar distribution of the light from various combinations of lamps and shades, and of the amount of light absorbed in each case by the shade.

(*b*) The action of each in efficiently producing downward illumination, together with the minimum of glare and shadow.

The arrangements experimented upon were as follows :—

I. Bare lamps.

II. Lamps enclosed in Holophane reflector (pattern No. 9,673), illustrated in fig. 1.

III. Lamps enclosed in Holophane reflector (pattern No. 6,046), illustrated in fig. 2.

IV. Lamps fitted with conical opal shades 10 in. diameter, 5 in. deep.

V. Lamps fitted with exactly similar enamelled iron shades.

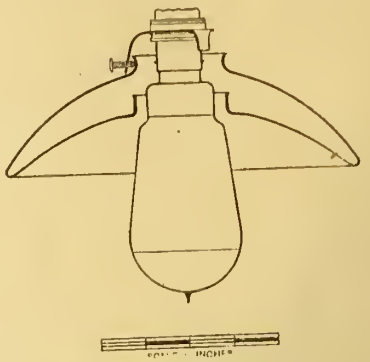


Fig. 3.—Silvered Glass Reflector. (Combination VI.)

VI. Experiments under (*a*) only were carried out on the lamp enclosed in a silvered glass reflector 8 in. diameter (see fig. 3).

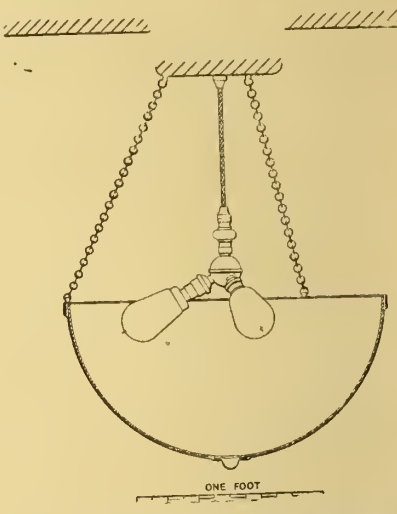


Fig. 4.—Opal Glass Bowl fitted with Three Lamps for Semi-indirect Lighting. (Combination VII.)

VII. Experiments under (*b*) were carried out on a group of three lamps within a hemispherical bowl 20 in. diameter (fig. 4). In this case the lighting was semi-indirect.

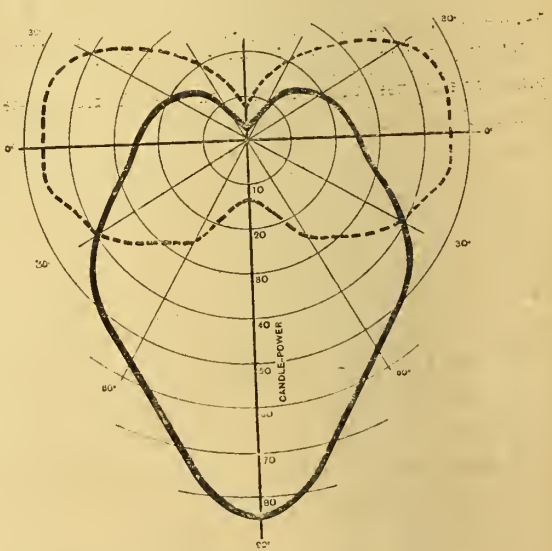


Fig. 5.—Polar Curve for Holophane Shade (No. 9673). (Combination II.)

The photometer* used for the experiments under (*a*) is of the swinging mirror type, and has been designed particularly for the photometry of arc lamps or other light

* For a description of this instrument see "The Measurement of Light and Illumination," by Prof. J. T. Morris, *The Ill. Eng.*, April, 1910.

sources where the light emanates from a fairly considerable area. The light source used for direct comparison was a small 4-volt tungsten lamp, which had previously

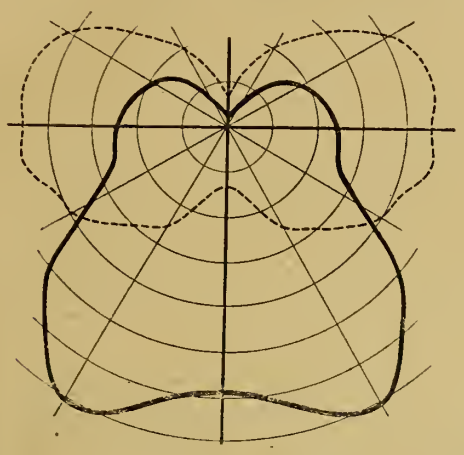


Fig. 6.—Polar Curve for Lamp fitted with Holophane Shade (No. 6046). (Combination III.)

been carefully aged and compared in its working position with a standard carbon-filament lamp. This latter was used for calibration purposes throughout the whole of the

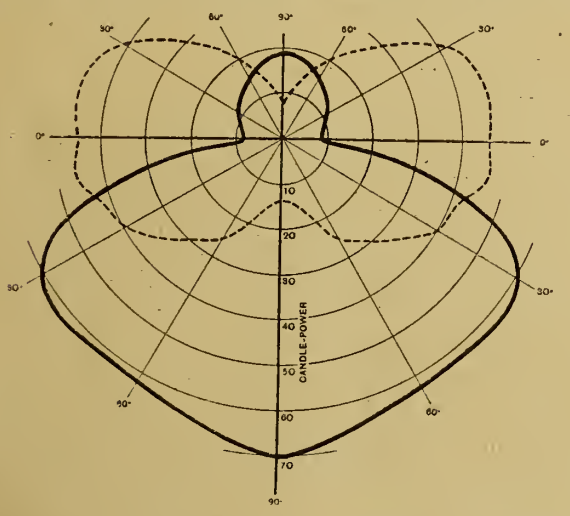


Fig. 7.—Polar Curve for 10″ × 5″ Conical Opal Shade. (Combination IV.)

tests under (*a*) and (*b*), so that the highest possible accuracy might be ensured with regard to the comparative values of the results.

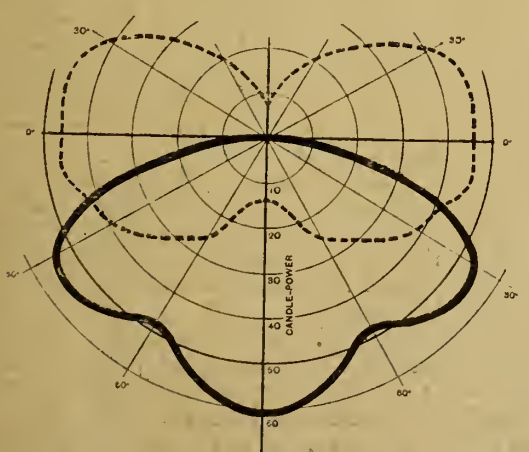


Fig. 8.—Polar Curve for 10″ × 5″ Conical Enamelled-iron Shade. (Combination V.)

The lamp used in obtaining all the polar curves was a 240-volt Osram with obscured pip, the power taken being 60·5 watts. The mean spherical candle-power was deduced from the polar curves by Rousseau's construction.

The polar curves corresponding to combinations II, III, IV, V, VI, are shown in figs. 5, 6, 7, 8, 9, while an analysis of the results will be found in Table I.

The photometer was fitted with a Bunsen grease-spot screen, this having been found to be capable of very high accuracy if due precautions are taken with the measurements.

In cases I to V the light sources were fixed and the photometer head moved between them, while in cases VI and VI(*a*) the photometer head was at a fixed distance from the lamp and shade under test and the comparison lamp was moved.

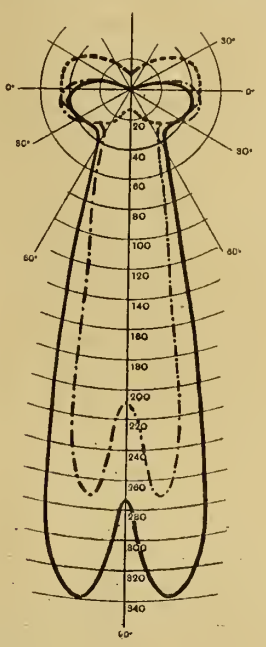


Fig. 9.—Polar Curves for Silvered Glass Reflector. (Combinations VI and VI(*a*).)

The object of the procedure in cases VI and VI(*a*) was to ascertain if the shape of the polar curve would be considerably affected by the distance between the photometer screen and the lamp and shade. It was thought that the considerable focusing powers of some shades might render the assumption of the inverse square law quite inapplicable, and the extent to which

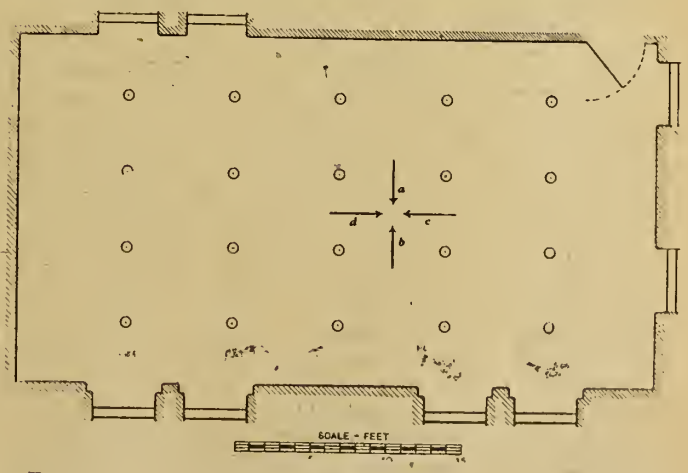


Fig. 10.—Plan of Room in which Experiments on Direct Illumination were Made.

this occurs may be gathered by comparison of the full and chain-dotted curves in fig. 9. This, however, is a very extreme case, and there seems little reason to doubt that the inverse square law will become applicable in every case if the photometer screen is at a sufficient distance from the shade, and the distance chosen in cases I to V is probably large enough. It should also be realised that although some divergence will generally arise in the shape of the polar curve when the photometer screen is fixed at a greater or less distance, the mean spherical candle-power, which is a measure of the total flux of light emitted, should remain

unaltered if the experimental work has been carried out accurately.

With each of the polar curves (figs. 5 to 9) the curve referring to the bare lamp is shown as a dotted line, and from this the reflecting effect of each shade may be gathered, and, as a further rough criterion of this reflecting effect the magnification of the downward beam is given in column 6 of Table I, while the efficiency* of the whole arrangement in lumens of total light flux emitted per watt input is given in column 8. The efficiency given in column 9 refers to the bare lamp as 100 per cent., and gives a direct measure of the amount of light which is not absorbed by the shade. It will be observed that the figures given in column 8 depend on the efficiency of the lamp, usually expressed in watts per candle-power, and on the efficiency of the shade as given in column 9. The watts per candle-power for the bare lamp are 1·31 for the horizontal beam, or 1·66 for the mean spherical value.

The high efficiency of the opal shade is somewhat striking, and this is confirmed by the illumination tests described later. A defect in this shade is found, however, in the fact that, when used singly, the illumination immediately beneath the lamp is patchy, but this would probably not have been the case if the shade had been curved or fluted. The trouble was entirely absent in the illumination tests in which a large number of lamps, grouped somewhat closely and at a fair height, were employed.

TABLE I.

(1) Reference No.	(2) Downward candle-power.	(3) Horizontal candle-power.	(4) Maximum candle-power.	(5) Angle of maximum candle-power.	(6) Magnification of downward beam.	(7) Mean spherical candle-power.	(8) Efficiency. Lumens/watts.	(9) Shade efficiency. Per cent.
I*	13·55	46·25	46·4	10° above H	1·00	36·3	7·52	100
II*	84·2	25·0	84·2	90° below H	6·2	29·5	6·11	81·3
III*	59·6	24·75	71·5	62° ,,	4·4	29·8	6·17	82·1
IV*	70·25	8·8	70·25	90° ,,	5·19	29·8	6·17	82·1
V*	61·0	0	61·0	90° ,,	4·5	20·95	4·34	57·8
VI†	273	36·8	338	85° ,,	20·15	29·4	6·1	81
VI(*a*)‡	207	42·25	268	85° ,,	15·3	29·7	6·16	81·8

* Average distance of photometer screen from lamp and shade about 18 ft.

† Photometer screen at 15 ft. 2 in. from lamp and shade.

‡ Photometer screen at 6 ft. 5 in. from lamp and shade.

It also occurs to the authors as being somewhat singular that the efficiency of all the shades tested, with the exception of the enamelled iron type, should be approximately the same, *i.e.*, about 82 per cent. With reference to the polar curves, the Holophane shade (combination III) gives the best downward distribution for most interior illumination, though it is really surprising how little the polar distribution affects either the efficiency or uniformity of the actual illumination when a room is lighted from a large number of points placed sufficiently high. It would appear desirable, however, to reduce the horizontal intensity as far as possible and so to bring the bulk of the light into the lower hemisphere, but there is no apparent objection to casting a considerable portion of the light upwards where a clean white ceiling is available for reflection. This practice has, moreover, the advantages of rendering the illumination more uniform and less productive of sharp shadows, and also secures a more pleasing effect by enabling the upper parts of the room to be clearly seen.

When the upper part of a room is of dark colour, the silvered glass type of shade is the most efficient to use, in that the whole of the light which is not absorbed by the shade may be thrown downwards, and the efficiency is good. The particular reflector tested had a smooth interior and resulted consequently in considerable "patchiness" in the light immediately beneath it, but this disadvantage would not be found if the reflecting surface had been corrugated or prismatic. A reflector of the Holophane type, silvered on the outside, should give particularly good results in this respect.

(*To be continued.*)

* As the lumen is the light flux emitted from a source having a uniform spherical intensity of 1 C.P. in unit solid angle, it follows that the total flux in lumens emitted from any source = M.S.C.P. × 4 π.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

In our last issue we referred at some length to the first day's proceedings of the I.M.E.A. at Brighton, when, owing to lack of time, discussion on Mr. Beauchamp's wiring paper was unfortunately cut short.

One new system of wiring mentioned by him, *i.e.*, "Cab-tire sheathed flexible" cleated on to the wall, appears to possess many points worth discussing at a meeting of this kind, and we refer to it elsewhere in this issue.

The next day's programme was a very full one, commencing with an early journey to Portsmouth, where the morning was devoted to a discussion on internal combustion engine papers by Messrs. Howard and Carr.

The Diesel engine provides a fruitful theme for discussion, and it was generally admitted that as used at present, in small sizes, it gives great satisfaction; the only wonder to us is that it has taken so long for its good features to be practically appreciated.

If we rightly interpreted the remarks of Mr. Day (of Mirrlees, Bickerton & Day) the outlook for the large size Diesel, in connection with electricity works, is not very promising, owing to the mechanical complications and increased cost involved. Mr. Leonard Andrews ably defended the big gas engine, criticising the figures given by Mr. Howard for a 10,000-KW. Diesel engine station, while Mr. Seaton solemnly informed the meeting that he had no idea there was so much trouble with the big gas engine until he attended a recent Manchester discussion, where the room was full of gas engine makers, but the users all seemed to have pressing engagements. Needless to add, the users of steam turbine plant could, and did, quote much lower running costs than the author for the large Diesel plant, and there seems little chance of the large internal combustion engine being adopted by the municipal engineer, at any rate, for some time to come.

The old question of oil fuel supply cropped up, and it was pointed out that the gas tar oil produced in this country is much more than sufficient for the whole of the heavy oil engine demand in this country.

With the conclusion of the discussion an adjournment was made, by car, to a seaside eating-house (?)—of evil memory—where one of the most indifferent 3s. lunches which we can call to mind was inflicted on the party. We, like the coster, could find no "bloomin word for it," and so, at the risk of repetition, must adopt the popular verdict—"rotten," with qualifications. We can only assume that it was a wily attempt on the part of the wiring contractor to exterminate the Association in the prime of its life.

In the afternoon a large party visited H.M. Dockyard, which, with its peaceful looking avenues and old world buildings, is so suggestive of retirement from the activities of this world, that it is difficult for the engineer visitor to realise that he is, in fact, in the constructional headquarters of the British Navy.

We confess to thoughts of Dalmuir (which the Association visited last year), of Elswick, and, perhaps, of another establishment across the sea, whose handiwork—the 27-knot *Von der Tann*—lay at anchor but a few miles away.

The visitors were permitted to view the Belliss-Dick Kerr direct-current generating plant, some 3,500 KW. of which is installed in the Dockyard power house, mostly in 600-KW. sets, also the exterior of the unfinished Dreadnought type *Orion*, with its 10 13·5 in. guns, Britain's last "last word" in naval construction; subsequently we scrambled on to a naval tender for a brief visit to the 20-year old battleship *Revenge*—used as a gunnery training school, a sort of steel *Victory*, which, unlike the old flagship, will shortly pass into the breaker's hands.

The afternoon was more remarkable for exercise than anything else, and a quiet evening was spent in a very pleasant cruise on the Solent, which, unfortunately for the sightseer, had but a few hours previously been denuded of the large fleet which assembled for the Coronation Review; the party returned to headquarters later in the evening.

On Thursday morning the Brighton meetings were resumed at the Royal Pavilion, when lengthy discussions took place on the purchase of fuel, and on street and shop front lighting.

As regards the former subject, probably most interesting were Mr. Chattock's remarks on the systematic coal testing carried out by the Birmingham electricity department, by means of which complete information has been accumulated in regard to 130 different classes of fuel in the Birmingham district, and the average price per ton has been reduced from 8s. to 6s. 10d.

The calorimeter, while, no doubt, a useful adjunct to the boiler house, has not been found essential to success, and not a few engineers pin their faith to practical boiler house tests—pounds of coal against units generated over regular periods—as the only reliable guide for fuel purchasing.

Mr. Frank Ayton incidentally drew attention to the speedy Berthier system (the litharge method) of fuel testing used by the Lot's Road station engineers, instead of the calorimeter—the time taken for a test being 20 minutes; and other speakers pointed out that the purchase of fuel on a heat-unit basis largely depended on the goodwill of the coal owner.

As regards shop front lighting, Mr. Seabrook (Marylebone) mentioned that the West Ham electricity department had been able to keep out the high-pressure gas lamp, while the neighbouring East Ham electrical undertaking, which charged a lower price, suffered from this form of competition; he came to the conclusion that price was not so material, but that West Ham's success was due to its business-getting department.

Mr. Haydn Harrison, who introduced the subject of street lighting, urged that the short loan periods for electric lighting, and the fact that the capital invested in street gas lighting had mostly been paid off, placed the former in such a tight position as regards competition, that a mutual arrangement between the two adversaries—taking Holborn as an example—would be the best way out of the difficulty. The cost came out practically the same for gas and electricity, except for capital charges—which, of course, are heavy in the latter case during the first few years. Mr. Harrison urged, and we would emphasise, the importance of having a share of the street lighting, if only for the advertisement.

It was suggested, however, with some reason, that as street lighting fittings have lasted 10 or 15 years, the L.G.B. might be brought round to a more consistent attitude if pressure were exercised.

Mr. Cramb's proposal that in order to meet the competition of gas in outside shop lighting, the supply authority should run such lighting in connection with electric street lighting, and charge inclusive figures for energy and maintenance, seems quite a good one.

After an adjournment for lunch, visits were paid to the Corporation sub-station at North Street, with its fine array of Westinghouse converting plant, and to the Brighton Railway locomotive shops, which are equipped with some 2,000 H.P. of motors, supplied from the public mains, and apparently give a remarkably steady load. The latter works have been modernised within the last few years by Mr. Earle Marsh, the locomotive superintendent, and now compare favourably with any others of the same kind; they are fully equipped with electric travelling cranes and electric driving—in some cases individual drive—is used throughout. The smith's shop is a model for such establishments, with its independent motor-driven forced draught and exhausting plant.

The visitors were shown the first "Atlantic" type locomotive, constructed by the Brighton Co., nearing completion, a machine similar to those which the company has previously purchased, and which merits some consideration when electrification schemes are in the air; they, no doubt, also envied the small gold mine in the form of copper fireboxes which the company uses in all its locomotives.

The annual dinner of the Association which was held in the Royal Pavilion in the evening, proved a very enjoyable function. The toast list was a short one, and "the chair" commendably brief in its remarks; it fell to the lot of the Mayor, Councillor Thomas-Stanford, to reply to the toast of his Corporation, which he did in an excellent speech, while Mr. Ferranti, as President of the I.E.E., replied for the guests, including the ladies, who for the first time were present in large numbers at the annual dinner.

An excellent musical programme was provided, which to the regret of many, was barely commenced when an adjournment took place to the Grand Hotel for dancing.

Friday morning's business meeting brought the Convention to a close.

After the election of officers and council for the year 1910-11, the annual report was taken as read; we summarise its contents elsewhere. The new council is as follows:—

President: G. Wilkinson (Harrogate). Vice-presidents: C. E. C. Shawfield (Wolverhampton), and R. A. Chattock (Birmingham). Past presidents: S. L. Pearce (Manchester), W. W. Lackie (Glasgow), and J. Christie (Brighton). Engineer members: Messrs. Cramb (Croydon), Long (Norwich), Richardson (Dundee), Ayton (Ipswich), Wyld (Birkenhead), Furness (Blackpool), Seabrook (Marylebone), and Watson (Bury). Municipal council members: Messrs. Bruce (Sunderland), German (Brighton), West (Coventry), Willock (Glasgow), Rowntree (Harrogate), and Crowther (Sheffield). Hon. solicitor: Alderman Pearson (Bristol); Hon. treasurer, J. E. Edgcome (Kingston-on-Thames); Hon. secretary: H. Faraday Proctor (Bristol), as before.

The meeting was of a semi-private character and, in many ways, it would have been better had the Press been excluded from the hearing of what may be termed official secrets, and therefore freely discussed elsewhere by those whose interests are most concerned.

However, we appreciate Mr. Christie's tactful handling of an awkward situation; indeed, to his genial chairmanship is in large measure due the series of pleasant meetings which have been held at Brighton.

Looking back over a number of these Conventions, one is tempted to suggest that an important body such as the I.M.E.A. could with advantage improve its arrangements on such occasions.

For instance, provincial accommodation, and particularly luncheons, leave a good deal to be desired, and it has been suggested that were London the regular meeting place, and we are inclined to the opinion that country members would gladly make for the metropolis, which caters for all tastes, difficulties under these heads would disappear. On the other hand, the division of the members into several parties, each with its own chairman and hotel, would, no doubt, give greater satisfaction all round than the present system of fixing a headquarters and leaving the odd men to shift for themselves in provincial towns.

Coming so soon after the Coronation festivities, the visitors were able to admire the electrical illuminations on the extensive sea front, West and Palace piers, hotels, &c., the Grand Hotel—the Association's headquarters—being the exception, illuminated by gas on a calm night, but in darkness at other times.

In this respect it resembled the headquarters of the local gas company, which however, with the aid of a man and a torch, made brave attempts, between gusts, to show the electrical visitors what gas illuminations should be like.

The Municipal Convention and Wiring.

Wiring questions have been prominent within recent years at the meetings of municipal engineers, and Mr. J. W. Beauchamp's practical paper on "Modern Wiring" is specially useful at this time when some of the municipalities are seriously considering the advisability of instituting their own wiring departments.

Most supply authorities realise that the small consumer in large numbers would be a desirable asset to the central station, and the recent Brighton discussion shows that many consider the initial outlay for wiring to be the chief barrier which now stands in the way of the general adoption of electricity.

In most districts this class of consumer can only be obtained in bulk by the offer of wiring on easy hiring terms, or at slightly increased supply rates, and in those places it will probably pay to accept the burden and risk of such methods for recovery of initial expenditure.

Mr. Beauchamp leaves the question open as to whether the actual wiring could best be done by contractor or supplier; but he suggests, we think rightly, that in the majority of instances, organised schemes for wiring small houses in quantity can be arranged with most effect by the municipality.

The author has not much to say in favour of existing cheap systems, and appreciates the fact that the policy of accepting the lowest tender, for imperfectly specified work, is demoralising. He would seek a system which would be reliable; less costly than present better class wiring; and as capable of easy specification as the standard work of the gasfitter or plumber.

In the search for such a system and to attain desirable uniformity of practice, he would, in a measure, disregard the various existing wiring rules, as he considers that attempts to conform to regulations of the I.E.E., insurance companies, and local authorities, have a tendency to keep the cost of wiring unnecessarily high.

The paper was prepared before the new issue of the I.E.E. Rules, but the author has in several instances anticipated changes from the 1907 Rules—for example, the higher rating of cables as a factor in cost reduction is advocated.

It seems to be the case in wiring that inefficient installations may be in conformity with all existing rules, and good work may be done in almost complete disregard of them. Experiences, opinions and interests differ and clash, local practice varies, and new systems and conditions of supply make entire agreement on uniform standards very difficult. Wiring may perhaps be made more reliable than the work of the gasfitter, but it can never be so simple of specification.

Mr. Beauchamp is in favour of framing yet another set of rules; these to be of a simple and definite character but rigidly enforced. He considers that they should be under the control of someone directly interested in the supply undertaking involved, and not administered by any outside central body. Yet, in view of possible competition with other supply companies, he would have these regulations applied in a flexible manner. Such flexibility would hardly tend to more uniform practice or more reliable work, and contractors, to live, would require to cultivate the friendship of the station engineer more assiduously than ever. The interest of insurance companies in wiring rules appears to have been overlooked.

It may be that municipal engineers, as a class, do not rightly appreciate all the difficulties of proper wiring, and its adaptation to the varying conditions of use and building structure, and many will too lightly undertake themselves—or delegate to subordinates—the task of preparing or enforcing wiring specifications.

The notorious variation in tenders goes to show that many specifications are vague on really essential points, and should warn the public that the preparation of wiring specifications is rightly the work of consulting engineers, who are experienced and expert in this branch of the electrical industry.

To us it would appear that the obstacles to the general adoption of electricity can be most surely overcome by a more orderly advance on the part of the whole electrical army working in harmony and utilising to the full the specialised knowledge of each section. By concentration each section increases in efficiency, and is able more rapidly to adapt its work to changed conditions. It is a disturbing factor when one division seeks to fulfil the functions of another. Municipal engineers, consulting engineers, contractors, and manufacturers each usefully occupy their own field, and it is to the interest of each class to set a boundary to their duties and respect the special knowledge of others. In discussion, the plane on which they mingle should be the higher one represented by the Institution: in trade they ought to co-operate, not oppose one another.

With regard to wiring questions, efficiency as a rule is best attained by employing only skilled labour, controlled by responsible contractors—the contractors working to the specification of experienced consulting engineers, who have duly weighed the special and local conditions, and can give consideration to the interests of the clients, be they owners, builders or suppliers. In the case of repetitive work, such as small houses in quantities, fees are probably best arranged beforehand in the form of low rates per outlet point, the rates being sufficient to cover the cost of inspection of work before it is covered up. Finally, installations all over the country should be brought into conformity with essential rules and tests framed by the Institution. Here Mr. Beauchamp's suggestion of graded sets of rules is worthy of serious consideration. But the real desideratum is yet to seek, namely, a very cheap method of wiring which complies with the best rules and tests.

The pressure at which small installations are supplied varies, but manufacturers have long been making H.V. accessories, and little, if anything, is to be gained by lowering the resistance, or reducing the spark gaps on these. The lower pressures are generally on A.C. circuits, where, owing to their nature and the common adoption of auto-transformers, it is advantageous to have good margins of safety on switches, &c. Manufacturers can influence cost reduction by judicious standardisation of everyday articles, and the standards should have the approval of the Institution. Distinct definitions of carrying capacity are much needed for accessories, as many of the fitments on the market are overrated in regard to this.

Attention is directed to the value of inspection of samples of concealed wiring. In all conduit systems, inspection is simplified if the cables are fitted on the "draw-in" method. The tube runs require more careful planning than is the case with "threading" methods, and the cables themselves have less handling, and are likely to last longer as the plaster may be allowed to dry before wires are put in place.

In the brief comment on this paper, in our last issue, we referred to wiring through joists—suggested by several speakers. We do not consider that the ideal cheap system is to be found in this direction. The method was much used in America at one time, but is now almost abandoned, although the greater use of wood in building construction was more favourable to its adoption there, than is the case in our brick and lime buildings with soundproof floors. Such a system can only be fitted with reasonably low labour costs on new buildings, before floors are laid, and very excellent cable insulation is required to withstand the after labours of the carpenter and plasterer.

With regard to earthing, the author notes the importance of grading the earth connections to sustain the main fusing current without appreciable temperature rise.

On systems where the apparatus and tubes are not continuous, a substantial earthing wire or tape running throughout the installation is proposed. Again, it is suggested that in systems where slip sockets are used, only those portions which are in wet situations should be earthed and the remaining lengths isolated by insulating couplings, further protection against corrosion and accidental contact being provided by brading the external surface of the tube lengths. Situations occur where these methods may be applied with advantage, but they are not so common in small installations, and we consider that as a general rule it is preferable to make the metallic sheath electrically continuous throughout. To insulate the outside of tubes adds to the cost, the external insulation may retain dampness, and in nearly all buildings it is not difficult to arrange local insulators between conduits and structural metal work or gas pipes. It is right to emphasise the importance of avoiding contact with such metal work, the dangers of which are often overlooked by wiremen, or the bellhanger or gasfitter who follows the wiremen. Such harmful contacts can only be effectively tested for, however, if the conduit is quite continuous electrically.

We are attracted by the proposal to encourage the use of flexible armoured systems for heating requirements. The heating circuits in small houses are simple, and the outlet points being near floor level enable one to adopt surface wiring without offence. Much of the objection to install "heating" is overcome if the tenant gets a system which he can take with him when removing to other premises.

It is apparent from the foregoing, and more evidently so from the more detailed report of the paper and discussion given elsewhere in our columns, that rules for wiring can deal only with general principles, and that no simple specification can be made applicable to the varying conditions of practice.

A gas stove on rental can be removed if the tenant or his

successor declines to use it, but not so with electric wiring. It may be possible to devise a sound system of surface flexible wiring radiating from one centre to each light, and capable of easy removal. An alternative and better method would be to make the house owner permanently responsible for the house wiring, and collect the rental from him. In the latter case it might be necessary to use better cable than indicated in Mr. Beauchamp's table of costs, otherwise, by the time the owner had paid for the installation, its useful life would be at an end.

Modern Wiring Practice.

By J. W. Beauchamp, Chief Electrical Engineer, Tunbridge Wells.

(*Abstract.*)

It is the object of the writer to draw attention to the features of modern wiring practice and regulations in so far as they influence the cost of small installation work.

To enforce regulations in detail, without obstructing work and progress, is a comparatively expensive matter, requiring experienced and conscientious inspection and a decided sense of proportion on the part of the inspector. The proper course appears to lie in drafting simple and definite rules dealing with :—

1. Safety of the consumer.
2. Non-interference with the proper working of the supply to other consumers.

The requirements of these regulations to be made as light as possible, but the enforcement of them to become more stringent.

A change in this direction should secure greater uniformity of work, tending to lower the cost of high class wiring and force up the quality of the lower class work, as in the latter almost all the trouble arises from insufficiently skilled labour ; the employment of competent and full priced wiremen would frequently reduce the prime cost of jobs, and save good material from being reduced to a secondhand condition before it is even put to work.

Simple model specifications issued by the supply authority describing the requirements of good practice suitable for several different classes of wiring work would do much to render practice and prices more uniform. In any case, in view of the rapidity with which electrical practice changes and the fact that so much of our work is secured in competition with other systems of light and energy supply, it is undesirable that wiring regulations, however simple, should be administered in an inflexible manner, or pass under the control of any centralised body not directly interested in the commercial development of the supply undertakings involved.

An analysis of the published regulations of a number of British and foreign authorities controlling or advising upon electrical work shows how great a divergence exists in their requirements, and suggests that, even after allowing for climatic differences and local conditions, the cost of wiring must be affected considerably by the varying limits imposed.

The usual I.R. test depends more upon dryness of the building and care used in connecting up fittings than upon the actual resistance of the dielectric, and a fair result may be obtained from wiring which has suffered considerably by careless workmanship and may be doomed to early failure. For these reasons, a much lower I.R. than is usually called for would suffice, but should be supplemented by inspection of samples of hidden work in every case.

The limits of capacity of branch circuits vary from 2 to 15 amperes ; it would appear that the true limit lies in the ability to make proper current-carrying connections in the various "loop-in" fittings used on branch lighting circuits ; 10 amperes should be a workable maximum.

The limit of motor capacity which may be connected to one side of a three-wire system ranges between 1½ and 9 kw. ; these limits should depend upon the capacity of the system ; in some cases most stringent regulations are issued by very large undertakings.

The motor starting current maximum is best stated in "limiting amperes" for any motor on a system or district, according to the capacity of cables or transformers.

Amongst several existing provisions which now seem curiously out of date are the following : Motors to be insulated ; no installation to have less than two branch circuits ; no copper fuses to be used ; S.P. switches to be used on each main ; meter shunt wire to be taken to lamp side of consumer's main switch ; slip conduit prohibited ; metal conduit to be avoided if possible.

A few, however, are conspicuously in advance of the period when they were written—for example : Bathroom lights to be out of reach of persons in water ; tubes and frames to be continuous and well earthed to waterpipes ; no elbows to be used in conduit ; no single wires to be used, and none less than 3/22's ; the use of key socket holders to be restricted ; internal lighting fittings to be insulated ; meter main coil and all S.P. switches to be on live side of supply (this provision should be tested for and insisted on in all cases).

The Government Regulations of the South African Union recommend that all conduit and fittings should be out of reach of persons standing in or on the bath, or on a wet floor, and that porcelain switches should be used and key socket holders avoided ; such a regulation has much to recommend it.

Several regulations in the more modern codes could be made general with advantage, *e.g.* : Electric irons to have some indicator showing when current is on ; capacity of cables for motors to be calculated on basis of short-period overload ratings, and on basis of starting currents ; key socket holders in groups of not more than eight to be controlled by one separate switch ; (one lamp of each group might have a plain holder, when the burning of that lamp would indicate that the control switch was "on").

In addition, a distinct definition of current-carrying capacity for switches and fuse fittings is needed ; most modern patterns fulfil every requirement with regard to breaking circuit, but are greatly overrated so far as concerns their power of carrying full-load current continuously.

Earthing Regulations mostly fail to define the essential requirements for security from risk of shock or fire, which are that every part of a metallic sheathing or conduit system containing conductors shall be permanently connected to earth by a conducting path of sufficiently low resistance to carry, without sparking or heating at any part, the maximum current which the main fuses of the installation will pass.

The earth wire also, whilst requiring a definition of minimum size for reasons of mechanical strength, should have a stated size depending on the capacity of the installation ; the minimum might be No. 18 S.W.G. The sizes used should bear a relation to the main fuses, or circuit-breaker setting, of the system protected, being selected to carry the full current required to open the circuit without appreciable rise in temperature. Where local circumstances require the earthing wire to be of considerable length, its area should be proportionately increased. As an example of safe practice :—For all lengths up to 20 yards, and current up to 50 amperes, No. 18 S.W.G. ; up to 100 amperes, No. 14 S.W.G. ; up to 250 amperes, No. 12 S.W.G.

The earth connection can be tested at intervals from different points of the installation by taking an ammeter reading between it and the live poles of the wiring through a small known resistance. The readings will show up any change in the state of the earth connection and prove its energy discharging capacity in a way which tests with a bell or lamp do not do.

It is desirable to avoid connection to girders and constructional ironwork, which is often insulated by concrete, and even if it appears to be well earthed, may be so through gas or other pipes making variable contact, and subject to removal ; to gas pipes of any kind ; to hot water and hydraulic supply pipes, as they are often jointed with imperfectly conducting material or are only connected to a water supply system through a tank and ballcock ; to water pipes drawing supply from cisterns fed by ballcocks, or from wells, as the connection may be broken by lowering of the water level below the delivery or suction pipes ; to other earth connections provided for telephones or bells, as these may increase in resistance or provide an alternative path through the instruments to other earths.

In an ordinary house wired with slip-joint tube, a leakage current occurring at any point at all remote from the service entry will probably have to run the gauntlet of sundry loose connections under floors and behind lath partitions on its way to earth. Undoubtedly these considerations present one of the gravest objections to the simpler systems of metallic conduit. Some device is needed to protect concealed wiring mechanically without involving the danger of spreading a leak, or the difficulty of furnishing a completely earthed sheath.

It would seem worth while to consider the extension of the principle of I.E.E. Rule 46 (1907 Ed.), earthing only portions of tube within usual reach in wet places, and keeping the remainder in isolated single lengths by the use of fittings and sockets which actually insulate instead of partially connecting as at present.

The principal weakness of the earthing precaution lies in the fact that it is not essential to the working of the installation, and the wires and joints upon which it depends may suffer damage without the fact being revealed until they fail to give the expected protection.

The first test of a good-class slip conduit lies in the interchangeability of the tubes and fittings and the possibility of making firm metal-to-metal joints at all points after removing the enamel. One of the reasons for using inferior conduit on low grade work lies in the fact that fittings are an easier fit and more rapid erection is secured, at the expense, of course, of continuity.

One of the greatest safeguards for the consumer lies in the use of correctly proportioned fuses, and, where possible, the cartridge form or the modern development of the old Edison screw plug fuse, such as the "Zed" and "Dial" fuses should be used. Consumers should be provided with simple information with regard to fusing, as it is not possible to prevent untrained persons from replacing blown fuses. The supply authority could well take this matter up by using printed cards to be fixed by the service cut-out and the distribution boards, stating the usual fuse sizes rendered in terms of lamps and wire gauges.

The metallic-filament lamp has led to a very general use of pressure-reducing transformers on A.C. distributions over 100 volts, and in some cases also on direct-current supplies where the importance of the installation has justified the use of rotary transformers. The use of low pressures has not apparently made much difference to wiring practice, nor has it become general to use material of lower insulating quality on new work where pressures of 50 to 100 volts are intended.

Small transformers are responsible for a considerable number of faults on consumers' premises, particularly where their cores and frames are connected to earth.

It is somewhat unfortunate that suppliers have not endeavoured to keep control over house transformers by a rental system, which would have done much to keep up quality and avoid troubles which have arisen from improper selection of voltages, errors in connection, and waste through excessive magnetising consumption.

B.C. holders, used for lamps hanging below the holder, will carry 2 amperes (400-c.p., 200-volt, metallic lamps) without trouble, and 1¼-ampere radiator lamps (250-watt, 200 volts) with holder beneath the lamp. Where, however, heating lamps are hung downwards, trouble may arise owing to the concentrated updraught of hot air. The percentage of holders called upon to carry more than 1 ampere (100-c.p., 100-volt, metallic lamp) is quite small, and some modification of the plungers and springs for such purposes should not be difficult to arrange.

The most important recent development in wiring appears to be the re-introduction of the concentric principle in the form of the "Stannos" wiring system. This material is now well known, and where it is possible to work on the surface of a building and use concentric conductors with the outer or return sheath earthed, a saving in cost of 10 to 15 per cent. over slip-joint conduit wiring can be secured by means of it in the hands of men accustomed to its use. As the superior economy of this system over conduit is only apparent when the wire is used concentrically, it has so far been most successful on alternating supplies, where the use of a transformer affords a ready means of isolating the consumer's wiring from the supply network; as such transformers may also be used to reduce voltage, their cost is not altogether chargeable to the concentric wiring.

The great value of this material lies in the fact that faults quickly develop into short-circuits and put the bad section out of use, whilst repairs are easily carried out; in addition, all the simplicity and advantages of a single-pole system are secured.

Flexible Wiring has been much discussed from time to time, but no effort made to define its utility or to establish any regulations which might make it safe for certain classes of work without rendering it too expensive; in consequence, a considerable amount of such wiring is actually in use in this country, the material being used in a most improper manner, and only saved from failure by its high quality. A heavy armoured and fairly flexible cord to carry up to 10 amperes without overheating, and provided with good plug terminal fittings and fuses of the cartridge type, might reduce the first cost and consequent difficulty of inducing users of electric light to put in heating and cooking apparatus; such wiring could also be a tenant's fixture capable of removal to, and use in, other premises.

A disadvantage peculiar to all fixed surface-wiring systems lies in the difficulty which is met with when redecorating walls and ceilings, particularly when papering. This fault is sometimes lost sight of by those who advocate such systems on the grounds that existing decorations will not be injured.

The influence of the system of wiring adopted upon cost is indicated by the following figures, which, although actually variable according to circumstances, are relatively representative of the principal methods available for wiring small houses. On the cheaper systems labour costs become a much smaller proportion of the total, suggesting that it is only under some organised scheme of wiring houses in quantity, such as might be arranged by a supply authority, that the fullest economy of these methods can be realised.

Relative Cost per Light of Wiring in Small Private Houses complete with Metallic Lamps and Simple Pendants.

	Percentage of No. 1.		s.	d.	Per Light. £	s.	d.
Screwed seamless conduit (steel) and 600 meg. class non-association cable.	123	Conduit ...	5	9	1	2	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	5	3			
Brazed slip conduit with clamp continuity fittings.	116	Conduit ...	5	6	1	1	3
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	3			
Brazed slip conduit and 600-meg. class non-association cable.	107	Conduit ...	4	0	0	19	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
Brass-cased paper tube ...	104	Tube ...	3	6	0	19	0
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
No. 1.—Close joint slip conduit (steel) and 600-meg. class non-association cable.	100	Conduit ...	2	9	0	18	3
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
Wood casing and 600-meg. class non-association cable.	96	Casing ...	1	3	0	17	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	9			
Stannos wiring (concentric).	71	Cable ...	6	3	0	13	3
		Fittings ...	5	9			
		Labour ...	1	3			
Twin rubber and lead-covered cable.	71	Cable ...	6	3	0	13	3
		Fittings ...	5	9			
		Labour ...	1	2			
Rubber and cotton flexible and button insulators.	70	Cable ...	5	9	0	12	9
		Fittings ...	5	9			
		Labour ...	1	3			
600-meg. class non-association cable and cleat insulators.	57½	Cable and insulators	3	6	0	10	6
		Fittings ...	5	9			
		Labour ...	1	3			

Discussion.

A brief discussion took place on this paper.

Mr. S. E. Fedden (Sheffield) said that his department had little trouble in getting houses of £30 per year rental, providing they were not piped for gas, and even smaller houses might be secured if the builders' co-operation were obtained. While not an advocate of jerry wiring, he thought it necessary to practice economy, and many features of the wiring regulations would have to be modified if the small consumer was to be connected. Even where a carefully considered installation was put in, the consumer added indiscriminately to his load. It was a great pity that installation work in so many towns was in the hands of contractors; the consumer wanted sufficient light at a reasonable cost, but the contractor's idea was to supply as many lamps and fittings as possible. His mistakes had to be rectified by the supply authority, who were often blamed for them in addition. He had always believed in the 200-volt lamp, and did not favour pressure reduction; in Sheffield there were cases where the use of auto-transformers had increased, instead of decreased, the consumers' accounts, and the Corporation had had to replace the transformers owing to their excessive magnetising losses. As to Stannos wiring, it was too expensive; a certain job for which estimates were prepared came out as follows:—With wood casing and 600-meg. cable, £35; with I.M.E.A. "flex," £35; with Simplex steel armoured "flex," £41 10s.; and with Stannos concentric, a double-wound transformer and earthed outer, £42 10s. He did not like either slip joint or the more expensive screwed conduit, but had not found a substitute.

Mr. F. M. Long (Norwich) said that 14 years ago they started free wiring of small houses of £10 to £15 rental, and he found that most of the troubles were electrolytic, and not due to overloading; as these only occurred in damp places, it was necessary to adopt suitable wiring. The general practice was to attach the wires to the joists, and this was found satisfactory. In new houses close joint tubing in the walls was used, but solid tubing was more satisfactory; pure rubber flexible, though rather more costly, was preferable to vulcanised.

Mr. W. A. Vignoles (Grimsby) thought that more attention should be given to wiring on easy terms, and that everyone should have power to carry out such work. All slip joint systems of wiring were bad, as it was not possible to make them mechanically continuous, and the clips were often missing. The system they had found most economical was to use two single lead-covered wires, run through holes in the joists, with wires to switches in tubing in the walls. He had found paper-insulated lead-covered cable satisfactory in large installations. Earthing was an important point, where there were gas pipes; in concluding, he drew attention to the use of the double-wound transformer on A.C. systems, with pressure reduction to 25 volts, and no fuses on the L.T. side.

Mr. Frank Ayton (Ipswich) advocated the use of wood casing, which in damp situations, should be supported on insulators and coated with waterproof paint. In his opinion switches should be rated on a wattage basis and an endeavour be made to standardise ceiling roses and switch blocks for wiring positions, also wall plugs and sockets, which were not interchangeable though nominally the same size.

Mr. A. J. Cridge suggested the necessity of using some discretion in enforcing wiring regulations; and owing to lack of time Mr. Beauchamp decided to communicate his reply to the proceedings.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Notice to English Firms.

In your issue of last week you have a letter under the above heading from T. O. Mullings, engineer in charge of the Electric Light Works, Mansourah, Egypt, which apparently refers to myself. After returning from Egypt, I travelled for an electric lamp firm on commission (being an old telegraph and electrical engineer, *too old at* 40) this being the only way to earn a living. As this did not pay me, I applied to other General Electric Manufacturing firms for employment, but got reply that they had no vacancy for a traveller. In course of conversation with these firms, and as I had been both in Egypt, India and other countries, I was asked could I give the names of any buyers of electrical plant. Naturally I did so, and as all managers want new business I suppose they wrote to these addresses—Mr. F. T. Murdoch, the proprietor of the Mansourah Works, being one of them. I was asked could they use my name. I replied that it would be useless, as although I knew most of them personally, I had *not had* commercial dealings. So you see it was purely a business affair of no benefit to me except that they promised, in the event of their getting orders, they would make me a present as commission.

I am now travelling for the firm T. O. Mullings refers

to, and in course of my occupation I wrote to Mr. F. T. Murdoch (Mr. Mullings's *employer*) asking for orders for our goods—*is there harm in this?* I should think Mr. Mullings would be only too glad to get a list of various firms' prices without grumbling and trying to injure an innocent person.

Moreover, Mr. Mullings is untruthful, as both his employer, Mr. Murdoch, and himself have on several occasions been in my company. In fact, I have letters from Mr. F. T. Murdoch since leaving Egypt—and again I did not state I worked for him, but had been employed in Egypt, &c., and at Mansourah, and knew them, which is a fact.

In fairness to myself, I trust you will kindly insert this in your next issue.

Wm. O. Rogers.

Bradford, *July 1st*, 1911.

Diversity of Tariffs.

I wish to draw your readers' attention to the present diverse methods of charging for current used by motor-generators supplying projection arc lamps in connection with cinematograph machines.

At present my company has 12 machines running from 12 noon until 10.30 p.m., and the cost varies from 3¾d. to 0·875d. per unit. In two cities we are charged at full lighting rate because the authorities state that the ultimate use of the power is the production of light. Our reply to this is :—

(*a*) The projection arc is the apparatus by which we carry on our business, and, from our point of view, more essential to us than a lathe in a machine shop or a circular saw in a timber yard.

(*b*) The load factor is a good one—45 per cent. to 50 per cent.—and therefore for this reason alone the current should be cheap.

(*c*) An electric arc furnace undoubtedly produces light, but we have never heard of one being charged at full lighting rate when taking current from a public supply.

In conclusion, I may mention that in one city where the supply is single-phase A.C., we have an auto-transformer installed as an emergency standby for the generator, and the current to motor-generator is charged at power, while that consumed when the transformer is in use is charged at lighting rate.

Is this consistent with business principles?

Provincial Cinematograph Theatres, Ltd.,
RONALD GRIERSON, *Engineer.*

London, W., *July 3rd*, 1911.

Advantages of "Free Wiring."

The objections raised by Mr. Goody to "free wiring" are quite in order on the system he has mapped out, but it must be remembered that all systems are not alike, and the difference between them gives one an opinion quite contrary to his. For instance, there is the municipal undertaking supplying electricity, also the independent supply authorities, and the difference between these alone makes the difference of opinion.

The system adopted here is :—Three points are wired in any house complete with tungsten lamps (from 25 to 100 C.P., as desired), and opal shades on a payment of 5s., and energy is supplied at 6d. per B.T.U. (5d. per unit being the ordinary charge), with no meter rent or any other charges ; the tenant is held responsible for the lamps, &c., and to put them in thorough repair when leaving the house. Should extra lamps be required, for instance, in bedrooms, &c., a charge of 6s. each is made, which covers nearly 75 per cent. of the cost of same, as will be seen.

A trial of the above system was made last summer, which generally is a slack period to permanently-employed wiremen, and about 70 houses have now been fitted with an average of four lights each.

Taking the average cost of installing three lights using 40 ft. of 1¾-in. casing and capping, 20 ft. 1½-in. c. and c., 30 yd. 3/22 cable, six 3½-in. round teak blocks, one 6 × 6 block, three ceiling roses, three tumbler switches, three holders s.c. and c.g., two cut-outs, three tungsten lamps, three shades 8-in. opal, one D.P. switch, 2 yd. flex 35/40, labour and accessories, the cost works out to £1 8s. 4d., including the fixing of the meter and main cut-outs ; out of this 5s. has been paid, leaving 23s. 4d., not including the meter, mains and fuses.

The supply to houses is effected by aerial lines run parallel to the street ; two swan-neck insulators are screwed into the nearest pole, and two insulators are cemented into the wall. A No. 12 hard-drawn copper-wire forms the mains to the wall insulators, from which insulated wires are taken to the cut-outs ; in many instances one pair of mains serves two to three customers, and in this way as many as a dozen or more customers are connected up in two days. The first day the insulators are cemented into the wall, and the next the wires are run, two men being employed on mains. New houses are piped and the conduit is laid in the plaster ; in fact, there is absolutely no difference between these customers and the one who pays for his wiring, as regards the system of wiring.

The advantages of the system are many. The light has been brought within reach of the labourer ; he is, as is generally the case in a colliery district, either a chairman, member or deacon of some committee, club or public institution, therefore he has a voice in the matter of lighting should it come his way, for he has tried it with very little cost to himself, and at the same time is a customer one would rather have than lose. It is the most economical light he can use, getting 5¼ hours' light from a 32-watt lamp for 1d., the price of gas in this district being 4s. 3d. per 1,000 cb. ft. The gas company here have a "free installation scheme," supplying three points with inverted mantles, and a cooking range ; the price of gas is raised to 5s. 6d. per 1,000 cb. ft., no meter or cooking range rent being charged.

The gas company have carved their way to success by this method, and it is now left for us to follow on the same lines, for we can do no better ; but the greatest drawback to us lies in the excessive price charged for prepayment meters, namely, from £3 10s. to £4 10s. each, exceeding the cost of wiring for three lights by over 200 per cent., the extra charge levied of 1d. being more for the payment of the meter than the wiring ; therefore, unless the meter makers can turn out as cheap and reliable a meter as the electrolytic type, I shall content myself with using the latter.

A. Preston, *Electrical Engineer.*

Ammanford Electric Supply,
Carmarthenshire, *June 26th*, 1911.

Appointment of Meter Tester.

I should like to draw your attention to the above notice in the "Situations Vacant" column in the current number of the REVIEW.

I submit, Sir, that from the purely business point of view it is bad, from the moral standpoint it is simply scandalous, to ask for a *competent* assistant to do *responsible* work, of the order they require, for 26s. per week !

If the notice means what it says, it also means that the Stoke-on-Trent people will not find anybody in their own district who is *competent* enough to do the work ; is then a man to come from the ends of the earth—and to live in digs—for 26s. weekly ?

With regard to the moral aspect, words fail me ; something is evidently very wrong with the electrical industry (or its chiefs) to countenance such a thing.

I should hope and think that the people concerned will feel ashamed of themselves when they read their own advertisement, together with the one immediately underneath it.

Responsible Meter Tester.

Birmingham, *July 3rd*, 1911.

Electrical Fatality.—Early in June a watchman, named Wilkins, employed by the Victoria Falls Power Co., was killed while cleaning in a high-tension chamber. Part of the station was dead and part alive, and somehow or other the deceased got his foot inside the live Section ; the sole of his left foot was burned away.

LEGAL.

National Telephone Co., Ltd., *v.* the Postmaster-General.

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Farwell and Kennedy, on Wednesday of last week delivered a considered judgment in this case upon the cross appeal of the parties from a decision of the majority of the Railway and Canal Commissioners.

The Master of the Rolls, in giving judgment, said: The appeal depended upon the true construction of what was known as the purchase agreement of 1905. The effect of the agreement was that on or as from December 31st, 1911, the company was to cease to transact any telephonic business within the monopoly, and the Postmaster-General was to purchase, subject to certain exceptions, all the property of the company in or as on that same date. The Railway and Canal Commissioners were to settle any differences as to the exceptions and also the value as on December 31st, 1911, of everything purchased and not within the exceptions. It would be observed that all plant, land and buildings in use at the date of the agreement of 1905 were to be purchased on December 31st, 1911. But plant subsequently acquired by the company was only to be purchased if it was constructed in accordance with a scheduled specification, and land and buildings subsequently acquired were only to be purchased if acquired or constructed with the consent in writing of the Postmaster-General. It was part of the arrangement that the Postmaster-General should have the right to object to buy certain property which would otherwise fall within the terms of Clause 2, provided he gave notice 12 months beforehand, and the Commissioners were six months beforehand to award whether the objections were capable of being maintained. The Commissioners were also on, or as on, December 31st to ascertain the value of the purchased property in case of difference. This part of the arrangement was found in a clause which it was necessary to read carefully:—"In the case of (*a*) plant not constructed in accordance with the specifications and rules set forth in Schedule 3, and (*b*) plant of any kind, land and buildings in use on January 1st, 1911, for the purposes of the company's licensed telephonic business in competitive areas, the Postmaster-General may, by notice in writing given to the company not later than January 1st, 1911, object to buy such plant, land or buildings as he considers will be unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911." It would be observed that the right of objection to plant on the ground of construction under (*a*) was without limit of locality, whereas the right to object to plant, land and buildings under (*b*) was limited to competitive exchange areas, a phrase defined in Clause 1. It was plain that, although (*a*) was wide enough to include competitive as well as non-competitive areas, in practice it must be confined to non-competitive areas. It was also plain that the words "plant of any kind" in (*b*) comprised all plant mentioned in (*a*), including the scheduled list plant. The battle in this Court had raged around the word "unsuitable." He agreed that the primary meaning of "unsuitable," apart from the context, was unsuitable in nature or quality. But that word did not stand alone, nor was it, in his opinion, the most important word in the sentence. It was not the same thing as unsuitable for use in the telephonic service by reason of its character or nature. The word "actual" confined the gift of prophecy to what would happen on December 31st, 1911, and forbade speculation as to what might happen at a more remote date. In his opinion, the meaning of the clause was reasonably clear. It dealt with the case of a competitive exchange area where the Post Office had already, or probably would have, a service in full operation. If the P.O. had in that area adequate provision for the needs both of the company's subscribers in that area and of its own subscribers in that area, the Postmaster-General was entitled to say, 12 months beforehand, "I shall not want this on December 31st. All the requirements of my service will be satisfied without this; it is not suitable for my requirements." The circumstance that (*b*) was not confined to plant but extended to land and buildings, seemed to strengthen the argument that the expression ought not to be narrowed so as to apply solely to nature or character. There were other indications in the agreement which confirmed his view, especially Sub-Sec. (*b*) of Clause 3. That sub-section dealt with plant constructed during 1911 and with buildings constructed or acquired during 1911, and such plant must be in accordance with the specification, or there would be no objection to purchase under Sec. 2 and by it a right to object to three months after December 31st was given. And the question for the Commissioners was to be "suitability of the plant for the actual requirements of the telephonic service of the Post Office on December 31st 1911." It seemed to him that these words could not be limited to nature and character for *ex concessis*, the plant was free from objection on that score. It was not easy to understand why (*b*) was limited to competitive exchange areas on any other view. In such cases there would obviously be a danger of duplication and of superfluous plant and buildings—a danger which would not exist to the same extent in non-competitive exchange areas. He had not overlooked the fact that (*b*) did not apply to all places in which competition existed, but was limited to 15 named competitive exchange areas. These were most important areas, and the parties were content to deal with them separately and apart from the rest of the country. With great respect to Mr. Justice A. T. Laurence, with whom Mr. Gathorne Hardy concurred, he thought he gave too narrow a construction to the words "unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911," and he agreed with the opinion of Sir James Woodhouse on this point.

The next question for decision arose upon Sub.-Sec. 2 of Sec. 3. The scheme of that clause was that the Postmaster-General was to give notice in writing of his objection before 1911. If the notice was not acquiesced in by the company, the company must obtain an award from the Commissioners before June 30th, 1911, that the property specified in the notice was suitable for the actual requirements of the telephonic service, otherwise the objection was to be deemed valid. Now, as the notice of objection must be given in 1910, 13 months before the subject matter of the purchase could be ascertained, it seemed to him impossible to contend that the notice must specify every detail. It must be sufficient to indicate in general terms the nature of the property to which objection was taken. For example, all plant falling under a particular description, attempting to give particulars of the place in which such plant will be found, or the quantity of such plant, it would be for the company to apply to the Commissioners for an award that the objection was wholly bad or partially bad. Sir Alfred Cripps put forward as an example a cable containing several hundred wires, some of which only were used for licensed telephonic business. The company might contend that such a cable was in use for the purposes of the private-wire business, and that the Postmaster-General was bound to purchase it because the wires could not practically be severed. The Commissioners would decide one way or the other, and the cable would either be excluded from the purchase or not according to their decisions. He expressed no opinion on this point. The decision thus given would govern all similar cases, and there would be no difficulty in applying the principle to the very numerous items in existence on December 31st, 1911. He felt no doubt that a general notice such as he had indicated was perfectly good. It was not made bad because it might include items which could not be properly objected to. In his opinion all the notices were good in this sense, namely, that unless the company obtained an award in their favour, either wholly or in part, the property falling, on December 31st, 1911, within the category objected to, would be excluded from purchase. The opinion of the Postmaster-General expressed in the notice was, *primâ facie*, decisive, and the burden was thrown upon the company as challenging that opinion. It was obvious that questions of difficulty must arise. But he felt confident that the decision by the Commissioners of a comparatively small number of typical or test cases would dispose of these questions, and that with few exceptions the highly competent experts on both sides would agree to details without appealing to the Commissioners in their character as valuers under Clause 4 of the agreement after December 31st, 1911. With great respect to the learned Judge, he was unable to agree with his view as to the invalidity of the major part of the notice. His Lordship added that, in his opinion, the declaration contained in the order of May 29th, 1911, should be discharged and the following order substituted:—Declare that the words "unsuitable for the actual requirements of the telephonic service of the Post Office" in the purchase agreement do not relate solely to the nature or character of the plant, land or buildings. Declare that the fact that plant, land or buildings will not be actually required for the telephonic service of the Post Office on December 31st, 1911, owing to possession by the Postmaster-General on the said date of other plant or buildings adequate and suitable for the actual requirements of the telephonic service of the Post Office on that date, is a valid ground of objection by the Postmaster-General within the meaning of the purchase agreement. Declare that the above declarations are applicable only to competitive exchange areas as defined in Clause 1 of the purchase agreement. Declare that all the notices of objection given by the Postmaster-General were valid and sufficient."

The Lords Justices delivered judgments to the same effect, and the appeal of the Postmaster-General was therefore allowed with costs, and the cross appeal of the company dismissed with costs.

Canning & Co., *v.* Northern Metallic Flexible Tube Co.

(*Concluded from page* 1033.)

Mr. Waugh, K.C., opening the defence, said that plaintiffs had not made a machine of this nature before. The defendants agreed to purchase a plant which would do its work, and not an experimental machine. Plaintiffs' plant did not fulfil this expectation. Previously to its installation, defendants had never received complaints from customers about their flexible tubing, but now there was nothing but a succession of complaints, because the strip oxidised and rusted. If it were proved that orders ceased to come because of the unsatisfactory work of the apparatus, it would be for the Referee to consider what damages defendants were entitled to.

Mr. Albert Crowther, trading under the name of the defendant company, said he had been engaged in the manufacture of flexible tubes for some years. It was necessary to galvanise the steel strip used in this tubing in order to prevent rust. He decided to do the galvanising on his own premises and approached plaintiffs with a view of having a galvanising plant installed. A contract for £230 for a plant was submitted. The machinery was put down, but he never succeeded in producing saleable strip from it. Plaintiffs tried to do so themselves, but failed also, and eventually took it away, after an arrangement that the dynamo installed should be retained, but the rest of the plant renewed. Plaintiffs asked £350 for the second plant, but defendant refused to pay that sum, because he said the failure of the first plant had occasioned him considerable loss. Eventually it was agreed that the price should be fixed at £260. After its erection, the plant did not run properly. Eventually he wrote to the plaintiffs stating that the plant would never be a success until the iron and lead vats were replaced by slate vats and the terminal winder lined with wood. Not obtaining satisfaction, he refused to pay th

balance of the contract price, and the present action was commenced. Since he had had complaints about defective strip, owing to the inefficiency of the machine, he had lost orders, some of his customers having ceased to deal with him altogether.

Cross-examined, WITNESS said he was the sole partner in the defendant firm. He admitted that he had only taken up the galvanising branch of his business during the last four years, and did not profess to be thoroughly competent at it. He knew nothing about electric currents, &c., when the plant was installed. He denied that he worked the machine with damp sawdust. The machine ran with a varying speed instead of an even drive, with the result that at times the strip passed through the sawdust so quickly that it was not properly dried. The bad colour of the strip was not due to the inefficient drying of the sawdust bath, but to the fact that the electrolyte was not properly cleansed from the strip. The swill boxes failed to act efficiently.

MR. SHERARD COWPER-COLES, managing director of the Cowper-Coles Co., electro-metallurgists, said that he was the first man to introduce electro-galvanising commercially about 25 years ago. He examined the plant in question at Bradford. The dynamo was too small, and the galvanising tank was wrong from a mechanical point of view. The plant was also faulty from an electrical point of view. The anodes were not in the proper position. The passing of the strip in and out of the tank caused lamination. There was also belt slip, which gave a jerky action and increased the liability of the strip to snap. For good working it was necessary to have a very long tank and a straight run. It was not possible to get satisfactory results unless the strip ran horizontally through the electro-galvanising plant. So far as general design was concerned, he did not think the Bradford machine could ever be got to work satisfactorily.

Cross-examined by MR. TERRELL, WITNESS said there were only two makers of flexible tubing in England who galvanised their own strip.

WITNESS would not admit that a certain amount of sodium chloride or potassium chloride in the electrolyte would improve its efficiency. It was impossible to cleanse the electrolyte off the strip by means of the cold water jets fitted on the plant in question. The strip should be passed through a tank of boiling water.

MR. COWPER-COLES was still under cross-examination when counsel conferred, and MR. WAUGH asked the Referee to adjourn. A suggestion had been made which would be submitted to his clients.

The LEARNED REFEREE consented to an adjournment, and on Friday morning (June 30th), when the case was called, MR. WAUGH said that the parties had agreed to terms which were endorsed on the briefs, and would not be mentioned publicly. He asked his Honour to make an order in accordance with those terms.

MR. MUIR MACKENZIE made an order as desired.

The National Telephone Transfer.

ON Monday, July 3rd, before the Railway and Canal Commissioners, Mr. Justice A. T. Lawrence, the Hon. A. E. Gaythorne Hardy, and Sir James Woodhouse, had before them again the matter of the National Telephone Co., Ltd., *v.* The Postmaster-General, upon an arbitration in respect of disputes arising out of the agreement for the transfer of the applicants' undertaking to the Postmaster-General. Sir A. Cripps, K.C., Mr. Danckwerts, K.C., Mr. Forbes Lankester, K.C., and Mr. Morten, K.C., led for the applicants; and the Attorney-General (Sir R. Isaacs, K.C.), and the Solicitor-General (Sir J. Simon, K.C.), led for the Postmaster-General.

SIR A. CRIPPS said they now came to deal with the question on its merits. He had very carefully considered how they could best deal with it so as to minimise the trouble of an inquiry of this kind, and bring it, if possible, within reasonable limits. He thought he ought to call their engineer, Mr. Gill, in order to explain matters of fact, which it was necessary should be explained before they came to close quarters with some of the difficulties involved in the case. Before that was done, he would refer to the judgments given in the Court of Appeal. He then read the judgment of the Master of the Rolls and the other judges, and said that after the last hearing they wrote to the Postmaster-General asking him to give them some information on the question of duplication. The Postmaster-General replied on June 30th that the plant, lands, and buildings to which he objected on the ground that the same were not actually required for the Post Office telephone service, were described in Part 1 of the schedule to the notice relating to London, dated August 29th, 1910, and in the ninth paragraph of Part 2. Part 1 related to London, and in substance dealt with a number of exchanges and plant, wires and cables in connection with them, which, in the view of the Postmaster-General, ought to be excepted from the arbitration on the ground that they were not wanted. On Part 2 the Postmaster-General said there was only a portion of the plant he objected to, and the Postmaster-General had given four illustrations in his memorandum.

The ATTORNEY-GENERAL said the illustrations were not intended to be exhaustive. They referred to London, Brighton, Newcastle and Newport.

SIR A. CRIPPS said he understood the nature of the objection to be this: There was a change from the overhead to the underground system, as regarded the particular places indicated. When that was done there might still be the distributing wires overhead, and a distributing wire under the agreement was defined as a wire not more than a quarter of a mile in length. If it were more it ceased technically to be a distributing wire. What was suggested by the Postmaster-General, was that in changing from an overhead to an underground system, too much wire had been left, in certain cases, overhead, and some of it was not being used. He agreed they could not ask the Postmaster-General to take that which was not being used, but in these cases it would be a question of fact for the Court to decide. If the Court determined the point, say in regard to Tottenham and Wood Green, probably the engineers on both sides would work out the decision as affecting other places.

The ATTORNEY-GENERAL said the Postmaster-General stated in the letter of June 30th that it must not be understood that in giving these particulars he was confining his grounds of objection to the plant mentioned to the grounds of redundancy.

SIR ALFRED CRIPPS said he would first go into evidence so far as London was concerned. Probably the evidence as to London would cover other areas outside London. He intended to call engineers to show that the plant in London was suitable for the Post Office service.

Evidence was then called, when MR. FRANK GILL, engineer-in-chief to the National Telephone Co. since 1902, said he had had 26 years' experience of telephones, and had dealt with estimates totalling an expenditure of over £5,000,000. During the time he had been engineer-in-chief the company had added 300,000 stations to the system and 542 new exchanges. The work had been carried out under his supervision. In addition, many exchanges had been reconstructed and many lines placed underground, with the result that a large proportion of the company's plant and the connection of the services with the exchanges were on the most approved modern style. Particularly was this so in the case of the larger exchanges. About 68 per cent. of the total mileage of lines and cables were now underground.

SIR A. CRIPPS: Did you find any difficulty in applying these notices to the particular portions of your service?—Yes, no two competent engineers would arrive at the same conclusion on the matter.

His LORDSHIP: You mean the reading of the notices would be so very wide?—Yes.

WITNESS said there were 93 exchanges altogether belonging to the Post Office and the National Telephone Co. in the London area. Sixty-two of these belonged to the company and 31 to the Post Office. On December 31st, 1910, there were 118,596 exchange lines in the London area altogether. Of this number, 70,700, or nearly 60 per cent., belonged to the company and 47,896 or, roughly, 40 per cent., to the Post Office. The total number of exchange stations was 194,003, and of these 122,680 or about 63 per cent. belonged to the company and 71,323 to the Post Office. In substance the company's system comprised about two-thirds of the whole telephone system of London. In regard to the Avenue exchange, in witness's opinion, a considerable portion of the plant there ought to be maintained and utilised whatever the Postmaster-General's intentions might be. In the case of some of the notices it would be impossible to apply them for physical reasons, and, in other cases, they would amount to a ridiculous destruction of plant. In his opinion, the company had in substance no superfluous plant at all. Cables used for connecting condemned exchanges could not be done away with without interfering with other lines of communication passing through and beyond the area of those exchanges. In many cases within the London area separation between condemned lines and useful lines would be impossible. Into the Gerrard Exchange, for instance, to which he understood no objection had been taken, 33 cables entered, each carrying 600 pairs of wires, or in the aggregate 19,800 pairs. In 13 of these cables there were 496 lines connecting Gerrard with exchanges which had been objected to. These cables, however, were not separable because none of them contained only condemned wires. Most of the company's cables, too, contained spare wires. These wires were not more than was necessary, and were not separable from the other wires in the cables.

MR. JUSTICE LAWRENCE suggested that some method might be arrived at of avoiding the necessity for entering into so much detail. The Government, he said, thought they could not make their objections more plain in their notices, and, as things were, he did not see how the Court could get at the facts.

SIR JAS. WOODHOUSE said it appeared to him that what was really wanted was some scheme whereby the Post Office could show how the things they proposed to object to must come within the terms of the deed. That would save much necessity for going into detail.

The SOLICITOR-GENERAL: The agreement is an agreement by which we buy what we want, and we indicated what we wanted by the process of exclusion. It is not for us, but for them to explain their position.

SIR A. CRIPPS said his evidence was that not only on the question of "suitability," but on the question of "need" under Clause 3, there was the question to be considered of an inseparable piece of plant. If the plant was suitable at all, in however small a degree, or if it were wanted at all, then, according to the view of the company, and, as he believed of the Court of Appeal, if he appreciated its decision rightly, such plant could not be ruled out from the case under arbitration. When they came to determine prices, the degree of suitability and the degree of need might be important matters to consider. But what he had shown was that all these lines had, of necessity, elements of suitability, and could not be ruled out at this stage.

The SOLICITOR-GENERAL said he could hardly regard, as a way to the business solution, the proposal of the company that the Post Office should take over the whole of the company's undertaking, lock, stock and barrel.

MR. GILL was then examined as to the efficiency of the equipment of the company and its suitability for the service of the Post Office. He stated that the company had 880 instruments of the central battery type connected with the 21 London exchanges objected to by the Post Office. There were also 6,852 convertible instruments,

which, by quite a minor alteration, could be made practically central-battery instruments. In addition, there were 13,266 instruments of the local battery type. All these could be made, at a very small expenditure, available for use on a central-battery system. The local instrument when used in connection with a central-battery exchange, would still receive its energy for speech from the battery in the subscriber's office, but the method of communication would be greatly simplified so that the mere removal of the telephone from the hook would call the exchange, instead of having to ring. Answering other questions, Witness gave the result of certain calculations made by him, which showed, he said, that the central-battery system of the company was more economical than the magneto system of the Post Office. That central-battery system, he said, was very suitable for the use of the Post Office, and he, in fact, understood that the Post Office intended to adopt the central-battery system in some of its exchanges. Speaking as an engineer, Witness said any attempt to replace the 21 London exchanges objected to by December 31st would be likely to work an injury to the public service. Such a change, said the Witness, could not be effected in a short time, and ought not to be tried. In Witness's view, substantially all the plant covered by Part 1 of the notice was suitable for the working of the combined system.

Questioned with regard to the Postmaster-General's rejection of iron wire circuits, WITNESS said that in the few instances where iron wires did exist, they were suitable for the work. For instance, in one case, a very windy place, the ordinary copper wire was not stout enough, and with the consent of the Post Office itself, the company put up an iron wire there, and it was doing its work well. In such a case as that he was prepared to argue that iron wire was suitable.

His LORDSHIP: I thought the objection to the iron wires was that they failed in conductivity?—WITNESS: That is not so, my lord. The specific conductivity of iron wire is lower than that of copper wire, and if you want to get a certain degree of transmission, you must put heavier iron wire than would be the case with copper wire. So long as it is heavier, there is nothing the matter with it. There are only 86 miles of iron wire circuit belonging to the company, and of these 29 miles were especially arranged with the Post Office. Witness thought all the company's overhead wires would be suitable for the combined system.

SIR A. CRIPPS: As regarded the notice concerning any portion of your telephone line laid on or across or along a railway driven by electric power, have you ever had any danger or difficulty arising from the two systems coming into contact?—WITNESS: We have had one case where trouble arose, and that was in connection with the Bank Exchange and the District Railway in 1905, I think. At that time the District Railway was not an electric railway at all, but it was in the course of being converted, and ordinary precautions were not taken in connection with such work. By arrangement with the Telephone Co., the contractors who were converting the line were altering the position of our cables near the line. The railway line was not supposed to be alive, and the railway people had had instructions not to turn the current on until they had advised the company. Through some misunderstanding, however, the current was turned on. It so happened that one of the railway men had left a piece of steel troughing against the live rail. Without any examination to see if the rail was clear, the current was turned on and short-circuiting resulted, causing the trouble of fire. I do not know of any other case.

SIR A. CRIPPS: Are all your cables laid in the proximity of electric railways suitable for their work?—Yes: and they are safe.

Cross-examined by SIR J. SIMON, WITNESS said he did not know whether, if the Post Office succeeded in their objection in Part I of the notice, they would have no magneto system of telephones at all. He admitted that in a place like London the central-battery system was superior to the magneto system. If he were planning a new system he would have a central-battery system. It was probable that had the company's business not been coming to an end shortly they would have gone much further in substituting the central-battery system for the magneto system.

(To be continued.)

SELLON AND ASHBY AND THE HARTLEPOOL ELECTRIC TRAMWAY CO., LTD., *v.* THE HARTLEPOOL CORPORATION.

IN the King's Bench Division Mr. Justice Bray delivered his reserved judgment in this action to recover £12,963, the purchase price of the Hartlepool tramways. The Corporation were doubtful as to which of the plaintiffs were entitled to receive the money.

His LORDSHIP reviewed the proceedings taken under the arbitration and in relation to the special case, when he suggested that an action should be brought to see whether the plaintiffs were entitled to enforce the payment of the agreed sum of £12,963. It was contended at the hearing that the purchase price of the undertaking was payable to the plaintiffs, Sellon and Ashby, on the transfer of the undertaking to the Corporation, and that the company were willing to join in any conveyance to the Corporation. The contention of the Corporation was that they were not bound to pay any part of the £12,963, and that the property was not the property of the promoters within the meaning of Sec. 43 of the Tramway Act. The main question was what was the real construction of Sec. 43, and what was the true position of the promoters. It was clear that the plaintiffs, Sellon and Ashby, were the owners of the undertaking. They, and they alone, could be required to sell to the Corporation. The main point argued was that the tramways and other things mentioned in the particulars of claim did not belong to the promoters, and were not used by them within the meaning of Sec. 43. He (the learned Judge) was of opinion that they were so used. The tramways never became the property of the company, and they must have belonged to some one. He saw no difficulty in coming to the conclusion that they belonged to the promoters. He thought that was the legal result of what had passed, and in no other way could the Corporation obtain the tramways as they had a right to do under Sec. 43. The form of judgment would be a declaration that the Corporation were entitled to, and bound to purchase the undertaking upon payment of £12,963 to the promoters, and the plaintiffs must undertake to execute an assignment or transfer, and if the Corporation required it, the plaintiff company must join in the conveyance.

Costs would follow the event.

SPECIAL TRAMWAY FARE.

LORD SKERRINGTON has given judgment in the Court of Session in the action at the instance of the Edinburgh and District Tramways Co., Ltd., against Hope Park, S.S.C., 22, Claremont Crescent, Edinburgh. The defender boarded a special car on the day of the Rugby International at Inverleith, but declined to pay the special fare of 2d., and tendered 1d., the ordinary fare. The pursuers contended that they were entitled to provide additional special cars, and to demand for these fares in excess of the fares ordinarily charged but within the authorised limits. They sought declarator of that right and sued for 1d. The defender explained that he tendered the 1d. sued for, but that that offer was refused and the 1d. returned to him. Later he again tendered the sum sued for with judicial expenses. The pursuers refused to accept the tender and persisted in the present proceedings. His Lordship dismissed the action and found the defender liable in expenses, and on the motion of the pursuers' counsel found it unnecessary to dispose of the conclusion for declarator.

BUSINESS NOTES.

Tantalum Competition.—As our readers will observe in our advertising pages to-day, MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., are offering a couple of prizes in connection with their autumn publicity campaign. The prizes are of sufficient value to encourage a wide competition among those gifted in the preparation of showcard designs. The first prize amounts to £75, and the second to £25, and as the competition is open to anybody in the United Kingdom, and a large number of designs are sure to be submitted, it has been decided that for designs of more than average merit which may also be accepted, a solatium of £5 will be awarded. Of course, what is wanted is a design which will irresistibly take possession of the public mind, make a permanent impression, "fix" the tantalum lamp and its merits for satisfying consumers, without haunting one as some posters have a weakness for doing. The electrical man who is a designer, knows the argument that he wants to get home, and he knows to some extent from experience what is the point at at which the public are most vulnerable, but in opening the competition to everybody, whether electrically minded or no, Messrs. Siemens recognise that not all the ability of appealing to the public lies inside the electrical world, and it may be that the more or less uninitiated electrically, may bring into play ideas which shall, when put on a showcard, be a creditable effective sales-promoting advertisement which would put to shame many of the "things" that one sees on hoardings, and would be well worthy of a place beside—well, what? We need not enter into particulars here concerning the sizes of designs to be submitted, and the general conditions to be observed, for these are fully stated elsewhere, but it may be noted that political subjects are barred, and that it may be desirable to introduce in some way or other the features of the well-known "satisfied consumer" design which has done such good service. Printed leaflets giving full details have been issued to contractors, &c., in order that their customers may be fully notified of the competition, and copies of these can be obtained by anybody who has not received them. The competition is open until July 31st, and designs have to be sent to the firm at Tyssen Street, together with a copy of the advertisement conditions. We hope, after the result is declared, to publish the names of the prize winners in the columns of the ELECTRICAL REVIEW.

Bankruptcy Proceedings. — GEORGE MONTAGUE SELLICK, manufacturer of electrical accessories, 464, Romford Road, Forest Gate.—An application for an order of discharge was made on June 27th to Mr. Registrar Brougham, at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the bankrupt failed in January, 1907, with proved and provable debts to the amount of £473. The assets had realised £102, and a first and final dividend of 3s. in the £ had been paid to the creditors. Having been previously employed as clerk to a firm of electrical engineers, the bankrupt in June, 1895, without capital, started business on his own account as a manufacturer of electrical accessories at 68, Glen Park Road, Forest Gate. In 1897 he removed to 50, Park Lane, Tottenham; in the following year to 756, Romford Road, and in 1903 to 464, Romford Road, at which latter address he was trading at the date of the receiving order. Down to 1904 the business was fairly successful, but thereafter, owing to foreign competition, it fell off; in June, 1906, his difficulties were further increased owing to the expense of his wife's illness: and realising the hopelessness of his position, the bankrupt

filed his petition on January 31st, 1907. Since the receiving order he had been in employment as manager of an electrical manufacturing business, and was in receipt of a salary of £2 6s. per week. As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) omission to keep proper books of account; and (3) trading with knowledge of insolvency. His Honour upheld the report and imposed a further suspension of two years. Order entered accordingly.

Emanuel Ristori.—At the first meeting of creditors held on June 30th it was stated that the liabilities were £100,000, principally in respect of borrowed money. Mrs. Ristori (widow) said that she knew of no assets except a claim against the Aluminium Corporation, Ltd. In the absence of a quorum the meeting was adjourned for a week.

C. F. Lindop, electrician, lately carrying on business at 62, Dale Street, Liverpool.—Receiving order made June 29th, at Liverpool, on creditor's petition.

T. C. Francis, electrical engineer, 66, Liverpool Road, Stoke-on-Trent.—Receiving order made June 28th on debtor's petition. First meeting, July 12th, at Newcastle, Staffs.; public examination, July 18th, at Stoke-on-Trent.

Liquidation.—Messrs. Mountain & Gibson, Ltd.—A meeting is to be held at Parr's Bank Buildings, York Street, Manchester on August 1st, to hear a report of the winding up from the liquidators (Messrs. H. H. Bowden and A. Whittaker).

Direct Supply at Trade Prices.—A firm of electrical and mechanical engineers inform us that they recently asked an agent for a certain make of incandescent lamps to supply a consignment of the latter direct to one of the firm's clients, in order to save time: the agent took the opportunity to quote to the client the same terms and trade discounts as to the contracting firm, and even offered other lamps at lower prices than the contractors themselves could obtain, asking the purchaser in future to buy lamps direct from him. This is a fresh example of a practice which has frequently aroused the indignation of contracting firms, though in this case the makers of the lamps appear to have had no hand in the matter. It is difficult to see what benefit the agent derives from this unfair dealing; he gains nothing in price, while he naturally alienates the contractors, who are not likely to place any more business with him.

Catalogues and Lists.—Messrs. Thomas Broadbent and Sons, Ltd., Central Ironworks, Huddersfield.—Sixteen-page well-illustrated pamphlet containing a description of their automatic centrifugal clutch which is of particular service in connection with A.C. motor drives, large numbers having been supplied for this purpose for textile and similar machinery with satisfactory results.

Messrs. D. H. Bonnella & Son, Ltd., 58 and 60, Mortimer Street, London, W.—Eight-page pamphlet, Sec. L (No. 354) showing, and stating prices of, a number of their switches, wall sockets, pushes, plain and ornamental switch fronts.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—A set of lists of the company's electrical manufactures, in binding cover, arranged to facilitate substitution or addition of new publications as issued. The contents at present are as follows:—Sixteen-page price list of gutta-percha, india-rubber, silk and cotton-covered wires, jointing tools and materials; 16 pages devoted to prices of galvanic batteries; a four-page price list of electrical bells, pushes, &c.; a fine 62-page booklet containing a large number of illustrations, with prices all boldly indicated and brief matter conveniently arranged, of Silvertown telegraph and other instruments; descriptive circulars relating to the Rymer-Jones standard mica-tinfoil condenser, and the Rymer-Jones universal shunt; a 24-page price list of insulators, fittings, and tools for telegraph and telephone lines; an excellently produced brochure containing specification description of Silvertown dynamos and motors, voltages, B.H.P., speeds, code-words, and prices being plainly tabulated; and, last of all, a 24-page publication relating to Association electric light cables and wires. We have no doubt that this fine collection of literature concerning Silvertown manufactures, much of it admirably illustrated on art paper, and containing a great deal of price information, will prove of service to a large number of the firm's present and prospective clients at home and abroad.

The Underfeed Stoker Co., Ltd., Coventry House, South Place, Finsbury, E.C.—28-page pamphlet containing a full description, accompanied by various half-tone illustrations and line drawings, of their "Usco" air heater.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—Advanced leaflet showing their "New Departure" (15-ampere and 10-ampere) double-pole switch fuse, a feature of which is the complete removal of the switch fuse carrier for the replacement of the fuse. It is specially designed for controlling small motors, public street arcs, &c.

Messrs. Archibald J. Wright, Ltd., 41, Beech Street, Barbican, London, E.C.—New illustrated price list (8 pages) of electric head, side, tail and roof lamps, garage or inspection lamps, switches, ignition accumulators, charging boards, dynamos and batteries, ignition coils, measuring instruments, and other accessories for motor-cars and cycles.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, London, E.C.—Price list (No. S50) fully describing the essential features of their "Standard" flame arc lamps—10 hours and 16-18 hours. Tabulated particulars of size, burning hours, current, candle-power, weight, length of carbons and prices, are given.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—Illustrated price list of single-phase motors from 3 to 50 H.P., fitted with slip-rings and ball bearings.

Messrs. Haslam & Schontheil, Ltd., 11, Windsor Place, Cardiff.—Leaflet giving prices of cylindrical bellows for blowing out armatures, and of "National" electric compound for commutators.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Illustrated reprint (No. 114) relating to the use of aluminium wire in traction motors.

Trade Announcements.—Messrs. Gent & Co., Ltd., have removed their London office from 3A, Upper Thames Street, to more commodious premises at 25, Victoria Street, London, S.W., where all communications henceforth should be addressed. Telephone, "No. 548 Westminster." Telegrams, "Knifeedge, London."

Owing to increased business, Messrs. Marsh, Son & Co., Ltd., have removed from 15, Gerrard Street, Soho, to more commodious premises at 167 and 169, Wardour Street, Oxford Street, W.

Messrs. C. H. Davies & Co., are removing on July 10th to 153, Bracebridge Street, Birmingham.

The Electric and Ordnance Accessories Co., Ltd., are now (from July 3rd) represented for their electrical manufactures in and around the city of Sheffield for a radius of 10 miles by Mr. H. E. Ridley, 104, Marlcliffe Road, Sheffield. The agency for their "Vickers" centrifugal fans will remain as before in the hands of Mr. J. Crawford, 2, Exchange Street, Manchester.

Mr. E. H. Milner, electrical engineer, 48, Denmark Street, High Wycombe, has taken larger business premises at Oxford Road.

Mr. J. A. Adan, late of the Ghent electricity works, has commenced practice as consulting electrical engineer at Rue de Flandre, 31, Ghent, Belgium.

Swiss Machinery in India.—With reference to the comments published in this section last week concerning German machinery in India, we are reminded that Swiss electrical manufacturers have lately been successful in this market. For instance, the Maschinenfabrik Oerlikon has in hand a contract for three 3,000-KW. Oerlikon high-pressure steam turbines and three-phase generators; one 800-KW. mixed-pressure turbine and three-phase generator (Oerlikon series-parallel type); complete with condensing plant and air and circulating pumps driven by Oerlikon motors. The same company has also booked a large order for electrical equipments for two cotton mills from Messrs. Forbes, Forbes, Campbell & Co., of Gokak. The order comprises 227 single-phase commutator variable-speed, ring-frame motors; three vertical 900-B.H.P. three-phase generators; two vertical 90-B.H.P. D.C. and three-phase generators (double); and complete main and distribution switchboards, switch columns, switch boxes, main and distribution cable.

LIGHTING and POWER NOTES.

Accrington.—The B. of T. has approved of the draft order sanctioning the supply of electricity in bulk to the Haslingden Corporation, and also the laying of extra H.T. mains to the Baxenden borough boundary.

Barking.—The U.D.C. has asked the L.G.B. to postpone the proposed inquiry into the application for a loan for E.L. extensions, as the Council desires to go further into the matter.

Barrow-in-Furness.—At the monthly meeting of the T.C., the electrical engineer reported that there are now four or five houses at Biggar Bank, Walney Island, and that there is every prospect of a number of additional houses being built, and suggested that as the tramways are now being extended to there, an extension of the electricity mains for lighting and heating purposes be carried out by means of bare overhead wires, supported from the tram poles. The estimated cost of extension, together with pilot wires and distributors to the present houses, is about £407.

The Council approved, and resolved also that subject to a satisfactory settlement being arrived at, application be made to the L.G.B. for its sanction to the Corporation borrowing £5,600 for the supplying of electricity to Ramsden Dock, Barrow.

Bath.—The E.L. Committee of the T.C. has decided to apply to the L.G.B. for a loan of £100 for a booster.

Batley.—The Yorshire Electric Power Co. is proposing to extend its mains from Dewsbury to Gomersal, to supplement an existing main to Pudsey. The Dewsbury and Birstall Councils are offering no opposition, but the Batley Corporation objects to the breaking up of Bradford Road, which is already congested with electrical cables, pipes, sewers, &c. Last week the case was argued before Mr. W. A. Patchell, on behalf of the B. of T., when the company's proposals and recent negotiations with the Corporation were discussed at length.

Belfast.—The city accountant has submitted the accounts of the electrical undertaking for the year ending March 31st, 1911, which were considered highly satisfactory, the net profits, after paying the capital charges, being £13,766, from which the usual appropriations, including £5,000 towards the relief of taxes, were made.

Bradford.—A statement of accounts of the Corporation Electricity Department, just issued, shows, for the year ended March 31st, a surplus of £8,980, as compared with £7,399 in the preceding year, being an increase of £1,581. The income showed an increase of £4,117, the sources of which were £1,853 from general supply, £858 from bulk supply, and £770 from tramways. There had also been an increase in expenditure, amounting to £2,537.

Cardigan.—An E.L. scheme has been submitted to the Council by Mr. Fred. Swarbrick, of Leigh, Lancs., who offers to carry it out, by means of a company, if the Council does not care to take it up. The Council has decided not to promote the scheme, but not to raise any objection to the formation of a company.

Chatham.—In order to better meet the needs of its increasing business, the Kent Electric Power Co. has removed its offices to central premises at the corner of High Street and Railway Street, Chatham, at which address an electrical showroom will shortly be opened. All communications for the company should be sent to Railway Street, Chatham. Telephone, 357 Chatham.

Chester.—Mr. S. E. Britton, city electrical engineer, has prepared and submitted to the Lighting Committee a comprehensive scheme for utilising the River Dee water at the Old Dee Mills for the generation of electrical energy. In the event of expert opinion being favourable to the scheme, the Committee will proceed with it, application being made to the L.G.B. for sanction to borrow the sum of £5,000 towards the cost of executing the works, estimated at £10,000, which it is proposed to meet as follows: Appropriation from uninvested reserve fund, £5,000; and loan, £5,000. In view of this project, it has been decided to postpone the construction of a lock below the weir.

Croydon.—The B.C. has agreed to the following reductions in charges for current:—Flat rate, 4d. to 3½d. per unit; heating and cooking, 1½d. to 1d. for consumers using electric light; 1½d. to 1d. for all current for traction purposes above 2,000,000 units.

Dublin.—The Electric Lighting Committee of the Corporation has received the sanction of the L.G.B. for a loan of £50,000 to carry out an extension of the electricity works. A letter from the Board to the Committee states that it has received the report of its chief engineering inspector, on the inquiry held a short time since into the application for sanction to the borrowing of £128,129 for the carrying out of the extensions of the electric lighting of the city. As some time must necessarily elapse before the Corporation can be addressed at length on the inquiry, the Board thinks it desirable that in the meantime it should be enabled to borrow a portion of the amount of the loan in question, and accordingly sanctions the borrowing of a sum of £50,000, repayment to be made in a period not exceeding 20 years.

Eccles.—Sanction has been received from the L.G.B. to the borrowing of £3,294 for the provision and installation of a 500-K.V.A. steam alternator at the electricity works.

Gloucester.—A L.G.B. inquiry was held on June 27th into the application of the T.C. for a loan of £14,000 for electricity purposes. There was no opposition.

Hastings.—The Education Committee has decided to have the E.L. installed at Clive Vale and Tower Road schools, at an estimated cost of £185 5s.

Heston and Isleworth.—The electrical engineer reports having further interviewed the engineer to the Twickenham Electricity Supply Co., Ltd., respecting a supply of current in the Whitton Park area. As a result of this interview arrangements have been made for payment on a basis which has been approved by the Electricity Committee, and a formal application from the company for a supply of current has been received.

Hornsey.—A L.G.B. inquiry has been held into an application by the B.C. for sanction to borrow £9,600 for extensions to the buildings and plant at the generating station. It was explained by the town clerk that the land on which it was proposed to erect the buildings had been purchased some time ago as a site for baths. It was proposed to put in foundations for an additional boiler and cooling tower. The boiler house would then provide for two additional boilers, that was seven in all, and two additional bunkers, making seven in all. The electrical engineer said that the undertaking up to the present had done exceedingly well, and that the proposed extensions was to meet anticipated increased consumption.

Hoyland Nether (near Barnsley).—At the last meeting of the Lighting Committee of the U.D.C., one of the members expressed his disapproval of the present system of public lighting, and urged the Council to adopt a scheme of electric lighting for the district.

Hull.—The T.C. is considering the question of supplying current for lighting and power to St. Andrew's Dock.

Ilford.—The U.D.C. has fixed the price of current for the tramways at 1½d. per unit.

India.—A licence has been granted by the Municipal Commissioners of Chittagong to the agents of the A.E.G.-Lahmeyer Co. for the supply of electric lighting and power to that town. Chittagong is the headquarters of the Assam Railway, and it is understood that the railway is supporting the scheme. The main streets are to be lighted, and the power will be used for the driving of the punkahs, so much used in that part of India. The preliminary scheme is being drafted by Mr. H. R Speyer, A.M I.C.E

Kingston-on-Thames.—At the last meeting of the T.C., it was agreed that the electrical engineer, together with his chairman and vice-chairman, should visit the works of the M.A.N. Co., Germany, with a view to inspecting Diesel engine plant. It was suggested that similar engines would be shown at the forthcoming Olympia Exhibition, also that English made engines would be equally satisfactory, but in view of the size of engine contemplated, and the type which it is proposed to adopt, involving an expenditure of £8,000 to £10,000, it was agreed to visit the German works as stated.

Llangollen.—In connection with the deadlock existing between the Council and electric light company, the Council has asked the company if it is prepared to apply for a provisional order under the 1903 agreement.

London.—St. Pancras.—At the last meeting of the B.C. the Law Committee reported in regard to an action which had been entered against the National Telephone Co. for the recovery from the company of £180, being the cost of repairing damage done to the Council's electric mains and services, &c., in Upper Woburn Place by the company's workmen, that the company offered to settle the action by payment of the claim, each party bearing its own costs, and this was agreed to.

Metropolitan Asylums Board.—At the last meeting of the Board it was agreed to provide at Tooting Bec Asylum two electric lifts, capable of carrying 5 cwt., at an estimated cost of £210 per lift. The Committee stated that the hand lifts in the older blocks are so cumbersome that they are rarely worked unless absolutely necessary. With electricity at a 1d. per unit, the 5-cwt. lift would make 18 complete journeys with full load for 1d. The other working costs apart from electricity would be infinitesimal.

Oldham.—The T.C. has reduced the price for current on the flat-rate from 4d. to 3½d. per unit. For power the present rate of £2 10s. per KW. per annum, plus 0·5d. per unit metered, has been altered to £2 10s. per KW., plus 0·4d. per unit metered to consumers of 25 H.P. and over.

New Zealand.—The first step towards harnessing the Waira Falls for the generation of electricity is about to be taken. A survey party is presently engaged in defining the line between Kaikhoe and Horeke, and is to continue the work between the Falls and Whangerie and the Falls and Dargaville. The Government has made a small grant to cover the survey, which is to be completed as rapidly as possible.

Perth.—The Convener of the Corporation Gas Committee has issued a report strongly supporting the proposal to install electric stoking plant at the gas works. Such plant, it is estimated, would effect an annual saving of £1,000.

Salford.—Application is to be made to the L.G.B. for sanction to borrow £3,000 for extending mains and services in the Prestwich District. In accordance with recommendations contained in the report of Sir A. B. W. Kennedy, alterations to the engines at the electricity works are to be proceeded with at an estimated cost of about £20 per engine. Tenders are also to be invited for the supply and fixing of a new boiler.

South Africa.—The Cape Town Corporation has completed an agreement with the Municipality of Woodstock to continue the supply of electrical energy for a further term of seven years from December 31st, 1912, such agreement to remain in force, after the expiration of the period, from year to year. In connection with this agreement the Corporation is extending the area in which it supplies private consumers, and has accepted a tender from the Telegraph Manufacturing Co. (Colonial), Ltd., for the supply of the necessary cable; the amount of the tender is £1,090.

Southborough.—The U.D.C. has received from 29 residents a memorial requesting a supply of electricity for lighting. The Tunbridge Wells T.C. has already arranged to supply current to premises in the town, and the Kent Power Co. is in communication with the Council.

Stirling.—The T.C. has decided to replace all its Nernst lamps by metal-filament lamps, the cost being estimated at £40. An annual saving of £60 is expected.

Stoke-on-Trent.—The T.C., on June 29th, referred back to the Electricity Committee a proposal to wire on the hire-purchase system the premises of the Longton Working Men's Club. A member protested against the proposal, the legality of which he questioned.

Wellingborough.—The *London Gazette* contains notice of the revocation of the 1906 E.L. order.

Wharfedale.—The Wharfedale E.L. and Power Syndicate has notified the Guiseley U.D.C. of its intention to apply for a provisional order for the urban districts of Baildon, Burley, Guiseley, Ilkley, Otley, Yeadon and the rural townships of Esholt, Menston, Middleton and Pool. It is proposed to charge 3d. per unit for lighting, and from 2d. per unit downwards for power.

Willesden.—The L.G.B. has sanctioned the borrowing of £5,000 for mains and £3,000 for services.

Worksop.—The U.D.C. has decided to extend the mains to St. Cuthbert's College, and has applied to the B. of T. for permission to use overhead wires for this supply, and also for the purpose of lighting certain streets.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Mr. Pilcher, the general manager, has prepared a report for the Corporation Tramways Committee on the question of the Footdee tramways. After describing two new routes, the manager says it does not seem possible to make either of them pay. The Aberdeen tramway system, he proceeds, is fortunate in not having a single route which runs at a loss, and this has only been brought about by very careful planning of the routes. This year every route will show a clear profit. The Committee deferred consideration, and asked the manager to report with regard to the railless trolley system introduced at Leeds and Bradford.

Accrington. — The arbitration award concerning Accrington tramways came before Haslingden Gardians on June 29th. The old assessment had been £800. The union valuer provisionally assessed the electric tramways at £1,650. Accrington Corporation contended that the amount should be £650, and the case went to arbitration. The umpire's award was £2,548. It had been understood this arbitration should govern the assessment of tramways in Haslingden and Rawtenstall. The Assessment Committee has now received a letter from Accrington Corporation, which is of the opinion that the award is incomplete because the umpire does not state the basis of his finding, although this is required by the agreement of reference. The umpire replied that he went carefully into the figures before giving his award, and that there appeared to be nothing further he could usefully add. Accrington now asked the Assessment Committee to join with it in asking the umpire to meet two or three representatives of each authority and give the explanation of his settlement and award. Without this, it added, both authorities would be in the dark, and the award was no guide in fixing other tramway assessments. The Guardians regarded the umpire's award as final and binding, and they could not agree to the proposal to reopen the question.

Blackpool.—The Tramway Committee is to purchase for £2,000, four new tramcars of the "toast rack" pattern for use on the promenade during the warm weather. It is proposed to order two of the cars for this season, and two for next year.

Continental Notes.—Austria.—A scheme is under consideration for the construction of a light electric railway between Schwefel and Hohenem.

Denmark.—The electric tramways of Copenhagen, hitherto owned by the Copenhagen Tramway Co., will from August 1st be taken over by the municipality. The price has not yet been agreed upon. The managing director of the tramway company, Mr. Kai Norregaard, has been appointed municipal director of the tramways.

The municipality has laid a proposal before the T.C. to the effect that the wages of the staff be raised with 300,000 kroner (£16,666).

Croydon.—The annual report of the tramways manager (Mr. T. B. Goodyer) shows total receipts for the year ended March 31st of £87,497, and working expenses £63,791. After deducting amounts relating to interest, sinking fund, income-tax, &c., there was a net balance of £8,458, of which £4,800 has been devoted to relief of rates, and £3,658 to the renewals fund. The net balance was equivalent to 3 per cent. on the capital outlay; 19,476,576 passengers was carried, an increase of 770,972 on the preceding year, an additional 15,790 miles having been run. The receipts were 9·07d. per car-mile, an increase of ·23d. The through booking issues, covering journeys over the Croydon and the L.C.C. systems, were 892,358. The first complete year's working, following the opening of the L.C.C. extension to Norbury (where the Croydon system begins), resulted in the receipts of the Norbury route being increased by £14,542. The Council, after long discussion, decided, by 31 votes to 18, to re-open the Whitehorse Road route, closed a year or two ago because of its being unremunerative. It was not claimed that it would now pay, but it was hoped that the loss would be much less than before.

Cuba.—New electric railways are to be built in the province of Santa Clara, and important hydro-electric works will be established for the purpose of supplying the necessary motive power. The Habanilla Waterfalls, north of Cienfuegos, are to be harnessed, and it is hoped by this means to obtain the 30,000 H.P. which it is estimated will be required to work the 300 miles of railway, for which, it appears, a United States concern has secured concession. The line is designed to connect Cienfuegos with Cruces, Manicaragua, Santa Clara, Camiguani, Tunas, Fomenta, Sagua and Caibarien. The concessionary company undertakes to supply electrical energy to the towns through which the railway will pass, and also to a number of sugar refineries.—*Board of Trade Journal.*

East Kent.—The B. of T. has confirmed the East Kent Light Railway Order, which authorises the construction of light railways in the new colliery districts. The main line will be from Shepherdswell to Sandwich Haven, and there will be branches from Eythorne to Coldred and Tilmanstone, and from Eastry to Tingham.

Glasgow.—From the annual statement of revenue and expenditure issued by the T.C.'s Tramway Committee, it appears that the ordinary income amounted to £949,488, and the working expenses to £533,179, leaving a net revenue of £416,309, which for the previous year was £393,809. After adding interest on surplus revenue and rent of lines let to Dumbarton Burgh and County Tramways Co., the net revenue of £459,753 had been applied in meeting the rental of Govan and Ibrox Tramways, payment to Paisley District Tramways Co., interest on capital, sinking fund, &c., and amount carried to depreciation and permanent ways renewal fund, amounting in all to £391,075, the net balance of £68,678 falling to the common good fund in terms of statute. The gross revenue for the year showed an increase of £58,472, compared with that of the previous year, and the average traffic revenue per car-mile had been increased from 10·225d. to 10·461, while the working expenses showed an increase per car-mile of ·141d. In the report it is stated that the Committee has decided to install an additional turbo-alternator set at Pinkston, for which offers were under consideration, while in order to meet the increased load, an additional rotary had been installed at Partick sub-station. There were now on the routes 621 top-covered cars out of a total of 803, while 50 additional cars were under construction. The Committee had decided to put top covers on all cars except the converted horse cars, and the experiments having been found successful, all cars are to be provided with a suitable vestibule to protect motormen during inclement weather. The experience of the use of a.-h. meters on the cars had resulted in a number being fitted. In moving the approval of the balance-sheet at the T.C. meeting on Tuesday (July 3rd), Bailie W. F. Russell referred particularly to the amounts set aside for depreciation. In that connection the Committee, he said, had written off plant and general equipment, 48 per cent. of the capital expended, or about 5 per cent. per annum. The report was approved.

The T.C. at its last meeting discussed at great length the application by the motormen, conductors and other employés of the tramways department for improved conditions of service—which, along with points from the general manager's report, were published in a recent issue of the Review. Bailie Russell, the convener of the Tramways Committee, explained that when the Corporation took over the undertaking, the uniform wage was 24s. for a 60-hours' week of 10 hours per day. They had gone on, stage by stage, making the conditions and remuneration better for the men, until to-day they had a 54-hours' week and the minimum wage was 24s., advancing to 33s. per week. Mr. Lyon proposed that the working week should be 51 hours—a concession more welcome than the increase in wages—but the motion was defeated by four votes, the Committee's recommendation being adopted. A proposal to grant seven days' holiday with pay was also lost, besides a motion for the increase of the present minimum wage from 24s. to 25s.

Halifax.—The Tramways Committee has decided to provide shelters for tramway passengers at West End, Stump Cross, Boothtown, St. Jude's and Southowram. A shelter is now in course of erection at Queensbury, and one has been arranged for at Shelf.

Japan.—Some trials with electric traction are about to be carried out by the Japanese State Railway authorities on the Usui line.

Keighley.—At the last meeting, the T.C. discussed the proposals of the new Bill regarding trackless trolley services. Last year the Council's motor-buses ran 17,000 miles at a cost of 11¾d. per car-mile, including interest and sinking fund charges: only the Oakworth and Eastburn routes paid, the route *via* Bingley losing 1d. per mile.

Manchester.—The annual report of the Corporation tramways shows that the aggregate length of single track open for traffic on March 31st was 182 miles, including the lines over which the Corporation is exercising running powers. The gross profit on the year's working amounted to £290,952, the total revenue from all sources was £810,094, while the working expenses amounted to £519,142. To the profit, interest amounting to £11,616 is added, leaving available a sum of £302,568. Out of this amount £86,249 has been placed to reserve, renewal and depreciation, while £75,000 has been handed over in relief of the rates. Remarkable figures are given in the parcels department. In 1907 the department handled 141,715 parcels, and the total receipts were £1,685, showing a profit of £266. Last year the parcels carried numbered 948,074, the receipts were £10,018, and the profit £2,484. The passengers carried last year totalled 165,800,077, compared with 159,042,096 in 1910.

Morecambe.—The T.C. has applied to the B. of T. for a loan of £4,617 for doubling the tramway track, and £800 for additional cars. An extension of time for completing tramway No. 3 has also been applied for.

Plymouth.—The borough treasurer has presented a statement of income and expenditure in connection with the tramways undertaking during the financial year ended March 31st last. The income was £36,058, as compared with £35,380 in the previous year. The expenditure, other than interest and sinking fund charges, amounted to £26,664, which included the sum of £7,795 spent on repairs and maintenance. The expenditure for the preceding year was £26,407, including £7,011 for repairs and maintenance. To last year's gross profit of £9,393, was added £75 transferred from the district fund and £1,182 paid by the Plymouth, Stonehouse and Devonport Tramways Co. This made a total of £10,651, from which £9,273 was paid in interest and sinking fund charges, leaving a net profit of £1,377 to be applied in aid of rates, compared with £953 in the previous year.

The tramways manager has been instructed to report to a sub-committee generally as to the car-shed and workshop accommodation, and as to the provision of machinery for the repair of cars. The sub-committee will afterwards report to the Tramways Committee on the question.

The manager's traffic return for the five weeks ended June 17th showed that the passenger receipts for that period amounted to £3,726, compared with £3,440 in the corresponding period of last year, an increase of £286. Each of the five sections produced increased receipts. Up to June 17th the income from the tramways during the current financial year totalled £8,353, and the expenditure £7,851, as against £7,825 and £7,825 respectively last year.

South Lancashire.—Dissatisfaction prevails in the Farnworth, Walkden, Swinton and Worsley districts at the alleged inadequate service on the South Lancashire Tramway Co.'s system, and it is expected that concerted action will be taken by the local authorities to obtain a better service. For several hours during the day there is only a 20 minutes' service.

Stirling.—Representatives of the Town and County Councils and the Stirling and Bridge of Allan Tramways Co. recently considered representations made by the Tramways Co. asking to be relieved of part of its financial responsibilities. It was agreed that so far as the company's share of the maintenance of the roads was concerned, nothing could be done, but it was the feeling of the meeting that something might be done on some of the other points raised by the company.

Sunderland.—The annual report of the Corporation tramways undertaking for the year ended March 31st, 1911, has just been issued by the general manager, Mr. A. R. Dayson. The income during the year was £59,071 and the working expenses £37,188, leaving £21,882 to be carried to the net revenue account. The traffic expenses totalled £17,410, or 2·878d. per car-mile, a slight increase on the previous year. General expenses totalled £5,330, or ·880d. per car-mile: energy cost (at 1½d. per B.T.U.) £10,678, or 1·765d. per car-mile. There is a net balance of £4,344, an increase of £756 on the previous year. The reserve and renewals account now amounts to £29,694, being this year increased by £1,422, while £2,000 is paid towards the Borough Fund.

Uruguay.—H.M. Vice-Consul at Monte Video reports that a local engineering firm, representing a syndicate of French capitalists, has been authorised by the Ministry of Public Works to make surveys for an electric railway from Monte Video along the coast to Maldonado and Punta del Este, a distance of some 75 miles. The power is to be generated by means of low grade brown coal or peat, of which there are large deposits in the neighbourhood of Maldonado. The line is to be double, with overhead cables, and of gauge 1·676 metres. Plans are to be presented within three months from the middle of May. The principal object of the line is the development of the port of Maldonado, and the line will further bring into use large sections of fertile land in the neighbourhood of the coast.—*Board of Trade Journal.*

U.S.A.—The New York City authorities have ordered the construction of a new subway line, which it is expected will be worked by the Brooklyn Rapid Transit Co.

Wigan.—The engineer and manager of the tramways department, in his report to the Tramway Committee, stated that a substantial reduction had been made in the traction energy consumption, which, in his opinion, was attributable to the installation of meters on all the cars. For the last few weeks the consumption per car-mile showed a decrease of ·07 of a unit, and on the first nine weeks of the current year this represented a saving in energy alone of approximately £150.

York.—The Tramways Committee is recommending the City Council to adopt a scheme for extending the tramway system from near the railway station by Bishopthorpe Road to the South Bank area, a populous district at the back of the racecourse, at an estimated cost of £17,000.

The Committee also submits four alternative routes to the Heworth district, one to cost £39,088, another £25,263, a third £56,021, and the fourth £67,144.

TELEGRAPH and TELEPHONE NOTES.

Chicago Telephones.—The possibilities of telephone development are well illustrated by a note in the *Electrical World*, stating that the Chicago Telephone Co. has passed the quarter-million mark in the number of telephones in service in the city of Chicago. This is about one telephone for every nine inhabitants. Chicago has more telephones than any other city in the world except New York, and more in proportion to population than New York. It has twice as many as London, and five times as many as Paris. If London had one telephone for every nine inhabitants, its total would be about 750,000 telephones, or five times the number at present in use.

Federated Malay States.—There are 63 telegraph offices and 12 telephone exchanges in the F.M.S., with 650 telephone subscribers; 5,135 miles of wire are in use, of which 3,117 are telephone lines.

Iceland.—A private company on the Vestmann Islands, on the south-west of Iceland, has obtained a concession to lay a submarine telegraph cable between these islands and Iceland.

Japan.—The Japanese Department of Communications has decided to erect a direct telephone line between Kobe and Arima *viâ* Rokkosan.

Wireless Telegraphy.—Scandinavia.—The telegraph department has ordered three large radio-telegraph stations from the Gesellschaft für Drahtlose Telegraphie, Berlin, to be established on the island of Spitzbergen, at Hammerfest and at Bergen. They are all to be built according to the latest Telefunken system with "singing sparks" for 1,000 cycles per second, and 5 KW. in the antenna. The station at Spitzbergen will further be so designed that if required it can take 6·5 KW. in the antenna. The stations at Spitzbergen and Hammerfest will be furnished with complete charging plant and accumulators, while the Bergen station will be supplied with energy from the local electricity works. The Spitzbergen station will further be furnished with complete spare plant. The range of these stations under ordinary circumstances will be about 1,000 km. in the day time, but at night it will probably be considerably greater.

The Nordenfjeldske Steam Ship Co. has ordered two new ship installations from the A.E.G. for its tourist steamers.

In Sweden (Karlskrona), and Denmark (Copenhagen), the Telefunken Co. have furnished similar 5-KW. stations, and a 10-KW station has been established at Gothenburg.

The wireless stations at Lofoten—the big fishing centre on the North-West Coast of Norway—have proved to be of great importance to the fishing. At Sorvaagen, for instance, the wireless messages received between March 20th and 31st this year made an average of 35 telegrams of 14-16 words each a day.—*Elek. Tidskrift.*

United States.—According to a Bill passed by Congress, after July 1st ocean-going vessels carrying more than 50 passengers will be liable to a fine of £1,000 unless they are equipped with wireless-telegraph apparatus capable of transmitting messages not less than 100 miles, and manned by an operator carrying a certificate issued by this or another Government.—*Electrical World.*

The Baltimore Bridge Co. has received the contract for the three large towers for the wireless system to be used by the Navy Department, near Washington, D.C. The plans of the Navy Department include the erection of towers at Ft. Myer, Va., on the opposite side of the Potomac from Washington, with a main tower 600 ft. in height, and two others of 450 ft. About 900 tons of steel will be required for building these towers. When completed the wireless system is to be capable of sending messages between 2,000 miles and 3,000 miles, and by relays to cover the North Altantic, so that it will be possible to communicate with vessels on the coast of Europe and Africa. The instruments to be used in this system have been building and under trial at Brant Rock, Mass., for over two years, final decision to erect the system being withheld until satisfactory performance of these instruments was made. The Baltimore Bridge Co. submitted alternative bids for the towers as follows:—For one 600-ft. steel tower, $105,541; for two 450-ft. towers, $63,440; for two of the foregoing with complete auxiliaries, $122,954; one 600-ft. tower built on different specifications from the foregoing, $42,101; two 600-ft. towers, $82,368.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—July 16th. The Municipal Authorities of Perregaux are inviting tenders for the concession for the electric lighting of the town during a period of 30 years.

Australia.—July 19th. Insulators, telephones, copper wire and iron wire, for the P.M.G.'s Department in Queensland. See "Official Notices" June 2nd.

Melbourne.—July 18th and 21st. (*a*) 4 tons 6 cwt. of bar hard-drawn copper cables, and (*b*) 35,700 incandescent lamps, for the City Council. See "Official Notices" June 30th.

August 15th.—80,000 insulators, and india-rubber-covered wire for the P.M.G.'s Department. See "Official Notices" June 30th.

South Australia. — August 9th. (*a*) Letter box fronts (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

New South Wales.—August 9th. P.M.G. Letter-box fronts See "Official Notices" to-day.

Queensland.—August 23rd. Letter box fronts, for the P.M.G. Department. See "Official Notices" June 30th.

August 16th. — Cable, conduits, cast-iron pipes, iron poles insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" to-day.

Tasmania.—July 31st. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria. — August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" to-day.

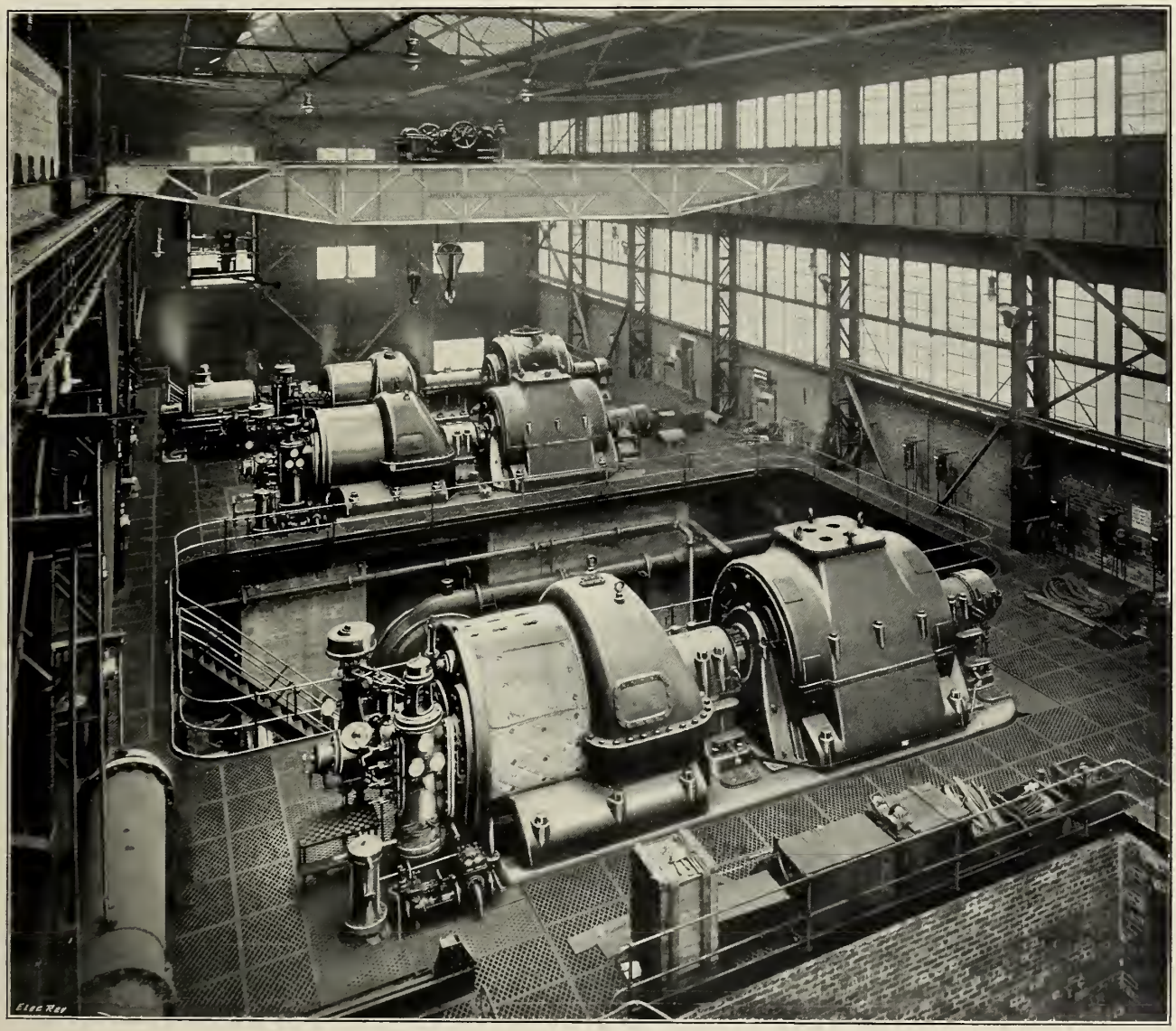
Belfast.—July 17th. Circulating water and motor-driven air pumps, for the Corporation Tramways and Electricity Committee. See "Official Notices" June 30th.

(*Continued on page 23.*)

ELECTRICAL POWER DISTRIBUTION ON THE NORTH-EAST COAST.

The New Generating Station at Dunston-on-Tyne.

The North-East Coast power system now covers an area of over 1,000 sq. miles, extending from Blyth in the north, to Guisborough in the south, and westward from the coast to Consett and Bankfoot. At the present time it is supplying some 150,000 H.P. of plant in connection with railways, tramways, collieries, shipyards, lighting, heating, cooking, and chemical works. Its principal generating station is at Carville-on-Tyne, which is coal-fired, while it obtains a large quantity of power from stations utilising waste heat from coke ovens, blowing engines, &c. The principal of these are at Blaydon, Newport, Weardale, Bankfoot and Bowden Close. Others are in progress at Redcar, Port Clarence and elsewhere. The steady growth in the company's business has entailed the erection of an additional coal-fired station, which has recently been built at Dunston-on-Tyne, and is here described.



Interior of Engine Room, Dunston Power Station.

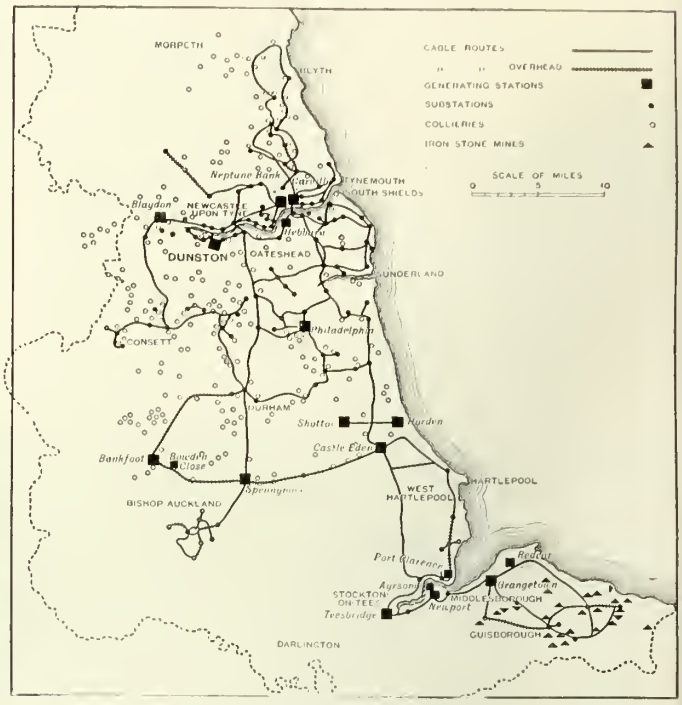
The Dunston power station of the Newcastle-upon-Tyne Electric Supply Co.—one of the largest and most recently designed power stations in Europe—contains several novel features. Its construction was decided upon by the company about three years ago in order to provide for the continued increase in business, amounting to about 20,000 H.P. per annum. Although the company has still some spare land at Carville, it was considered by the engineers to be better to put the next instalment of generating plant higher up the Tyne. A site of about 30½ acres was obtained on the south bank of the Tyne at Dunston, about three miles above the High Level Bridge, and by the river some eight miles from Carville. One reason for this course was in order to obtain in the neighbourhood of the station plenty of land for the accommodation of further new processes which are being attracted to the district, as a result of the low price of electrical power. The company is already supplying large electro-chemical works near Carville, but the land available for future developments near Carville is not large, whereas at Dunston there is, at present, plenty of land available for future requirements, besides the spare land on the company's site. Another reason for this policy, apart from the desirability of having two stations for the sake of greater security of supply, railway access, coal supplies, &c., is that it has resulted in practically doubling the carrying capacity of the very heavy cable network which exists on both sides of the Tyne, for, as the map shows (p. 20), Dunston station is situated near one end of the Tyne network, whereas Carville is situated towards the other end. The cables which run on each side of the Tyne are connected together at Car-

ville by means of the tunnel constructed by the company under the river, and higher up the river by way of the two bridges of the North-Eastern Railway, the King Edward Bridge, and the old High Level bridge. It will, therefore, be seen that the erection of the Dunston station improves the position of the company, not only from the point of view of generating station capacity, but also, to a most important extent, from a distribution point of view. The site is directly opposite the western end of the Elswick works of Messrs. Armstrong, Whitworth & Co., and the frontage to the Tyne is some 900 ft.

As the North-Eastern Railway Co. has bridges over the Tyne both at Blaydon and at Newcastle, the Dunston power station being situated about midway between the two, coal



Exterior of Dunston Power Station.

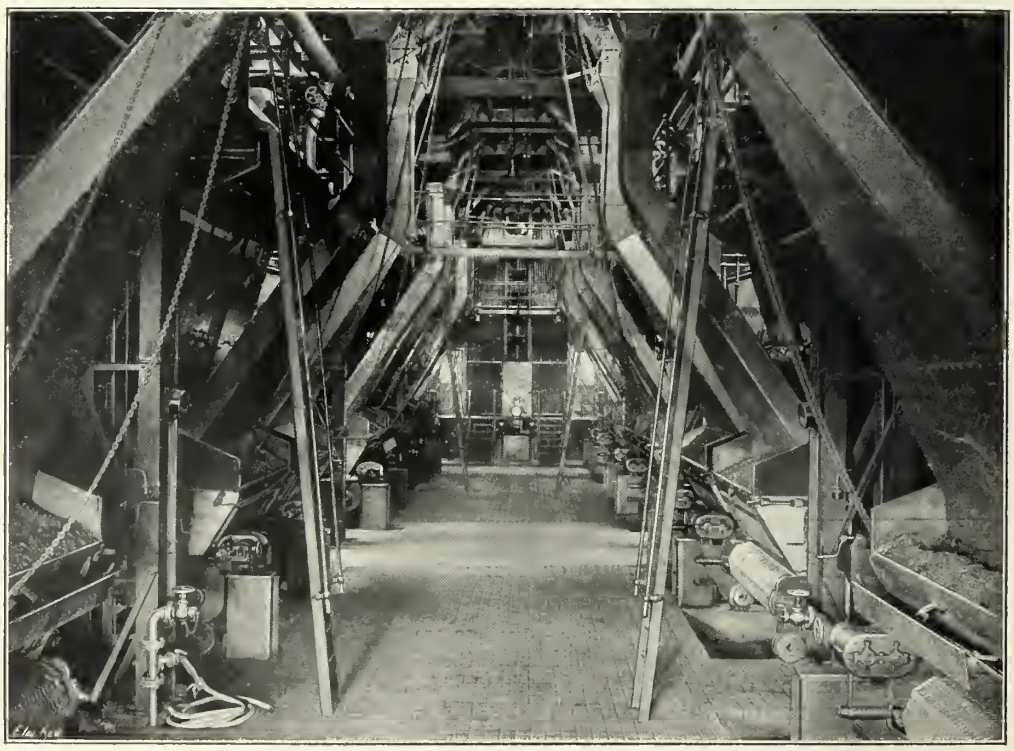


Map of Area Supplied by the Newcastle-upon-Tyne Electric Supply Co.

supplies can be obtained with almost equal facility from either the Durham or the Northumberland coalfields. Condensing water is obtained from the River Tyne by means of suction pipes for each generating unit, taken direct to the river.

The main ideas underlying the design, for which Mr. Charles H. Merz, M.Inst.C.E., is responsible, are those embodied in the paper on "Power Station Design" read by Messrs. Merz and McLellan before the Institution of Electrical Engineers in 1904, and the essential features of the station are apparent from the accompanying drawings and other illustrations. Before describing in detail the plant installed, it may be of interest to call attention to some of the main considerations affecting the design. The station generates three-phase current at a periodicity of 40 cycles and a normal voltage of 5,750 volts. The steam pressure is 200 lb. per square inch, and the steam is superheated, the total temperature being practically 570° F. The station is laid out so as to accommodate eventually six generating units each of 8,000 KW. continuous capacity and 10,000 KW. maximum capacity, or a total capacity of nearly 50,000 KW. If further extensions are necessary, it is intended to commence a new engine room. The engine room has so far been built for four units, of which three are already installed. For every two units there will be one boiler house, or three boiler houses in all, of which one has so far been completed. On each side of each boiler house there are four boilers—three of which are capable of driving one generating unit at full load—or eight boilers per house, so that eventually there will be 24 boilers in the station.

The lowermost portion of the boiler house consists of a very roomy basement some 18 ft. 6 in. high, in which the ashes are dealt with, and in which ash bunkers are provided under each boiler, capable of storing the accumulation of ashes of 14 hours' working at full load. This means that at ordinary load factors each ash bunker need only be cleared once in every 24 hours. The ashes are removed by trucks, which are elevated by electric lifts, and dump the ashes into a large overhead ash bunker for each boiler house. This ash bunker has a capacity equivalent to from two to three days' working of the boiler house, and is arranged over a railway siding, so that ashes may be either taken away by rail



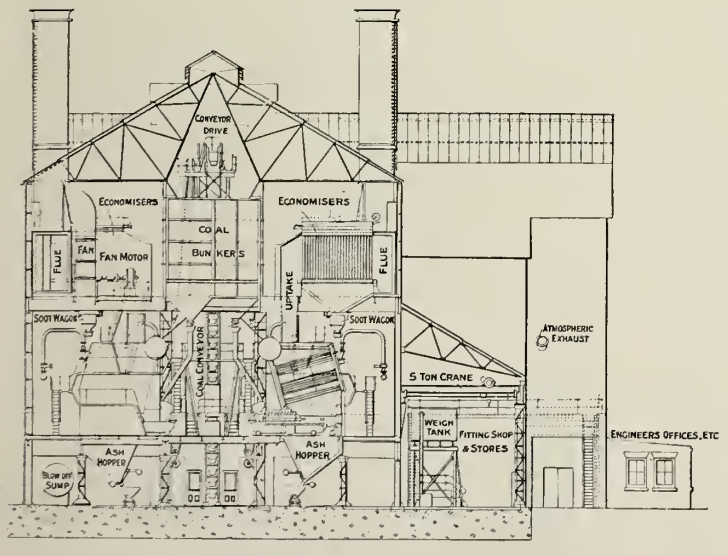
Interior of Boiler House.

or carried in railway trucks to the quay and dumped into barges. On the next floor are the boilers themselves. The boilers are grouped together in pairs, each boiler having its own superheater and economiser, but the gases from each pair of boilers are dealt with by one separately driven fan and chimney, both placed immediately over the corresponding boilers. Between the economisers, which are arranged overhead in pairs, and down the centre of the boiler house, there are placed extensive coal bunkers which are capable of holding a week's supply of coal, assuming the station to be operated at 50 per cent. load factor. The whole boiler installation is designed so that when working at maximum economy the chimney gases are reduced in temperature to below 300° F.



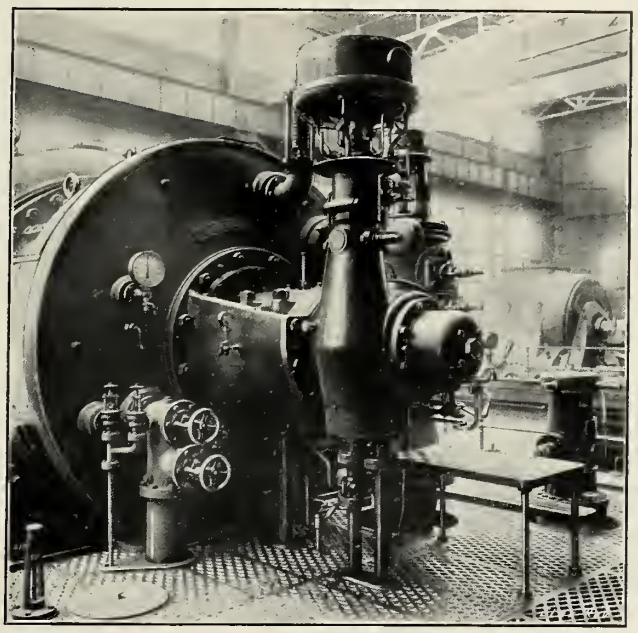
Coal Conveyor: Driving End.

The coal, which is delivered to the receiving hoppers by bottom-dumping trucks, first of all goes (if necessary) through a coal breaker, and is then lifted by means of a Babcock & Wilcox conveyor capable of dealing with 40 tons of coal per hour. It may be recollected that, at the Carville power station, it is possible to run the railway sidings right over the boiler houses. On account of the configuration of the land at Dunston, this was not possible, and advantage has been taken of the necessity for a conveyor to install at



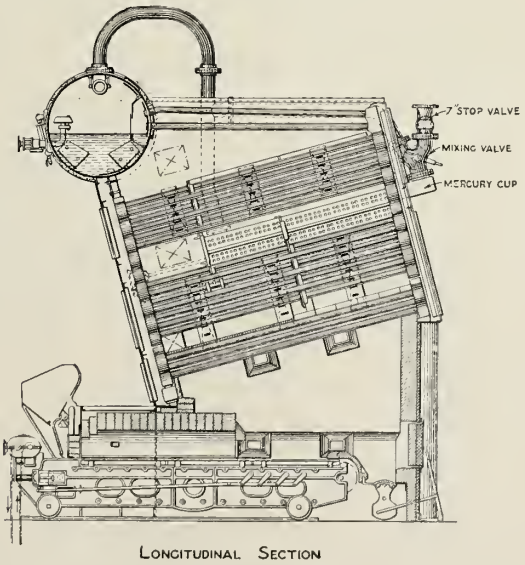
Section of One Boiler House.

the end of the boiler house a large coal store capable of accommodating some three weeks' supply of coal, in addition to that in the bunkers over the boilers themselves. The coal store is arranged so as to receive coal when desired from the same conveyor as that which feeds the boiler-house bunkers. Underneath the coal store there is a tunnel in which there are filling hoppers, which again feed into the same conveyor, so that the one conveyor either delivers coal direct to the boiler house bunkers or delivers it to the coal store or takes from the coal store up to the boiler-house bunkers. If it is desired to extend the storage capacity, this can be done by putting additional floors in the coal store, this being of a sufficient height for the purpose. As is well known, it is not possible to store any great depth of coal in one place owing to the risk of its firing, and the storage of coal in layers some 12 ft. deep on separate floors will be a great advantage from this point of view. The coal from the boiler-house bunkers is led by vertical gravity shoots direct into the boiler receiving hoppers, whence it is fed into the boilers by Bab-



Governor and Valve Gear of A.E.G. Turbine.

cock & Wilcox chain grate stokers, the grate area per boiler being 168 sq. ft. The economisers, of which there is one to each boiler, are situate at the top of the building, where the fans and fan motors are also placed, in a well-lighted and roomy economiser house. The boiler house is arranged with a series of galleries at different heights for water tenders and in order to obtain access to the economisers, fan motors, &c. Each mechanical stoker and each economiser scraper is driven by a separate enclosed electric motor.



Longitudinal Section

Section of Babcock & Wilcox Boiler, Marine Type.

The design, as will be seen later from the drawings, provides that eventually there shall be three end-on boiler houses, each with its own coal store, on the land side of the engine room. The buildings are all steel frame structures, very little brickwork being used at all. All the main switchgear is arranged in a separate building some 150 yards away from the engine house, thus allowing not only of a very light and convenient engine room, but of a switch house into and out of which cables can be taken on any side, thereby greatly facilitating future extensions.

There is one coal store, boiler house, and set of coal-handling plant, for each set of eight boilers, and one boiler house to each two turbo-alternator units. There is one main steam pipe, feed-water pipe, hot-well feed pump, and set of ash-conveying plant for each set of four boilers. There is one economiser and coal shoot for each boiler. Each turbo-alternator unit has its own set of engine-room and boiler-house auxiliaries, supplied with power from an independent "unit" transformer.

(To be continued.)

THE RAILLESS TROLLEY AT LEEDS AND BRADFORD.

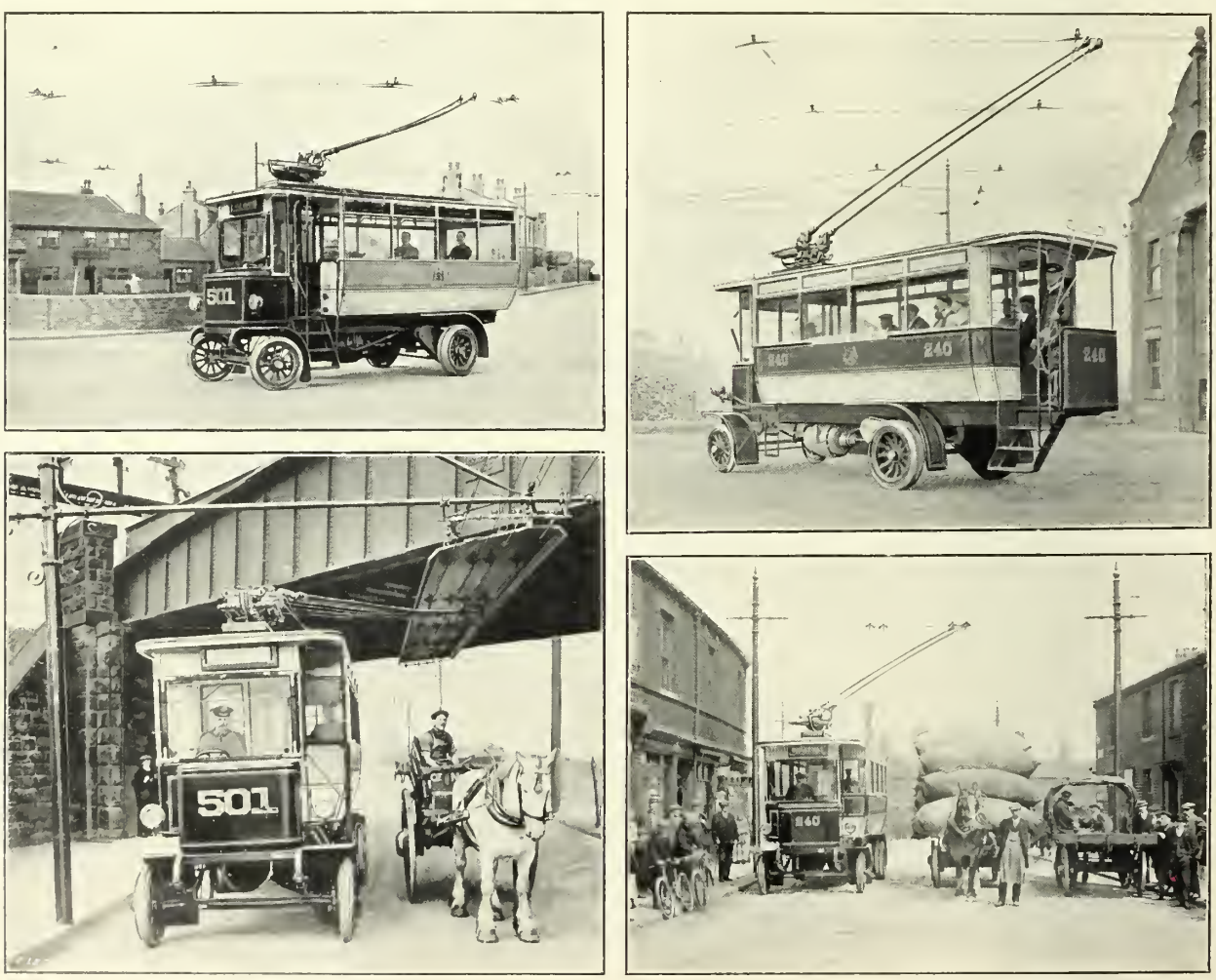
The official opening of the Leeds and Bradford railless trolley systems took place simultaneously on June 20th, the respective Lord Mayors being responsible for inaugurating the two services. At Bradford a route extending from the Thornbury car-shed, along the Leeds Road tramways to the intersection of Laisterdyke, and thence about 1½ miles aeross to Dudley Hill, has been equipped, while the Leeds system extends from City Square to Farnley, about 3¾ miles, nearly a mile of which is along an existing tramway. In the ease of the latter system, the route passes under several railway bridges, one of which we illustrate. The vehicles in each case have been supplied by the Railless Electric Traction Co. London, to the joint specification of Mr. C. J. Spencer and Mr. J. B. Hamilton, the respective general managers of the Bradford and Leeds tramways.



Dudley Hill Terminus, Bradford Railless Trolley System.

Each vehicle provides seating aecommodation for 28 passengers, and is equipped with two 20-h.p. Siemens interpolar traction motors with shunted fields, driving through worm-gears and chains to the rear road wheels, which are solid rubber tired.

Series-parallel controllers are fitted, and energy is taken



(Leeds.) (Bradford.)

Views on the Leeds and Bradford Railless Trolley Systems.
(Leeds views by City Tramways Department.)

off the overhead wires by means of a double under-running trolley, as shown in our views. The steering is arranged so that the vehicles will turn round in a radius of 12 ft. measured from the inner rear wheel, and two sets of brakes are provided, one set acting directly on drums on the rear road wheel hubs, and the other, on the countershaft.

There is ample provision for avoiding obstructing vehicles by the railless 'buses, a deviation of 15 ft., centre of trolley wire to centre of vehicle, being possible.

The vehicles which have a wheel base of 13 ft., and an overall width of 7 ft., are fitted with transverse rattan spring seats and polished oak interiors, while outside they are finished similarly to the tramway cars of the respective Corporations.

The overhead equipment, which is similar in many respects to that provided for the tramways, except, of course, as regards the duplicate trolley wires, has cost about £1,250 per mile, while the vehicles cost about the same as single-truck tramway cars.

In conclusion, we are indebted to the managers of the Leeds and Bradford tramways for the illustrations which we publish.

CONTRACTS OPEN.

(*Continued from page* 18.)

Belgium.—The municipal authorities of Jumet have just invited tenders for the supply and laying of armoured cables in connection with the electric lighting undertaking.

Canterbury.—July 12th. Fine coal and large Welsh steam navigation, for a year, for the Corporation Electricity Works. Henry Fielding, town clerk.

Cardiff.—July 14th. Cables, economisers and induced draught installation, for the Corporation. "See Official Notices" June 23rd.

Colchester.—July 15th. 5,000 tons steam coal for the Borough Electricity Committee. Borough Electrical Engineer, 28, Osborne Street.

Cowdenbeath.—July 10th. Diesel oil engine and continuous-current generator, for the T.C. See "Official Notices" June 30th.

Dundalk.—July 24th. Buildings, plant and materials for the electric lighting of the Urban District for the U.D.C. See "Official Notices" to-day.

Eccles.—July 16th. The Corporation is inviting tenders for the high efficiency motor-driven centrifugal pump, duty 63,000 gal., 35 ft. lift per min. Specifications and form of tender (£1 1s. returnable) from H. W. Angus, borough electrical engineer, Cawdor Street, Patricroft.

France.—July 11th. The French Post and Telegraph authorities in Paris (103, Rue de la Grenelle) are inviting tenders for the supply of 15 tons of galvanised iron wire 1 mm. dia., 100 tons ditto 3 mm. dia., and 200 tons ditto 4 mm. dia.

August 1st.—The Prefect of the Department of the Gard, at Nimes, is inviting tenders for the concession for the construction and working of a steam or electric tramway between St. Ambroix and Bagnols.

Ilford.—July 15th. Wiring and fittings for the electric lighting of Cleveland Road School, for the Education Committee. See "Official Notices" to-day.

London.—Poplar.—July 15th. Overhead coal bunker, coal conveyor, and extension and modification to existing conveyor, at the B.C. electricity works. See "Official Notices" to-day.

L.C.C.—July 19th. Electrical installation at the Hamond Square elementary school. See "Official Notices" to-day.

Newport (Mon.).—July 10th. Best quality small coal for the Corporation Electricity Works, for 3, 6, 9 or 12 months. Borough Electrical Engineer, Town Hall.

Olympia Exhibition.—July 10th. The Executive Committee of the Electrical Exhibition invite estimates for an electrical sign to be fixed outside Olympia for use during the period of the Exhibition. See our advertisement pages for June 30th for further particulars.

Pontypridd.—July 18th. Additional unit at the Treforest refuse destructor for the U.D.C. See "Official Notices" to-day.

Redditch.—July 10th. Single-phase alternator coupled to a Willans steam turbine, condensing plant and pipework, for the U.D.C. See "Official Notices" June 30th.

Salford.—July 17th. One water-tube boiler with superheater, for the Corporation Electricity Department. See "Official Notices" June 30th.

Spain.—The Municipal Authorities of Oalaf (province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of three years.

July 21st.—The authorities of the Government Small Arms Works at Oviedo are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes at the factory during a period of six years.

July 24th.—Tenders may be sent to the offices of the "Gobierno Civil de la Provincia de Lerida," Lerida, for the establishment and working of a telephone system in Cervera.

July 26th.—Tenders are invited ("Gobierno Civil de la Provincia de Santander," Santander) for the establishment and working of a telephone system in Torrelavega.

Stockton-on-Tees.—July 11th. Switches, cut-outs, instruments, &c., for main switchboard, addition to cooling tower, one superheater and one feed water meter, and steam and exhaust pipes and valves, for the Corporation. See "Official Notices" June 30th.

Swinford.—July 10th. Suction gas plants, engines and dynamos, storage battery, &c., switchboard, overhead lines and street lamps, for the R.D.C. See "Official Notices" June 23rd.

Walthamstow.—July 21st. Feeder cables and stoneware conduits for the U.D.C. See "Official Notices" to-day.

York.—July 17th. 2,000 yd. high-tension three-phase underground cable for the City Electricity Department. See "Official Notices" to-day.

CLOSED.

Ashton-under-Lyne.—Messrs. Venner & Co. have received the contract for meters over 10 amperes.

Austria.—The Austrian Siemens-Schuckert Co., of Vienna, have secured a contract for the establishment of a centre electric lighting station in the town of Dux, Bohemia.

Barrow.—Tramways to Biggar Bank.

Steel poles, bases and trimmings.—Messrs. John Spencer, Ltd.
Overhead trolley wire and other fittings.—B.I. and Helsby Cables, Ltd.

Bolton.—The Tramways Committee has accepted the tender of Messrs. J. Booth & Sons for the steelwork required in the erection of the new car repair shed, in Sheffield Street.

Bombay.—The Bombay Electric Supply and Tramways Co., Ltd., has placed an order with the Bastian Meter Co., Ltd., for 300 of their small three ampere meters.

Bristol.—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. Siemens Bros. for cables for the new sheds at Avonmouth.

Dewsbury.—The T.C. has accepted the following tenders:—

Messrs. Cowans, Ltd.—Feeder switchboards.
Messrs. Callender's Cable and Construction Co., Ltd.—Feeder cable.

Glasgow.—The offer of Messrs. Ross & Co. for the supply of the electrical stores for the Trustees of the Clyde Navigation has been accepted.

The T.C.'s Committee on Tramways Works and Stores have recommended the acceptance of the following contracts:—

Dry cells.—Wm. M'Geoch & Co., Ltd.
Tower wagon chassis.—Halley's Industrial Motors, Ltd.
Copper rail bonds.—United States Steel Product Co.
V.I.R. cables.—Liverpool Electric Cable Co., Ltd.
Special track work.—Lorain Steel Co.

Haslingden.—The Corporation has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for underground cables.

Heckmondwike.—The U.D.C. has accepted the tender of the Houghton Main Colliery Co., Ltd., for 3,500 tons of coal for the Electricity Works, at 7s. 10d. per ton; and that of Henry Lodge, Ltd., for 700 tons, at 7s. 3d. per ton.

Heston and Isleworth.—The tender of Messrs. Krupka and Jacoby has been accepted by the U.D.C., at £80, for the annual supply of metallic-filament lamps for street lighting.

Leyton.—The U.D.C. has accepted the tender of the Union Cable Co., Ltd., at £164, for the supply of turbo-generator connecting-cables.

London.—Hackney.—The Electricity Committee received the following tenders for yellow flame arc lamp carbons :—

		Price per 1,000 pairs.
Ship Carbons, Ltd.	(accepted)	£3 0 0
Underwood, Manchester, Ltd.		3 0 0
Wm. Geipel & Co.	(accepted)	3 0 0
Chas. W. Webster		3 2 10
Brush Electrical Co., Ltd.		3 4 6
H. G. Mayer & Co.		3 6 6
General Electric Co.		3 15 6
Sloan Electric Co.		3 17 5
Hayman & Co.		3 19 7
Electrical Co., Ltd.		4 14 0
" "	(alternative offer)	4 9 0
Crompton & Co.		4 10 3
G. Braulik		4 17 0
Radium Electric Co.		5 2 6

The Committee mentioned that Messrs. Underwood were the agents of Ship Carbons, Ltd., so their tender was not further considered. The contract for 100,000 carbons has therefore been divided equally among the two remaining lowest tenderers.

L.C.C.—During the Whitsuntide recess the Highways Committee received tenders as follows for the overhead equipment of the Brixton to Herne Hill tramways :—

Dick Kerr & Co., Ltd.	(accepted)	£2,093
Clough, Smith & Co., Ltd.		2,148
B. I. and Helsby Cables, Ltd.		2,152
R. W. Blackwell & Co., Ltd.		2,462

An outfit of checking meters for Greenwich generating station is to be obtained from the British Westinghouse Electric Co. at £113., A spare hoisting motor for coaling cranes for Greenwich generating station has been obtained from the Electric Construction Co., Ltd., at £165.

For the supply of compressed air cleaning apparatus and lifting plant for car-sheds the Committee received the following tenders :—

(1) Compressed Air Cleaning Apparatus.

Globe Pneumatic Engineering Co., Ltd.	(accepted)	£1,505
Reavell & Co., Ltd.		1,557
Westinghouse Brake Co., Ltd.		1,563
Tilghman's Patent Sand Blast, Co., Ltd.		1,690
Watlington & Co., Ltd.		1,736
Alley & Maclellan, Ltd.		1,934

(2) Lifting Plant.

S. H. Heywood & Co., Ltd.	(accepted)	£1,790
East Ferry Road Engineering Works, Ltd.		1,917
Alex. Chaplin & Co. Ltd.		*665

* Incomplete tender.

Shoreditch.—The Lighting Committee has recommended the acceptance of the following tenders for coal :—

J. Hudson & Co. Ltd.—Scotch washed peas, 11s. 5d. per ton.
G. J. Cockerell & Co.—Cowdenbeath washed peas, 11s. 6d. per ton.

For service and arc cable the tenders of Messrs. Siemens Bros. and Co., Ltd., at £108 and £33, have been accepted.

Norwich.—Messrs. Venner & Co. have recently received orders for 334 time switches, bringing the number in use in this town considerably over 400.

Nuneaton.—The T.C. has accepted the following tenders :—

Galloways, Ltd.—Engine and pumps, £1,723.
Heenan & Froude, Ltd.—Refuse destructor, £775.
John Thompson.—Lancashire boiler, £310.

Stoke-on-Trent.—The T.C. has accepted the tender of Messrs. Veritys, Ltd., for electric fittings for King's Hall, at £777.

Wigan.—The T.C. has accepted the following tenders for the annual supply of stores required by the Electric Light and Tramways Departments.

Electric accessories.—General Electric Co.; Eckstein Heap & Co.; Parmiter, Hope & Sugden; British Thomson-Houston Co.
House service boxes.—Henley's Telegraph Works Co.
Carbons.—Morgan Crucible Co.; H. G. Mayer & Co.
Overhead material.—B.I. and Helsby Cables, Ltd.; Watlington & Co.
Brake blocks.—Taylor & Jones.
Tramcar accessories (steel spindles and graphite brushes).—Fleming, Birkby and Goodall.
Tires.—Percy Clark & Co.
Tramcar resistances.—Wallwork & Co.
Springs.—Lion Spring Co.
D.K. armature coils.—P. R. Jackson & Co.
Armature coils.—British Westinghouse Co., Ltd.
D.K. 33N field armature coils.—Dick, Kerr & Co., Ltd.
Armature coils.—P. R. Jackson & Co.
Gear cases.—British Thomson-Houston Co.
Gear wheels.—British Hele-Shaw Clutch Co.
Sundries.—L. Andrew & Co.

The E.L. Committee report having received tenders for the supply of plant to the Pemberton Station. These being considered unsatisfactory the electrical engineer was instructed again to invite tenders for the plant.

Worthing.—Five firms tendered for the additional plant required at the Corporation generating station and these having been examined by the resident electrical engineer, Mr. G. Porter, the T.C., on the recommendation of the Electricity Committee, decided to accept that of Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, with generators by Messrs. Bruce Peebles & Co., at £3,965. 21 weeks is the period for the completion of the contract.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

Orders for the week ending July 15th, 1911 :—

Headquarters will be open from 10 a.m. to 4 p.m. on Monday, Tuesday, Wednesday, Thursday and Friday.
Saturday, July 15th.—The Sheerness detachment will parade at headquarters at 3 p.m. Dress:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before this parade.
Plymouth Detachment will parade as above at 9.30 a.m. Arms will be issued before the parade.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Cab-tire Sheathed Conductors.—An extremely interesting novelty in connection with house wiring was brought forward by the St. Helens Cable and Rubber Co., Ltd., of Warrington, at the recent Convention of the I.M.E.A. It will be remembered that in our issue of April 22nd, 1910, we described and illustrated the "cab-tire sheathed" trailing cable for coal-cutting machines introduced by the company, who being one of the largest manufacturers of cab tires in the world, conceived the brilliant idea of utilising the wear-resisting qualities of the material for the protection of trailing cables. This application proved most successful; although these cables are exposed to what are probably the most arduous conditions of use known to the electrical industry, being constantly rubbed on rocky surfaces, trodden on, immersed in water, and otherwise ill-treated, we are informed that the makers have never received a single complaint regarding the wearing qualities of the cables, which, moreover, to comply with the rigorous requirements of the Home Office, have to be examined every shift in order to avoid risk of shock to the user. The excellent results obtained prompted the firm to extend the application of the cab-tire sheathing—which, while it contains rubber, and possesses the flexibility and resilience of that material, is not called rubber—and we have before us a specimen of twin flexible for house wiring, which is sheathed with cab-tire. The conductors appear to be 22/36 S.W.G., insulated with pure and vulcanised rubber, and are enclosed in a protective tube of cab-tire material $\frac{1}{16}$-in. thick at the thinnest parts, the overall diameter being $\frac{5}{16}$ in.; the external appearance is very similar to that of compo gaspipe, but leaden in colour. The advantages claimed for it are that it is cable and conduit combined; it can be run in any position, being simply cleated or even stapled up, is perfectly flexible, cannot be kinked even of deliberate purpose, is waterproof and shock proof, takes up the minimum of space, and cannot be injured without the aid of cutting tools. We have stamped on the cord, pinched it flat in a vice, and banged it on a table with the sharp edge of a poker (afterwards cutting it open for inspection) without inflicting the least injury on either the sheathing or the insulated conductors. A cut in the sheathing, made with a knife, does not tend to spread when the cord is twisted or bent in all directions. When exposed to the flame of a match it burns quietly, the flame travelling along the cord at a very slow rate. From the tests we have made we have formed the opinion that this cord possesses excellent qualities, and will prove of great value in reducing the cost of wiring. No reliance is placed upon the sheathing as an insulator. As Mr. Beauchamp said in his paper at the M.E.A. Convention, bad workmen can reduce first-rate material to secondhand quality in the process of erection, but it would be very difficult to damage this cab-tire sheathed material, and we cordially commend it to the notice of all who are interested in cheap wiring. A question may be raised as to its durability; this, we think, is fairly met by the long experience gained with the material for tires, and the makers have exposed it even to the action of ozone for long periods without appreciable effect—one of the most drastic tests to which material containing rubber can be exposed. We are informed that Messrs. Callender's Cable and Construction Co., Ltd., and Messrs. Siemens Bros. & Co., Ltd., are also making this cab-tire sheathed cable, under licence from the St. Helens Co.

Inquiry.—The makers of "Elektra" carbons are asked for.

Appointment Vacant.—Resident engineer for the Dundalk U.D.C. electricity undertaking (£250). See our advertisement pages in this issue.

Croydon Corporation Tramway Sports.—The annual sports of the Croydon Corporation Tramways Athletic Club will be held on Wednesday, July 26th, at 2.30 p.m., on the Brighton Railway Co.'s Athletic Club's Ground, Borough Boundary, Mitcham Road.

Institution Notes.—Institution of Municipal Engineers.—At the annual meeting of the Western District on July 15th, a paper on "Municipal Engineering as a Profession" will be read by Mr. B. Wyand.

Iron and Steel Institute.—At the Turin meeting of October 2nd and 3rd, a number of papers, the subjects of which are now announced, are to be read. One of these is entitled "On the Application of Electrical Energy to the Manufacture of Iron and Steel in Italy" by Cav. Ing. Remo Catani.

Municipal Co-operation with Private Enterprise.—A fresh scheme of proposed municipal co-operation with private enterprise is reported from Darmstadt, where the city authorities have invested £350,000 in electricity works and tramways, but the financial results are far from satisfactory, particularly in the case of the tramways. Not only so, but the extension of the latter is hampered by the suburban steam lines of the South German Railway Co., whilst at the same time the financial situation of the city prevents the raising of capital for the acquisition of the steam lines and their conversion to electric traction, and the construction of new tramways and the development of the electricity works. In these circumstances the city authorities some time ago approached the A.E.G. with a view to securing the company's co-operation in the matter. A draft of a scheme has now been prepared for the formation of a limited company in which shares would be subscribed for by the city and other local authorities, the A.E.G. and the South German Railway Co. The new company would take over the municipal electricity works and tramways, purchase the suburban steam lines in question and erect a large generating station, whilst the town would receive for the lease of its undertakings a sum which would assure the payment of interest on and redemption of the capital expenditure hitherto made. The city would also participate in future increases in the gross receipts and would receive dividends on the shares held by itself. At the end of 30 years the city would have the right of purchase at the book value of all the works erected by the leasing company.

Parliamentary.—Brighton, Hove and District Railless Traction Bill.—This Bill was before the Court of Referees on June 29th, on the question of the *locus standi* of the Brighton Corporation. Mr. Lloyd, K.C., who appeared for the Corporation, explained that the promoters, who were the Brighton Omnibus Co., originally proposed a scheme to run a service of railless trolley vehicles from Portslade, through Hove and Brighton, to Rottingdean. Now it was only proposed to run a service from Brighton to Rottingdean, and the Corporation objected to the truncated service. Brighton already had an experience of isolated systems, and did not want the main approach road to the town occupied with a small system which, he contended, would be unremunerative. Mr. Wedderburn, K.C., for the promoters of the Bill, said all they asked for was to substitute the railless-trolley system for self-contained motors on the road from Brighton to Rottingdean. This route was outside Brighton, and was supported by the Rottingdean people. The Court decided that the *locus* of the Corporation should be restricted to the question of electricity and water mains.

The Royal Assent has been given to the Metropolitan Electric Supply Co. (Acton District) Act, 1911.

In the House of Commons on June 27th, the Telephone Transfer Bill was given a first reading, and the Middlesbrough, Stockton-on-Tees and Thornaby Tramways Bill was read a second time.

In the House of Lords on June 28th, the East Kent Electric Power Bill was read a second time, and the Nottinghamshire and Derbyshire Tramways Bill, and the South Lancashire Tramways Bill, were read a third time and passed. On July 3rd, the L.C.C. Tramways and Improvements) Bill and the Metropolitan Electric Tramways Bill were read a second time. On July 4th, the Bristol Tramways Bill was read a second time.

A Walking Race for the Electrical Trade.—A London-to-Brighton walking race open to all amateurs employed in the electrical trades will take place on Saturday, July 29th. We are informed that although most of the prominent long-distance walkers in England to-day are connected with the electrical trade, notably H. V. L. Ross, T. Dumbill, F. E. Roberts, W. Brown, &c., it is not to encourage the champions that the walk is being promoted, for the prizes for the novice section will be quite as numerous and valuable as the scratch prizes, while it is also proposed to present time certificates to all who complete the walk in under 10½ hours, as a memento of the event. Donations to the prize fund are being solicited from employers and others, and the promoters would be glad of further assistance on the committee from enthusiasts. The entrance fee will be 3s., and entry forms will be ready in a few days. We understand that the General Electric Co., Ltd., has offered an "Osram" trophy of the minimum value of £5, the value to be increased according to the support accorded to the event; other donations have been either promised or given. A further sum of about £30 is required, while all cyclists who are willing to assist on the day as attendants to the competitors, &c., and gentlemen willing to assist with their motor-cars, are asked to communicate with the hon. sec., Mr. S. C. Haynes, May-Oatway Fire Appliances, Ltd., 92-4, Paul Street, London, E.C.

Electrical Contractors' Association (Inc.) Annual Dinner.—On Monday last the annual dinner of the Association was held at Frascati's; Mr. G. Harland Bowden presided over a gathering of about 100 members and guests. After the loyal toasts had been heartily honoured, Mr. R. Tweedy Smith proposed the "Houses of Parliament," referring to his own aspirations in that direction, and emphasising the necessity of putting the utmost pressure upon Members to prevent the undue extension of municipal trading. Mr. H. Terrell, K.C., who was to have replied, wrote regretting that he was compelled to attend at the House of Commons.

Mr. H. H. Berry, proposing the "Electrical Contractors' Association," said the Association had had a most successful year. Mr. Bowden had travelled the country building up a fighting fund, with which they would be able to fight a coming Bill. They had done well to choose him as President for a second year.

The toast was drunk with musical honours, and the President, in his reply, said they had increased their membership during the past year by 20 per cent. He had had a gratifying reception in all parts of the country, and the result was that a handsome sum was at their disposal, and the sources were not exhausted. Seeing that members of the M.E.A. had proved themselves good friends to the contractors, was it not a pity that friendly relations could not be established between the two Associations? He was sure that they, as well as the contractors, were disappointed at the negative result of the Conference. The rock upon which they split was the fact that while the policy of the contractors must be to fight in order to retain the means of livelihood, that of the municipal electrical engineers led in the direction of municipal trading. He wished the British public could be educated to realise the point at issue. The municipal engineer had done his work well in cheapening electric light, power and traction, but could it be right for the municipality to enter private premises and carry out work, cutting out the contractor, who was himself a ratepayer? They were fighting in the last ditch, against a most unfair form of competition. He cited the recent united action of the medical profession as a parallel case (which we may say, however, it is not). The British public must be educated to understand the position of the contractor, and the members of the Association must show steadfastness of purpose and devoted loyalty to the Association, not attaching undue importance to local interests.

Mr. Rawlings proposed "The Institution of Electrical Engineers, the Cable-Makers' Association, the National Electrical Manufacturers' Association, and kindred associations," expressing gratitude to the I.E.E. for valuable assistance, especially for the Wiring Rules; to the cable-makers for maintaining the standard of quality in the face of severe competition; to the (late) president of the M.E.A., remarking that if it were guided by such men the contractors need have no fear; and to the National Electrical Manufacturers' Association, suggesting that the manufacturer was at present the only member of the industry making any money, and acknowledging the good work done by the Association. He proposed that the next organised debate should deal with the question "when does a manufacturer become a contractor," and *vice versâ*. Mr. Ll. B. Atkinson, in reply, pointed out that Herbert Spencer had shown that all development was from the simple to the complex, and that this could be observed in the electrical industries. The Institution, in his opinion, had done wisely in avoiding commercial questions, which could be more usefully dealt with by the various associations performing specialised functions, and he asked them to look upon the formation of these associations as a stage in the development towards a higher and more complete organisation, to the advantage of the whole industry. Mr. F. H. Nalder, President of the N.E.M.A., replied for that body, denying that manufacturers were any better off than others in the electrical industry, and pointing out that negotiations between representatives of the different associations had often produced happy results for all parties. Mr. E. C. Wallis, in eulogistic terms, proposed "The Health of the President," who, in reply, expressed his gratification at the hearty reception of the toast and on his re-election as President, remarking that he was sufficiently rewarded by the cordial support of the members, which he sincerely appreciated. The proceedings were enlivened by a programme of music and recitation, under the direction of Mr. Richard Triggs.

Annual Outing.—The annual outing of the St. Pancras B.C. generating station's staff took place on Saturday, July 1st, to Brighton. As many as possible of the staff were present, and dinner was served at the Washington Hotel, with Mr. J. T. Baron, the supervising engineer, in the chair. After the usual loyal toast the chairman proposed the "Success of the Undertaking," coupling with it the name of Mr. Sutton, senior shift engineer of King's Road Works, who also acted as hon. secretary and treasurer of the outing. Mr. Sutton suitably replied, and then proposed the health of Mr. Baron, their immediate chief, who, he said, they were most pleased to see with them. Mr. Baron, on replying, was received with cheers, thanked them, and expressed himself highly gratified with the general good feeling existing.

Liverpool Tramway Sports.—The eighth annual amateur athletic sports, promoted by the Liverpool Corporation Tramway Employés' Social and Thrift Society, were successfully held at the society's ground in Green Lane, on Thursday and Friday, June 29th and 30th, under the honorary presidency of Mr. C. W. Mallins, tramways general manager. The Lady Petrie Cycle Challenge Trophy, competed for by branches of the society, was won by the holders (Walton). The prizes were presented by Lady Petrie, wife of the chairman of the Tramways Committee.

Electrical Mill Driving.—The Textile Institute, which has its headquarters in Manchester, has decided to co-operate with the I.E.E. in making a general investigation into the application of electricity in textile mills at home, on the Continent, and in America. A committee of 28 (14 from each Institute) is being formed.

The Reduction of Staff in Germany.—The question of the reduction in the staff at the Frankfort dynamo works, as a result of the transfer of the latter to the A.E.G., was raised at the recent meeting of the Felten & Guilleaume-Karlswerk, of Mulheim. As the company's accounts included the officials' provident fund, a shareholder pointed out that, in consequence of the amalgamation of the works with the A.E.G., a number of officials had been deprived of employment and 200 were given notice at the end of March, who had, in part, been employed at the Frankfort works for years. Some of the officials had addressed a petition to the directors, asking that a portion of the provident fund should be devoted to the support of

the officials who had become out of work, and the shareholders asked whether the directors would be prepared to grant the request. Dr. Gnauth, who replied to the question, is reported to have stated that the promise given at the meeting held last October had been kept, and the directors had continued to pay the salaries of those officials who had lost their positions through discharge, until the acquisition of a new situation. Nevertheless, the number of requests which had reached the directors was comparatively small, and that probably justified the conclusion that the number of necessitous cases also was not very large. This was also confirmed by what the speaker had heard in regard to how many officials of the Frankfort works had found occupation with the A.E.G. and elsewhere. If the number of requests had been small that was also due to the circumstance that the A.E.G. had afforded the opportunity to the officials of seeking other employment by continuing to pay salaries far beyond its legal obligations. The directors of the Felten & Guilleaume Co. continued to grant support to the unemployed officials in cases of necessity, but the question of utilising the provident fund for the purpose was quite another matter. Negotiations on the subject would have to be conducted between the company and the A.E.G., but they would be difficult, as the proposal was not a claim which could be legally put forward.

Dunston Power Station.—On Wednesday, by invitation of the Newcastle-upon-Tyne Electric Supply and the County of Durham Companies, an inspection of this new generating station, of which we commence a description elsewhere in this issue, was made by a large party of gentlemen. Luncheon was subsequently served at Newcastle, Dr. J. T. Merz receiving the guests: the company included Mr. S. Z. de Ferranti, who proposed the toast, "Electric Power Supply," to which the chairman replied. We shall report the event more fully in our next issue.

The Batti-Wallahs.—Arrangements have been made for the Batti-Wallahs' Society to visit and inspect the R.M.S. *Olympic* at Southampton on July 29th. The party will be subsequently entertained at lunch by the President, Mr. W. Slade Olver, on board the Royal Motor Club yacht *Enchantress*, and will witness a regatta in the afternoon.

£30,000 Gift for Chemical Laboratories.—Mr. Ralph Collingwood Forster, J.P., of The Grange, Sutton, who has already given £4,500 to complete the site for the new chemical laboratories at University College, has written to Prince Arthur of Connaught, the president of the Appeal Committee, intimating his intention to commemorate Coronation year by making a further gift of £30,000 to the College, in the hope that the building of the laboratories may be speedily proceeded with.

The Brighton Metropole Illuminations.—The most attractive hotel illuminations in Brighton, during the Coronation, were those on the Hotel Metropole, where some 2,200 Ediswan lamps were employed, the installation having been carried out by the hotel staff under Mr. Mahood, the electrical engineer. This building was in marked contrast to its neighbour, the Grand, which relied on "the lively flicker and sparkle of gas," as an interested contemporary has it.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. G. Waring has been appointed to the position of shift engineer of the Eccles Corporation, in place of Mr. E. J. Ward, resigned.

Mr. P. J. S. Tiddeman, late electrical engineer to the former Stoke-on-Trent T.C., has withdrawn his appeal to the treasury for compensation for loss of office owing to the Federation scheme.

The Loughborough T.C. on Monday decided to increase the salary of Mr. J. H. Dent, and to appoint him deputy electrical engineer.

The Croydon B.C. has agreed that the salary of the borough electrical engineer (Mr. A. C. Cramb), £600, be increased by £50 a year, rising to £800; and that the salary of the assistant engineer be increased by two instalments of £25 each to £350.

On June 27th the staff of the Farnworth U.D.C. electricity and destructor works presented Mr. A. J. Hutchinson, the chief engineer and manager, with a marble timepiece, suitably inscribed, to celebrate the occasion of his marriage, which was to take place on 29th ult. The presentation was made by Mr. W. Phethean, the chief assistant engineer, supported by Mr. W. E. Waters, secretary, and other members of the staff.

The Finance Committee of the Burnley Corporation has recommended that the salary of Mr. J. E. Starkie, borough electrical engineer, be advanced from £350 to £400 per annum.

Tramway Officials.—The Halifax Tramways Committee has recommended the T.C. to increase the salary of Mr. J. W. Galloway, engineer, from £250 to £275 per annum.

General.—Mr. J. Douglas Collier has just arrived in this country from Japan. His visit chiefly relates to the order recently placed with his firm (Messrs. L. J. Healing & Co., Ltd., Japan) by the Imperial Government, for a 10,000-H.P. gas-driven generating station to be installed on the new electrified line between Tokio and Yokohama. Mr. Collier expects to be here for several months before returning to Japan, and correspondence intended for him should be addressed, c/o Messrs. Tozer, Kemsley and Fisher, Ltd., 84, Fenchurch Street, London, E.C.

Mr. J. G. Lorrain, consulting engineer and patent agent, has removed to Staple Inn Buildings, Holborn, London, W.C.

The Royal Society of Arts has awarded its Albert Medal to the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., for his experimental researches into the laws governing the efficient action of steam in engines of the turbine type.

Consequent upon the retirement of Mr. Steinitz, the following staff changes are announced by the Brush Electrical Engineering Co., Ltd.: Mr. B. Broadhurst is appointed general manager, with headquarters at Loughborough; Mr. W. Johnstone is appointed assistant manager, with headquarters in London; Mr. G. S. Wood (at present works manager at the Witton Works of the General Electric Co.) is appointed works manager at Loughborough.

The Bridlington T.C. has appointed Mr. Fred. Whiteley, of Leeds, as electrician at the Royal Prince's Parade.

The Southampton Harbour Board has appointed Mr. G. E. Tilling as electrician.

Mr. P. C. Jones has resigned his position as control gear sales engineer to the British Westinghouse Co., and joined Messrs. Allen West & Co., Ltd., of Brighton, in a similar capacity.

Obituary.—We regret to record that Mr John Gilley who was with the Foster Engineering Co., Ltd., from the commencement, and was their first outside representative, died on June 14th from consumption. Mr. Gilley had many friends in the trade.

Mr. F. E. Baines.—We regret to learn that Mr. F. E. Baines, C.B., who for some 40 years filled various important offices in the General Post Office, including that of Assistant Secretary and that of Surveyor-General of Telegraphs, passed away on Tuesday last at Hampstead, aged 79 years.

Dr. G. Johnstone Stoney, F.R.S.—We regret to learn from the *Times*, just as we go to press, that Dr. George Johnstone Stoney, Sc.D., F.R.S., passed away on Wednesday morning, at the advanced age of 85 years. Dr. Stoney was a president of Section A of the British Association, and he served on the Committee of that Association which, many years ago, decided on the C.G.S. system of units, and he is credited with being the first to suggest the name "electron." He had been a Fellow of the Royal Society since 1867. His eldest son is Mr. Gerald Stoney, who, as manager of the Parsons turbine works, is well known to, and esteemed by, so many electrical and other engineers.

NEW COMPANIES REGISTERED.

Record Electrical Co., Ltd. (116,488).—This company was registered on June 24th, with a capital of £20,000 in £1 shares (10,000 preference), to carry on the business of manufacturers of and dealers in electrical machinery and appliances, electric measuring instruments, meters, wires, cables and other apparatus and appliances, &c., and to adopt an agreement between C. W. von Roemer, J. W. Record and T. J. Boorne. The subscribers (with one share each) are:—J. W. Record, 5, Beech Avenue, Gatley, Cheshire, electrical engineer; T. J. Boorne, 34, Marlborough Road, Wimbledon Park, S.W., electrical engineer. Private company. The number of directors is to be less than two or more than five; the first are J. W. Record, managing director, and others to be appointed by the subscribers; qualification, £5; remuneration as fixed by the company. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

W. C. Tackley & Co., Ltd. (116,522).—This company was registered on June 27th, with a capital of £500 in £1 shares, to carry on the business of electrical and mechanical engineers, electricians, manufacturers and dealers in electrical equipment and machinery, &c. The subscribers (with one share each) are:—T. M. Marris, 25, Ingersoll Road, Shepherd's Bush, W., secretary; A. E. Lees, 2, Livingstone Road, Palmers Green, director. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; no qualification necessary. Registered by Arthur Benjamin & Cohen, College Hill Chambers, E.C.

F. G. Edey & Co., Ltd. (116,551).—This company was registered on June 29th, with a capital of £3,000 in £1 shares, to take over part of the assets of the business carried on by F. G. Edey & Co. at 25, Warwick Lane, E.C., and to carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The subscribers (with one share each) are:—F. E. Edey, 25, Warwick Lane, E.C., electrical engineer; D. Edey, 25, Warwick Lane, E.C., electrical engineer. Private company. The first directors are F. E. Edey and D. Edey. Registered office, 25, Warwick Lane, E.C.

Corona Lamp Works, Ltd.—(116,527).—This company was registered on June 28th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electric lamps, fittings, batteries, accumulators and electrical accessories, &c., to acquire the business carried on at 10, Ascham Street, Kentish Town, and at 47 and 51, Stanley Road, Southfields, as the Corona Lamp Works Co., and to adopt an agreement with G. N. Ogilvie. The subscribers (with one share each) are:—G. N. Ogilvie, 13, Buckingham Gate, S.W., electrical engineer; A. N. C. Mackley, 36, Victoria Street, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are G. N. Ogilvie (chairman and managing director) and A. N. C. Mackley; qualification, £10; remuneration, £200 each per annum. Registered office, 10, Ascham Street, Kentish Town, N.W.

British Arc Welding Co. (North-East Coast) Ltd. (116,568). This company was registered on June 30th, with a capital of £20,000 in £1 shares, to take over a process for electrical welding under a grant or licence given by the British Arc Welding Co., Ltd., to R. F. Brigham and R. Cowan. The subscribers (with one share each) are:—R. F. Brigham, 186, Westoe Road, South Shields, engineer and ship repairer; R. Cowan, Grosvenor Road, Westoe, South Shields, engineer and ship repairer. Private company. The number of directors is not to be less than two or more than six; the first are R. F. Brigham and R. Cowan (managing directors for 10 years). The British Arc Welding Co., Ltd., have the right to one nominee on the board; qualification, £400. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

CITY NOTES.

General Electric Co., Ltd.

THE report of the directors for the year ended March 31st, 1911, to be submitted at the meeting to be held at 67, Queen Victoria Street, E.C., on Monday, July 17th, is as follows :—

The net trading profits and income from investments, &c., amount to £119,146, to which must be added balance brought forward from last account, £8,919, making a total available profit of £128,065. After deducting debenture interest and depreciation amounting to £32,331. there remains a balauce of £95,734, out of which the dividend on the preference shares at the rate of 5 per cent. for the year ended March 31st, 1911, has been paid, absorbing £12,500. and there is transferred to reserve account, £43,616, leaving an available balance of £39,618, which the directors recommend should be appropriated as follows : Provision for managing director's and employés' bonus, £7,431 ; provision for dividend on ordinary shares at the rate of 5 per cent. for the year ended March 31st, 1911, £19.973 ; balance to be carried forward, £12,214. The reserve account is as follows : The balance at March 31st, 1910, was £158,488, to which has been added out of profit for the year ended March 31st, 1911, £43,616, giving a total reserve account of £202,104. Out of this amount the directors have decided to apply towards writing down goodwill and patents the sum of £92,104, leaving a total reserve account of £110,000. The directors have to record with deep regret the death during the year of their late chairman and managing director, Mr. G. Byng.

"The result of the trading for the year to March 31st, 1911, has been satisfactory. The factories at Witton, Salford, Birmingham and London have been well employed during the year. The removal of all manufacturing departments other than telephone and telegraph apparatus from Salford to Witton has been completed, the central stores from Manchester have also been removed to Witton. The additional capital expenditure incurred during the year has been principally devoted to the housing of these departments. The investment account comprises mainly investments in undertakings owned or controlled by this company, and is developing to the satisfaction of the directors. Further ordinary shares to the number of 1,156 have been allotted during the period covered by the accounts, to the directors and staff at par. Mr. L. G. Byng, and Mr. A. H. Railing, who were appointed directors by resolutions of the board, dated January 16th, 1911, and April 11th, 1911, respectively, being eligible, offer themselves for re-election.

Mr. E. G. Byng also offers himself for election.

For the interest of our readers we give below the comparable figures from the reports for the three years ended March, 1909, 1910 and 1911 :—

	1909.	1910.	1911.
Net trading profit and income from investments	£78,201	£95,462	£119,146
Depreciation and deb. interest ...	26,987	27,057	32,331
Balance	51,213	68,404	95,734
Pref. div.. 5 per cent. for the year	12,500	12,500	12,500
Available balance	38,713	55,904	83,233
Managing director's and employés' bonus	3,871	5,590	7,431
Ordinary dividend, 5 per cent. ...	18,697	19,395	19,973
To reserve account...	16,145	22,000	43,615
Balance carried forward	—	8,919	12,214
Reserve fund total...	£136,488	£158,488	£202,104*

* As £92,104 of this is now applied towards writing down goodwill and patents, the total reserve is £110,000.

Goodwill and patents now stand at £1 in the balance-sheet.

The company's investments consist of debentures, stocks and shares to the amount of £121,556, and the income upon these was £11,280 for the year. Sundry creditors stand at £218,620 ; sundry debtors at £402,227 ; stock in trade at £340,138 ; and bank balances and cash in hand amount to £56,744. We congratulate the General Electric Co. upon doing a record year's business, also upon their conservative policy in handling the profits. The temptation to pay a big dividend on the ordinary shares has been resisted, and the distribution is continued at the rate of only 5 per cent., the large balance of profit being put to reserve, and from reserve being applied, with the assistance of other moneys taken from that fund to the wiping out of goodwill and patents.

Mexican Light and Power Co.—A dividend of 1 per cent. on the ordinary shares is payable July 15th.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum on the preference stock, for the quarter to June 30th, and a first quarterly interim dividend of 1¼ per cent. on the ordinary stock.

Indo-European Telegraph Co., Ltd. — An extraordinary general meeting was held on June 28th, at which new articles of association were adopted.

Edmundsons' Electricity Corporation, Ltd.

THE report of the directors for the year ended March 31st, 1911, to be presented at the annual meeting on July 13th, states that the net profit, after payment of interest on the debenture and prior lien debenture stocks, amount to £16,138, as compared with £10,768 last year. Adding to this amount the balance of £25,578 brought forward from the last year, there remains the sum of £41,716, which the directors recommend should be carried to reserve. The gross trading profit has increased by £2,335. The dividends and interest received have increased by £4,068, and the Urban Co. guarantee is less by £854, whilst the loss on working the local authorities' undertakings is increased by £1,871, the greater part of which is due to payments for interest and sinking fund on sums paid to this company in respect of work carried out during previous years. The investments in and advances to subsidiary and other companies amount to :—Shares, £790,004 ; debentures, £220,098 ; advances, £492,659 = £1,502,761. The following are the gross profits of subsidiary and other companies for the years 1909 and 1910 :—

Name.	Gross profit (before providing for capital charges and depreciation). 1910.	1909.	Lamps connected (equiv. 33-watt). 1910.	1903.
Alderley	£2,213	£1,792	21,377	19,114
Bromley	12,693	12,512	95,307	89,282
Folkestone	15,465	14,049	118,049	111,748
Guernsey	5,526	5,696	95,833	90,079
Isle of Wight	12,367	11,396	107,028	98,997
Ilfracombe	1,029	1,154	16,607	18,960
Lymington	1,588	1,602	17,370	17,843
Melton Mowbray ..	2,215	2,004	19,889	18,074
Newmarket	2,401	2,494	25,988	24,443
North of Scotland ..	5,097	4,016	66,597	59,864
Ramsgate	1,902	1,909	31,661	27,372
Scarboro' Trams ..	—39	—677	—	—
Salisbury	5,974	5,739	37,813	35,797
Urban Co...	45,300	43,113	525,160	476,596
Winchester	7,114	6,921	60,235	58,653
Wycombe	4,931	4,823	53,379	51,025
Cromer	909	924	13,430	12,466
Dorking	1,767	1,862	18,363	17,208
Frome	907	1,266	33,153	30,199
Hamilton	2,695	2,905	48,670	43,106
Surbiton	3,615	3,839	35,974	33,758
Total	£135,669 (Inc. £6,337)	£129,339	1,441,883 (Inc. 107,299)	1,334,584

The total capital expenditure in the above undertakings has increased from £2,825,225 to £2,911,080 (Inc. £85,855).

Greenwood & Batley, Ltd.—In their report the directors state that, after providing for interest on the debentures, expenses of management and doubtful debts, the accounts for the year to March 31st show a profit of £20,198, plus £2,211 brought forward, making £22,409. In reference to the subsidiary and connected companies, although some of these give satisfactory results, the directors consider it advisable to depreciate and also to provide for a possible loss in connection with others, and for this purpose they have transferred the sum of £10,000 from the reserve, together with £3,000 from the above balance. This leaves £19,409 to the credit of profit and loss, out of which £10,000 has been written off for depreciation. A dividend for the year at the rate of 7 per cent. per annum on the paid-up cumulative preference share capital, absorbs £7,027, and leaves a balance of £2,381 to be carried forward. The works have been maintained in a high state of efficiency, and are well employed at the present time.

Prospectuses.—*Canadian P. J. Mitchell Co., Ltd.*—We have received a copy of the prospectus of this company, the registration of which was recently recorded in our "New Companies" section (ELECTRICAL REVIEW, June 23rd, p. 1010). The company will acquire the goodwill of the business connection and organisation established in Canada by Mr. P. J. Mitchell, of Caxton House, S.W., including that in connection with the supply of Rateau patent exhaust steam plants, and the agenies held by him in Canada for a number of important firms (among them Greenwood and Batley, Ltd., Lassen & Hjort, Higginbottom & Mannock, Ltd., and others). The purchase price is £1,000, payable in 20,000 fully paid ordinary shares of 1s. each ; there is no cash payment ; 20,000 6 per cent. preference shares are offered for subscription. Among the agreements mentioned in the prospectus is one whereunder Mr. Archibald Parker Smith will act as general manager of the company in Canada, and one appointing Mr. W. Armstrong technical manager in Canada, both for a period of two years, at £500 per annum each.

Metropolitan District and London Electric Railways Joint Power House Rent Charge Stock.—The subscription list is to close to-day in the above 4 per cent. stock offered for sale at par by Messrs. Speyer Bros.

The Tri-State Railway and Electric Co., Ohio.—The Municipal and General Securities Co., Ltd., have been offering for sale $668,000 6 per cent. bonds to bearer of $1,000 each at 95 per cent., with a bonus of 25 per cent. common stock. The operating managers are Messrs. J. G. White & Co., of New York

Continental.—FRANCE.—La Société de l'Energie Electrique de la Basse Loire, of Paris, is increasing its capital from £48,000 to £80,000.

J. G. White & Co., Ltd.

The annual meeting was held on Thursday last week at the offices, 9, Cloak Lane, Cannon Street, E.C., Mr. J. G. White presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 1053), said that at the last annual meeting they were able to allocate to reserve and dividends the largest profits in the company's history. That day they were able to congratulate one another on further progress; the net profit for the year having amounted to £91,466, as against £64,801 for the previous year. Not only was this profit by far the largest ever shown by the company, but the increase over the preceding year was also the largest ever made. It was, however, as stated last year, not to be expected that profits so large as these could be realised every year, the results of the period under review having exceeded their own expectations. At the same time they still considered the position of the business in hand as being quite satisfactory and the outlook most encouraging. Referring to the balance-sheet, they would note that the quick assets of the company in the form of cash and loans against securities amounted to £136,332, an increase of about £18,000 over the figures shown in the preceding year. This quick asset item was nearly double the total single creditor item on the other side of the balance-sheet, although this latter item included certain considerable contingent provisions; so that this cash, and practically cash item, was more than double the actual total debts. The item of sundry creditors of £71,897 was larger than last year, indicating an increase in the business. The figure for investments stood at £150,781, which was also considerably more than twice the company's total debts. This item showed an increase of approximately £28,000 over last year. Their investments in associated companies were practically fixed and permanent, and included a controlling interest in the shares of the Building Construction Co., Ltd., which had built a number of the most important buildings in London. During the past year a considerable new investment in this class was made by the formation of the Municipal and General Securities Co., Ltd., with a capital of £50,000, all owned by this company (and now having a surplus of over £12,000), to carry on a general financial business in the purchase, sale, and issue of securities. The first half-year of this Securities Co.'s operations had been most successful. The aggregate par value of shares of this class owned by the company was about £152,000, included in the balance-sheet at under £87,000. The syndicate class of investments were usually taken in connection with efforts to secure new business, either financial or engineering. They made a general practice of immediately writing down each such investment to a nominal value of £1 regardless of cost. As a consequence the balance-sheet value of this class aggregated some £10, although the total par values exceeded £20,000. The general investments were the securities taken in connection with contracts or promotions, or purchased with the expectation of selling at a profit. The financial profit previously mentioned had resulted largely from the sale during the past year of securities in this class. As to present valuations of this class, personally, he should not be willing to see the lot sold at double balance-sheet figures. The dividends received during the year on securities owned (omitting one large dividend from a syndicate now in liquidation which could not be considered as a regularly recurring item), amounted to £12,439, or 8·2 per cent. on the present total of the investment account, and more than sufficient to pay 6 per cent. dividends on the company's entire preference and ordinary share capital. They would understand that the company's financial department was becoming increasingly important. Growth in this direction was likely to continue. This had been accomplished by departmentalising, and without interfering with the efficiency of the company's engineering and construction departments. On the contrary, they believed that these departments were better able than ever before to undertake a wide range of engineering and construction work, partly because of the increasing experience of the engineering and construction staff, and partly due to the wider scope of work undertaken. Recently additions to these departments had been made of men specially skilled in designing and supervising the construction of hydro-electric and other water-power developments, water supply systems, sewage disposal plants, &c. This general field of engineering should become increasingly important to the company. During the year increased business in the operation of tramways and electric lighting properties resulted in the formation of a separate department for the operating management of these and similar companies. This department was now prepared to furnish offices, board room accommodation and secretarial services, as well as expert advice to boards of directors, to purchase at low prices supplies and materials needed for companies managed, and generally to assist in working out efficient and economical management for properties, and to substantially aid in their progressive and systematic development. The items of sundry debtors and works in progress, aggregating £158,596, also showed an increase over the last account. This, like the increased creditors, indicated the greater volume of work in hand in their engineering department. Plant, instruments, and stock of materials, now stood at the nominal valuation of £1, which valuation spoke for itself. Purchase of business stood at £15,000, to which figure it was written down from £47,975 out of the profits of the previous year. They were proposing this year to wipe this account out altogether, though his personal opinion was that in future balance-sheets the item should appear at a nominal figure of £1. Referring to the profit and loss account, there was no item which required any comment, except, perhaps, the figure of £12,057, "percentage to directors and staff." The principles behind this item were fully explained to them last year. The directors in charge and the staff had earned their contingent salaries, and were quite entitled to share in their prosperity. The next point was the distribution of the remaining profits for the year. They believed in a generally conservative policy with reference to dividends. The strong position of the company at the present time was to a considerable extent due to the building up of substantial reserves out of profits. During the 10½ years of the company's life, including the distribution recommended in the report, the company would have paid out in dividends £160,708, and had retained in the business out of profits £182,787. This surplus had been mainly contributed by the ordinary shareholders for the benefit of the company as a whole. Had all the company's profits for the last five years been distributed to shareholders, leaving the reserve at about £57,000, the preference shareholders would have received, including the proposed dividends for July 1st next, a total of 60 per cent. instead of 45 per cent., and the ordinary shareholders would have received 302 per cent. instead of 95 per cent. In other words, after allowing for proposed dividends, the preference shareholders had contributed to the surplus remaining in the business 15 per cent. on the par value of their shares, and the ordinary shareholders 207 per cent. The directors believed in continuing the policy of building up reserves, and, therefore, proposed that of the sum of £88,812 now available for distribution, £15,000 be allocated to writing off the balance of purchase of business account, and a further £15,000 be placed to the credit of a new reserve account for the equalisation of future dividends. This total sum of £30,000 having been set aside, the directors felt justified in recommending a dividend of 7 per cent. for the half-year on both the preferred and ordinary shares, making with the interim dividend of 5 per cent. paid January 1st, a total distribution of 12 per cent. for the year. As they knew, the preferred shares were cumulative as to 6 per cent., and thereafter they shared with the ordinary up to a total distribution of 12 per cent., the ordinary being entitled to remaining surplus profits. They further recommended an extra dividend of 10s. per share, or 50 per cent. on the ordinary shares, making a total of 62 per cent. for the year, leaving a balance of £19,813 to be carried forward to next year's accounts. In this connection they might note that the amounts added to reserve, writing down of goodwill, and increase in carry forward, exceeded 60 per cent. on the ordinary shares.

Mr. J. B. White seconded the motion, and the report was adopted.

Chili Telephone Co., Ltd.—The report of the directors for the year ended March 31st, 1911, states that the aggregate number of subscribers at all centres at the end of the year was 9,919, as compared with 8,818 at the beginning, or a gain of 1,101. The gross revenue in Chile from all sources was: In 1910-11 $2,041,198, in 1909-10 $1,851,689, an increase of $189,509. The expenditure in Chile was: In 1910-11 $976,570, in 1909-10 $926,387, an increase of $550,183. The net income in Chile from all sources was: In 1910-11 $1,064,627, and in 1909-10 $925,301, an increase of $139,326. The average rate of exchange for the year was 10·90d., as compared with 10·49d. in the previous year, giving an increase for the year of 0·41d. Converted into sterling at these rates, the figures given above are: In 1910-11 £48,357, in 1909-10 £40,411, an increase of £7,946. The liquid assets and liabilities in Chile on March 31st, 1911, were valued at 10½d., the current rate of exchange on that day, the same rate at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £2,987 brought from the previous year, is £49,131, of which £22,805 has been carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 15th last, and the directors now recommend a final dividend of 4s. per share, free of income-tax, leaving a balance of £3,225 to be carried forward. The £110,000 new share capital, which was authorised at the extraordinary general meeting of the company held last November, was duly issued and distributed to the shareholders, thus increasing the issued capital to £330,000.

Puebla Tramway, Light and Power Co.—The directors' report, says a financial daily, shows a further improvement in the results for the year 1910, as compared with previous years, the net profits in Mexico having been £61,677, as against £48,677 for 1909, or an increase of 26 per cent.; and as against £27,354 for 1908, or an increase of 125 per cent. After meeting all expenses and bond and other interests there remains a balance of profit for the year of £5,441. The gross and net receipts of the light and power business continue to show satisfactory increases, and with the restoration of peace and an improvement in the condition of the cotton industry, the results of this section should continue to actively expand. The tramway receipts have, however, shown a decrease in 1910, which is attributable to abnormal trade conditions, and to an unusually heavy expenditure on maintenance. As indicated in the report for 1909, the growing demands of the City of Puebla, the absorption of the company's present available supply of power, and the necessity under the company's concessions of providing 16,500 H.P. within the city boundaries by 1913, have rendered it imperative for the directors to take steps to provide funds for the development of the Tuxpango Falls belonging to the company. For the purpose of financing this development it is proposed to take power to create an issue of $3,000,000 5 per cent. prior lien bonds, with the right to increase when required to an amount not exceeding $6,000,000 ranking *pari passu*.

Egypt.—The balance-sheet of the Compagnie Egyptienne Thomson-Houston, of Brussels, for the last financial year shows a profit of £6,052.

Madras Electric Supply Corporation, Ltd.

The directors' report for the year ended December 31st, 1910, the first complete year of working since the opening of the generating station, states that the number of units of electrical energy sold was 1,882,787, compared with 267,568 units sold in 1909. The following figures show the progress of the company :—

Year.	Consumers.	Equivalent connections in 8-c.p. lamps.	Units sold.	Gross revenue.
1909	355	29,296	267,568	£5,057
1910	719	75,329	1,882,787	£17,454

During the past year 2,611,061 units were generated and distributed at an average cost of 1·08d. per unit. The board consider this satisfactory. Applications from new consumers for current for power and lighting continue to be received in satisfactory numbers. There are still some matters of difference between the company and the contractors, which have been referred to arbitration in accordance with the terms of the contract. The board have appointed Messrs. Merz & McLellan to be the consulting engineers to the company. Mr. A. M. Quill has been elected a director of the company in place of Sir Ralph Moor, deceased.

Total units generated	2,611,061
Public lamps	2,733
By special contract	1,158,743
To consumers by meter for lighting	703,305
To consumers by meter for power	18,006
Total sold	1,882,787
Used on works	166,749
Not accounted for	561,525
Accounted for	2,049,536
KW. connected for public lamps	16
Total maximum supply demanded, KW.	2,288

Continental Electrical Enterprises Co.

The Continentale Gesellschaft für Elektrische Unternehmungen, of Nuremberg, which owns, manages, or is otherwise interested in, various electric railways, tramways, electricity works, &c., is best known in recent years from the circumstance that the company has endeavoured to introduce, although unsuccessfully so far, the suspended electric railway system in Berlin, where a short trial section was erected two or three years ago. According to the directors' report for 1910-11, most of the undertakings with which the company is concerned, were more remunerative than in the preceding year. The following figures are extracted from the accounts for the two years :—

	1910-11.	1909-10.
Preference capital	£1,556,000	£1,556,000
Ordinary capital	44,000	44,000
Bond capital	408,000	420,000
Gross profits	126,000	134,000
Net profits and balance forward	80,700	80,200
Dividend on preference capital, per cent.	4½	4½

It will be seen that most of the capital is represented by preference shares. This is explained by the fact that in a re-arrangement of the capital a few years ago the ordinary shares of consenting shareholders were converted into preference shares, the dissentient proprietors only forming £44,000 of the total share capital, and having so far received no dividends. As to the financial results of the various undertakings, the report states that the receipts of the Barmen-Elberfeld-Vohwinkel suspended railway, the system used on which it is desired to introduce in Berlin, increased from £70,000 in 1909-10 to £76,000 in 1910-11, and the surplus rose from £31,000 to £34,000 in the two years respectively. Of the French companies the Société Industrielle d'Energie Electrique, of Paris, had advanced its rate of dividend from 3 per cent. in 1909, to 4 per cent. in 1910, the Société Continentale de Traction et d'Eclairage par l'Electricité (Libau), of Paris, had also raised the rate from 3 to 4 per cent., whilst the Compagnie du Chemin de Fer sur route de Paris a'Arpajon had again distributed 4½ per cent. The report also gives particulars of other investments, and the undertakings under the company's control—the Barmen suspended railway and the works at Berchtesgaden, Gunzburg, Jassy and Muhlhausen, in Thuringia—are valued in the balance-sheet at £1,083,000.

It was mentioned at the recent general meeting that the new financial year would presumably also yield favourable results, as efforts were being made to equalise the higher wages paid by effecting economies in the working of the individual undertakings. The company had now also devoted its attention to the question of overland central stations, and was participating in their erection in various localities.

Victoria Falls Debentures.—It is reported from Berlin that the recent offer of debentures in the Victoria Falls and Transvaal Power Co. met with considerable success, and that it would be difficult for the issuing institutions to proceed with the allotments, especially as 26 places of subscription had to be considered. The 5 per cent. loan, which is for £1,300,000, resulted in the receipt of subscriptions for about £12,000,000, on which an embargo against transfers within a specified time was imposed, and only a small percentage can therefore be allowed on these applications, whilst other applications cannot be considered. A small portion of the loan is being reserved for the purpose of obtaining a quotation on the Exchange.

Hankow Light and Power Co., Ltd.

The fifth annual meeting was held on Wednesday, last week, at the offices, 21, Ironmonger Lane, E.C. A representative of the Electrical Review, who attended to report the proceedings, was informed that the meeting was private.

The directors' report stated that there had not been any change in the issued share capital during the year ended March 31st, 1911. In August, 1910, the directors authorised an issue of £12,000 of 7½ per cent. first mortgage debentures at 95, constituting a first charge on the company's assets, and £10,800 of debentures were applied for, allotted and paid up in full. The trust deed for the debentures provides that the company will redeem the debentures by annual instalments of not less than 10 per cent. The proceeds of the above issue have been applied in repaying the mortgages on the company's property, discharging the amount due to the estate of Poole, Lauder and Co. and other creditors, and providing for the cost of additional plant. In March last the directors accepted tenders for a 300-KW. plant, which is now practically finished, and will, it is expected, be shipped to Hankow in July and installed at the company's power station in time for the winter service. The lighting franchises from the English, French and Russian Concessions have now been formally assigned to this company. A new system of public lighting has been installed in the Concessions which is giving every satisfaction. There has been a steady increase in the private lighting and power department in the number of consumers of current for lighting purposes during the past year. The receipts for the year, as compared with the period for the six months ending March 31st, 1910, are as follows :—

	Year ending March 31st, 1911.	Six months ending March 31st, 1910.
Private lighting	£6,770	£3,678
Public lighting	1,825	832
Power	59	85
Meter rents	278	118
Installation and repairs	49	Nil
	£8,981	£4,663

The figures for the six months ending March 31st, 1910, cover the winter months, when, of course, the current consumed is much larger. The working expenses were 50·89 per cent. of the total receipts, as against 56·64 per cent., showing a decrease of 5·75 per cent. No depreciation has been written off plant, machinery, &c., but the directors point out that, as the debentures will be redeemed by 10 equal annual instalments, and it is their intention to charge such instalments against profits, this method of redemption will consequently create a reserve fund, which will be utilised as a provision to meet any depreciation of plant and machinery. The balance (credit) of the trading account for the year was £4,410, less discount and allowances £227, and adding transfer fees, &c., £45 —£4,229. After deducting interest, administration expenses, &c., there remains a balance of £1,433. The balance standing to the debit of revenue account at March 31st, 1910, was £3,947, so that there is now a debit balance of £2,514. The total capital expenditure during the year was £543. The Hon. A. S. Northcote and Mr. John May have been elected directors to fill the vacancies created by the retirement of Mr. R. C. Wyatt and Mr. John Macgregor, and the Hon. A. S. Northcote has been elected chairman. The directors record their appreciation of the services rendered by Mr. R. P. H. Davis as manager of the company in Hankow. They also congratulate the shareholders on the fact that, owing to the repayment of the mortgages and the discharge of the other liabilities of the company, coupled with the advantages accruing to the company as the result of Mr. E. R. Day's visit to Hankow, the company is now in an entirely satisfactory and independent position.

Chilian Electric Tramway and Light Co., Ltd.—The directors report that the result of the operations for the past year, after deducting interest and redemption of debentures, London office and other charges, shows a balance to credit of profit and loss account of £106,564, to which must be added the sum brought forward, £8,988, making a total net balance of £115,553. From this amount, says the *Financier*, £60,000 has been placed to renewals reserve account and £5,000 to insurance suspense account. After providing for the above there remains an available balance of £50,553, out of which a dividend of 6 per cent. on the preference shares, amounting to £39,000, has been declared, leaving a balance of £11,553 to be carried forward. In the year under review the tramways carried 83,148,755 passengers, earning $7,308,957, as against 75,670,443 passengers, earning $6,436,720, in 1909. The receipts for light and power during 1910 amounted to $1,070,272, and the total working expenditure amounted to $2,438,005, leaving a net profit of $1,632,267, against the net profit earned in the previous year of $1,224,764. The operation of the tramways shows a very satisfactory increase over the figures of the previous year.

National Telephone Co., Ltd.—The directors, subject to final audit, recommend the following dividends for the half-year ending June 30th, 1911, after payment of the dividends on the preference shares :—At the rate of 6 per cent. per annum on the preferred stock. At the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases, carrying £200,000 to reserve, and about £18,000 forward. The transfer books will be closed from July 14th to 27th, both days inclusive, and the dividend warrants will be posted on the latter date.

Japan.—The balance-sheet of the Tokio Electric Light Co. for the last financial year shows a net profit of £159,984. A dividend at the rate of 11 per cent. is being declared.

MARKET QUOTATIONS.

Wednesday, July 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a ,, ...	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£12 10	..
a Copper Sulphate	,,	£23	..
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£92	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %) ..	,,	£11	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b ,, Wire, in ton lots ..	,,	£102	..
b ,, Sheet, in ton lots ..	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6¾d.	⅛d. inc.
c ,, Tube (brazed)	,,	8¼d.	..
c ,, ,, (solid drawn) ..	,,	7d.	..
c ,, Wire, basis	,,	6⅝d.	..
c Copper Tubes (brazed)	,,	9⅝d.	⅛d. inc.
c ,, ,, (solid drawn ..	,,	8¾d.	⅛d. inc.
g ,, Bars (best selected) ..	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars ..	,,	£69	..
e ,, ,, Sheets ..	,,	£74	..
e ,, ,, Rod ..	,,	£62 10	..
e ,, ,, H.C. Wire	per lb.	7⅝d.	..
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	8/6	..
h India-rubber, Para fine	,,	4/2	1d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	46/3	6d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 10 to £13 15	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5 to £8 7 6	5/- dec.
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large ..	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£192 to £193	£3 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£ 9 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

No sooner does the Stock Exchange get over one mal-influence than another comes along to take its place, and to be, if anything, rather more depressing than its predecessor. It would be as easy as it would be wearisome to reiterate the various causes which have militated against Stock Exchange investment and speculation during the past six or eight weeks. Suffice it to say that the latest of all, viz., the Moroccan trouble, assumed a gravity more portentous than most of the adverse influences which had gone before, and although the critical time is supposed to be over, the aftermath of the nervousness still remains.

In the circumstances, it is not to be supposed that this week's story in any of the markets will read satisfactorily from the point of view of holders of shares. There has been a very general drop round the markets, and confidence has received a fresh shock which acts as a preventive, even where it has no more active effects. The considerable gamble in Marconi shares goes on merrily, and after touching 49s. 6d., the shares fell back to 44s., from which they recovered this (Tuesday) afternoon, to 45s. 4½d.

So far as the Coronation traffics are concerned, it may be safely said that their influence is practically *nil*. The Underground Lines have done well, but this did not stop a fall of 5 points in Central London Deferred, following upon the drop of 2 last week. The price has gone down to 56 upon a small amount of stock being forced upon a narrow market, and the Ordinary declined to 71 in sympathy. On the other hand, Metropolitan Consolidated, after dipping to 17, has firmed up again, and Districts are quietly steady. A number of issues in this market, as in the other departments, were quoted *ex* dividend on June 30th and July 1st. At present, we have not detected an example of that stock which, according to the Stock Exchange jest, only changes when it is marked *ex* dividend, and therefore automatically becomes reduced to nothing in course of time.

Electricity Supply shares are a firm market, and there are improvements in St. James' Ordinary, Charing Cross Preference, and Westminster Ordinary. The Coronation celebrations have had the effect of diverting a few inquiries to this section, and, although not much business has resulted, it is at least something for a little interest to be aroused in the shares. For those who are seeking an investment in electricity supply shares, we would suggest that the market is likely to be quiescent for, at any rate, a few months. The summer is generally a poor time for illumination shares, and it would seem that the present year is not likely to prove any exception to the general rule. But for those who consider that the market has a chance of improvement in the autumn, we would indicate Metropolitans, County of London, and Westminsters, as being three of the best examples to be found in this list. There is a tip to buy London Electric shares, they being valued on an apparently conservative basis. It must be remembered, however, that the nominal value of the shares is £3, and that the company is paying small dividends. The contract with the Brighton line is, of course, a very useful factor, but we should prefer either of the three already mentioned for investment purposes.

The Notting Hill Company is rearranging its capital account in order to get rid of the founders' shares, and, in consequence, the official quotation has been withdrawn from the Stock Exchange list. In exchange for the founders', new Deferred are being given, and the price of these 1s. shares is about 30s. It seems rather an odd idea to eliminate founders' shares by the issue of Deferred shares, which carry rights somewhat similar to those which are being superseded, and the scheme has not been altogether favourably received in the market. The newly-created Cumulative Preference are nominally 11 to 12, and the non-Cumulative 10 to 11, both being £10 fully paid. No active market, however, has yet been made in either of these classes.

The feature in the Foreign and Colonial Supply department is the continued strength of Montreal capital stock, which has risen a further 2 points after its big rise of the past three weeks. The improvement of 5 points in Shawinigan capital stock has been followed by the suggestion that there may be an amalgamation scheme on foot. Northern Light and Power bonds are flatter than ever. Mexico Tramways are 3 points lower and the bonds are ½ better, while Mexican Light and Power bonds are also slightly higher.

In the Telegraph market, the principal excitement, as already noticed, is concerned with Marconi shares. It would appear as though some of the big sellers had been caught badly short of the shares, and, being found out, they were made to pay a pretty stiff penalty for their action. At the time of writing, the company's report is not out, but it is expected at any minute. Anglo-American Telegraph and American Telephone and Telegraph stocks have both given way, the latter to the extent of 10 points. The movement in the former was due to the statement of the chairman at the Globe Telegraph and Trust meeting, that, so far as he knew, there was not even yet an agreement between these two companies. Considering the time that the matter has been in suspense, it would seem that the shareholders are well within their rights in asking that the business should be brought to a head and definitely settled. American Telephone and Telegraph is *ex* 7 points in respect of the rights to the new stock, and 2 for the dividend, so the actual decline is a trifle. The Eastern group is quiet, and, except for a fall of ⅛ in Eastern Extensions, there is no movement worth mentioning. West India and Panama Preferences are a shade easier, and Western Telegraphs lost ¼.

Further excitement was provided by very sharp fluctuations in National Telephone Deferred. The price went down with a rush on the announcement that the company had failed in its appeal to the Courts against the Post Office. Upon this becoming known, there was a slump from 121 to 113, but a subsequent recovery to 118 occurred on buyers stepping in who had been watching for an opportunity to pick up the stock if there should be a fall of this description. The Third Preference have been involved in that movement, but the Senior Preferences did not move.

Messrs. Speyer Brothers are offering 2¼ million pounds 4 per cent. rent charge stock at par in the Metropolitan District and London Electric Railways Joint Power House. The security is amply covered.

In the Manufacturing group the changes which have occurred are in nearly every case the result of *ex*-dividend markings. There are, however, falls of ⅛ in Edison & Swan shares, and of $\frac{1}{16}$ in Electric Constructions, the latter wiping out the improvement of last week. It may be explained in this connection that where a stock or share is marked *ex* dividend in the price lists over-leaf, and the fall in the price merely reflects the amount deducted, no alteration is notified in the column recording rises and falls. Although nominally the security is quoted lower, actually there is no real change in the position, and it seems inappropriate to refer to a stock having fallen, say, two or three points when the change is simply due to the fact of the quotation being made *ex* dividend at the last Stock Exchange pay day.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ —10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102 xd	..	4 8 3
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	+ ⅛	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4¼ xd	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	+1	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100 xd	..	4 10 0
City of London, Ord.	10	7	7	11¾ — 12¼	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123 xd	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	99 —102 xd	..	4 8 3
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½ xd	..	5 9 3
County of London, Ord.	10	5	5	7⅝ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	110 —112 xd	+3¼	4 0 4
Do. 4½ % Second Deb.	Stock	4⅛	4⅛	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	9/16 — 13/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2½ — 3	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4⅛ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7¼	..	6 11 0
Kensington & Knightsbridge, Ord	5	8	9	7 — 7⅜	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅜ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¼ — 4	— ⅛	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝ xd	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —103 xd	..	4 7 5
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½ xd	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 — 99 xd	..	5 1 0
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7¼	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9⅝	+ ⅛	5 5 3
Do. 7 % Pref.	5	7	7	6⅜ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3⅛	3⅛	84⅛ — 86⅜ xd	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅛ — 1⅜	..	Nil
South London, Ord.	4	5	5	2 1/16 — 3 1/16	..	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½ xd	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1¼	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3¾	⅜ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3¾	2½ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord,	5	10	10	7⅞ — 8⅜	+ ⅛	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛ xd	+ ⅛	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5¾	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅛ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	94½ — 96½	+ ½	5 3 8
Canadian Gen. El. Com.	$100	6	6	108 —111	..	5 10 1
Do. 7 % Pref.	$100	7	7	121 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	..	6	1/16 — 1/8	..	6 8 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½ xd	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83 — 85	..	5 17 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	3/32 — 5/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104 xd	+1	4 16 2
Madras, Ord.	5	Nil	Nil	2⅝ — 3¼	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	+1	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 87½ xd	+ ½	5 14 3
Mexican Lt. & Power, Common	$100	4	4†	82½ — 84½	..	4 14 8
Do. 7 % Cum. Pref.	$100	7	7	106 —108	..	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94⅛ — 95¼	+ ¼	5 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	+ ½	5 8 8
Montreal, Lt., H. and Power	$100	..	8	173 —177	+2	4 10 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	52 — 54	—7	9 5 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½ xd	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	120 —123	+5	4 1 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109 xd	+ ½	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½ — 93½ xd	+1	5 6 11
Victoria Falls Power, Pref.	1	Nil	Nil	1⅝ — 1⅞ xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100 xd	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	143 —145	—1	5 10 4
Do. Collat. Trust	$1000	4	4	94 — 96 xd	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3¾	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113¾ —114¾	+ ¾	5 4 7
Do. Def.	Do.	25/-	30/-	26¼ — 26½	— ⅜	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 — 7¼	— 1/16	5 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½ xd	+1	4 9 5
Cuba Telegraph	10	6	6	10 — 10½	..	5 11 7
Do. 10 % Pref.	10	10	10	17½ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101 xd	..	4 9 1
Direct United States Cable	10	4	5	7⅜ — 7⅝	— ⅛	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136½ —139½	..	5 0 4
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13⅛ — 13⅜	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞ — 11⅞ xd	..	5 3 3
Do. 6 % Pref.	10	6	6	13 — 13⅜ xd	..	4 8 11
Great Northern Telegraph	10	18	18	31½ — 32½	— ¼	5 11 7
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 5/16 — 2 5/16	+ 3/32	Nil.
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	⅜ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104½ —105½	+ ¼	5 13 9
Do. Def.	Do.	6	6	116 —120	—3½	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	— 1/16	4 13 0
Do. 3½ % Deb.	Stock	3½	3½	98 —100 xd	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100 xd	+ ½	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	101 —102	+ ½	4 8 3
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88 xd	+ ½	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101 xd	+ ½	3 19 3
Reuter's	8	5	5	8⅝ — 9⅛ xd	+ 3/16	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	6†	7 1/16 — 7 1/8	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5 3/16 — 5 5/16 xd	..	4 9 11
West Coast of America	2½	2½	2½	1⅜ — 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½ xd	..	4 0 5
West India and Panama Telcg.	10	Nil	2	2¼ — 2⅝	..	7 12 5
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	— ⅛	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	100 —102 xd	+ ½	4 18 0
Western Telegraph, Ltd.	10	7	7	13¼ — 13⅜	— ¼	5 1 10
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ —102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— ⅝	.	Nil
Do. 5 % Pref.	1	5	5	⅝— ¾xd	+ 1/16	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1⅛	+ 3/16	Nil
Do. 6 % Pref.	10	3	3	3¾— 4¼xd	..	7 1 2
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	70 — 72	+ ½	4 3 4
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	55 — 57	—5	3 10 2
Do. 4 % Deb.	100	4	4	104 —106	..	3 15 6
City & South London, Ord.	100	1⅜	1½	31½— 32½	..	4 12 4
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	..	4 12 7
Do. Do. 1901	100	5	5	104 —107	..	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½— 13¼	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅝— 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1⅝— 2	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼— 2⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82 xd	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82 xd	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98 xd	..	4 1 8
London United Trams, 6 % Pref.	10	Nil	Nil	⅜— ⅝	..	Nil
Do. 4 % Deb.	100	4	4	75 — 78 xd	..	5 2 7
Metropolitan Railway Consol.	100	1	1⅜	47¼— 47¾	+ ¼	2 17 7
Do. Surplus Lands	100	2⅜	2⅝	68 — 70	..	3 18 7
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	28½— 29	..	Nil
Do. 6 % Dob.	100	6	6	145 —147 xd	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98 xd	..	4 1 8
Do. 4 % Prior Lien	100	4	4	101 —103	—1	3 17 8
Do. 4½ % First Pref.	100	..	3½	88 — 90	..	3 12 3
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32— 1 1/32	..	5 6 8
Do. Def.	1	Nil	Nil	⅛— 3/16	..	Nil
Do. 5 % Pref.	1	5	5	29/32— 1 1/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	100 —102 xd	..	4 8 3
Do. 5 % Deb.	100	5	5	102 —104	..	4 16 2
Potteries, Ord.	1	2	..	1/32— 3/32	..	..
Do. 5 % Pref.	1	5	5	1/32— 1/32	— 1/16	7 13 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	..	1/32— 1/32	..	..
Do. 4 % Deb.	100	4	4	73 — 78 xd	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	+ ½	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	—1	4 9 1
Do. 6 % Income	100	Nil	10/-	65 — 67	—3	0 14 11
Do. Power House Debs.	100	..	4	101 —103	+1	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛— 3/32	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛— 2⅜	..	..
Do. 4½ % Deb.	100	4½	4½	82 — 85 xd	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16— 5 5/16	— 1/16	4 14 6
Do. 2nd Pref.	5	5	5	4 13/16— 5 1/16	— 1/16	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	100 —102	— ½	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104 xd	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞— 11⅜	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½— 98½ xd	..	5 1 6
Brisbane Trams Invt., Ord.	5	8½	8†	6¼— 6⅜	..	6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	99 —102 xd	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8	146 —150	..	5 6 8
Do. Pref. Ord.	100	6	6	128½—132½	..	4 10 7
Do. 5 % Pref.	100	5	5	111 —113	..	4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½—102½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5⅜— 6¼	..	4 0 0
Do. 5 % Pref.	5	5	5	5 — 5¼	— ⅛	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103 xd	..	4 7 5
Cape Electric Trams	1	Nil	Nil	1/32— 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅝— 5⅞	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97 xd	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —103	+ ½	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32— 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	91½— 94½	..	5 5 10
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	⅝— ¾	— 1/16	8 0 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101 xd	+ ½	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98 xd	+ ½	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90½— 93½ xd	..	5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½	..	4 18. 6
Mexico Trams Com.	$100	6	7	121 —123	—3	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	95 — 96	+ ½	5 4 2
Do. 6 % Bonds	100	6	6	97½— 99½ xd	+ ½	6 0 7
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅛	— ⅛	6 15 7
Do. 6 % Pref.	5	6	6	5¼— 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	11/16— 15/16	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	101½—103½ xd	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜— 5⅝ xd	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100 xd	..	4 10 0
Rio de Janeiro Trams	$100	2	5	113½—114½	—1½	4 7 4
Do. 1st Mort. 5 % Bonds	..	5	5	100¼—101¼ xd	..	4 18 9
Do. 5 % Mort. Bonds	100	5	5	95½— 96½	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	181½—183½	—2½	5 9 0
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	..	5	5	98 —100	..	5 0 0
Un. Elec. Trams Monte Video	5	7	7	5¾— 6⅜ xd	+ ⅛	5 9 10
Do. 6 % Pref.	5	6	6	4¾— 5⅜ xd	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	..	4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	1⅛— 1⅜ xd	..	7 7 8
Do. 6 % Pref.	1	12	9	⅝— ⅞ xd	..	6 17 2
Babcock & Wilcox	1	24	20†	5⅝— 5⅞	..	4 5 4
Do. Pref.	1	6	6	1⅜— 1⅝	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞— 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	100 —102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32— 1/32	..	Nil
Do. Deb.	100	4	4	59 — 62 xd	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	+ 1	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	3/32— 1/16	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	1/16— 1/32	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛— ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44 xd	..	10 4 6
Callender's Cable	5	15	10†	8 3/32— 9¼	— 1/32	8 2 2
Do. Pref.	5	5	5	4⅞— 5⅛ xd	+ ⅛	4 17 7
Do. Deb.	100	4½	4½	101 —103 xd	+2	4 7 5
Castner-Kellner	1	17½	7½†	3⅜— 3½	..	5 1 6
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/32— 3/32	..	Nil
Do. Deb.	100	5¼	5	57⅓— 67½ xd	..	7 8 2
Dick, Kerr	1	5	6	⅛— 15/16	..	6 8 0
Do. Pref.	1	6	6	33/32— 1 3/32	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	1/32— 1/16	— 1/32	Nil
Do. fully paid	5	Nil	Nil	1/16— 2 3/32	..	Nil
Do. 4 % Deb.	100	4	4	69 — 71 xd	+1	5 12 8
Do. 5 % Seoond Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	1/32— 1/16	— 1/32	Nil
Do. Pref.	2	7	7	⅛— 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10½— 10¾	..	6 10 3
Do. Deb.	100	5	5	102 —103½	..	4 16 7
General Electric, Pref.	10	¼	4	88 — 93	..	4 6 0
Do. Deb.	100	15	15	12⅛— 12⅞	..	5 16 6
Henley's, Ord.	5	4½	4½	4⅝— 5⅛	..	4 7 10
Do. Pref.	100	4½	4½	106 —108	..	4 3 4
Do. Deb.	10	10	10	11½— 13½	..	7 8
India-Rubber, G. & T.	10	5	5	10½— 10¾ xd	..	4 15 3
Do. Pref.	12	17½	20	36½— 38½	..	6 5 0
Telegraph Construction	100	4	4	99 —101 xd	+1	3 19 3
Do. Deb.	1	Nil	Nil	⅛— ⅜	..	Nil
Willans & Robinson	5	3	Nil	½— 1 1/16	..	Nil
Do. Pref.	100	4	4	55 — 65	..	6 3 1
Do. Deb.						

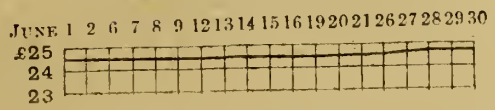
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

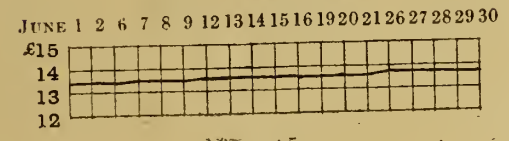
METAL MARKET.

Fluctuations in June.

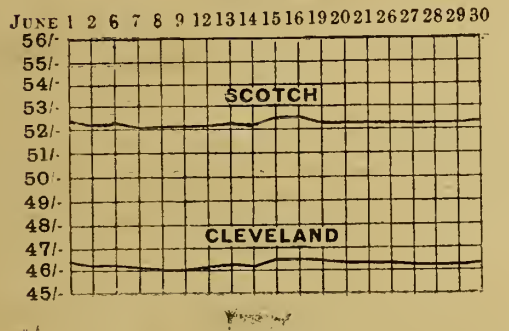
SPELTER (G.O.B's.).



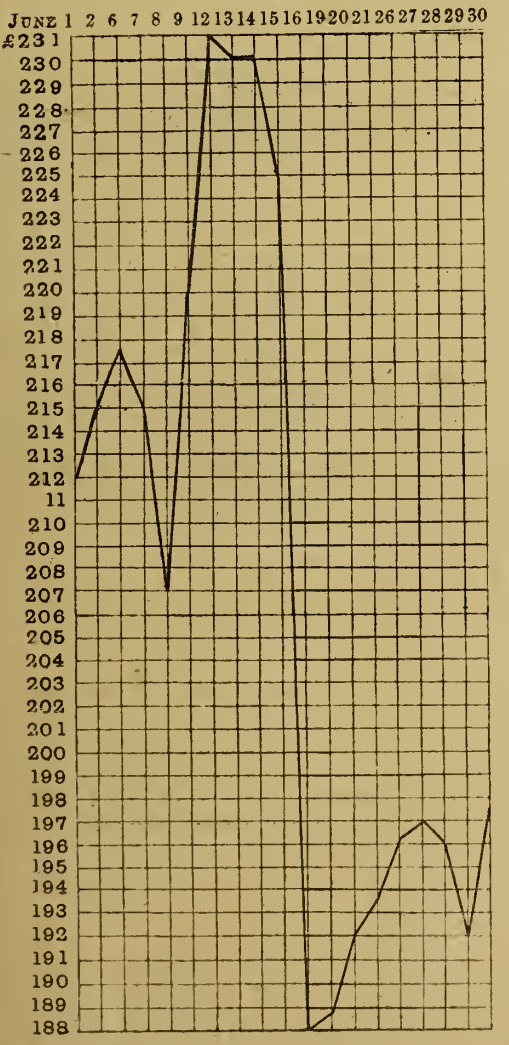
LEAD (ENGLISH).



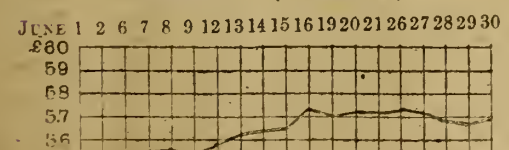
IRON.



TIN.



COPPER (G.M.B's.).



OLYMPIA ELECTRICAL EXHIBITION.

The following is a list of the exhibitors who have down to date booked space at the Exhibition of September 23rd to October 21st. In publishing this list we also print for the information of our readers, in order to save disappointment later on, the following excerpt from Rule 5 of the Rules and Regulations :—

"Exhibitors, the nature of whose displays necessitates them showing goods of other manufacturers, agree not to advertise such makers' names either upon the article shown or upon their stands, unless such goods are manufactured by a fellow-exhibiting firm or are specified on the space contract. Any contravention of this Rule will render the offending exhibitor liable for any damage that the Committee or the management may incur."

Armorduct Manufacturing Co., Ltd.
Abbey Electric Co.
Aerators, Ltd.
Adams Manufacturing Co., Ltd.
Aster Engineering Co., Ltd.
Auto Recorder Co.
Alexander, Geo. H.
Allen & Simmonds, Ltd.
Brook, E., Ltd.
Brook, Hirst & Co., Ltd.
Berry, Skinner & Co.
Bruce Peebles & Co., Ltd.
British Vacuum Cleaner Co., Ltd.
Bastian Electric Heating Syndicate, Ltd.
Bastian Meter Co., Ltd.
British Thomson-Houston Co., Ltd.
Brush Electrical Engineering Co., Ltd.
Buckton, Joshua, & Co., Ltd.
Bat Meter Co., Ltd.
Barker, John, & Co., Ltd. (Kennedy Bending Machine).
Bennis, E., & Co., Ltd.
Benjamin Electric, Ltd.
Bonnella & Son, Ltd.
Braun & Co.
Brunner, Mond & Co., Ltd.
Bullers, Ltd.
Burton, C. W., Griffiths & Co.
British Metal Engraving Co., Ltd.
Bristol (The) Co.
British Aluminium Co., Ltd.
British Electric Transformer Co., Ltd.
Berry Construction Co., Ltd.
British Prometheus & Co., Ltd.
Bell, Heslop
Boosey, W. E., & Co. (The Trident Co.)
Churchill, Chas., & Co., Ltd.
Crypto Electrical Co.
Chamberlain & Hookham, Ltd.
Credenda Conduit Co.
Cateaux, J. L., & Co.
Coventry Chain Co. (1907), Ltd.
Consolidated Pneumatic Tool Co., Ltd.
Callender's Cahle & Construction Co., Ltd.
Cassier, Louis, & Co., Ltd.
Concordia Electric Wire Co., Ltd.
Corona Lamp Works Co.
Dowsing Radiant Heat Co., Ltd.
Drake & Gorham, Ltd.
Dorman & Smith
Dussek Bitumen Co.
Dugdill, J., & Co.
Electrical Review
Electricity
Electrical Times, Ltd.
Electrical Engineering
Electromotors, Ltd.
Electrical Press, Ltd.
Everett, Edgcumbe & Co., Ltd.
Electric Ordnance & Accessories Co., Ltd.
Ebonestos Manufacturing Co., Ltd.
Elliott Bros.
Electrician
Engineering Instruments, Ltd.
Electrical Apparatus, Ltd.
Escaré & Denelle, Ltd.
Eyre Smelting Co., Ltd.
Efandem Co.
Electrical Engineer, Ltd.
Emanuel, A., & Sons, Ltd.
Edison & Swan United Electric Light Co., Ltd.
Engineer, Ltd.
Eastman & Warne
Eastman & Son (Dyers and Cleaners), Ltd.
Evershed & Vignoles, Ltd.
Ferranti, Ltd.
Falk, Stadelmann & Co., Ltd.
Foster Engineering Co., Ltd.
Famous Diamond Steel Co.
Globe Electric Co., Ltd.
General Electric Co., Ltd.
Galsworthy, Ltd.
Geipel, W., & Co.
Goodchild, G. W., & Partner
Gambrell Bros.
Gent & Co., Ltd.
Hands, A. C.
Hopkinson, J., & Co., Ltd.
Hornshy, R., & Sons, Ltd.
Hervé, L.
Hoffmann Manufacturing Co., Ltd.
Henley's, W. T., Telegraph Works Co., Ltd.
Holophane, Ltd.
Hawkes, O. C., Ltd.
Holmquist Electric Co., Ltd.
Hart Manufacturing Co.
Hill, Siffken & Co.
Hardware Trade Journal, Ltd.
Imperial Lamp Works (Brimsdown) Ltd.
Imperial Electric Co.
Iron and Coal Trades Review.
Isenthal & Co.
Imperial Lighting Co.
Ironmongers' Chronicle and Hardwareman.
Johnson & Phillips, Ltd.
Jandus Aro Lamp and Electric Co., Ltd.
Jacobs, W. & R.
Lundberg, A. P., & Sons
Lancashire Dynamo and Motor Co., Ltd.
Le Carbone
Lea Recorder Co.
Longstreth's Ltd.
Lucy, W., & Co., Ltd.
London Decorative Metal Works, Ltd.
Litho ite, Ltd.
Linolite Co.
Laing, Wharton & Co., Ltd.
Leskole Co., Ltd.
Lanston-Monotype Corporation, Ltd.
Lister, R A., & Co., Ltd.
Muirhead & Co., Ltd.
Major & Co., Ltd.
Morgan Crucible Co., Ltd.
Marryat & Place
Mawdsley's, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Metalite, Ltd.
Medway's Safety Lift Co.
Nalder Bros. & Thompson, Ltd.
Nalder Bros. & Co.
National Telewriter Co., Ltd.
Nicholson, W. T., & Clipper Co., Ltd.
Nelson Bros. (Bradford)
Oliver Arc Lamp, Ltd.
Ozonair, Ltd.
Pope's Electric Lamp Co., Ltd.
Paul, R. W.
Pinchin, Johnson & Co., Ltd.
Purcell & Nobbs
Phillips Commutator Grinder Co., Ltd.
Phœnix Dynamo Manufacturing Co., Ltd.
Parmiter, Hope & Sugden
Pooley & Austin
Proctor, James, Ltd.
Phillips, J. W. & C. J.
Parsons, C. A., & Co.
Post Office London Telephone Service
Pape, Richard, Ltd.
Pirelli, Ltd.
Post Office Telegraphs
Premier Electric Heaters, Ltd.
Reyrolle, A., & Co., Ltd.
Rhodes, J., & Sons, Ltd.
Ronald Manufacturing Co.
Rühl, O., Ltd.
Rapid Magnetting Machine Co., Ltd.
Renold, Hans, Ltd.
Reavell & Co., Ltd.
Sunderland Forge & Engineering Co., Ltd.
Sterling Telephone & Electric Co., Ltd.
Sun Electrical Co., Ltd.
Sunheam Lamp Co., Ltd.
St. James' and Pall Mall Electric Light Co., Ltd.
Smith, J. Ciceri
Simmonds Bros., Ltd.
Schaffer & Budenberg, Ltd.
Spagnoletti, Ltd.
Siemens Bros. & Co., Ltd.
Silver Replating Powder Co.
Samuel Bros., Ltd.
Stern-Sonnehorn Oil Co., Ltd.
Simplex Conduits, Ltd.
Stone, J. B., & Co.
Ship Carbons, Ltd.
Synchronome Co.
Slingshy, H. C.
Tucker, J, H., & Co.
Thomas, Bertram
Tella Camera Co.
Tackley, W. C., & Co.
Union Electric Co., Ltd.
Union Cable Co., Ltd.
Unbreakable Pulley and Mill Gearing Co., Ltd.
Venner & Co.
Vedovelli, Priestley & Co.
Vickers, Ltd.
Willcox, W. H., & Co., Ltd.
Watson, Duncan & Co.
Whipp & Bourne
Walker, Horrocks & Co., Ltd.
Waygood, R., & Co., Ltd.
Westinghouse Brake Co., Ltd.
West, Allen & Co., Ltd.
Westminster Engineering Co., Ltd.
Western Electric Co., Ltd.
Wiggin, H., & Co., Ltd.
Wallach Bros., Ltd.
Weil, L., & Reinhardt
Westinghouse Cooper Hewitt Co., Ltd.
Wright & Wood, Ltd.
Wandsworth Electrical Manufacturing Co., Ltd.
Wright, Alex., & Co., Ltd.

THE ELECTRO-METALS STEEL-REFINING FURNACE.

In recent years great advances have been made in the electric smelting of steel, and although most of the earlier work was done on the Continent, there are now several furnaces working successfully in England.

The latest type to be introduced into this country, and one that in several ways has undoubted advantages, is the Electro-Metals furnace. This furnace is of the arc type as opposed to the induction type, but it differs from other arc furnaces inasmuch as two-phase current is employed. The principle on which the furnace is based is that of having two electrodes entering through the roof, while the neutral return is a carbon electrode embedded in the bottom.

The current arcs from the top electrodes on to the slag and metal, and then passes through the metal and the refractory lining of magnesite or dolomite to the neutral electrode, either of these materials for lining when hot being a quite sufficiently good conductor.

A furnace of this type, in operation in Sheffield, consists of an iron tank, lined with refractory brickwork, and inside this the hearth is formed by ramming in either dolomite or magnesite. The carbon terminal, forming the neutral point, is held in an iron casting bolted to the bottom of the furnace, and the top of the carbon comes just flush with the brickwork lining, so that it does not project into and in any way weaken the lining of tamped dolomite.

The roof, which consists of an angle-iron framework carrying silica bricks, is removable, so that when the bricks become worn too thin for further work the roof is taken off and replaced by a new one. The whole operation of changing requires about 20 minutes.

There is a working door at each end, and another one at the tapping spout, and at the back are mounted the holders and regulators for the electrodes carrying the two phases. These holders are of quite a new type, and may be considered as one of the special features of the furnace.

The electrode is placed in position, and a set-pin is tightened up; this drives the copper plates carrying the cables tight against the electrode at the same time. As this arrangement is easily manipulated, it is possible always to keep the electrical contact at that part of the electrode where it enters the furnace. In this way the electrical losses in the electrodes are reduced to a minimum.

The whole furnace is mounted on curved rails, on which it is tilted.

The electrical plant consists of two single-phase transformers of 400 K.V.A. each, transforming from 2,000 to 50, 60, or 70 volts. These transformers were specially designed by the British Westinghouse Co., Ltd., for electric furnace work. The switchgear consists of one two-pole main oil switch in circuit with the H.T. mains.

There is an ammeter on each phase reading to 8,000 on the L.T. side, and one reading to 12,000 in circuit on the neutral; one voltmeter with three-way switch for reading the voltages of the A and B phases, and one power-factor meter.

The capacity of the furnace is only 2½-3 tons, and it will be seen that this particular furnace is overpowered, but this was done intentionally, as it is probable that the owner of the works will install a larger furnace at a later date.

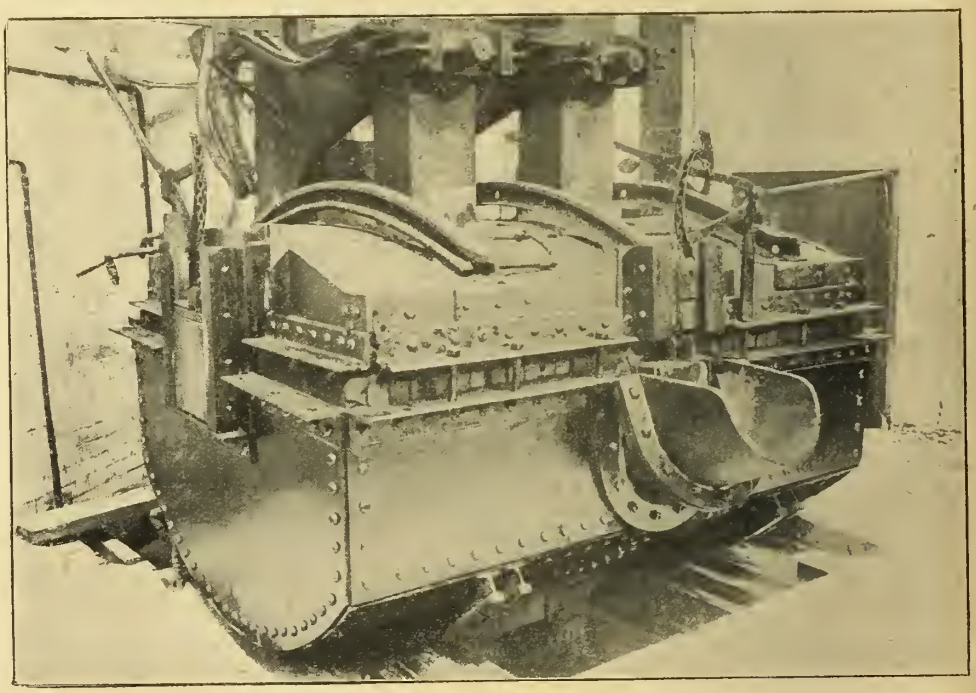
Compared with single-phase furnaces, the Electro-Metals system has the advantage of allowing the current to be taken direct from the mains of either a two or a three-phase supply, without the intervention of motor-generators, which, compared with transformers, are not only very inefficient, but are also costly in initial outlay and running costs.

Another advantage of the Electro-Metals arrangement is that during melting from the cold, the furnace runs very smoothly. It is stated that this feature is so marked that the Sheffield Corporation allows this furnace to be started on a cold charge during the peak load.

Apart, however, from the purely electrical aspect of the question, it has been found by experience that the two-phase arrangement with two electrodes at the top and one at the bottom has decided metallurgical advantages. One of the great troubles in arc furnaces has always been that the heating is extremely local, with the result that, although the current is raised to such an extent that the heat from the arc overheats and seriously damages the upper part of the furnace, there is very often cold unrefined metal lying in the bottom of the hearth. In the Electro-Metals furnace this difficulty has been quite overcome; the passage of the current through the dolomite lining keeps the bottom of the furnace well heated all over, and it does this with the loss of very little energy and without in the least weakening or breaking up the bottom. In addition to this thermal effect, it has been found that, unlike either a single-phase or a three-phase arrangement, the two-phase current causes both horizontal and vertical movements in the bath. These movements rapidly bring all parts of the metal under the influence of the arc and into contact with the refining slag. In this way the time and energy consumption for refining are much lowered, and at the same time local overheating of the furnace and lack of homogeneity in the metal are done away with.

This furnace has been installed at the Sheffield Annealing Works, Warren Street, Sheffield; large numbers of steel makers have already seen demonstration charges treated, and great satisfaction has been expressed at the results. Already some 80 charges have been put through, and it is possible to put through three charges a day.

The illustration shows the furnace in use; it is of the Grönwall type, and the same pattern is installed at Trollhättan, Söderfors, Domnarfvet and Arvika.



Electro-Metals Steel Furnace at Sheffield.

THE ROYAL AGRICULTURAL SHOW.

Although more electrical apparatus is shown at each Royal Show than appeared in the previous year, the increase is very slow when the advantages of electricity for the farmer and country estate owner are considered, and even supposing private generation to be impracticable, a large and increasing number of farms and estates are within reach of public supply mains.

The electric driving of farming machinery was very meagrely represented, and excepting for a number of motors belted to fodder machines on the stand of Messrs. Mann, Egerton and Co., the examples could be counted on the fingers of one hand. In fact, only two other motors were to be seen:—One by Messrs. Tangyes, Ltd., driving a three-throw pump, and the other belted to a straw press by Messrs. Ruston, Proctor & Co., Ltd.

The dynamos made a fair show, most of them being direct-coupled to oil or petrol engines for country house lighting. A complete plant, including "Chloride" batteries and accessories, was shown by Messrs. Boulton & Paul, Ltd., and two equipments by Messrs. R. A. Lister & Co., Ltd., the exhibit of the last-named firm being of particular interest. The installation was entirely automatic, the engine and dynamo being started up through a patent relay and auto-starter when the lamps were switched on, whilst these operations were reversed and the plant automatically shut down when no current was demanded. Of course these results cannot be achieved without a battery, but the latter is a very small

affair, consisting of ignition-type cells which are contained in a cabinet behind the switchboard.

Two complete plants were shown by Messrs. Lister, together with a series of lamps to demonstrate the automatic operation. It should also be stated that similar arrangements are applied to installations consisting of two or more generating sets which are started up and shut down according to the demand for current.

These two plants were started and stopped by simply switching lights on and off for the benefit of our representative, and they fully substantiated the claims made for them. An important feature is the mounting of the entire equipment, excepting the switchboard and battery, upon a steel frame, the plants being delivered in this form and ready for work without any foundations.

An installation complete, excepting for the battery, was shown by Messrs. Collingham & Owen, the dynamo of 2½ kw. at 110 volts being direct coupled to a vertical oil engine.

Oil engines direct coupled to dynamos were shown by Messrs. Richard Hornsby & Sons, Ltd., and several other firms, whilst gas-driven generators were exhibited by Messrs. Tangyes, Ltd., and the National Gas Engine Co., Ltd.

Several very interesting oil engines were shown without dynamos, but which are particularly suitable for the economical generation of electricity. One of these, by Messrs. J. W. Brooke & Co., Ltd., was a new type 10-B.H.P.



Electric Arch at Burton-on-Trent.

paraffin engine with hot bulb ignition. This engine has one cylinder of the four-cycle type with oil injection into the vaporiser by a governor controlled pump, hence air only is compressed. A lamp is required for a few minutes at starting, after which the ignition is automatic, no magneto or battery being needed.

(To be continued.)

India.—In view of the increase of electrical work, the East Indian Railway Co. has arranged for the provision of a separate office and workshop for the electrical department of the company, at the Carriage and Wagon Works, at Lillooah.

CORONATION ILLUMINATIONS AT BURTON-ON-TRENT.

Messrs. Bass & Co., of Burton-on-Trent, have always been noted for the beautiful decorations with which they adorn their offices in



Electric Arch at Burton-on-Trent.

times of royal rejoicing, but during the Coronation they excelled all their previous decorations with a most beautiful display. Their premises naturally have a very wide frontage, and upon this designs were erected which were illuminated by about 4,000 lamps. The most prominent feature of the whole was an elaborate electric arch across the brewery entrance, between two sections of the premises.

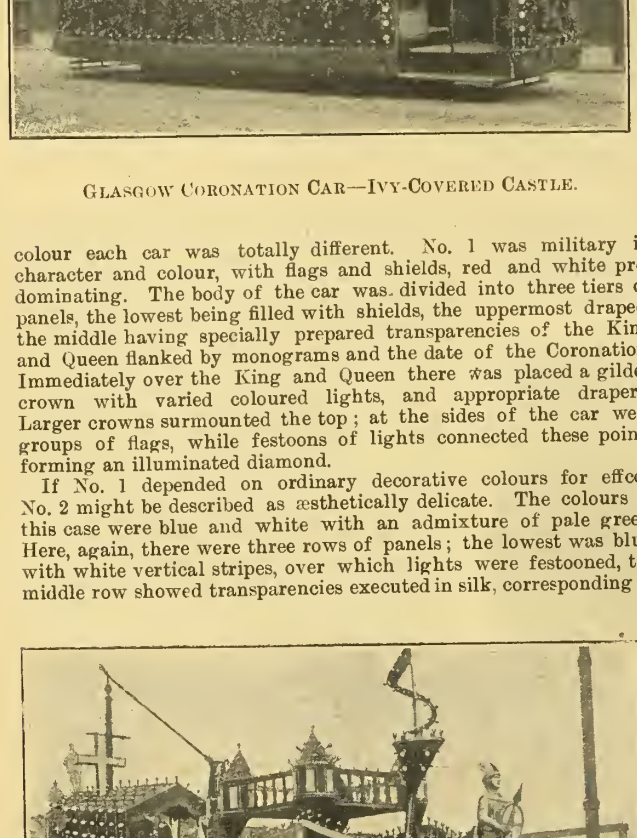
The arch shields, and stars, were illuminated with 8-c.p. lamps, and the foliage, which consisted of beautiful rose spray, millinery and flowers, was illuminated by about 1,000 miniature lamps. A number of photographs that are before us as we write, show how effective the display was by night. We reproduce views of the arch by day and by night. A well-known artist was commissioned to paint a large portrait of the King and Queen, and these were framed in crystals. The arch already mentioned weighed approximately 2 tons, the design being the national emblems, shamrock, rose and thistle, illuminated by suitably coloured lamps, the whole being surmounted by the Imperial crown, under which were the portraits of their Majesties. Large stars, coats of arms, lions' heads, flambeaux containing globes, all find a place in the design, and the whole of them were wreathed in roses. Some idea of the brilliancy can be obtained from the fact that each star contained about 270 8-c.p. lamps. The whole design of the floral spray in colour represented ropes of pearls, rubies, and turquoises, and crowds of people went into the town from the surrounding country to view what was considered to be one of the most beautiful displays of electrical illuminations in the country.

The whole of the design was the work of Mr. W. B. Ollis, the chief engineer of Messrs. Bass & Co, and the illuminations were supplied from the Corporation mains

Tramcar Conductor's Experience.—An unusual accident happened at Carlisle on June 21st. While a tramcar conductor was endeavouring to adjust a trolley upon a wire at the Warwick Road terminus as the car was moving, the rope caught his thumb, fastening it in a noose. He was slung up 10 ft. from the ground, unable to help himself. The driver of a motor-car seeing the man's plight ran his car underneath the conductor, and an occupant of the car standing up was able to get hold of the man and help him to get his thumb free from the rope. Apart from the shock the conductor suffered, he was uninjured by the accident.

ILLUMINATED TRAMCARS AT GLASGOW.

Celebrating an important event, by running a number of gaily decorated and brightly illuminated cars, is not a new departure for the Glasgow municipality. On quite a recent occasion the fiftieth anniversary of the introduction of Loch Katrine water to the city was commemorated in this fashion. A very appropriate display has just been made in celebration of the Coronation, and the effect was most successful. Running the cars on a series of nights over an extended area with a big population, made variety of effect a desideratum. There were a number of such cars, and in design and



Glasgow Coronation Car—Ivy-Covered Castle.

colour each car was totally different. No. 1 was military in character and colour, with flags and shields, red and white predominating. The body of the car was divided into three tiers of panels, the lowest being filled with shields, the uppermost draped, the middle having specially prepared transparencies of the King and Queen flanked by monograms and the date of the Coronation. Immediately over the King and Queen there was placed a gilded crown with varied coloured lights, and appropriate drapery. Larger crowns surmounted the top; at the sides of the car were groups of flags, while festoons of lights connected these points forming an illuminated diamond.

If No. 1 depended on ordinary decorative colours for effect, No. 2 might be described as æsthetically delicate. The colours in this case were blue and white with an admixture of pale green. Here, again, there were three rows of panels; the lowest was blue, with white vertical stripes, over which lights were festooned, the middle row showed transparencies executed in silk, corresponding to

Glasgow Coronation Car Representing a 16th-Century Vessel.

those on car No. 1, but with blue substituted for red. The uppermost row had a blue foundation with white lattice work, and in addition a wreath encircling a crown. Over all there were festoons of evergreens. A feature of this car was two neatly constructed hexagonal towers, studded with lights on each rib, with circular openings on sides, glazed with white silk and illuminated within. Festoons of lights proceeded from the top of these conical towers to a clump of greenery at the sides of the car, again forming into a brilliant diamond.

No. 3 design (which we illustrate) might be described as typically Scotch. It represented an old embattlemented ivy-covered castle with diamond-paned Gothic windows, crowns and cannon, and flagpoles, from which the old National Flag, St. Andrew's Cross, fluttered. In the case of No. 3 a row of amber-coloured lights toward the bottom were made to represent flowers growing around the base of the castle.

No. 4, which we also illustrate, has been wrongly described as a Viking ship. It has been designed to show a 16th century vessel, and may be taken as representing the period when Scotland had a navy of her own. It was the gallant James IV who first created an effective Scots navy. His special pride was the *Great St. Michael*, the largest ship then existing—the *Dreadnought* of her day—to build which he wasted all the woods of Fife, and she cost the enormous sum, in those days, of £30,000, and carried a crew of 300 sailors, 120 gunners, "more great ordnance in her than the French King ever had to the siege of any town," as James himself boasted, and 1,000 marines.

St. Michael, the Archangel, is represented in the car-ship by the armed figure at the prow, but the design of this car more nearly approaches the type of the ships of James V. As the cross on the car-ship indicates, James was the last king to rule over Roman Catholic Scotland. Glasgow's *St. Michael*, which has been designed in honour of the Coronation of James's lineal descendant, King George V, has been constructed and illuminated by Messrs. Claud Hamilton, Ltd., Glasgow and Aberdeen.

The designs and decorative work of cars Nos. 1, 2 and 3, were by a Glasgow firm—Messrs. Wylie & Lochhead, Ltd., upholsterers to his Majesty the King. The Corporation Tramways Department were responsible for the illumination effects.

CORONATION ELECTRICAL ILLUMINATIONS.

Electrical engineers in many of our towns seem to have been showing considerable enterprise and ingenuity to secure the most telling effect from local illuminations for which they were responsible. Among other examples that have been brought to our notice was the effort of the Borough Electricity Department at Islington. Nightly in this London borough does Mr. Albert Gay's department tell forth in letters of light that "electricity is cheaper than gas," and that "power 1d. per unit, lighting 3d. per unit" are the charges which make it so, but at Coronation time this was placed in the shade, so to speak, by the erection, at a height of about 180 ft. between the two chimneys of the electricity works, of a length of 140 ft. of "Fairyland" strip bearing 300 16-c.p. lamps, supporting at different points of the strip three stars, each lighted by over 30 16-c.p. lamps. It will not be difficult for the reader to imagine that lights fixed at such a height presented a unique effect, and they were visible from all points for miles around.

At Bedford the Electric Lighting Department carried out the illumination of the Town Hall and the river under the supervision of Mr. R. W. L. Phillips, the borough electrical engineer. We have been privileged to see a number of photographs of the night effects, and from these we gather that the result must have given the Council and the public considerable satisfaction. Altogether some 8,130 coloured lamps were used in the scheme, which embraced the two sides of the river betweeen the Town Bridge and the Suspension Bridge, three bridges, and the Town Hall. The Town Hall, in addition to festooning, had a large electric crown and two letters "G." and "R." On the bridge over the Duck Mill weir appeared the crown over the date "1911" and the Royal names in blue lamps with a green border. The stone arches of the Town Bridge were picked out in red and white, whilst over the piers and along the string course ran a line of green lights. Festoons of white lamps hung from the lamp-posts over the parapets, and the letters "G." and "R." were in amber-coloured lamps.

The Suspension Bridge was adorned with lines of red, white and blue, and also green lamps, outlining the principal features of the structure. The letters G. and M. in amber were shown on either side of a device of shield and draped flags.

On both sides of the river were festoons of red, white and blue, alternating with green, hung between the trees, and on poles where trees were wanting. The festoons appeared on the water-edge round the rink island up to the locks, and then lined the path in the recreation ground and on the Embankment at a little distance from the water, so that the trees were silhouetted in the reflection. The lamps were placed 10 in. apart, 15 lamps in each series on 210 volts.

About 300 lamps were utilised for the illumination of the *Lodore*, which headed the procession of boats. The electric current for the lamps was supplied from an accumulator carried on board.

No doubt it has struck many of our readers in different parts of the country that it was a pity that so much good work should be expended upon illuminations which were only to serve for a night or two—especially when they formed such excellent advertisements for electricity! We can quite understand the desire to get rid of imitation foliage and some other decorations that were none the better for the downpour of June 23rd, but to quote the first case that comes to us as we write, what a splendid advertisement it would have been for the London, Liverpool and Globe if it had made its electrical illuminations a permanent, or at any rate a continued, nightly display! At Bedford, we are glad to learn, the extensive installation referred to above is to remain up all through the summer, and the illuminations will be repeated on gala nights, such as the regatta on July 27th. If it is not too late, perhaps other places, where the idea has not been mooted, will see the wisdom of continuing their illuminations, per-

haps as an advertisement of the town, perhaps, because their loyalty is not satisfied with a mere passing and temporary outburst, and partly, though only incidentally, of course, because the electricity supply department stands to gain both from the general advertisement and from the addition to its load.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

The lecture theatre of the Institution of Civil Engineers was very well, but not uncomfortably, filled, on Wednesday last week, when Mr. Alexander Siemens, as president both of the Institution and of the Conference, opened the proceedings. He said that in calling this Conference together the Council had endeavoured to define the scope of discussion by declaring its object to be—

"To consider the methods of preparation to be adopted by those who contemplate entering the engineering profession in compliance with conditions laid down by the by-laws for election into the Institution."

The by-laws demanded that a candidate should possess :—

1. A sound general education, developed upon lines suited to subsequent scientific study ;

2. A competent knowledge of those branches of science which form the basis of engineering ;

3. Practical training under actual engineering conditions.

In addition, there was the necessity common to all professions, which Prof. Max Müller, in his first lecture on the Science of Language, defined as follows :—

". . . . no science and no art have long prospered and flourished among us, unless they were in some way subservient to the practical interests of society . . . . that interest depends on the practical advantages which society at large derives from these scientific studies."

Applying this principle to the problem submitted to the Conference, it might be expressed by saying that a young engineer should be educated so as to become a dividend-earner for his employer, for this was the most reliable indication of his merit, and the corresponding reward would not be wanting. For the same reason he should possess some knowledge of business methods and of law, not with a view of becoming his own lawyer, but in order to be able to judge when legal advice was needed.

Besides all these requirements, he would find one or more modern languages very useful for obtaining remunerative employment, as the value of his services was thereby increased in the estimation of his employer.

It was hardly necessary for him to insist on the value of proper training for engineers after what he tried to demonstrate in his address last year, that modern civilisation owed its characteristic features to the success of the engineer in improving communications and in superseding manual labour by mechanical power.

While it was not proposed that definite resolutions should be arrived at by the Conference, but that it should be simply a means of forming and maturing the views of those interested in the subjects brought forward for discussion, the Council had felt that it would be desirable to give the widest and most immediate publicity to the proceedings of the meetings, and had accordingly invited the attendance of representatives of the Press at the gatherings. In this respect, the course taken differed from that adopted for the professional discussions of the Institution.

Mr. Siemens then proceeded to express the great regret which all attending the Conference would feel at the enforced absence of Prof. Capper, confined to St. George's Hospital as the result of an accident, and of two of the Vice-Presidents of the Conference, namely, the President of the Board of Education (Mr. Walter Runciman), and the Secretary for Scotland (Lord Pentland).

The other Vice-Presidents, Sir William White and Sir John Wolfe Barry, then addressed the meeting. Sir William remarked upon the fact that that Conference represented the third step taken by the Institution of Civil Engineers in recent years with regard to the education of engineers. The first step was taken during Sir John Wolfe Barry's presidency with its introduction of the examination system as one qualification for membership ; the second step had been the Conference on Education during his own presidency, and the third would be the revision of their own by-laws with regard to the training of engineers. In passing, he made reference to the fact that the introduction of examinations had resulted in a coaching system, not exactly along lines which they had anticipated. In the first instance, British training had been mainly practical. Then came a revulsion of feeling which had made it mainly scientific. They now realised that it was necessary to blend these features. The President and Council of the Institution of Civil Engineers, in summoning that conference, were serving not only the interests of that Institution, but those of the whole profession.

Sir John Wolfe Barry expressed his entire belief in the best possible practical training being given to engineers, but felt that the grounding of a thorough scientific training was of equal importance. The introduction of the examination system had been to the advantage of the entire profession. He felt, too, that the general education of an accomplished gentleman should not be lost sight of.

The Conference then split into two bodies, Section III remaining in the lecture theatre, while Sections I and II adjourned to the library.

Dealing with the subject of Literary Education and Engineering before Sections I and II, the Rev. James Gow, Headmaster of Westminster School, said that Latin was seldom included in the preliminary education of an engineer, or boys who intended to be engineers paid little attention to this subject ; and it was probable that, where Latin was neglected, no very close study was given to any other language. He proposed to argue that a literary education, up to a certain point, was of as much value to the engineer as to anybody else ; and that, at least in the higher walks of his profession, he was likely to be injured by the want of it.

It was notorious, at least to schoolmasters, that a boy who passed from the classical side to the modern side of a school had an immense advantage in inductive science over those who had been educated entirely on modern lines. Latin, as taught, with grammar and dictionary, was inductive science almost in the abstract. Language was incomparably the cheapest and the most rapid introduction to inductive science ; and a boy who had had a thorough drilling in Latin had acquired orderly habits of mind which made inductive natural sciences easy to him.

Secondly, the engineer was doubtless often called upon to command a gang of foreign workers. The sooner and the better he learnt their language the more easily he would control them and direct their labour. The necessary elements of language must always be the same, and the man who, by training, was alive to this fact and on the watch for these elements, had a great advantage over another who learnt at haphazard.

Thirdly, though it was perhaps not the business of the engineer to make contracts, it was undoubtedly his business to understand them and to give and receive orders accordingly. These transactions required a careful and exact appreciation of words. The larger the interests in which the engineer was concerned, the more necessary it was that he should study his instructions closely and be quick to discern a verbal difficulty.

Something also should be said of literary studies proper—the world of books, poetry, history, and the rest. It would be advantageous to the engineer to discern not only what was mathematically possible but also what was artistically impossible ; not only what was cheap, but also what was nasty. For this purpose some general culture was necessary, such as made a man liberal in mind and sympathetic to the common run of his fellows. And this same culture which kept a man from being a prig might also serve to keep him from becoming a beast. Most of the mischief that was done in life was done in leisure, and the rational employment of this time was the real object of general education. The man who could be happy with a good book was master of himself, and saved from a hundred base temptations to which the engineer was peculiarly liable, since he was so often lonely in a far country and a cruel climate. There was no fear that literary culture would absorb too much time. The boy who was going to be a first-rate engineer would not take any more literary education after the age of 16 or thereabouts. The best plan was to give a boy a general education, mainly literary, up to 16, and at that point to watch him closely, and put him to what he wanted to learn. If he was clever, he would be successful ; if he was not clever, he would at least be happy and proud of his calling.

"The Extent to which Mathematical and Scientific Subjects should share with other Subjects of Literate Education the Attention of Schoolboys who intend to enter later the Engineering Profession" was the subject discussed by Prof. S. P. Thompson. He said that in the present chaos of secondary education, the schools of the type which chiefly furnished boys to the engineering profession were almost wholly destitute of any organisation adapted to that end. In general, schoolmasters devoted their energies to preparing a few scholarship candidates, and had no definite educational aim whatever for the bulk of the boys. Until this hopeless state of things was radically altered, British education would continue to be in a bad way. He contrasted this state of things with that which existed in the secondary schools all over Central Europe. If the

German boy failed to pass the Maturity Examination of his school, he was marked as unfit for professional life. The immense advantages of the reasoned organisation of these secondary schools could hardly be overstated. A good systematic secondary education was guaranteed to the majority of the boys.

Here the State had not yet (save in Scotland) organised the secondary schools. Each University wasted its energies over holding matriculations and the like. Almost all the professional bodies also held amateur matriculations or preliminary examinations of their own to test the general education of candidates for entrance. The result, educationally, was muddle, waste, inefficiency.

Eight years ago the Institution of Civil Engineers appointed a Committee to report on the best methods of training for all classes of engineers. The recommendations in respect of preparatory education, contained in pages 8 to 10 of the Committee's Report, stated admirably, from the point of view of the engineering profession, the requirements toward which the schools should be organised to work.

Many mistaken notions were abroad as to science teaching in schools. At school the first object of science teaching should be to evoke interest, not to impart the facts or data of science, still less to systematise their re-discovery. All that had its place later. The fossilisation of science teaching was the thing now most to be feared. Elementary mechanics, the foundation of all engineering, could be made thoroughly attractive by a live teacher who handled his subject in a human way. The bad teacher, of course, could make even electricity as dull and distasteful a subject as the conjugation of irregular verbs. Not until a boy was 15 or 16, and was approaching the stage of matriculation, should science be allowed to degenerate into a grind. Any specialisation in scientific subjects before that stage had been passed was essentially out of place and harmful.

A great change had come over mathematical teaching during the last 10 years; the recommendations of the Institution Committee of 1906 had already been widely adopted in the schools.

One difficulty had been the stupidity of inspectors who had not grasped the importance of the reforms. The benumbing influence of the older Cambridge traditions was also felt. Bad teaching was responsible more than anything else for distaste for mathematics. A really capable teacher would make his boys enthusiastic over matters that, in the hands of others, were deadly dull.

Of all the changes that had come over the teaching of mathematics, the greatest was the almost complete disappearance of Euclid. Theoretical geometry was now taught on other lines. But he was not sure whether the loss was not greater than the gain. If it were approached rightly, after practice in geometrical drawing which familiarised the learner with the concrete facts, the study of Euclid constituted an unrivalled training in methodical and cogent reasoning. But Euclid was gone, and it was his deliberate opinion that boys nowadays were less capable of following a sustained train of thought than they used to be. Training in thinking and in the correct expression of thought was more essential than the study of any particular subject. These things were more important in the long run, and vastly more important in the ultimate making of a professional engineer, than the acquisition of a hoard of scientific facts.

The discussion on these two papers was opened by Sir John Wolfe Barry, who was strongly opposed to any system which encouraged the degeneration of secondary schools into houses of cram. He had seen secondary schools where too much was attempted with boys up to 16 years of age. The mind required development, and he quite agreed with Dr. Gow that the training of the mind resulting from the study of languages was correct and beneficial. Both authors agreed that specialisation up to the age of 17 was undesirable. Another point of view was that they did not want to make engineers merely engineers, but also men who could adapt themselves to the exigencies of life. More culture was wanted; and it must be brought into a boy's ideas in his early years.

Mr. Theo. Reunert said he entirely concurred in the views advanced in both papers.

Mr. W. H. D. Rouse thought that, as a rule, parents should direct the curriculum, although he had known instances where they desired that boys should not take certain subjects of general utility, because they considered that those subjects would be of no use in the particular professions their sons were intended for. The schoolmaster was subjected to the influence of uninstructed public opinion, as well as of various public bodies which generally consisted mainly of ignorants. He quite agreed that the multiplied examinations were working much mischief. Oxford and Cambridge local examinations were simply hotbeds of cram. No education imparting general intelligence could possibly be carried out by schools preparing pupils for these local examinations: and no examination could be conducted on healthy lines without the co-operation of the State or outside bodies and the teachers.

Mr. W. Whitaker was of opinion that Dr. Gow had rightly stood up for the educational value of literature. The study of science would be much more beneficial if it were carried out with greater regard to making it interesting: and he shared Prof. Thompson's regret at the discontinuance of the study of Euclid, for there was nothing to supply its place. The real object of education was to get them into good methods of thought and not to store the mind with facts.

Dr. R. M. Walmsley thought that parents were largely to blame for miseducation. The difference in the value of a Scotch and a English education was due to the different degree of interest taken by the parents. It was necessary to instruct public opinion as well as pupils. The prevailing absence of an adequate knowledge of German was a serious matter for English engineers.

Dr. Stanley De Brath thought that want of system in the early years of boys' training was responsible for the present unsatisfactory state of affairs. There was a lamentable want of interest in the matter.

Prof. Abel pointed out the importance to engineers of an adequate knowledge of the properties of matter and of learning to think dynamically, but problems were mostly brought down to that state in which they could be solved statically. As a means of inculcating coherent thought Euclid was invaluable, and its study should be insisted on.

Colonel Capper, R.E., said the importance of a sound general education during a boy's earlier years could not be overrated. Technical specialisation was best deferred.

Mr. T. H. Bailey said that sometimes the clever boys were not successful. Public schools did not want to turn out professional men, but to give that sound general and moral training which would fit students to take up any technical subject.

Dr. Gow, replying, said that public schools would welcome advice and information from that Institution.

Prof. Thompson pointed out that the existing deficiency of secondary education was not the fault of the schoolmasters. A departmental committee was now considering the subject. Dr. Gow and himself both deprecated too early specialisation.

"The Question of Specialised Entrance Examinations for Courses of Study in Engineering Science" was the subject of the address by Prof. Alfred Schwartz, who defined the functions of the secondary school and of the college course as follows:—

(*a*) The function of the secondary school is to give a liberal general education, that is, to impart a limited amount of knowledge, in a range of subjects so selected and dealt with as to develop the mental faculties in a comprehensive manner.

(*b*) The function of the college course is to impart a certain amount of knowledge of a specialised character, and to train and develop further the mental faculties along specific lines.

The function of the entrance examination for university or college courses in engineering science might be taken to be the determination of the fitness or otherwise of the candidates to pursue the contemplated course of specialised study.

The matriculation examination of a university should be essentially a test of general education and should admit to all faculties. The governing bodies of the leading professional societies, however, had exhibited a growing tendency to call for some degree of specialisation in the matriculation examinations. These special demands had to be met by the secondary schools.

The average boy of 16 years of age who had had a liberal general education was not usually in a position to negotiate successfully these specialised entrance examinations; he therefore extended his school course, the final portion of which was devoted to "preparing" him to meet the requirements of the examination market, or of his future career.

Mathematics was invariably made obligatory, and the standard of the examination in this subject should therefore be such as might be compassed in the course of a liberal general education. The science subjects selected for tuition varied in different schools, and this fact was recognised in the matriculation and entrance examinations by giving an option to the candidate in the selection of subjects. The fact that these options were widely exercised rendered it impossible to commence the college courses in these subjects otherwise than *ab initio*. It was evident, therefore, that the treatment in the secondary schools of science subjects other than mathematics must be regarded as having an educative value rather than an instructional one.

The object of teaching modern languages in the secondary schools at the present time was not so much the investigation of the logic of language, and the reflex action of its grammar on the structure of other languages, as to furnish the ability to think and speak and write in a foreign tongue. This teaching of modern languages might therefore be regarded as specialised instruction. Here, again, the average boy of 16 years of age fell short of the standard aimed at. Instruction in German frequently formed part of the courses in the engineering colleges, and, regarded as specialised instruction, it was not there out of place.

It was particularly necessary, in the case of the engineer, that his secondary school training should be on as liberal lines as possible, since his subsequent training in the college, the workshop and the office was largely materialistic.

Mr. Jackson, who opened the discussion, expressed his objections to specialised examinations. The real object of any examination was only to ascertain the extent to which students possessed good general knowledge and ability. The danger of making early training too practical, and later training too theoretical, could not be too strongly insisted on.

Mr. W. H. Patchell remarked that a knowledge of Spanish was more important to engineers than French or German, in view of the immense extent of Spanish-speaking territory open to them in South America. He wished to protest most strongly against certain matriculation examinations, which an honestly educated boy uncrammed could not possibly pass.

Dr. W. C. Unwin, Prof. Spooner, Dr. Stanley De Brath, and Prof. E. W. Marchant also briefly contributed to the discussion.

(*To be continued.*)

Fire.—A fire occurred in a stores shed of the Premier Accumulator Works, at Northampton, on the afternoon of June 28th. An employé was assisting in the removal of the stock when he stepped back into a carboy of sulphuric acid.

INTERNATIONAL ELECTRICAL CONGRESS, TURIN.

In our issue of March 31st we gave a list of the subjects to be dealt with at the International Congress of the Applications of Electricity at Turin, in September next. We are now informed that there is every prospect that the Congress will realise the expectations of its promoters, and will result in material benefits to the industry of applied electricity. The General Rules have recently been issued, and can be obtained from the "Congresso di Elettricità," Politecnico, Turin, to which address applications for membership and subscriptions should also be sent. Prof. L. Lombardi is the president, and Messrs. C. A. Curti and G. Semenza are the secretaries of the Organising Committee. Amongst the official reporters, 31 in number, are Prof. S. P. Thompson (on Converters, Rectifiers and Motor-Generators) and Major W. A. J. O'Meara (on the Various Systems of Multiple Telegraphy).

Arrangements have been made to reserve accommodation at ten hotels in Turin, for those who apply for it before August 20th, at reduced prices. The subscription to the Congress is 20s. for full membership, including the entertainments and visits of interest, and a copy of the printed *Transactions*, &c. Members' relations may obtain the right to attend the meetings, visits and entertainments for a fee of 8s. Applications should be forwarded as soon as possible. Besides the official reports, other original communications from the members may be read and discussed, provided that due notice has been given to the Organising Committee. All communications will be printed in the *Transactions* in the language in which they were presented. A list of the papers announced up to the end of May is appended :—

1. M. P. Boucherot (Paris): "Les phénomènes électromagnétiques qui résultent de la mise en court-circuit brusque d'un alternateur."
2. Dr. Hallo (Karlrushe I, B., Germany): "Cascadenumformer."
3. M. Huber Stockar (Zurich): "Aluminium für elektr. Leitungen."
4. Ing. Elvio Soleri (Turin): "Gli estremi limiti di applicabilità dei cavi ad alta tensione."
5. M. J. Routin (Lyon, France): "Regulateurs automatiques."
6. M. Jules Neher (Geneva): "Misuratori elettrici a tariffa multipla."
7. Ing. Alberto Dina (Palermo, Italy): "Su alcuni metodi di prevenzione delle sovratensioni interne."
8. Mr. S. Q. Hayes (Pittsburg, Pa., U.S.A.): "Commercial Apparatus for 100,000 volts service."
9. Prof. Riccardo Arno (Milan): "Watt-voltamperometri elettrodinamici e a induzione."
10. Prof. Riccardo Arno (Milan): "Di una soluzione del problema della compra-vendita razionale dell'energia elettrica."
11. Ing. Pietro Lanino (Rome): "La trazione elettrica in riguardo alle esigenze del servizio ferroviario."
12. Dr. W. Kummer (Zurich): "Ueber die Ausbildung der Triebfahr zeuge für elektrischen Vollbahnbetrieb mit Einphasenwechselstrom."
13. Ing. Guillaume Gyaros (Budapest): "Traction électrique appliquée aux lignes vicinales spécialement par rapport au système du courant continu à haute tension."
14. Dr. Osuke Asano (Tokio): "Progress in Electrical Installation in Japan."
15. M. J. A. Montepellier (Paris): "La technique de l'accumulateur électrique notamment en ce qui concerne l'accumulatenr alcalin fernickel."
16. "M. Etienne de Fodor (Budapest): "Etat actuel de la question de la destruction des ordures en combinaison avec les usines électriques."
17. Mr. Leon Gaster (London): "The International outlook in Scientific Illumination."
18. Dr. Charles P. Steinmetz (Schenectady N.Y., U.S.A.).
19. M. le Prof. Quirino Majorana Calatabiano (Rome): "Ricerche di telefonia senza fili."
20. Dr. A. E. Kennelly (Cambridge, Mass., U.S.A.): "The Rotating Electric Current Field."
21. Mr. T. C. Martin (New York, U.S.A.): "The Electrotechnical Industries of America."
22. Mr. C. O. Mailloux (New York, U.S.A.): "Electrification of Railroads."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The New Zealand Customs Authorities have recently issued a regulation providing for a form of certificate which is to be sealed to or printed on invoices of imported goods as a declaration of value. This certificate will be accepted as evidence of the proper basis of value for duty of the goods appearing in the invoice subject to the collector's right to challenge at any time the accuracy of the values upon which duty is to be paid. The certificate, of which the following is a copy, is required in addition to the usual certificate of origin for British goods imported under the preferential tariff.

Declaration in Support of Invoice Values.

(*To be sealed or printed upon invoices.*)

I, ...

do hereby certify as follows :—

1. That I am (*) ..... the exporter of the goods specified on this invoice or upon the invoice sealed hereto.

2. That the said invoice is in all respects correct and true, and that all charges are correctly and separately stated thereon.

3. That the said invoice exhibits the fair market value of the said goods when sold for home consumption in like quantity and condition in the principal markets of the country at the time when exported directly to New Zealand, without any deduction (*a*) on account of bounty, or on account of any royalty actually payably thereon, or payable thereon when sold for home consumption, but not payable when exported; or (*b*) on account of any discount for export only or on account of any special discount or cash discount except where so clearly and separately specified, or on account of any special consideration whatsoever.

4. I also certify (*a*) that, unless otherwise clearly stated, all prices or discounts specified in the said invoice are allowed to all buyers of similar quantities alike, and that they are not specially cut prices or discounts, or discounts or prices allowed specially to agents or on account of a contract to take goods greater in quantity or value than those appearing upon the said invoice within a stated period; (*b*) that no arrangement or understanding affecting the purchase-price of the said goods has been, or will be, made or entered into between the said exporter and the purchaser, or by anyone on behalf of either of them, either by way of special discounts, rebate, salary, compensation, or in any manner whatsoever other than as shown in the said invoice.

Signature.....

Witness.....

Dated at....., this.....day of ....., 191 .

The surtax of 2½ per cent. of the amount of duty payable at the rates specified in the Tariff, which has for some year or more been levied on all goods with the exception of tobacco, cigars and cigarettes, has been abolished to date from March 31st of this year.

FRANCE.—The French Customs Authorities have issued the following decisions as to the duty to be levied on certain imported goods :—

Sliding rails of iron or steel for conduits for electric tramways are to be dutiable as "rails of iron and steel" if they are rough or simply pierced with holes for the bolts. If they are thinned and planed or otherwise marked they are to be dutiable as "fixed railway material."

SALVADOR.—The Salvadorian *Diario* for April 6th contains a Decree of the National Assembly imposing a surtax of 20 per cent. (payable in gold) of the duties inscribed in the Customs Tariff, in respect of all merchandise imported into the Republic except flour, and certain specified cotton goods and leather, the Tariff duties on which are reduced.

Durban Corporation Electricity Staff.—The annual gathering of the Durban Corporation Electricity Department, in the form of a smoking concert, took place on May 20th, at the "Prince of Wales Hotel," Durban, when upwards of 50 members of the department were present. The committee responsible for the arrangements consisted of Messrs. Smith, Woods, Harding, Bush, and E. Poole as hon. sec. and treasurer, and an excellent programme was gone through. Mr. Roberts, borough electrical engineer, acted as chairman, and in reply to the toast of "The Department," proposed by one of the visitors, he thanked the staff for the manner in which they had run the department during his absence in England, and said that it was gratifying to know that from what he had seen in England, Durban was maintaining its position in electrical matters. A big field of development was in front of them.

Stoker Contracts.—The following is a list of recent sales of stokers, &c., for electrical undertakings by the Underfeed Stoker Co., Ltd.:—Hammersmith Borough, 4 A; Kensington and Knightsbridge Electric Light Co., 2 E; United Electric Tramways of Monte Video, 9 E; Eastbourne Corporation, 2 A; Borough of Shrewsbury, 2 B.

Coronation Illuminations.—The yellow silk lanterns which formed an important part of the Coronation electrical display in Piccadilly, from St. James' Street to Constitution Hill, were supplied by Messrs. Taylor & Co., of Hatton Garden, to the number of 3,400, to the order of Messrs. Speedy Eynon & Co.

* Insert the word "partner," "manager," "chief clerk," "principal," or "principal official," giving the rank and the name of the firm, as the case may be.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,439. "Self-recording electric fire alarm." S. W. H. Enwards. June 19th.

14,478. "Systems of electric lighting." S. W. Rushmore. June 19th. (Complete.)

14,504. "Production of periodically varing currents of high frequency." E. Weintraub. (Convention date, June 18th, 1910, United States.) June 19th. (Complete.)

14,505. "Electric transportation systems." G. E. Vaughan. (M. E. Sturgis, United States.) June 19th. (Complete.)

14,525. "Switch operating and controlling mechanism. J. McGregor. June 19th.

14,569. "Electric telegraphy." E. S. Heurtley. June 20th.

14,587. "Mercury, and other vapour, electric lamps." H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. June 20th.

14,590. "Telephone mouthpieces." L. Steinberger. (Convention date, August 6th, 1910, United States.) June 20th. (Complete.)

14,591. "Telephone mouthpieces." L. Steinberger. (Convention date, August 20th, 1910, United States.) June 20th. (Complete.)

14,604. Electric pocket lamps." E. Neudoerffer. June 20th.

14,613. "Telephones." B. Gwozdz. June 20th. (Complete.)

14,615. "Electric relays." W. R. Sykes Interlocking Signal Co., Ltd., J. C. Sykes and R. W. Tarrant. June 20th.

14,619. "Magneto-electric machines." F. R. Simms and Simms Magneto Co., Ltd. June 20th.

14,646. "Electrically-driven clocks or watch works of the primary or self-controlling type." T. Rushton. June 21st.

14,649. "Metal telegraph poles." J. Brunschwyler and C. Ingli. June 21st. (Complete.)

14,650. "Electrical distributing systems and fittings therefor." L. M. Waterhouse and Simplex Conduits, Ltd. June 21st.

14,683. "Telephone transmitters." Siemens Bros. & Co., Ltd., and C. R. Riber. June 21st. (Complete.)

14,685. "Electric arc lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 21st. (Complete.)

14,691. "Telegraph transmitters and the like." J. Gibiansky and S. C. J. Merlo. June 21st. (Complete.)

14,704. "Device for operating or controlling electric switches and the like from a distance." J. L. Odgers. June 21st. (Complete.)

14,727. "Wireless telegraphy." H. Murray. June 21st.

14,729. "Electrodes for electric arc lamps." C. Conradty. June 21st. (Complete.)

14,731. "Glow lamps for advertising purposes." G. Rainaud. (Convention date, June 22nd, 1910, France.) June 21st. (Complete.)

14,769. "Batteries." H. W. Darby. June 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Alternating Electric Current Distributing Systems. G. Berry. 12,926. May 27th.

Apparatus or Appliances for Automatically Lighting and Extinguishing Gas, Electric and other Lamps, and for Analogous Uses. C. Earle. 13,052. May 30th.

Switches for Use in the Control of Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 13,195. May 31st.

Starting Devices for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 13,224. May 31st.

Controllers for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg Co.) 13,325. June 1st.

Electrical Transformers. British Thomson-Houston Co. (General Electric Co.) 13,694. June 6th. (Addition to 13,278 of 1904).

Torsion Dynamo Meters. R. R. Bevis and M. G. Clayton. 13,833. June 8th.

Lectrically-operated Carriage Return and Line-spacing Mechanism for Typewriters and the Like. C. S. Du Belle. 13,910. June 8th. (June 8th, 1909).

Motor Tractors for Agricultural Purposes. P. Saul. 13,932. June 8th.

Electric Furnaces. C. Hering. 15,139. June 23rd. (July 6th, 1909.)

Quick-break Switch-on Circuit Breaker applicable to Arc Lamp and other Electrical Circuits. T. Littler, Jun. 16,485. July 11th.

Electro-Mechanical Controlling Devices. Adams Mfg. Co. (Cutler-Hammer Mfg. Co. 17,110. July 18th.

Means and Appliances for Removing and Replacing Electric Light or like Bulbs in their Sockets. F. C. Upton. 17,873. July 27th.

Electric Switches and Signs. W. K. L. Dickson. 18,359. August 3rd.

Alternating Electric Current Motors. British Thomson-Houston Co. (General Electric Co.) 19,359. August 17th.

Hangers or Ears for Overhead Electric Wires or Conductors. J. W. Speight and H. R. Walmsley. 21,522. September 16th.

Secondary Batteries. D. P. Dunne. 21,922. September 21st.

Telephone Exchange Circuits. Siemens & Halske Akt.-Ges. 22,013. September 22nd. (January 29th, 1910).

Apparatus for Stopping and Returning to the Initial Position Electrically Operated Mechanisms. W. P. Thompson. (Wirth, Beck & Knauss, firm of.) 24,808. October 25th.

Method of Producing X-ray Pictures and Appliances therefor. A. Bauer. 25,205. October 22nd.

Suspension Chain for High-Pressure Electric Transmission Wires. Soc. Vedovelli Priestley et Cie. 27,174. November 22nd. (April 5th, 1910.)

Apparatus for Causing Electrical Impulses for Transmission to a Distance. J. A. Gardner and A. Ferguson. 27,223. November 23rd.

Telephone Exchanges with Automatic Call Distributors. Siemens & Halske Akt.-Ges. 27,860. November 30th. (December 9th, 1909.)

Electric Lighting and like Systems supplied from Variable Speed Dynamos. Leeds Forge Co. and T. Ferguson. 28,695. December 9th.

Composition for the Use of Electric Insulating and other Commercial Purposes. H. P. Rasmussen. 28,834. December 12th.

Automatic Electric Heat Control. H. G. Geissinger. 29,463. December 19th. (December 22nd, 1909.)

Means for Converting Electric Currents for Supplying Electric Motors. Crompton & Co., Ltd., and H. Burge. 29,726. December 21st.

1911.

Electric Arc Lamps. J. O. Girdlestone and C. F. G. Thorkelin. 5,806. March 8th.

Alternating-Current Arc Lamps. Körting & Mathiesen Akt.-Ges. 6,783. March 29th. (March 29th, 1910.)

Electric Voltage Regulators. Allgemeine Elektricitäts Ges. 7,668. March 27th. (March 26th, 1910.)

Manufacture of Metal Filaments for Electric Lamps. G. Ludecke and Imperial Lamp Works (Brimsdown), Ltd. 132. January 2nd.

Apparatus for Use in Wireless Telegraphy. Dr. Erich F. Huth Ges and R. Hirsch. 5,248. March 2nd. (August 3rd, 1910).

Electric Incandescent Lamp. O. Schaller. 9,815. April 22nd. (April 22nd, 1910.)

Book Notices.—*Arithmetic of Electrical Engineering.* Second edition. 1911. London: Whittaker & Co. Price 1s. net. —In this, the second edition, some additional examination questions have been inserted, and corrections have been made. A great variety of examples, many of them worked out in detail, are given; there is little to be said by way of comment upon them, and we have found very few inaccuracies, though it is not always true (p. 34) that a "B.O.T. unit of electrical energy is supplied when the product of the volts, amperes and hours (during which the energy is supplied) equals 1,000." This is only generally true of direct-current supply. Again, on p. 35, the expression, "candles per hour" is quite wrong. We may suggest that shortened methods of calculation might be introduced where possible, and results should not be shown to unpractical degrees of apparent accuracy. The questions as a whole rather relate to "electricity and magnetism" than to the broad subject of "electrical engineering."

Practical Dynamo and Motor Management. London: S. Rentell and Co. Price 6d. net.—This little book contains concise instructions for the guidance of attendants, showing the probable causes of, and approximate remedies for, a variety of troubles such as are likely to arise in the working of both D.C. and A.C. machines; the matter is plainly written by one who knows what he is talking about, and should be of use to a wide circle of readers.

"Principles of Electrical Engineering." By Harold Pender. 1910. London: Hill Publishing Co. Price 17s. net.

"Steam Turbines." By Joseph W. Roe. 1911. London: Hill Publishing Co. Price 8s. 6d. net.

"Bulletin of the Association des Ingénieurs Electriciens." June 1st, 1911. Liége: Rue St. Gilles, 31.

"Rubber." By Philip Schidrowitz. 1911. London: Methuen and Co. Price 10s. 6d. net.

"Science Abstracts." Sections A and B. Vol. XIV, Part 6. June 26th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

Bulletins 1-5, 7-9 and 11 of the Bureau of Mines. 1910. *Bulletins* 366, 383, 385, 402, 412 and 423 of the United States Geological Survey. 1908-9. *Circulars* 1-3 of the Bureau of Mines. 1911. Washington: Government Printing Office.

"The National Insurance Bill Summarised." By L. W. Evans, M.P. 1911. London: National Union of Conservative and Constitutional Associations. Price 1d.

The Chamber of Commerce Journal publishes with its July issue a Special Supplement dealing with the British Empire as a supplier of foodstuffs and of raw materials for British industries.

The Hill Publishing Co., Ltd., have issued a new catalogue of technical and scientific books published in connection with *Power* and other well-known American journals, copies of which will be furnished free on application.

Patent Applications.—The Saltpetersäure Industrie-Gesellschaft G.m.b.H. have made application for the restoration of their patent No. 7,320 of 1907, for "Improvements in arc furnaces for the electrical treatment of gases."

Mr. Samuel Marsh Young has applied for the restoration of his patent No. 13,746 of 1903, for "Improved method for operating signals on electric railways."

The International Rotary Motors, Ltd., and W. A. Richards have applied for the restoration of patent No. 18,193 of 1904, for "Improvements in and relating to internal combustion engines," granted to C. W. Redrup and W. A. Richards.

All the above expired owing to the non-payment of renewal fees.

It is announced in the *London Gazette* of June 30th that the Automatic Electric Co., the owner of patent No. 809 of 1908, granted to W. P. Thompson for "Improvements in automatic calling devices for telephone exchanges" (communicated by the Strowger Automatic Telephone Exchange, of Chicago, now absorbed in the Automatic Electric Co.), has applied for the term of the patent to be extended. The application will be heard in the Chancery Division in London on July 29th. Messrs. Bower, Cotton and Bower, 4, Bream's Buildings, Chancery Lane, E.C., are the solicitors for the petitioners.

The Royal Show.—The silver medal was presented to Messrs. R. A. Lister & Co. by the Royal Agricultural Society at the Royal Show, Norwich, for the Bruston automatic electric lighting plant. His Majesty the King inspected the plant in operation and had the system explained to him by Sir Ashton Lister.

THE

ELECTRICAL REVIEW.

VOL. LXIX. JULY 14, 1911. No. 1,755.

ELECTRICAL REVIEW.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C

REPRESENTATIVES ABROAD.

WE have frequently called attention to the importance of British firms maintaining suitable representatives abroad The point has been again strongly emphasised in a very businesslike report that has been made by Mr. R. Sothern Holland concerning our trade in South Africa. It is only in exceptional cases that all the necessary qualities of the commercial engineer are found combined in the same individual, and some firms when entering upon the work with definite resolves for big results, have sent men out in pairs, each of whom has specialised in his respective technical and non-technical duties. There are firms who send abroad non-technical men who have proved themselves good and efficient men at the works or in the London or other branch office, and they anticipate that such men will prove of similar value abroad. To men who have been abroad, it is unnecessary to point out how risky this may prove to be.

A firm's representative abroad is in a very different environment from that of home. He must meet men who have orders to place, whose engineering knowledge, while, perhaps, deficient on the practical side, is of no mean order on the theoretical side. These men have absorbed all the engineering of the class-room and are peculiarly well fitted to ask questions on engineering matters and able to differentiate the replies they receive. A non-technical man cannot long carry on upon the basis of talking round his subject. He cannot, in fact, satisfactorily meet the thousand and one inquiries that are put to him. He is bound, sooner or later, to disclose to observant inquirers that he is not in possession of the knowledge which he ought to have as an engineering representative. Other men he will meet who are thoroughly informed on both the practical and theoretical side, and these men will ask questions concerning the proportions of machinery which only an engineer can answer. In very numerous cases they will have to encounter men who, while occupying engineering positions, are in no way fitted to do so. These men seek information from the representatives of foreign firms, and must rely on them for the success of their undertakings. In what sort of a fix must a non-technical representative find himself when he is seeking orders in such directions! He cannot get the neccssary information and data from the engineer. He is not able to ascertain for himself the facts of the case, and we know that firms with this class of man to represent them are left out of the running when orders are given out. The business has gone right past British houses to German firms, in a number of cases that have been brought to our notice, because the German firm had a man on the spot who had every imaginable piece of information regarding technical details and prices at his finger ends.

There are many firms who rely for their representation upon the crectors they have sent out, thoroughly practical mechanics but not engineers. Such men can only be a

success up to a point. They are mechanics, and they have a reputation because of the excellent manner in which they have erected and set going some large installation of machinery. Such men are useful in certain places, but they fail to reach the level that should be attained by a truly engineering representative who, to reach the high-water mark of his duties, must be able not only to negotiate contracts with skill and tact, but also, without making it too obvious, to act as consulting engineer and keep his clients in the right line.

The difficulties involved are better understood by those who have had experience in foreign countries.

Another very weighty reason for technical experience is that the representative should be fully capable of laying down the law in respect of faults in his people's products. If he advises that certain parts are deficient in dimension or strength or bearing surface, or unsuitable for the prevailing conditions of the country, his people at home should be able to rely upon his advice and to act upon it. With a non-technical man these faults go on for years, accumulating bad opinions and causing loss of business. We have been told again and again that the works at home are far too prone to leave valuable suggestions unheeded. Experience shows that machinery that is perfectly satisfactory at home will fail abroad where there is more sun and dust and lubrication is more difficult. A common phrase in newspaper work refers to the courteous and enlightened foreigner. Now the foreigner is at best but human, and is not averse from pulling the leg of any firm's representative whom he may have discovered to be lacking in engineering knowledge.

A newspaper representative who collected local information described an engine breakdown as being caused by the big end of the connecting rod striking the back end of the cylinder, thus causing the vacuum to drop into the smoke box. This may be funny when it happens at home, but when parallel happenings occur in connection with the representation of world-renowned firms of engineering manufacturers, the matter ceases to be humorous and assumes a serious aspect from a trading point of view.

An engineering representative should be one who has good shop experience and knows fairly well the limits of his firm's capacity. He ought to have a fair general education, and if not fully acquainted with the language of the country, should be able soon to acquire it. He ought to have the manners and address of a gentleman. This is of importance. Even where manners and customs differ, the people appear to appreciate class distinctions very quickly. In our own Colonies men are known, of course, at once.

Tramcar Meters.

From time to time the old question of meters on tramway cars crops up again. Possibly someone reads a paper on meters, or some tramway manager seeks to convince a heedless Committee by means of a lengthy report on the saving effected by their use. We do not know whether Mr. T. B. Goodyer's summary of information respecting meters on cars falls directly or indirectly under either of these categories, but it certainly brings our knowledge of tramway practice, in this particular, nearly up to date.

The fact that of the 88 tramway systems which replied to Mr. Goodyer's appeal for information, 42 have meters in use on *all* their cars, and 24 others are either experimenting or thinking about it, should be sufficient to gladden the heart of the meter manufacturer, even if it does not convert the remaining recalcitrant 22 managers who have fitted no meters, and don't propose to fit any.

Looking through the list of those who have no meters, and give reasons, one is struck by the diversity of the latter.

For instance, Ashton, owing to interrunning arrangements, has on the average six foreign cars to one of its own on its track, and, similarly, its own cars are mostly in neighbouring areas; Blackburn and Kilmarnock have an affection for bonus schemes, and the former manager adds that he has found nothing reliable in the car meter line yet. Portsmouth is satisfied with a unit or less per car-mile, while Stalybridge oracularly states, "the Board provides its own current!" leaving one to infer that the roundabouts make up for the losses on the swings in Stalybridge.

Turning to the majority who have adopted meters on all or a portion of their cars, their remarks form probably the best series of testimonials that could be obtained for the use of meters on cars. In 27 cases percentage savings per annum are given, these averaging 12 per cent., and ranging from the 24·77 per cent., or £92 per car recorded for Mr. Goodyer's own system at Croydon, where ampere-hour meters are fitted, to Burnley's 5 per cent. with time meters on all cars and some few watt-hour-meters changed from car to car. On the L.C.C. tramways 40 mercury type ampere-hour meters are in use experimentally, but motor watt-hour meters have been discarded from 200 cars as unsuitable for the conditions. The meters are arranged in pairs with ratchet and pawl mechanism between, owing to the liability to reversal of polarity on the conduit routes.

Manchester has experimented with a number of types, including time, watt-hour and ampere-hour meters, and credits their introduction with some of the improvement shown.

Bury, in contradistinction to Blackburn, has found a "really reliable meter;" watt-hour meters are in use on all the cars, and a 22 per cent. saving has resulted. Aberdeen has been using ampere-hour meters for two years, and Walsall, which has had three years' experience with half its cars fitted with watt-hour and the other half with ampere-hour meters, remarks that the whole cost of fitting them was wiped out in the first nine months.

But it is needless to particularise further on this interesting report, which should be studied by all tramway managers.

There is one point, however, to which our attention has been drawn, that in at least six undertakings credited with using watt-hour meters, ampere-hour meters are actually employed, while we understand that Glasgow, Hull and Wigan are also fitting this type of meter.

Thus if we are correctly informed, Mr. Goodyer's figures should show only 9 systems using watt-hour, 44 using ampere-hour, and 6 using hour or time meters, which our readers can interpret for themselves.

The various replies show that there is a considerable indirect saving in wear and tear generally, the meter being an excellent indicator of the condition of the car and equipment.

An Appeal from Java.

No one rejoices more than we do at the increased activity and consequent success of the British electrical manufacturer and trader in foreign countries. Our repeated efforts to prevent any slackening of effort sometimes bring us communications from far and near that are of great interest and contain valuable hints. Our recent articles on the need for aggressive enterprise in China have brought us a letter from another electrical correspondent there whose experience confirms in many respects the view of the situation formed by Mr. A. R. Sillar, the writer of one of our articles. Our correspondent, however, maintains that the Chinese insist on buying in the cheapest market, and are quite satisfied with German and American machinery provided "it will do the work." In this view he is not altogether in accord with Mr. Sillar, and we print his opinion for the benefit of the commercial engineer, who may have to sell British-made material against strong foreign competitors whose representatives are on the spot. Of course we all recognise that any predilection that exists among foreigners for British-made goods is liable to be toned down if reasonable care is not taken in quoting competitive prices. This week we have received a letter from an electrical correspondent in Java, who asks us whether we can do anything to enlighten British firms regarding the opportunities that lie open to them there. We cannot do better than quote our correspondent's own words:—

I do not think that English makers of electrical goods of all sorts realise the value of the market in Netherlands India. Could you do anything to enlighten them? The telegraph service and some of the telephone nets are in the hands of the Government. Information as to their requirements can be obtained from the Department of Colonies at the Hague. Price-lists might be sent to the private companies, but the prices should be given in Dutch, French or German currency, as very few people will take the trouble to convert ours. Better still would be to appoint local representatives. All the leading makers of machinery in Great Britain have representatives in Java, and one sees their machinery in every sugar factory. Why cannot the makers of electrical goods do the same? There are about 140 sugar factories in Java alone, and they are nearly all lighted by electricity, not to mention other industries, but I rather doubt if there is a single British dynamo. There is also a good demand for bells, dry cells and other small supplies. I shall be happy to do what I can to assist you and others in the matter.

There is a disposition in many quarters to discount the advice given by Consuls. Naturally, as we have said before, they cannot give expert counsel of great value regarding electrical or engineering opportunities unless they, to some extent, specialise in those branches. Above, however, we give information from one who is not a Consul, but is in a position to know just what he ought to say regarding the situation so as to faithfully represent it to the mind of the British electrical manufacturer. We send it forth in our pages as a further small effort to benefit the British electrical exporter.

Imports and Exports in June.

The trade returns for the month of June are very satisfactory, particularly from the electrical point of view. The results are as follows :—

Total imports for June, 1911, £51,105,889; a decrease of £3,523,928, compared to June, 1910. The *electrical goods imported have fallen* by £29,305 to £98,990. Machinery is up by £120,677.

Total exports for June, 1911, £36,113,150. An increase of £1,313,496. The *electrical goods exported have increased* by £68,121 to £236,287. Machinery is up by £305,373.

Imports for six months show a decrease of £605,985, compared with the corresponding half of 1910.

Exports (British) for six months show an increase of £6,395,175.

The business of the month has been to some extent interfered with by the Coronation holidays and by the shipping strike. But for these factors, the exports might have been better still.

Electrical Power on the Rand.

Last month, at the annual meeting of the South African Institute of Engineers, Mr. J. A. Vaughan, the retiring president, alluded to the use of electricity in Rand mines and the fatalities that have been occurring in connection with such installations. Some time previously, when delivering his inaugural address to the same Institute, Mr. Vaughan pointed out that if the precautions which common sense alone dictated were taken, there need be no apprehension of any appreciable increase in the accident rate. Since then the electrification of mining plants has been proceeding steadily, though not so rapidly as had been expected. The change has so far proved successful, and the future appears to be quite as bright as was anticipated in respect of the reduction in power costs. As reported in the *South African Mining Journal*, Mr. Vaughan finds that the certificated winding engine drivers change from the steam winder to the electric exist with creditable adaptability and with complete success. Unfortunately there was a small increase in the number of accidents due to the use of electric power during the year, there being seventeen casualties including ten fatalities, as compared with fifteen casualties with the same number of fatalities in the preceding year. It appears that three white persons lost their lives through being required to work in close proximity to live H.T. conductors, the victims not being at the time engaged in electrical work, and possessing no knowledge of electrical practice. Mr. Vaughan repeated his previously expressed conviction that for this class of accident there could be absolutely no excuse. He alluded to the mass of suitable literature that was available on the subject of safeguarding the use of electricity in mines, and drew attention to the recommendations and draft regulations which have within the past six months received so much consideration in this country, in the pages of this journal and elsewhere. He recommended these regulations to the study of all resident engineers in South Africa, and suggested them as a fitting subject for a paper at one of their own meetings, in order to ascertain, by comparing practical experience, whether the stringency suggested in the regulations was necessary and was calculated to prevent the classes of electrical accident which occur in Rand mining installations. Mr. Vaughan's suggestion is supported by our mining contemporary named above, which, for the instruction of its readers who are not already familiar with them, is reprinting the regulations.

What is an Accident?

Although death due to disease is not, except in certain specified cases, the subject matter of compensation under the Workmen's Compensation Act, there have been many instances where compensation has been awarded for death which is practically due to disease. For instance, where it was proved that death was due to the effect on a man's diseased frame of the effort of tightening a nut, he was found to have been the victim of an accident. The question, however, is one of fact for the County Court judge to decide in each case. In a case heard recently at Poole, compensation was claimed by the dependants of an electrician whose death was said to have been caused by accident. It was asserted that the strain caused by fitting a joint in a pipe burst an artery in the man's brain—the cause of death being given as rupture of a diseased artery in his brain, causing paralysis due to the bleeding which improved at first. The bleeding eventually caused death. A medical man, called on behalf of the applicant, said that when admitted under his care the man was found to have partial paralysis of the right arm and leg, and was unable to stand, whilst his speech was indistinct. He thought the deceased was a man with hardened arteries. He progressed to a certain extent, but then had cerebral hemorrhage and died the following morning. The man was suffering from cerebral hemorrhage on admission, and he thought the second attack bore relationship to the first. Deceased never got quite well from the first attack. He recovered the use of his arm and leg during the three weeks. Deceased's arteries were liable to rupture spontaneously, and they were more likely to rupture under a strain. Cross-examined, the doctor said that in addition to his arteries being in that condition he had chronic Bright's disease. With a man whose arteries were in such a bad condition as the deceased's, and who was suffering from kidney trouble, cerebral hemorrhage was likely to occur at any time—whether he was asleep or sitting down doing nothing. Although it might occur spontaneously, of course it might occur when he was exerting himself. The exertion was likely to bring it about. His condition, however, was such as to account for the cerebral hemorrhage without any exertion at all.

We give this evidence because it is typical of the evidence often adduced in support of these claims. In the circumstances the County Court judge came to the conclusion that, although he had great sympathy with the applicants, he could not find that there was any connection between the accident and the cause of death, and he accordingly found for the respondents. The law is thus stated in "Accidents in their Medico-Legal Aspect": "A blow on the chest of a healthy man would probably produce no symptoms, but even a slight strain might rupture an aneurism and cause death to a workman afflicted with this disease. The aneurism may have developed during a long period of time when the man may have been working for other masters; disease of the arteries, quite independent of work, may have been the primary cause; but the cause of death would, none the less, be an accident under the Workmen's Compensation Act."

DISTRIBUTION AND EFFICIENCY TESTS ON LAMP SHADES AND REFLECTORS.

By LEONARD MURPHY, A.M.I.E.E., and H. L. MORGAN,
East London College.

(*Concluded from page 6.*)

The experiments under (*b*) were made with a Trotter portable photometer, and are recorded in Table II. In arrangements I to V a room,* of which a plan is shown in fig. 10 (page 5), was fitted with 20 lamps and shades similar to those previously described under the corresponding numbers. The size of this room was 42½ ft. × 23 ft. × 12½ ft. high. The lamps were so hung that their pips were at a height of 10 ft. above the floor, and the photometer screen was placed horizontally at a height of 3 ft. 1 in. The walls, which are of bare bricks of light brown colour, are largely taken up by windows, the blinds being up during the tests which were made at night. The ceiling was not in good condition, and would probably not reflect more than 40 per cent. of the light thrown upon it. On this account the results obtained are slightly more favourable by comparison to shades Nos. V, IV and II, than would be the case with a perfectly clean ceiling. The effect of the poor reflecting quality of the ceiling is most marked in a comparison of the results obtained with shades Nos. III and V. The efficiency of the latter is much lower than that of the former according to Table I, but, owing to the large percentage of light thrown upwards by No. III, the useful light is practically the same in both cases when the ceiling is dirty. In case VII a different room was used in which the ceiling was in good condition. The lighting was entirely from the one fitting shown in fig. 4, fixed about the centre of the ceiling beneath an ornamental plaster design. The dimensions of the room were approximately 19 ft. long × 12 ft. wide × 11 ft. high, and the photometer screen was placed 2 ft. 11 in. from the floor.

In order to obtain representative readings a very large number of points were photometered in each room, and the illumination at other points, symmetrical in position with those taken, was estimated. By this means the average illumination, which was assumed to be the arithmetic mean of all these readings, was most probably obtained with fair accuracy. Referring again to Table II, the figures in column (5) measure the improvement in the illumination due to the use of the shade, and from these figures it would not seem possible to obtain much more than a 50 per cent. increase in the illumination by the use of shades if a general and uniform illumination is desired. The efficiency given in column (6) refers the useful illumination at the table level to the same standard as that employed in Table I for the lamp and shade. The figures in this column are obtained by multiplying the mean surface illumination in foot-candles by the area illuminated in square feet, and dividing by the total power in watts absorbed by the lamps.

In column (8) a figure is obtained for the illumination efficiency in terms of absolute comparison. From Table I we obtain the total light emitted by the bare lamp for cases I to V as 456 lumens, being 36·3 mean spherical candle-power multiplied by 4π. This figure multiplied by 20, the number of such lamps employed, gives 9,111 lumens as the total light flux produced in the room, and by comparing with this the total lumens available as useful illumination at the table level, we find a measure of the efficiency of the illumination scheme employed. This method seems to be applicable to all interior illumination and, while the colour of the walls will undoubtedly affect the result somewhat, there is good reason to believe that it affords the engineer a good criterion of the efficiency of any lighting scheme. If the figure obtained in any specific case should fall below 30 per cent., it is obvious that the result can be considerably improved by the choice of suitable reflector shades, while 50 per cent. appears to be about the practical maximum. In studying these figures, the comparatively good efficiency of the semi-indirect method will come as a surprise to some who regard this method of illumination as being many times more expensive than the direct. That the figure of 39·5 per cent. obtained is actually higher than that for bare lamps, is probably accounted for by the fact that the lamps are placed in an oblique position, so that the maximum candle-power of the lamps is directly available in the upward and downward directions. The authors would not expect to find the efficiency so high if the reflected light came from the upper part of the walls instead of the ceiling.

The remaining columns (9) and (10) are not inserted for obtaining comparisons between the various shades as, in many cases, the result might have been improved by altering the height of the lamps. The object of these figures is to show how uniform and shadowless the lighting may be obtained with direct illumination, and also to emphasise the fact that considerable want of uniformity in the illumination cannot be detected by the eye. Referring to column (10) the term "diversity factor" is used in the sense proposed by Mr. Haydn Harrison, viz., the ratio of the maximum to the minimum illumination.

To the eye, every case cited appears perfectly uniform, and the amount of non-uniformity which cannot be visually detected with indirect lighting is very surprising. Previously, the room illustrated in fig. 10 had been lighted by two inverted arcs, and the result, which appeared perfectly uniform to the eye, showed a diversity factor of the order of 10 when measured!

Of much greater importance is the question of avoiding hard shadows, though the whole matter of the intensity and sharpness of shadows is an extremely difficult one to specify. The plan which the authors have adopted depends upon the amount of shadow cast by the body of the observer on the screen of the portable photometer used. As the light came from a large number of directions, it was first considered advisable to take readings of the illumination with the observer standing at each of four symmetrical points about the photometer. The direction in which the observer was facing for each of these four readings is indicated in fig. 10 by the arrows marked (*a*), (*b*), (*c*) and (*d*) respectively. It was soon found, however, that the mean of the readings taken at one pair of opposite sides invariably agreed with the mean of those taken across the remaining pair, although in some instances, an individual reading of one pair differed considerably from either one of the other pair. Thus while the mean of the readings (*a*) and (*b*) agreed with the mean of the readings (*c*) and (*d*), the ratio (*a*/*b*) might be considerably different from either (*c*/*d*) or (*d*/*c*). It was, therefore, decided to take readings in the directions (*a*) and (*b*) only, since the mean of these gives the true mean reading. From representative readings taken in all four directions, it also became apparent that the means of the values of the expression (*a*/*b*) or (*b*/*a*) (always taken as an improper fraction) would probably agree very closely with the mean of the expressions (*c*/*d*) or (*d*/*c*) if taken for the whole room. This follows, since in those places where (*a*) differs most from (*b*), (*c*) is very nearly equal to (*d*), and where (*a*) and (*b*) are most nearly equal, (*c*) and (*d*) are considerably diverse. From the mean of the ratio (*b*/*a*) or (*a*/*b*) an idea is thus obtained of the average difficulty that a person would experience from shadows when writing or drawing at the table level, but it must be admitted that this method takes no account of the hardness of the shadows. The importance of this objection will be seen when it is noted that the figure of 1·77, quoted for "shadow effect" due to the semi-indirect illumination in case VII, is much greater than any of the figures given for direct illumination, yet, on account of their softness, the shadows are certainly not more troublesome in the semi-indirect case than for the direct illumination.

The authors would also point out that, in order to get the value for the illumination when there are no shadows cast on the photometer screen, the readings in columns (2), (3) and (4) in Table II should be multiplied by a figure, which is some direct function of that given for the shadow effect in column (9), and this remark is also true with regard to the efficiencies in columns (6) and (8).

It is, however, an extremely difficult, if not impossible, matter with the type of photometer used, to obtain a reading of the illumination at a point without casting some shadow on the screen, and, if this reading can be obtained, it is

* For some other tests of the lighting of this room, with shades No. II fitted, see "Lighting of Some Schools and Colleges," by Leon Gaster and J. S. Dow.—*The Ill. Eng.*, May, 1911.

TABLE II.

(1) Reference number.	(2) Maximum illumination, ft.-candles.	(3) Minimum illumination, ft.-candles.	(4) Mean illumination, ft.-candles.	(5) Magnification of illumination due to shade.	(6) Efficiency $\frac{\text{lumens}}{\text{watts}}$.	(7) Shade efficiency from Table 1.	(8) Illumination efficiency.*	(9) Shadow effect $=\frac{a}{b}$ or $\frac{b}{a}$	(10) Diversity factor.	(11) Remarks.
I	3·87	2·10	2·88	1·00	2·42	100 %	32·2 %	1·14	1·84	Ceiling and walls well illuminated, glare from lamps considerable.
II	6·44	2·84	4·21	1·46	3·52	81·3 %	46·8 %	1·11	2·27	Lamps fitted at height recommended by shade makers.
III	5·85	2·86	3·92	1·36	3·28	82·1 %	43·7 %	1·20	2·04	Ceiling and walls fairly bright, lamp filaments entirely screened.
IV	6·08	2·84	4·38	1·52	3·67	82·1 %	48·8 %	1·21	2·14	Ceiling only slightly illuminated, glare worse than III, but not excessive.
V	5·01	2·63	3·84	1·33	3·22	57·8 %	42·8 %	1·17	1·9	Ceiling quite dark, illumination very uniform.
VII	2·43	·954	1·5	—	2·97	—	39·5 %	1·77	2·55	Excellent general illumination, no glare, very soft shadows.

* Illumination efficiency $= \frac{\text{Useful light at table level}}{\text{Total light produced by lamps}}$.

certainly of doubtful practical value for reading and writing surfaces.

The chief value of column (9) will probably be found in the measure by which the illumination efficiency is affected by the factor for "shadow effect," and, for this reason, this factor should be kept as low as possible. Taking two extreme cases, it will be observed that in case II the useful illumination could not be greatly improved by the elimination of shadows, but in case VII a considerable improvement might be made, although the shadows are not in themselves objectionable. Referring to the polar curve (fig. 5) for the shade used in case II, the reader will observe that there is a very strong illumination vertically downwards, so that every point derives practically the whole of its light from the lamp or pair of lamps immediately above it. This practice is commendable both on the score of efficiency and on that of avoiding large shadows, though the narrow shadows which are formed are very intense.

Summary of conclusions :—

1. That shades of the opal, prismatic or silvered-glass varieties may be relied upon to give an efficiency of about 80 to 83 per cent., or enamelled iron about 58 per cent.

2. That with bare lamps, about 30 per cent. of the light is available at the table level, but that with the most efficient shades this may be increased to 50 per cent. (This means that, in an extreme case, the illumination may be increased by about 65 per cent.)

3. That for rooms illuminated from a large number of well-distributed points, whose height is great compared with the distance between them, there is no necessity to obtain a shade which produces exactly any particular form of polar curve, but the light should be directed generally downwards, or upwards if a clean white ceiling is available for reflection.

4. That the illumination of an interior may be very non-uniform without this being apparent, especially when the illumination is partially or wholly indirect.

5. That shadows are more or less objectionable according to their sharpness of definition, and that, in general, they tend to lower the practical efficiency of illumination.

The above tests were carried out in the Electrical Engineering Department of East London College, and the authors take this opportunity of thanking the Governing Body for the experimental facilities.

Turbo-Blowers.—Messrs. Fraser & Chalmers, Ltd., of London, have just booked an important order for two turbines and blowers for the Stanton Ironworks Co., Stanton, near Nottingham, to work in conjunction with existing reciprocating engines in connection with their extensive blast furnaces.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

(*Continued from page* 38.)

Section III.—Scientific Training.—The first day's meeting in this section was opened by its chairman, Mr. R. Elliott Cooper, who said the object of the section was to discuss, and endeavour to settle, some of the difficult questions which presented themselves to young men who sought to obtain such practical training as would fit them for the career of an engineer, apart from any particular branch of engineering, and also to enable them to obtain the recognition of the Institution of Civil Engineers, which was becoming more and more important.

A great advance was made when it was recognised that it was essential that young engineers should possess a sound general education and also some scientific knowledge bearing upon the theory and practice of their profession. Although such an education had generally shortened the period of practical training, it had by no means taken the place of such training, or rendered it less necessary to all who hoped to succeed in their profession.

Real and useful practical training, whether in design, construction, or management of works, could only be obtained under the actual or commercial conditions, which necessarily could not be found in educational establishments.

A great mistake which many young engineers made was in thinking that all that was necessary on completion of their college career to make them efficient assistant engineers, was either to go into a workshop and spend, say two years, on the ordinary work of a mechanic, or (if "civil" engineering was to be their career) to go to a contractor upon some works of construction. The knowledge so gained was most useful, but without office training he was only half equipped for the work of his profession.

There was doubtless a belief in some quarters that the system of training by definite apprenticeship and pupilage had fallen largely into disuse, but taking the profession as a whole, that was not so. The result of an inquiry made on behalf of the Council some months ago, was that in 75 per cent. of the cases considered there were regular arrangements for pupilage, and in only 25 per cent. was no provision made for such regular practical training. The system of pupilage remained extensively recognised amongst consulting engineers, although the requisite term of such training had been shortened.

The Chairman then called upon Mr. A. F. Yarrow to open the discussion by reading his introductory notes on Subject F, "The Apportionment of Training between Practical Work and Scientific Study."

Mr. Yarrow said his observations dealt with only two points :—1. Although the advantages and disadvantages from a purely educational point of view of what was termed the "sandwich system" had been frequently dealt with, the social aspect of the question had, perhaps, been overlooked. In considering the question of engineering students, he and his staff had been frequently impressed by their need of being accommodated with courses of study which would enable them to get their practical training without the necessity of being banished from home influences for a continuous period of several years at a most critical time in their lives. London could no longer be looked upon as an engineering centre; consequently, it was necessary for young men to obtain their practical training in the North, where engineering workshops existed. If their practical and theoretical training could be so arranged that during the six summer months they worked in the shops while living in lodgings, and during the six

winter months they took up theoretical study in the colleges, living at home and subject to good influences and affectionate surroundings, this home influence was a source of great security, especially if the six months they worked in the shops were during the summer, when their spare time could be spent in outdoor pursuits. The colleges, especially those in London, should endeavour to arrange their courses of study so as to conform to the social conditions indicated above as desirable, and should arrange their engineering courses of study during the winter months. Many firms objected to take young men into their works for such short periods as six months, but those firms who had at heart the future success of their establishments should, at some small present inconvenience, be prepared to fall in line for the general benefit of the engineering industry. It must not be forgotten that in treating their apprentices with special consideration, firms might possibly be cultivating an advantageous connection for the future, for many apprentices attained positions of responsibility and had the means of placing orders with the firms where they learnt their profession. 2. They would draw attention to the desirability that in works some member of the staff should be looked upon as an adviser to the apprentices, it being among his duties to get into personal touch with each young man. He should be accessible at all times, and should make a point of interviewing each lad at least once in three months, and ascertain if he could be of service to him. He should also from time to time ascertain what progress was being made by those lads who attended evening classes, by periodical visits to the local technical schools. This system would not only be of great advantage to the lads themselves, but would enable employers to recognise ability and industry, and select wisely those young men whose services they might desire to retain when their apprenticeship terminated.

Mr. W. H. Allen then read his introductory notes on "The Requirements of Practical Training in Works, with the Necessary Complement of Scientific Study."

Mr. Allen said that during recent years they had seen a great change in ideas as to the value of engineering apprenticeship.

It was now fairly certain that no man could expect in future to take a good position in life as an engineer without having equipped himself for his work by scientific training and study, as well as by a period of apprenticeship in practical engineering under commercial conditions.

But one must not disparage the value of the workshop apprenticeship, as it was so often the lot of the engineer to have to deal with quantities of which they had, as yet, very little accurate knowledge. Experience of problems of this nature must be gained by personal contact with them.

A schoolboy coming direct to the works did not succeed so well or stand the same chance as the one who had been to college first. The man who set himself the task of obtaining his degree before entering the works stood a much better chance of securing a higher and more responsible position in life than the one trained in the reverse order.

In his opinion, if a young man conscientiously did his duty from six o'clock in the morning until six in the evening, he would find that as much as his health could stand, without burdening it by further serious study at night. His custom had been to give lectures weekly explanatory of the actual work being carried on in the shops, thus greatly increasing interest in and adding to the knowledge of the work being done.

As regards the requirements of workshop training, there seemed little doubt that a period of three years—the actual time depending on the previous education of the subject—comprising a year in the drawing office, should be spent in the works in a not too specialised manner; it should cover work in some or all of the branches of mechanical and electrical practice found in some of the better establishments. So long as this part of an engineer's training had to be carried out under commercial conditions, so long would it be more or less dependent on the state of trade and other local conditions. This was not altogether a disadvantage, for the alternating periods of exceptional activity in trade, and the reverse, would carry their own important lessons to the observant student.

It would always be difficult, if not impossible, to lay down a plan either for scientific study or works apprenticeship which would suit all, and each individual case required consideration on its merits. They were inclined at present to attach rather too much importance to the direct value of scientific study and too little to the development of the mental faculties generally and the cultivation of a true scientific insight.

The general discussion was opened by Mr. Robertson, who made some very trenchant remarks on the total want of education in one branch of the engineering profession, namely, locomotive engineering, as compared with other branches. Acting as consulting engineer to certain Indian railways, he and his partner had found that only 5 per cent. of the candidates for various locomotive engineering appointments were qualified. The word qualified only implied a sound knowledge of elementary mechanics, such as any intelligent schoolboy should possess. Most candidates neither had this, nor pretended to have it. Among the rejected candidates were men holding positions on British railways identical with those they sought to obtain in India. The remedy lay with British locomotive superintendents, who should not give these positions to unqualified men.

Prof. Arnold expressed astonishment at Mr. Robertson's remarks, and said his strictures could not be regarded as applying to the Midland Railway. He (Prof. Arnold) knew that company's system of training their premium pupils and apprentices intimately; the general well-being of the pupils and apprentices was the duty of one official, and from the educational point of view both premium apprentices and pupils at the Midland Railway Works had to spend two mornings in each week at Derby Technical School. The board of directors also had its own system of periodical examinations on which the pay and future of those examined depended. In one respect, however, he was in close sympathy with the last speaker. There was a lack of co-relation of work between the engineer and the metallurgist with whom the engineer avoided close contact. The fifth-year students on the Midland Railway had to give one day in each week to a special metallurgical course.

Prof. Dalby spoke of his close professional acquaintance with architects, and said he had never yet found an architect who had worked as a mason or as a carpenter or as a plasterer, or had acquired manual dexterity in these spheres. Architecture as a profession was older than engineering, and it had its four distinctive grades. There was first the architect, then the quantity surveyor, then the clerk of works, then the builder. If the architectural profession could dispense with manual dexterity, engineers could do the same. Engineering had its distinctive branches of occupation as had architecture, and these required different training.

Mr. C. Burge referred to the inefficient preparation given to young engineers for foreign work. In this country there now remained very little civil engineering work to be done, and in the future that branch of the profession must look to the Empire and to South American countries for employment. Academical education should have reference to foreign conditions. He spoke personally as one who had been pitch-forked into India and had there to unlearn much that he had learned.

Mr. E. Benedict dissented from the previous speaker, and quoted a dictum of Isambard Brunel's that an engineer should learn his business here and practise it abroad. He commended the practice of the Midland Railway Co. An important feature of either collegiate or shop life would be a sort of hostel. Particularly in shop life the conditions of a premium pupil living in a cottage near the works were capable of improvement. In any event, those accepting premiums from a number of pupils were under a certain moral responsibility. Credit, too, must be given to the magnificent educational medium which the workman often was.

Mr. A. H. S. McAllum, in referring to certain of Mr. Yarrow's remarks upon premium pupils, considered that the pupil did not know his own needs. He (the speaker) regarded engineering training as covering both study and practice. This was usually interpreted to cover training at works plus college tuition. He deprecated the keeping of the sets of systems distinct. Referring to Mr. Yarrow's sandwich systems, he considered alternate periods of six months each to be too long, more intimate mixing was desirable. He urged shorter hours for pupils working in shops who were attending evening classes, and thought it sufficed if they started work at 9 a.m.

Mr. J. M. Moncrieff said it did young men good to get up at 6 a.m. to learn the conditions of life. He also favoured shop training preceding college studies. A previous speaker had deprecated manual dexterity; he (the speaker) thought it necessary. They must remember that engineering covered a wider ground than architecture. Practical work should not be omitted from the civil engineer's curriculum.

Prof. E. G. Coker favoured a sandwich system, for the student with no knowledge of works conditions did not realise to what end the training was intended. He favoured an in-and-out method—six months in the college and six months at the works. The more general method of alternations of nine months at college and three months at the works was too short for the works. As regards an intervening holiday, after a severe six months at college, he was often asked, could students go straight to works? He answered, "Yes," as the works course was in some degree a holiday.

Mr. A. H. Preece thought the future of any young engineer depended upon his mental receptivity when young. School should teach the absorption, college the appreciation, and the works the application of knowledge. Was the student just leaving a public school fitted to appreciate the knowledge set before him? In his own college experience he had to attend a lot of lectures, but was not told why he had to learn. In an American college, the first year was given only to practical subjects, not to theoretical matters, in order to let the student appreciate what he should know. The tendency to try to teach the student practical work in college workshops and laboratories was a mistake; it was wrong to convey the impression to parents that college workshop training dispensed with subsequent practical training. He endorsed Mr. Yarrow's remarks as to the subsequent commercial value of good relations between firms and their premium pupils.

Prof. Dalby, referring to Mr. Yarrow's advocacy of the sandwich system, supported it because teaching became easier when allied with workshop training. The difficulty, however, was not with the colleges, but with the employers through lack of co-ordination between them. The sandwich system was also to be commended because of its facilitation of research work. He had negotiated with a large number of firms in regard to the taking of students, and found the premium often an obstacle.

The Chairman then called upon Sir H. F. Donaldson and Mr W. B. Worthington to read their respective introductory notes on "Practical Training in Workshops or on Works of Construction with Special Reference to Training in the Engineer's Office" (subject G).

Sir H. F. Donaldson said he desired to touch on one or two points such as the importance of knowledge of modern foreign languages, for which, he was of opinion, Latin formed an excellent groundwork; geography, physical, geological and ethnological; history, both of the world and of our own country; and literature, the love of which would frequently be found to be not only very valuable from a professional point of view, but extremely so for purposes of relaxation. To these he would add the more or less scientific study of accounting and book-keeping and allied commercial subjects. The want of such knowledge by engineers ha

not infrequently been found to be full of danger to undertakings with which he might be associated.

Such a training could not be properly effected in less than six or seven years; three years for theoretical study, and three or four years for practical training. There should be no specialisation in the study of the theory, as such education should be as wide as possible. Manifestly the theoretical study should precede the more or less specialised practical work. There was much to be said in favour of the proposal put forward by the Committee presided over by Sir William White, that there should be a preliminary year on practical work directly after leaving school, followed by theoretical study for three years, returning to practical work again for two or more years. Matriculation before leaving school, and evening work during the preliminary year, would largely correct the mental atrophy sometimes suggested.

Six years represented the absolute minimum period necessary to equip adequately a young engineer in some, if not most, classes of engineering. This minimum must, in order to comply with the Institution by-laws, be extended to seven years, of which four should be practical and office work.

Assuming that the theoretical work should be taken first, or after a year in the workshops, and that it would last three years, there remained the apportionment of the three or four remaining years.

Workshop practice was essential for all branches of engineering, and he set the minimum for the course for mechanical engineering at three years.

In the case of constructional or civil engineering, the author would, in addition to the theoretical education, allot at least 18 months to the shops, with an additional six months for the acquisition of practical electrical experience, and arrange that he should pass into the office for a period of 12 months.

As regarded the electrical engineer, the author considered that besides three years' theoretical study, four years' practical training was required; two years in the ordinary mechanical workshops, one year in electrical workshops, followed by one year of office experience.

Mr. W. B. Worthington said that practical training for the man who was to become an engineer—a member of a profession—necessarily included two distinct things. On the one hand, during that part of his training spent upon works he must, by observation and by taking some part in the work, acquire a knowledge of engineering operations, of economical methods of carrying them out, and of the time required for the purpose, as well as of the qualities and disposition of materials most suitable to meet varied circumstances. There was some danger that the importance of training in designing works under practical conditions might be lost sight of. It was with a view to check any tendency in this direction that the Institution had recently drawn attention to the necessity for every young engineer to spend a substantial part of his training period in the engineer's office as well as in or upon the works. During his term of office training, whether as a pupil or as an assistant under agreement to serve for a term of years, the man who was to become a civil engineer should have the opportunity of becoming familiar with as great a variety of work as possible. He must gain experience in draughtsmanship and design, specifying, costs and estimating. On the other hand, the mere fact of being a member of the staff in an engineer's office would not train a man to be an engineer.

The discussion was opened by Mr. Edward Hayes, who desired to emphasise the need of a thoroughly good general education. He believed that it was best for boys to go straight into the works after leaving school. Going first to college rendered boys unfitted for, and averse to, work in shops.

Mr. A. T. Walmisley, speaking as a civil engineer, regarded actual work in shops as unnecessary. His own practice was to send his pupils for six months to a firm doing constructional work, and he made each pupil write his report on the practical work carried out.

Prof. A. Barr disagreed with the last speaker—civil engineers had lost a lot of work to mechanical engineers for lack of practical training. He disagreed with Sir Henry Donaldson's apportionment of the pupil's time in the works. In mechanical engineering workshops in Scotland there were no premium apprentices, and they had not to differentiate between premium and ordinary apprentices. Generally apprentices formed a neglected class. Mr. Yarrow's arrangements for supervision were very good. He (Prof. Barr) insisted on those of his own apprentices who were not college trained attending evening classes.

Sir William White intervened for a few moments to point to the German and French systems. In Germany the authorities started their organisations of engineering education by studying the systems in other countries. As a result, they started by taking students straight from the secondary school (gymnasium) into the technical high school, and afterwards sending them into works. They had found it necessary to modify this course of study by interposing at least a year between the gymnasium and technische-hoch-schule. In France engineering education was divided between the polytechnics and the schools of application. Fundamental subjects were taught at the former before proceeding to the schools of application, after which came practical application in works. As regarded this country, he desired to refer the audience to the Admiralty system. Briefly this provided that practice and theoretical training went on side by side for five years, after which followed a course of the highest possible theoretical training.

Prof. C. J. Lambert was understood to urge the need for a greater knowledge of elementary physics and simple mechanics. Latterly too much attention had been given to the technical side and insufficient time to elementary fundamental physics.

Mr. E. B. Ellington said that apparently all were agreed as to the necessity for a course of practical training for the engineer On the whole he favoured the college preceding the works. The experience of Mr. Yarrow and of Prof. Barr was entitled to consideration, but their method to be successful required great co-ordination, which did not exist over great parts of the training. After all, the engineer had to direct workmen, not to be a superior workman. He did not think that the regular course of a mechanic's training was the best thing for a college man, who required rather to be trained in the direction of administration and economical production. Facilities should be given in works for pupils to have a different course of training to ordinary apprentices.

Mr. C. P. Hogg stated that the best means of securing practical training depended to some extent on the young man himself. In his own shops he took some pupils on a sandwich system, and some on a continuous basis. There was a great advantage in taking practice and science concurrently. Those previously trained in science alone had often a wrong sense of proportion. He favoured first the practical training, then the college training. The only loss was in the rustiness of mathematics.

Mr. A. P. Trotter remarked that each system had its advantages and that it was difficult to distinguish. Personally, he thought that the works course should follow the college course, as this sequence more often helped the young man away on erection work into a job. Ordinarily success in engineering was gauged on its money return. Yes, money values were very difficult for a young man to learn. The principles of prime cost work should be taught in the colleges.

Mr. F. O. Everard thought it unimportant from his firm's point of view whether pupils did the college or the works first. "Six o'clock in the morning" was sometimes a bugbear to the college trained man. His firm had tried the sandwich system in slices of alternate 12 months and had given it up.

Mr. J. W. Wilson said that the problem might be said to depend upon the fact that time was very limited, and that this time should be devoted to the best ends.

Mr. F. Zur Neddon said that exactly the same topics were now under discussion in Germany, and the schemes of 10 years ago were under revision.

Mr. A. F. Yarrow, in reply to the discussion on subject F, said that Prof. Barr and Prof. Dalby had each supported the sandwich system, and no one had criticised it. But, unfortunately, these discussions did not end in anything. London colleges did not work such times as would permit of a sandwich system being followed.

Mr. W. H. Allen, also replying to the discussion on subject F, asked whether supervision of pupils as described by Mr. Yarrow covered their hygienic and moral surroundings; also he would ask Sir William White whether the system found to be suitable to the Admiralty, was suitable for commercial work.

Sir H. F. Donaldson, in reply to the discussion on subject G, stated that the distribution of time in various departments was elastic. He went on to describe the manner in which the clergy co-operated in the supervision of his apprentices. Although Woolwich Arsenal was not a commercial undertaking, the course of training was such that his best men were always snapped up.

Mr. W. B. Worthington, also replying to the discussion on subject G, referred to the inadequacy of a pupil only spending three months out of his pupilage in the office.

The meeting then adjourned.

(*To be continued.*)

The Institution of Electrical Engineers. — The annual Conversazione of the Institution of Electrical Engineers was held on Thursday evening, the 6th inst., at the Natural History Museum, South Kensington, S.W. The meeting was very successful, about 1,200 persons being present. The President, Mr. S. Z. de Ferranti, and Mrs. de Ferranti, with the Council of the Institution, received the guests in the Central Hall of the building. Amongst those present were Sir A. J. Tedder, Sir Walter Howell, Sir R. J. Parker, Sir Sidney Hutchinson, Sir William Ramsay, Sir Walter and Lady Wilkins, Lord Justice Buckley, Admiral Moore, R.N., General E. H. Allenby, Major W. A. J. O'Meara, Mr. C. Honoratus Lloyd, K.C., Mr. Sidney Morse, Mr. R. K. Gray, Dr. Silvanus P. Thompson, F.R.S., Col. R. E. Crompton, Prof. Perry, Prof. T. Mather, F.R.S., Prof. H. E. Armstrong, F.R.S., Mr. C. H. Wordingham, Mr. W. H. Patchell, Mr. F. Gill, Mr. W. M. Mordey, Mr. J. F. C. Snell, Mr. F. H. Nalder, Mr. W. Duddell, F.R.S., Mr. J. S. Highfield, Mr. H. Hirst, Mr. Spagnoletti, and Mr. P. Rowell, the secretary of the Institution. Excellent programmes were given by the string band of the Royal Engineers in the Central Hall, and by the Alexandra Ladies' Quartette in the Shell Gallery. As a meeting place for old friends this gathering loses none of its popularity, and although one cannot help noticing the number of new faces which appear and the absence of many who a few years ago were constant in their attendance, this function remains one of the most pleasing of the year.

Annual Outing.—The employés of Messrs. Bruce Peebles & Co., Ltd., selected Crieff this year as the site for their recent annual outing, and a party numbering over 400 left Edinburgh thither bound soon after seven in the morning. Sports and prizes, drives, walks, golf, &c., were enjoyed to the full. Lunch and tea were served in the Porteous Hall.

THE BRUSTON PATENT LIGHTING SYSTEM.

An interesting innovation in private electric power plant practice has recently been effected by the development of the Bruston self-starting and stopping generating set, to which reference was made in our article on the Royal Agricultural Show last week. The salient feature of this plant is its extreme simplicity. The generating set (see fig. 1) consists of a constant-field shunt-wound dynamo, belt-driven (at 1,200 R.P.M.) from an improved low-speed single-cylinder Lister petrol engine (which may be converted to town gas supply in five or ten minutes). Engine and generator are mounted on an H iron foundation frame, which also carries the circulating water tank, petrol tank and a solenoid motor starter (controlling the engine as below). The set is delivered in running order, and merely requires to be placed on felt or lead pads on a firm floor; no foundation bolts are required, the vibration at full load being imperceptible. A simple switchboard, mounted on a cabinet containing the small secondary battery required, completes the apparatus, the *modus operandi* of which is best followed by reference to fig. 2.

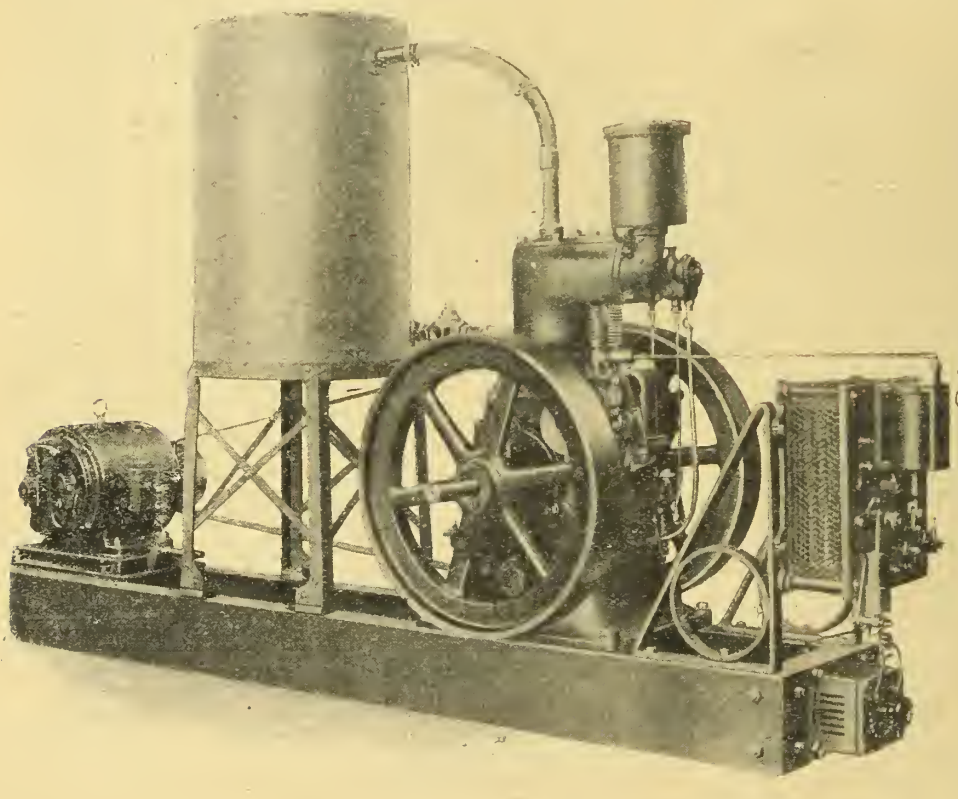


Fig. 1.

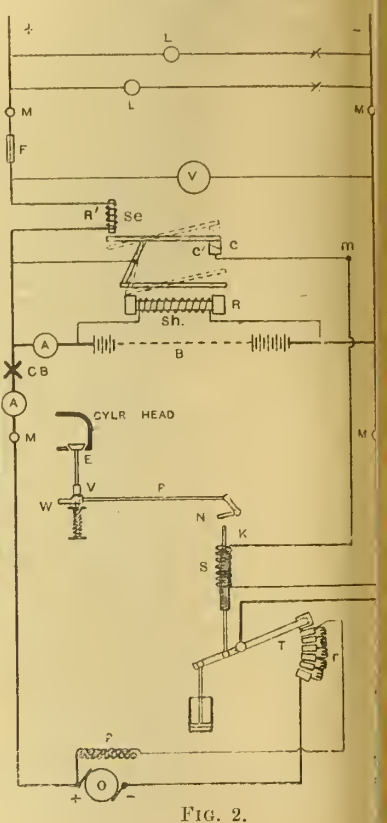


Fig. 2.

"Bruston" Patent Lighting System.

The secondary battery is permanently connected across the supply mains M M, and a Bruston patent relay is placed in circuit as shown diagrammatically at R R'. Until the demand of the load L L exceeds a certain critical limit, predetermined by the adjustment of R R', the whole output is from the cells B. As the load increases, however, the M.M.F. of the shunt coil R decreases, while that of the series winding R' increases; ultimately the latter predominates and the linked armatures are rocked to the position shown in full lines (fig. 2). The carbon-tipped relay contacts *c c'* are thus closed and the motor-starter solenoid S is excited by B; the dynamo D then starts up as a motor (by energy drawn from B), the engine exhaust valve E being meanwhile held up by a wedge piece W thrust under a sleeve on the valve rod V. The slotted wedge W is connected by the rod P to a bell-crank lever, the heel N of which is raised by an extension of the solenoid starter core when T has cut out about half of the resistance *r*. The machine D thus starts up on light load, but when the set is well under way, the exhaust valve is released and the engine runs under full compression. Its cylinder having been meanwhile filled with explosive mixture, the engine at once takes up the load; what was the back E.M.F. of D, running as a motor, quickly exceeds the available line voltage, and D and B in parallel thenceforward supply the load L (actually B is first fully charged, and then merely "floats" on the supply mains, only giving any output on sudden peak loads).

From 5 to 10 seconds after the closing of the relay contacts *c c'*, the engine is running on full load, the energy required to start up being some 25-50 watt-seconds. The discharge rate of the battery B is sufficient to cope with any likely sudden load increment, till such time as the engine takes over the load, but in cases where a heavy starting load is to be usual (*e.g.*, motor or arc supply), it is advisable to provide an auxiliary tumbler switch whereby the engine may be started just before the advent of the load in question. The generating set can easily be started by hand should this be necessary at any time.

Whenever the load L L falls below the critical value to which the relay R R' is adjusted, the generating plant is automatically stopped by the exact inverse of the above action.

It will be obvious that the battery need only be of quite low ampere-hour capacity, since its sole functions are to supply very light loads and to control the starting and stopping of the engine set. For a 50-volt 120-light installation, a set of 26 20-ampere-hour ignition type sealed cells are employed; "end" cells are clearly unnecessary. With a fully charged battery (52-volt terminal P.D.), the control relay is usually set to start the generating set when more than six 13-watt lamps are in circuit, but should the battery become partially discharged, by alone supplying a few lamps for several hours (or by standing idle for some time), the engine starts when 3, 1 or 0 lamps are in circuit, according as the battery P.D. is 50, 48 or 44 volts. In other words, the battery is automatically charged whenever its P.D. falls to 44 volts, and otherwise is left to supply 1, 3 or 6 lamps according to its state of discharge. The charging current seldom exceeds 6 or 7 amperes, but the type of battery employed will yield 40 amperes discharge current and endure long periods of complete discharge without permanent injury.

Should the engine ignition fail or the petrol supply become exhausted, the circuit breaker C B (fig. 2) protects the battery from any damage. The whole load L L would then fall on B, and though the latter would rapidly discharge, it would suffer no permanent injury, and would at once recharge on remedying the engine fault. Should the driving belt of the generating set break or ride off its pulleys, D would run "light" from the battery supply; the governed engine would run light at full speed (1,200 R.P.M.), and B alone would supply the load for some time, as before. At present no indication of failure of the main supply (from D) is provided beyond that naturally given by the discharge of B.

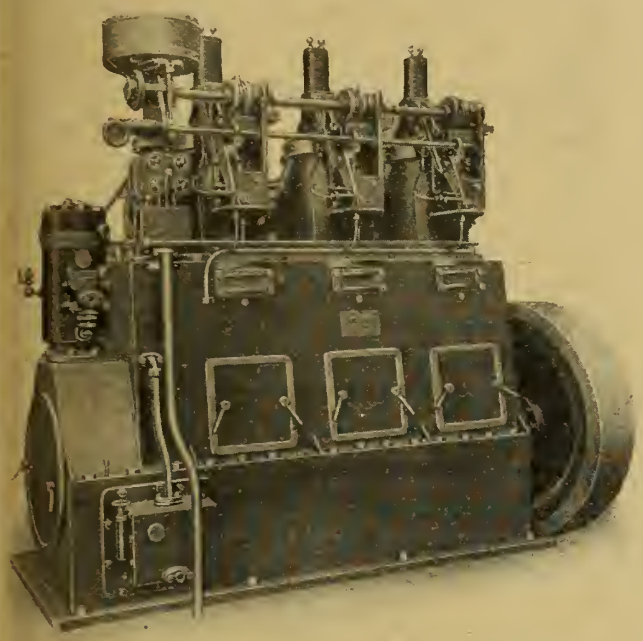
The driving engine is provided with magneto-ignition and forced lubrication; a 1½-pint oil tank and settling sump in the engine pedestal requires refilling once in five or eight weeks. A 3-gallon petrol tank needs refilling once in from one to four weeks, according to the average daily load, and a 50-60-gallon circulating water tank enables a "120-light" engine (about 3 or 4 H.P.) to be run continuously at a considerable overload for 12 to 15 hours without overheating. The space occupied by a 120-light generating set is 9 ft. × 4 ft. × 5 ft. 6 in. in overall height, and the weight in running order is only 15 cwt. The switchboard contains one volt and two ampere-meters, the Bruston controlling relay, and the circuit-breaker and fuse shown diagrammatically in fig. 2. The approximate overall dimensions of the switchboard and battery cabinet are 3½ ft. × 2½ ft. × 2 ft. The whole plant is thus remarkably light and compact. If the switchboard is located in the engine room as is usual, only two service mains need be carried from the latter to the distribution board; the third wire *m* is, in any case, quite a small conductor, merely carrying the relay current.

The advantages of the Bruston system are obvious. No engine-room attendant is required, the capital outlay is low, and the small battery required is operated under favourable conditions. It is claimed that the engine-room plant may be left unattended for weeks at a time, and that the running costs are low. The type of engine employed consumes about 0·65 pint of petrol (or 18 cb. ft. of town gas) per B.H.P.-hour, and the fuel costs appear to be about 1½d.-1¾d. per unit.

THE ROYAL AGRICULTURAL SHOW.

(*Concluded from page* 34.)

Messrs. Willans & Robinson, Ltd., are showing a new two-cycle three-cylinder Diesel possessing features of great interest. This engine has been brought out with a view to obtaining the advantages of the well-known four-cycle Diesel

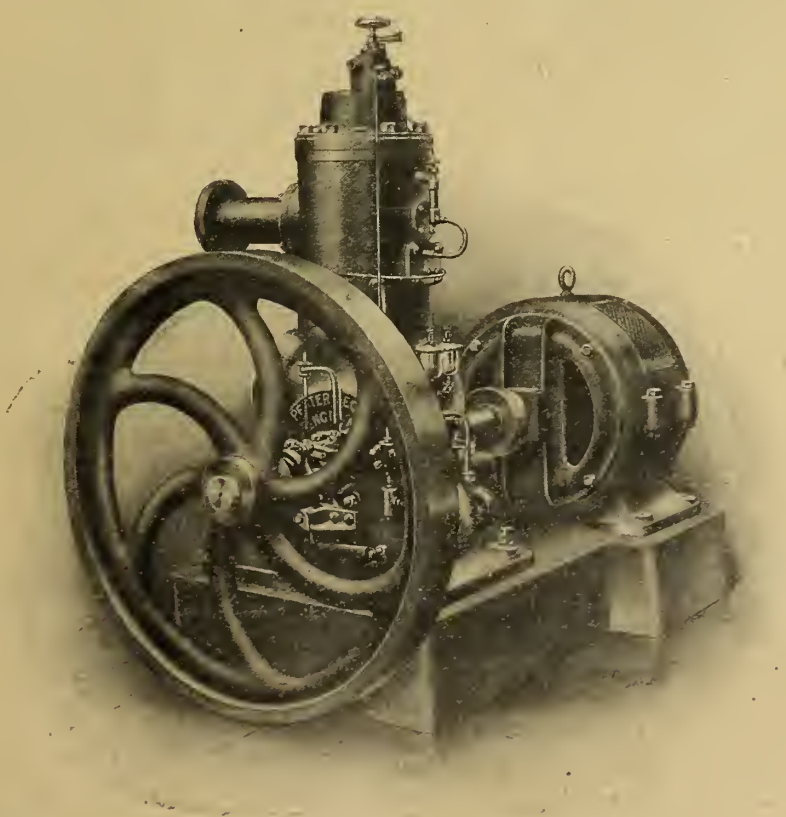


Two-Cycle Three-Cylinder Diesel Engine by Messrs. Willans & Robinson.

type together with lightness, low cost and even turning, these objects having been successfully attained in the engine shown at Norwich. In addition to the high compression and fuel injection distinguishing the Diesel type, two important improvements over the ordinary two-cycle oil engine have been introduced—first, the crank chamber is not used for compressing the air or explosive mixture; secondly, the exhaust and air-inlet ports are situated at opposite ends of the cylinder. The opening and closing of the ports is effected by a reciprocating cylinder liner or sleeve in which the piston works, the two being operated by separate crank pins, much after the fashion of the central valve and piston of the Willans steam engine. By giving these crank pins a certain angular difference, the exhaust and air-inlet ports are opened at the bottom of the stroke. Air at about 2½ lb. pressure is delivered by a ring piston on the lower end of the sleeve above mentioned, and sweeps out the waste gases, leaving the cylinder full of pure air for the compression up-stroke. The remainder of the engine is substantially similar to the Willans-Diesel four-stroke type, excepting that it is totally enclosed. This engine, which is the first one built, develops 75 B.H.P. at 450 revs., and should be particularly suitable for driving electric generators.

Another very interesting engine is the two-stroke semi-Diesel by Messrs. Petters, Ltd., of 15 to 18 B.H.P., for which the makers guarantee a consumption of crude or residual oil not exceeding half a pint per B.H.P.-hour. As in nearly all small two-stroke engines, the crank case is made use of to compress the charge to a low pressure, so that it will enter the cylinder quickly when the inlet port is uncovered by the piston. In this case, however, only pure air is so treated, the oil being injected by a pump at the top of the stroke. The air rushing in from the crank case sweeps out the burnt gases, and leaves the cylinder full of air, which is compressed as the piston comes up. The compression used (160 lb.) is much lower than the Diesel, hence a vaporiser is needed, which has to be heated by a lamp for a few minutes before starting. The cooling water is circulated by a rotary pump, and the lubrication is forced to the piston and connecting rod, whilst rings are used in the main bearings.

Our illustration shows this engine direct-coupled to a dynamo, for which purpose it is well suited, owing to the even turning from having an impulse every revolution.



Two-Stroke Semi-Diesel Engine by Messrs. Petters, Ltd.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cheap "Stannos" Wiring.

A propos of the recent discussion of wiring systems, which subject, by the way, seems likely to become a hardy annual, I should be glad if you could afford space for a few remarks bearing more particularly on "Stannos" wiring.

You may recall, some two years ago, publishing a letter from me over the signature "Wireman," in which was described a system I had devised, but which subsequently proved to be almost identical with the "Stannos" system, which made its appearance some weeks after the publication of my letter.

I have since had considerable experience of "Stannos" wiring, and I must say that, shorn of its weak points (which it is not my province to point out here), it seems to provide as cheap and reliable a system as could be wished for. But, if used as the manufacturers intend it to be used, it is not very cheap and certainly not so reliable.

I have, in this town, installed some 200 points in about 30 different premises using "Stannos" wire concentrically; the cost per point complete with plain fittings and metal lamp averages 8s. 2d.

These results were obtained although I was severely handicapped by lack of "plant" (ladders, &c.) and accessories; often having to pay three or more visits to a job in order to complete it. The majority of the buildings here do not lend themselves to low costs, as the walls are of stone and from 18 to 29 in. thick.

It is hard to see how Mr. J. W. Beauchamp arrives at his figure of 5s. 9d. per point for fittings, unless he is quoting full list prices for the various articles; one thing is certain, his labour costs won't allow of much reduction.

I may say that the work here has been done in good class manner, and comprises both surface and concealed wiring. What I have done here can, of course, be done elsewhere, and I am prepared to guarantee as good, if not better, results on similar work anywhere, providing I have complete control as I have here.

Should any of your readers desire further particulars, I shall be pleased to supply them, or, if they happen to be near this part of Ireland and care to see the work, I will gladly arrange for them to do so: my address will be found in the "Situations Wanted" column.

I enclose a summary of one job, taken at random from my work book, showing the costs for an installation of ten points.

Cost of wiring premises of Mr. S—— (butcher) for 10 points.

Labour, 16 hours at 1s. 2½d.	£0	19	4
Wire, 110 yd., 1/18 "Stannos"	1	0	7½
„ 6 yd., 3/20 „	0	3	6
Fittings, switches, fuses, shades	0	14	6½
Lamps, 10 at 1s. 8d. each	0	16	8
Cast-iron "Z" house fuse-box...	0	2	8
Sundries	0	3	0
Total	£4	0	4
Per point	0	8	0·4

Note that house service fuse and service cable are included above.

S. C. Hughes.

Cloughjordan,
Co. Tipperary, Ireland.

Wooden Poles.

Our attention has been drawn to correspondence in your paper *re* an article by Mr. R. E. Neale on overhead lines in your issue of June 2nd, but we presume that the poles which Mr. Neale refers to are unpreserved, as what he states about poles giving way in the fourth or fifth year would not be applicable to properly-creosoted poles, and we would recommend that he tries such where suitable, as we agree with Messrs. Armstrong, Addison & Co., in your issue of June 6th, that poles when properly creosoted should have a life of 30 years, and often more. We should also think that the cost of the poles which he recommends is considerably higher than that of wooden poles of equal strength. We take it that the poles are about 32 ft. long, and should think that a wooden pole to do the same work would probably cost less, but do not know the comparative cost of these steel ones. Are we right in taking same as 36s. or 37s. each for poles only? Perhaps he would give us this either through your paper or direct.

For **Richd. Wade, Sons & Co., Ltd.**
Christopher Wade, *Managing Director.*

Hull, *July 10th*, 1911.

[As Mr. Neale has already explained, the remarks referred to were contained in the original article from which he quoted.—Eds. E.R.]

Copper.—Messrs. Merton's monthly return shows a net reduction on European visible supplies of 2,441 tons, the total for the end of the month standing at 70,172 tons. American stocks increased during May by 196 tons, being 74,105 tons at the end of that month. Total stocks (excluding Holland and Germany) were 5,259 tons lower at the end of May than for April 29th. Taking into account an increase of 475 tons on the quantity afloat from Australia, the gross reduction on European stocks is 2,916 tons. Supplies are slightly under the average, but not noticeably low. Total deliveries amount to 36,517 tons, against 46,659 tons, the difference being attributable to the recent holidays. Stocks in Rotterdam have been reduced by 50 tons, and the Hamburg stocks are estimated at 10,100 tons, 400 tons less than for the end of May.

PARLIAMENTARY.

Central London Railway Bill.

Lord Barnard's Select Committee of the House of Lords commenced the consideration of the Bill promoted by the Central London Railway Co. on July 4th, which authorises the company to make a short double line about ½ mile in length, commencing at Wood Lane Station and terminating by a junction with the authorised Ealing and Shepherd's Bush Railway of the Great Western Railway Co. The Bill has already passed the House of Commons.

The Hon. J. D. Fitzgerald, K.C., who appeared for the promoters, said that the Great Western Railway Co. had been authorised to construct a railway between Ealing and Shepherd's Bush, which would be electrically equipped, and if the proposed extension was carried out, it would give a direct service between Ealing and the City. When the Liverpool Street extension of the Central London Railway was opened it would give direct communication between Ealing and Liverpool Street. The only opponents were the Metropolitan Railway Co., who complained that the extension would be a breach of an agreement between the Great Western Railway Co. and the Metropolitan Railway Co., made in 1865, to the effect that neither would assist in the promotion of any Bill which would set up competition with the Hammersmith and City line which they jointly owned. He contended, however, that the Metropolitan Railway Co. would not be prejudiced, because their line and the Central London line were not in real competition until they reached the City.

Sir Henry Oakley, late chairman of the Central London Railway, gave evidence to the effect that the company had undertaken to run 136 trains a day to Ealing. It was proposed at first to have two stations on the extension—one at Ealing and the other at North Acton.

Sir J. Inglis, general manager and consulting engineer for the Great Western Railway Co., said the direct access to the City by the Metropolitan line, was insufficient for the development of the Great Western long-distance suburban traffic, and for various reasons their efforts to get more than 14 through trains a day from the Metropolitan Co. had been unsuccessful.

After hearing some further evidence on July 5th, the promoters met the Metropolitan Railway Co. with an undertaking that pending any application next session by that company for a junction and through running of trains between the Hammersmith and City line, and the Ealing and Shepherd's Bush line, the Great Western Railway, while reserving their rights to oppose that application, would do nothing in the construction of the line from Ealing to Shepherd's Bush to prevent or prejudice the carrying out of the proposals.

On this understanding the preamble of the Bill was found proved.

Chiswick U.D.C. Bill.—On July 6th Mr. Helme's Committee of the House of Commons had before them the Bill of the Urban District Council of Chiswick which, amongst other things, provided for a service of railless trolley vehicles, for which the estimate was £5,000, and £6,000 for the electrical equipment of the same. There was no opposition to the proposal, but a report was received from the Home Office to the effect that the Commissioner of Police had grave doubts as to whether the system would prove suitable for a London suburb. The Committee, however, allowed the clauses.

Metropolitan Railway Bill.—The Bill promoted by the Metropolitan Railway Co. came on July 6th as an unopposed measure before the House of Lords' Committee on Unopposed Bills, and was ordered to be reported for third reading. The principal proposal in the Bill is the construction of a new station at Mount Pleasant, between King's Cross and Farringdon Street Stations.

Third Readings.—In the House of Lords on July 10th, the Liverpool Overhead Railway Bill was read a third time; and in the House of Commons on July 11th, the Winchester Corporation (Electric Supply) Bill was read a third time.

The N.E.M.A. Secretaryship.—As will be observed from a notice appearing to-day in our advertisement pages, the National Electrical Manufacturers' Association is requiring the services of a secretary at a minimum salary of £500 per annum. The secretary will have to establish central offices, engage staff, and to undertake the executive work, and the necessary organisation of the Association, which position, owing to the growth of the Association and other calls on his time, the present secretary is unable to accept. The Council hope to secure the services of a gentleman of energy and resource, and of recognised position in the industry, with experience likely to be useful in such work, but not necessarily acquired in a similar capacity. The central offices will be situated in London. Communications are to be sent to the Chairman of the Association at Balfour House, Finsbury Pavement, E.C.

The Electrical Engineers' Ball.—The Executive Committee of the above have forwarded from their surplus fund, a sum of £20 to the Institution of Electrical Engineers' Benevolent Fund, and a like amount to the Electrical Trades' Benevolent Institution.

LEGAL.

The National Telephone Transfer.

(*Continued from page* 14.)

Sir John Simon, continuing his cross-examination of Mr. Gill, asked if it were not a fact that the National Telephone system in the City was practically an overhead system, and Witness admitted that there were more overhead wires than underground wires.

And so far as it is an underground system in the City, it is substantially because it uses the underground system of the Post Office?—Substantially so, but not entirely.

So that substantially leaving out the underground system that you have hired or leased, the Post Office is an underground and yours an overhead system?—I think that is substantially right.

And the Post Office have got a very complete underground system?—I think they have.

Do you suggest that it would be necessary for the public service that the Post Office when it took over the business of the company would have to lay down more underground wires?—In small lines.

You mean tributary side streets?—Yes.

But the main arteries are fairly covered?—Yes.

In answer to other questions, Witness said he knew that the Post Office was and had been for some time engaged in connecting telephone subscribers with its own main line, and installing its own instruments.

Sir J. Simon: And it is being done in anticipation of the Post Office taking over the company's business?—I rather think it is being done in anticipation of a favourable award.

It will be a material question to answer to what extent the Post Office has made arrangements, and is making arrangements, to provide the alternative system?—Yes, that is obviously so.

You know that they have been doing this work for some time?—Yes.

And that they have approached subscribers in your area?—I believe that is so.

And the Post Office do not want your overhead wires?—No.

And they did not want your instruments?—No.

And they do not want an exchange which corresponds with your instruments?—No, they all go together.

In answer to other questions, Witness said as a matter of choice he would prefer an underground to an overhead system in the interests of economy.

In the course of further cross-examination, Witness mentioned certain underground cables laid by the company at Kensington.

Sir John Simon took the opportunity to explain that the Postmaster-General was not only willing, but desirous of taking over part of the company's property. He was authorised further to say that the Post Office made no objection to taking over any part of the company's underground workings and plant laid in the public streets, but not those laid on private property. He desired especially to guard himself against being supposed by this to waive objections of the Post Office to lines laid along the electric railways.

Cross-examined with reference to the separability of wires in the cables, Sir J. Simon asked if it were witness's contention, set up against the Postmaster-General, that the presence of a single pair of private wires in a cable threw upon the Post Office the obligation of buying the whole cable?—You are asking me a legal question which I cannot undertake to answer. All I say is, you cannot separate the wires.

In the London area to be developed by the Post Office all the exchanges belonging to the company are substantially overhead systems?—Probably most of them are overhead.

In each area which we object to there is a Post Office system?—Yes, I think so. Witness said it was quite possible to have two sets of underground cables running usefully down either side of a street. The Post Office had it frequently in places. It did not necessarily mean in cases where the company's underground cables ran underground in the same streets as the Post Office cables that the former's plant was superfluous there. In fact, he could not conceive of any underground plant being unnecessary.

Cross-examined with regard to Part II of the London agreement, Witness said that, although the company had certain non-metallic circuits, most of them were removed. He was, however, prepared to argue that those which were left were suitable for their purpose.

Sir J. Simon said that in cases where the company had copper-covered wires with an iron core the Post Office did not raise any objection to such wires on the grounds that they were bi-metallic. Of course, they might have such wires overhead running from a condemned exchange, but that was another matter. With regard to want of audibility, Sir John informed the Court that the Post Office did not want to take advantage of any temporary want of audibility, but they only desired to reject plant where the want of audibility was due to constructional difficulty.

On the question of the comparative efficiency and economy of the local-battery system and the central-battery system, Witness admitted that the central-battery system was generally more economical, because fewer operators were required to attend to a given number of calls. This, however, was not always the case; for instance, he did not think the company could work the Avenue Exchange, London, any cheaper, and he was quite sure the Post Office could not.

Re-examined by Mr. Danckwerts, K.C., Witness said in connection with the fire alluded to at the Bank Exchange, there was no fuse at the time which might have avoided the accident, because the work of conversion on the District Railway had not been completed, and the men had not finished moving the telephone cables. The railway company turned the current on as a result of a misunderstanding, and he thought he was right in saying that they accepted the liability and paid for the damage caused. Witness said that the Telephone Co. specially protected circuits in close proximity to power wires and rails by an adequate system of fuses.

Mr. Danckwerts: There may be cases where the fuses are really unnecessary?—There are many such cases.

In the case of tramways, said Witness, the telephone wires were protected by putting a fuse on either side of the tramway. In the case of overhead wires, there were two ways of protecting the telephones. The first, to make it so that the telephone wires could not come down on the bare tramway or electric railway power wires, and in the second place, to protect against such an event by means of fuses, so that if they did come in contact there would be no danger. There was really no danger in the face of these precautions in erecting telephone or telegraph wires near overhead power systems; in fact, the Post Office had taken compulsory powers to attach their telephone and telegraph wires to the poles of tramway and electric railway systems.

Mr. Danckwerts: The fact then that a telephone wire is running along an electric railway does not necessarily render that line unsuitable for the telephone service?—No, that fact does not render it unsuitable.

There are advantages in overhead wires for telephone work?—Yes, chiefly on account of clearness in transmission. Overhead wires are better transmitters than covered wires.

Mr. Wm. Cook, assistant engineer-in-chief of the National Telephone Co., said he had studied telephone systems both in this country and abroad. He recollected no other case of trouble arising owing to an electric power transmission line coming into contact with a telephone wire belonging to the company except the case of the Bank exchange which had been mentioned. There were a large number of the company's lines laid in the proximity of electric railways, and in some cases the cables were laid under electric railways, but no trouble ever arose.

Mr. H. F. Parshall, chairman of the Central London Railway, was called, and said he had had a long experience in connection with high-power lines in various capacities.

Examined by Sir Alfred Cripps: You have had to deal with telephone wires in close proximity to high-power systems?—Yes, in practically every case where a high-power system has come under my attention.

Have you telephone lines on the Central London Railway running in close proximity to the high-tension cables?—Yes, the power cables, distribution cables and telephone cables are in close proximity. In our private exchange we have 60 points, which means a large number of lines.

Have you ever had any difficulty owing to the proximity of the telephone cable to the high-tension wires?—No, we have never had any suggestion of trouble. It is open to absolutely no criticism, and if we were going to erect new plant to-morrow we would do so on exactly similar lines.

With regard to the Lancashire Power Co., there you have lines for power purposes run overhead, and extending over a large district?—Yes, they extend over several hundreds of square miles. It is a high-tension system, and the crossings are very numerous, but we have had no trouble with the local authorities at all with regard to danger, or the suitability of our arrangements.

Is there difficulty, danger, or inconvenience owing to a telephone wire being in close proximity to a high-tension wire?—No; on the other hand, it is very often the greatest possible convenience. Take our Central London Railway, for instance. I do not know where else we could put our telephone wires with the same convenience and accessibility.

Has the system used on the Central London Railway been carried out in a like manner in Glasgow, Dublin, Bristol and other places?—Yes, as a consulting engineer I have carried out in any number of places high-tension underground systems with power cables at 6,500 volts mixed up with 500-volt cables and telephone wires. There has never been any accident, and furthermore, these systems have been approved by the Board of Trade.

Suppose you had a leakage in such systems, what would happen?—If there were a leakage, the circuit-breakers would act and effectually prevent any damage. With high-tension current leakage is less likely to damage property than in the case of low-tension current, because the effect of a leakage is more immediate. In fact, damage by leakage is almost impossible in the practical working of high-tension systems. In the working of the Central London Railway there has been one accident to a cable, but the circuit-breakers came into operation immediately, with the result that the current was cut off and no damage was done at all.

You know the District Railway Co.'s system very well. Is there any possible objection in your view to the way in which the telephone cables are laid along that system?—No, I should say if there were any objection, it would not be justified by practice.

Witness thought that the change-over of the telephone service from the National Telephone Co. to the Post Office should be done gradually and in a business-like way, and that it was a mistake to endeavour to change the whole system over at once. Such an operation could only result in great public inconvenience.

Cross-examined by Sir Rufus Isaacs, Witness admitted that he had not had specific experience as a telephone expert.

You told us just now that a great deal of public inconvenience would result from the way it was proposed to take over the National Telephone Co.'s business; but surely that would depend entirely upon what preparations are made before the date of the change?—

Entirely ; if proper preparations were made previously, there would be no inconvenience.

Assuming that all preparations have been made in advance, so that the Post Office will be ready to supply the National Telephone Co.'s subscribers on a given date, then there will be no inconvenience to the public ?—Assuming that to be the case, quite so ; but I have been through the Avenue Exchange, and I have seen no such preparations.

But you cannot know what we are doing, can you ?—I know what you are doing at Hampstead ; you are filling up people's houses with wires and apparatus they do not want.

Is Hampstead worked on a magneto system ?—Yes.

You sometimes have a great deal of difficulty at Hampstead with your telephone, do you not ?—No ; but I had a good deal of difficulty last winter, when I tried to get on to my brother, who was on the Post Office service.

I am told that this morning you were rung up. Was it not a considerable time before you got into communication with the gentleman who desired to speak with you ?—Very likely, but that might have been optional on my part.

Do you suggest it was ?—Well, when one is in the midst of one's ablutions, one does not want to run to the telephone.

The telephone in your London Wall office works efficiently, I hope ?—Yes ; I have no reason to complain.

That is a central-battery system ?—Yes.

Witness said the Central London Railway Co. had not laid any telephone cables in the streets proper ; their system was confined to the railway tunnels.

When you are laying a telephone system in a railway tunnel like that of the Central London, you have, as a matter of convenience, to lay your telephone cables in the racks ; carried in the same way as the high-power cables ?—Yes, that is so.

Re-examined by Sir Alfred Cripps, Witness said that on systems such as the Central London Railway they would never lay their cables in the street. Cables in the tunnel were in an accessible position, from end to end ; they were in an absolutely dry place and not subject to electrolysis or mechanical damage.

(To be concluded.)

[Eventually, after a long consultation, the parties agreed to a form of declaration on terms which, it was hoped, would enable the matter to be settled on a business basis, and the Court made an order accordingly. The terms were not disclosed.]

Compensation Claim.

At Rochdale County Court on Friday, Mr. P. Cockcroft appeared for the dependants of Hamlet Tattersall, 52, of 14, John Street, Castleton, who was killed on May 1st when at work for W. Shepherd and Son, of Rochdale, repairing the roof of a shed, through touching some electric wires (500 volts) which ran a few feet above the roof.

Mr. Cockcroft said the dependants of the deceased were five in number, and he explained that £227 had been paid into Court in settlement of the claim for compensation. The ages of the dependants ranged from 8 to 16 years. Three of the children lived at Castleton and two at Rochdale with adult sisters. Tattersall's wife died four years ago. William, one of the children, earned 10s. a week, and Frank, another child, 5s. a week.

His Honour Judge Bradbury : I see that the funeral expenses and other debts amount to £35.

Mr. Cockcroft : The body was brought from Buxton to Rochdale to be buried.

His Honour said he would appoint Mary Alice Tattersall guardian of the three elder children, and Ellen Tattersall guardian of the two youngest. The sum of £35 was to be at once paid out. For a period of two years Mary Alice Tattersall was to receive 26s. a month towards the children's maintenance, and Ellen 32s. a month for four years. Very soon two of the elder children would be able to keep themselves. At the expiration of the times he had mentioned, fresh applications must be made to him. The payments to the elder sisters would date from the time of the fatality.

London Electric Supply Corporation, Ltd., *v.* Westminster Electric Supply Corporation, Ltd.

This case came before the Court of Appeal on Monday, upon the appeal of the plaintiffs from a judgment of Mr. Justice Joyce.

This was an action arising out of a dispute between the two companies as to the construction and effect of an agreement entered into by them relating to the management and working of the undertaking of the plaintiffs in a certain area in Westminster by the defendants. The facts were reported by us at the time of hearing. Sir A. Cripps, K.C., Mr. Gore Browne, K.C., and Mr. Austen Cartmell appeared for the appellants ; and Mr. C. A. Russell, K.C., Mr. Younger, K.C., and Mr. S. Kennedy, for the respondents.

Sir A. Cripps stated that the sole question in the case was the construction of the agreement. Both the companies obtained their provisional orders in 1889, after an inquiry before Major Marindin. For some time afterwards the continuous current, which was supplied by the defendants, held the field to a great extent, but later, when the metal-filament lamp came into use, the demand for a supply of alternating current became larger. There were stringent conditions against the various companies in the same area assisting one another, as it was thought that they might by doing it be acting to the detriment of the public. In 1908 an Act was passed by which powers were given to electric lighting companies working in the same area to come to terms so as to prevent undue competition as regarded management and working in the districts where the two companies had powers. It was under the powers of that Act that the two companies in this case came to terms in the Westminster area. There was some discussion about the terms. When the agreement was first suggested, the London County Council said it was really the sale by the plaintiff company of its undertaking to the defendant company in the Westminster area. Under the Act they were not entitled to do that. After negotiation and certain alterations, the agreement took the form in which it was now before their Lordships. The great question in the case was whether the defendant company were entitled to refuse to supply alternating current through their mains when it was demanded by consumers. Mr. Justice Joyce had held in effect that, upon the construction of the agreement, there had been a sale by the plaintiff company of their undertaking in the Westminster area and that the plaintiffs had really no interest in the Westminster area at all, whereas the fact was that the plaintiff company still had large powers and rights in that area. The plaintiff company, by the agreement, had to be paid by the defendants in proportion to the amount earned by the defendant company by the supply of alternating current in the Westminster area, and the plaintiffs' case was that the defendants were not entitled, under their powers under the agreement, to destroy the plaintiff company's chance of earning profits by the supply of alternating current. He (counsel) contended that the learned judge had put a wrong construction upon the agreement, and that the plaintiffs were entitled to the relief they claimed.

Mr. Cartmell having followed on the same side, Mr. C. A. Russell, on behalf of the defendants, supported the judgment in the Court below.

At the conclusion of the argument of counsel, the Master of the Rolls delivered judgment, dismissing the appeal.

Lord Justice Farwell delivered judgment to the same effect.

Lord Justice Kennedy, while feeling more difficulty upon a point raised as to the declaration, did not see his way to differ from the conclusion arrived at by the other members of the Court.

The appeal was therefore dismissed with costs.

Electrobus Litigation.

The litigation between the Reorganisation Control Syndicate and International Motor Traffic Syndicate, with reference to the disposal of the 'busses and parts of the old London Electrobus Co., came before Mr. Justice Neville again, when Mr. Jenkins, K.C., on behalf of the Reorganisation Syndicate, applied for the costs of the shorthand writers' notes and transcript of the hearing before him in February last.

Mr. Justice Neville said that he did not think he ought to accede to an application of this sort made, when, but for its peculiar nature, he should have forgotten all about the case. The application would, therefore, be dismissed with costs, but without prejudice to any summons the plaintiffs might issue to vary the order as given out by the Registrar.

The Charing Cross Company Summoned.

At West Ham Police Court on Wednesday last week, the Charing Cross, West End and City Electricity Supply Co., Ltd., of Pudding Mill Lane, Stratford, were summoned by Mr. W. Williams, Home Office Factory Inspector, on five informations, for that they, being occupiers of a factory in which electric energy was generated, did fail to comply with certain regulations.

Mr. R. O. B. Lane defended.

According to the report in the *Stratford Express*, Mr. Williams said that the proceedings were taken under the Regulations which partly came into force in 1909, and partly in 1910. These Regulations were made to minimise the dangers in the generating of electricity in workshops. The actual facts in this case occurred on Thursday, April 13th, when there was a very bad accident at the works. These works were very fine, and for the most part consisted of a very lofty one-floor building running nearly the whole length of the premises. There were two galleries or platforms, and it was on the second one of these that this particular accident occurred. A man, George Charles Avent, a competent switchman, who had been employed for some years by the company, for some reason went into the "extra-high tension chamber," and met with an accident. In the first place, the man seemed to have received a shock at 10,000 volts. Unfortunately, he had lost an arm. His point was that the conductors should have been properly screened.

The man Avent, on oath, said that on the day in question he commenced work on the gallery at 7 a.m., cleaning the oil switches of the machines. He was cleaning the interlocking switch when he suddenly got a shock, and that was all he remembered. It was by the firm's instructions that he did this work.

Cross-examined, Witness was quite conversant with the Regulations, and knew that Regulation 8 said that they should not go in the extra-high-tension chamber while the wires were alive. They were also given verbal instructions. On this particular day all the

switches in the extra-high-tension chamber were dead except one. He knew this one was alive.

Why did you not ask for this wire to be disconnected?—It was practically impossible. You could not run the system.

You mean it would be inconvenient? Your arm came in contact with the live wire?—Yes.

For the defence, Walter Henry Kingston, the engineer-in-chief, was called, and said that if it was essential for men to enter the chamber, provisions were made that the wires should be made dead, and he had a printed coloured drawing at the back of the board showing how each one of the wires could be made safe. Avent had no business in the chamber.

Evidence was given by Thomas Goulburn and Frank Bates, two shift engineers, to the effect that they never gave Avent any orders to be in the chambers, that he had no right there, and that all precautions had been taken.

Mr. Gillespie, in the result, said he must hold that due diligence was used, and he supposed Mr. Williams would withdraw the summonses.

Mr. Williams: The object in bringing the case is to emphasise the necessity of precautions being taken.

Mr. Gillespie: I think due diligence was used, and quite see that as long as the men keep outside they are absolutely out of danger, but they seem to be able to go in without observation.

Mr. Lane: The place is sometimes used in cases of emergency, and it must be possible to get at the key at once.

Mr. Gillespie: It strikes me as peculiar that a man is able to get into the place without being under observation. Cannot something be done more than give instructions?

Mr. Williams: I think further precautions will now be taken.

Mr. Lane: Yes.

The summonses were withdrawn.

BUSINESS NOTES.

Hospital Installation Tenders.—The question of the tenders for the electrical installation of the new hospital extension at "Alder Hey," West Derby, Liverpool, was brought up at the meeting of the West Derby Board of Guardians on July 5th. An expenditure of some £10,000 is contemplated on an installation of about 2,500 lights, with 150 fans, generating plant, and bell and telephone installations. Some criticisms had been levelled at the Guardians on the ground that the small committee appointed to deal with the business selected eight firms to tender for the work, three being outside firms, with no local representation or associations, and one a German concern. The clerk (Mr. H. P. Cleaver) said the work was done at the instance of the Building Committee, and was approved by the Board. There had been nothing wrong in the matter, and the Board accepted all responsibility.

The Scottish Exhibition.—At the Scottish Exhibition of National History, Art and Industry, now being held at Glasgow, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., are exhibiting a representative collection of their manufactnres. These include an assortment of hose, packing, valves, washers, buffers, belting, carriage tires, mats, cables, "Silvertown" fonntain pens, heel pads and shoe soles, cells, ebonite goods of various kinds, testing and telegraph instruments, and gutta-percba goods. Cards are displayed announcing the fact that the company's golf ball, the "Silver King," won the Amateur Championship and the "Cruden Bay" Professional Tournament. Last week the Open Championship was won by Harry Vardon, playing with this ball, and to this list of successes must be added the Scottish Professional and Midland Championships, and the Tooting Bec and Bramshot Cups. The floor of the stand is covered with india-rubber tiling, of which the company were the pioneers some 22 years ago. It has been successfully laid in nearly 200 vessels and in over 60 banks, insurance offices and public buildings, and recently in Buckingham Palace and Marlborough House.

Holiday Literature.—We have received from the Health Resorts Association, of 29, John Street, Bedford Row, W.C., three official guides which may be of service to readers who are turning their thoughts early to holidays in this Exhibition year. One relates to Cardiff, Penarth and Barry; the second to Llandrindod Wells, and the third to Deal. All contain many excellent views, and copies can be obtained free from the town clerks of Cardiff, Llandrindod Wells and Deal respectively.

Osrams on the Wing.—We congratulate the General Electric Co., Ltd., upon a novel and successful experiment—the delivery of Osram lamps by aeroplane; this particular piecc of business they have carried over the heads of all comers. Requiring to send a consignment of Osram lamps from their Worthing depôt to Messrs. Page & Miles, Ltd., Brighton, they sent them per "Valkyrie" monoplane. We learn that the whole experiment was carried out with conspicuous success, a perfect descent being made in the Hove Marine Park, by arrangement with the Hove Corporation, at 8 o'clock last evening, where a messenger with a cart awaited the arrival of the flying machine, and immediately conveyed the case of Osram lamps to its ultimate destination. When the case was opened, all of the lamps were found to be in perfect condition. This, we believe, is the first time that aerial transport of goods has ever been attempted. A crowd of over 5,000 had gathered at the park upon learning the news, and heartily cheered the aviator (Mr. Barber, of Hendon) again and again upon his success. The feat was the more meritorious, because the enclosure is only a very small one, measuring little over 250 paces from corner to corner. We understand that the inventor of the "Valkyrie," who piloted his own machine upon this venture, is presenting any proceeds which may result therefrom, to a prize fund for the further encouragement of aerial navigation.

Rubber Prices.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., announce that owing to the fall in the market price of rubber, a reduction in the price of their rubber-insulated wires and cables came into force on Monday last, 10th inst. Their price-list, No. 40, dated October, 1910, will accordingly be subject to the following discount:—Association grades—2,500 megohm, 600 megohm, 300 megohm, 600-volt: C.M.A. and Association pure india-rubber flexibles—27½ per cent.

Trade Announcements.—Mr. H. W. Teeton has removed from Lichfield Street to larger premises in Foundry Street, Hanley.

Messrs. Baxendale & Co., of Miller Street Works, Manchester, announce that their business has been registered as a private limited company, and will in future be carried on under the style of Baxendale & Co., Ltd. The step has been taken purely for family reasons, and the company will consist solely of the partners in the firm, who will continue to devote their attention to the management, &c., of the business.

Mr. Guy Campbell, formerly sales manager of Holophane, Ltd., has joined the Benjamin Electric, Ltd., who have opened new offices and showrooms at 117, Victoria Street, Westminster, S.W., which is now Mr. Campbell's address. The works and warehouse are at 1A, Rosebery Avenue, E.C., as before. The Benjamin Electric, Ltd., have purchased the stock and goodwill of C. F. Trippe, of 36, Brooke Street, Holborn, E.C., and all communications should be sent to their new offices, as above. We understand that it is the intention of the company to manufacture, among other products, specialities necessary for industrial lighting.

Mr. A. M. Cramp has taken over the business of electric light and power contractor recently opened by Mr. J. R. Kay, at 13, Regent Street, Haslingden.

Messrs. Gent & Co., Ltd., finding their old office and stores in High Bridge, Newcastle-on-Tyne, too small for their growing business, have taken new premises at 52, Blackett Street, with accommodation for stores, showroom and offices.

Catalogues and Lists.—Messrs. W. Lucy & Co., Ltd., Eagle Ironworks, Oxford.—116-page catalogue being the latest edition of the firm's "Handbook of Electrical Ironwork." In tbe various sections of this publication are contained numerous line drawings and exterior illustrations of such manufactures as the following:—Street lighting brackets, watertight hoods, controlling gear for street lighting, lamp-posts for incandescents and arcs, fuse-boxes and sealing troughs, joint and service boxes for various kinds of mains, dividing boxes, disconnecting boxes, straight through, three and four way; feeder and section pillars for lighting, power and traction respectively, high and low-tension apparatus, feeder boxes, pathway frames and covers, time-switches, speed and frequency indicators, engineers' storage bins, and so forth.

Messrs. Cranmer & Cheshire, Steward Street, Spring Hill, Birmingham.—Fifty-eight-page excellently illustrated price list, in art paper, relating to a variety of electric light fittings (brackets, electroliers, pendants, standards, ceiling fittings, hall lanterns, shades and shade carriers), also signs, switch parts and other metal parts for the service of the electrical trade. The illustrations of metal-work include many fine specimens of art-metal switch cover and bell-push plates, also some serviceable lines of water-tight and bulk-head fittings.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—We have received an advance copy of a pamphlet illustrating and describing the new "Fortiter" ampere-hour meter which is referred to on another page of this issue.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—New price list (104 pages) containing a great deal of tabulated information, with clearly indicated price-figures, regarding their electric cables and wires insulated with vulcanised and unvulcanised india-rubber. The catalogue contains all the sizes and types usually listed by the firm, with a section dealing with high-tension and extra-high-tension cables from 2,200 volts to 11,000 volts. Association and non-Association cables are dealt with in separate sections, and in addition, pages are devoted to aerial cables, flexible cables for dynamo and motor connections; motor-car flexibles; gutta-percha wires; flexible-trailing cables for coal-cutting machinery, &c.; ozone proof cables; fire-resisting cables; cables for chemical works, &c.; bell wires, flexible cords, jointing materials, patent cable suspenders, &c. A new type of protection is included in the Home Office flexible section of the list, which consists of a hard core braiding which forms a very durable covering and obviates the necessity for the earthing of armouring wires. Other contents include particulars of conductors, and details of radial thicknesses of dielectric and lead sheathing, &c., published by the Engineering Standards Committee. Any reader who requires a copy of the catalogue can secure one on application. Messrs. Henley's have just made substantial increases in their discounts from this list, and they will forward a note of same to anyone in the trade upon application.

Messrs. G. W. Goodchild & Partner, 30-32, Farringdon Road, London, E.C.—We have received a 240-page book from this firm, containing very full information regarding Messrs. Ludw. Loewe and Co.'s small tools, gauges and standard parts. There are alphabetical and classified indices, a telegraph code, conversion measurement tables, innumerable neat half-tone and line illustrations, prices, and so on, the classes of manufactures covered being indicated thus: Chucking tools, cutting tools (cutters, reamers, counterbores, threading tools and chasers), measuring tools, and standard parts.

Messrs. Plutte, Scheele & Co., Ltd., 18 and 19, Queenhithe, London, E.C.—New list of eight pages, giving illustrations and prices of various voltmeters, ammoters, motor-car accessories, &c.

The Ansonia Brass and Copper Co., New York.—Thirty-six-page booklet regarding Tobin bronze, of which they are the sole manufacturers.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Sixteen-page illustrated catalogue of electric motor-fans for cooling, ventilating, exhausting and blowing purposes. Sizes, voltages, periodicities, speeds, current consumption, prices and such like particulars are clearly tabulated. The contents include a combined fan and table lamp, a combined fan and fruit dish, and lampholder fans.

Book Notices.—*The Care and Management of Ignition Accumulators.* By H. H. U. Cross. London: E. and F. N. Spon. Price 1s. 6d. net.—This is one of the "S. & C." series, of which a number of examples have recently reached our hands. The author gives directions for the charging of ignition accumulators by the several means commonly available, and for their repair when damaged in various ways. The instructions are generally very clear and detailed, the author having evidently had experience of the operations he describes, though this has led him to take for granted a certain amount of technical knowledge on the part of the reader. The third section deals with the use of small accumulators for country house lighting on a miniature scale, only five cells being used, in conjunction with a ¼-h.p. oil engine and a dynamo giving 6 amperes at 15 volts, which items are collectively styled "the plant," and are applied to the energising of 12 8-c.p. 8-volt lamps. The book should be much appreciated by amateurs with plenty of leisure, for whose benefit it appears to have been written.

"*Proceedings* of the American Institute of Electrical Engineers," July, 1911. Vol. XXX, No. 7. New York: The Institute. Price $1.00.

"Wiring Houses for Electric Light," and "Low Voltage Electric Lighting with the Storage Battery." By N. H. Schneider. 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the American Society of Mechanical Engineers." July, 1911. Baltimore, Md.: The Society. Price $1.00.

"Raddoppiatore Statico di Frequenza." Extract from the *Proceedings* of the Associazione Elettrotecnica Italiana. By G. Vallauri. Milan: From the Author.

For Sale.—The Wigan Corporation has for sale two 150-kw. G.E.C.-Willans sets, three Lancashire boilers, two condensing plants, three feed pumps, one Green economiser, &c. See our advertisement pages to-day.

Liquidations.—Buchholtz Reversible Turbine Syndicate, Ltd.—A meeting will be held on August 14th at 2, Coleman Street, E.C., to hear an account of the winding-up from the liquidator, Mr. George Noble.

Electro-Peat Coal Co., Ltd.—A meeting is to be held at 11, Ironmonger Lane, E.C., on August 9th, to hear an account of the winding-up from Mr. Lacey Downes, the liquidator.

Bankruptcy Proceedings.—C. F. Lindop, electrician, Liverpool.—First meeting, July 19th; public examination, July 24th; both at Liverpool.

Holidays.—The Westinghouse Works, Trafford Park, Manchester, will be closed from 5.30 p.m. on Friday, July 28th, until 7 a.m. on Tuesday, August 8th, 1911, for the annual holidays. No goods can be received or despatched between the above dates, but a small staff will be in attendance to deal with matters of extreme urgency.

Messrs. G. & J. Weir, Ltd., of Cathcart, Glasgow, announce that their works will be closed for the fair holidays on Thursday, July 13th, and will re-open on Tuesday, July 25th.

The Walsall Electrical Co., Ltd., announce that their works will be closed from Saturday, July 29th, until August 10th, for stocktaking and the annual holidays.

LIGHTING and POWER NOTES.

Accrington.—The T.C. has agreed to supply Messrs. Howard & Bullough, Ltd., with an extra day power supply for about 200 kw. at £2 per kw. of maximum demand plus ·5d. per unit for five years, subject to a minimum annual consumption of 500,000 units.

Algeria.—A company has been formed with a capital of £18,000, for the purpose of supplying Ain Temouchent, Oran, with electrical energy for lighting and power purposes.—*African Engineering.*

Ashburton.—The U.D.C. has decided to oppose an application by Messrs. Ferguson & Co. for a prov. order for electric lighting.

Bacup.—The electrical engineer to the Corporation has been requested to furnish a report and estimate for the supply of electricity at the Stacksteads end of the borough.

The question of wiring, &c., in connection with the electric lighting of the Market Hall, municipal offices, and accountant's office, has been left in the hands of the chairman and vice-chairman of the Finance and Markets Committee and Councillor G. Smith, with a request that the other Committees also concerned with the lighting of the departments under their control be asked to refer the matter to the above sub-Committee.

Bideford (Devon).—At the last meeting of the T.C., notice of a company intending to apply for a prov. order to supply electricity for Bideford was received, and it was decided to take the usual steps.

Bognor (Sussex).—The U.D.C. on Friday received from Mr. W. Tate a notice of his intention to apply to the B. of T. for a prov. order for electric lighting.

Bradford.—At the last meeting of the Sewage Committee, the engineer's report was considered as to obtaining a supply of electricity for power and lighting at the sewage disposal works at Strangford and at the pumping station at Apperley Bridge, and it was decided that application be made to the Electricity Committee for the supply of electricity required, the charge to be £3 per annum per kw. of maximum demand, plus ½d. per unit metered, less the usual discounts allowed to large consumers, and the Committee guaranteed a revenue of not less than £303 per annum for 10 years, on condition that the Electricity Committee extends its mains to Apperley Bridge.

The Electricity Committee is seeking authority for the expenditure of £4,145 on an extension of mains from Eccleshill to Apperley Bridge, and the construction of a transformer chamber on the route.

Canada. — Our correspondent writes as follows:—American and English capital has been interested in the establishment of an electric smelting plant at Chats Falls, on the Ottawa River, about 20 miles west of Ottawa. This water-power is capable of developing 141,000 h.p. A development of 20,000 h.p. will not cost over $8.00 per h.p. Active work preparatory to the erection of the plant will begin early next spring. The country surrounding the Falls on the Quebec side of the Ottawa River is rich in iron ore, the only difficulty being transportation. It is, therefore, proposed to build an electric railway from the Falls to the mines. Chats Falls is looked upon as an ideal spot for a large electric smelting industry.

The engineers of the public works department are engaged in making a survey in the vicinity of Cedar Rapids and Beauharnois on the St. Lawrence River with a view of ascertaining whether the claim of the Long Sault and Canadian Light and Power Companies (who are seeking a charter from the Government), that the development of power will not interfere with navigation on the St. Lawrence, is justified.

Carnarvon.—The lighting of Carnarvon Castle, on the occasion of the Investiture of the Prince of Wales, was by electricity throughout, an installation of 10,000 c.p. having for the first time been made. This part of the work was entrusted by the Office of Works to the National Construction Co., and has been carried out by Mr. D. O. Evans, the company's manager and engineer for North Wales. It is understood that nearly all the new lighting arrangements are to be permanent. The service is run from the town electrical supply under the King's Gate to the switch room in one of the old guardrooms by the side of the entrance. A cable is then run to the Granary Tower and into the North-east Tower (one of the restored towers). Another cable passes across to the Chamberlain's Tower (the Prince's retiring room). Six cressets, replicas of the fittings in the Chapel of the Pyx in Westminster, each of which is provided with four 50-c.p. lamps, are fixed in the Chamberlain Tower. The Eagle Tower is similarly furnished, while in the North-East Tower and the Queen's Tower lamps are affixed to old-style brackets, the same system of illumination being adopted through all the corridors.

Cardigan.—With reference to a proposed scheme for electric lighting, the T.C., on July 4th, decided to appoint a deputation to visit Newcastle Emlyn, Carmarthen and Llandilo, and ascertain how the schemes in force there were working. The deputation on Monday strongly urged the Council to erect electricity works.

Chard.—Messrs. J. & W. Purves, of Exeter, have informed the T.C. that they are applying for a prov. order for electric light.

Cheltenham.—At the last meeting of the T.C. the town clerk was instructed to give statutory notice to the Cheltenham R.D.C. and the Winchcombe R.D.C. of the intention of the Council to apply for a prov. order for the supply of electrical energy to the parishes of Lechampton, Swindon and Prestbury, in the Cheltenhan rural district, and the parishes or hamlets of Bishops Cleeve, Southam, Brockhampton and Woodmancote, in the Winchcombe rural district.

Chester-le-Street.—The Durham County Electric Supply Co., which is competing for the public lighting contract, has arranged for a deputation from the U.D.C. to inspect installations under its control.

Conway.—The R.D.C. has decided to consent to the Colwyn Bay and Colwyn U.D C. extending the electrical mains to that portion of the parish of Llysfaen known as Colwyn, and which is in the rural area.

Continental Notes.—France.—A new company has lately been formed at Somain (Nord) with a capital of £10,000, and the title La Société Electrique de l'Ostrevent, to establish a small electricity generating station for lighting and power purposes.

La Société Departmentale de Distribution d'Energie Electrique is the name of a new company which has just been formed at Belfort to establish a small central electric lighting station.

Austria-Hungary.—The municipal authorities of Buda-Pesth intend to set up an electric power plant with a capacity of 10,000 kw., at a cost of about £416,000.

The owners of the Buda-Pesth Electric Railway have applied to the local authorities for permission to extend their electric generating station on the bank of the Donau.

A syndicate has been formed at Görz with a view to setting up electric power works. It is proposed to provide the town with electrical energy by the coming winter.

A project has been submitted to the Water Rights Commission for the use of the falls of the Leiser between Gmund and Seebach for the generation of electrical energy at Spittal (Carinthia).—*Board of Trade Journal.*

A scheme for the establishment of hydro-electric works on the Danube between Pressburg and Raab, has been submitted to the Hungarian Ministry for Agriculture by the firm of Albert Buss and Co., of Basle. The project comprises the construction of three dams at Pressburg, Weiselburg and Raab, to yield 141,000 h.p., and electrical energy would be supplied from the hydro-electric works to these towns for lighting purposes, and to industrial undertakings in the locality. An expenditure of from £1,250,000 to £1,660,000 would be required to carry out the works.

Dartford.—The U.D.C. has decided to supply current at d. per unit to consumers guaranteeing a minimum annual consumption of 150,000 units, who would undertake that their demand should not exceed 100 kw. per hour between 4 p.m. and 6 p.m. in January and December.

Dawlish.—At the last meeting of the U.D.C. the question determining the present agreement with the gas company was discussed. The E.L. Committee recommended that the offer of the E.L. Co. as to the lighting of the Strand for one year as an experiment be accepted, subject to the Gas Co. waiving their agreement so far as the lighting of the Strand was concerned. The Gas Co. wrote that they were prepared to accept notice for six lamps in the Strand on condition that the Council allowed the company to remove six lanterns in any part of the town agreed upon, and to replace them with lanterns and fittings of an equal candle-power to those suggested by the E.L. Co. and on the same terms, viz., that all gas used in these lanterns be paid for by the Council at half the usual price—2s. per 1,000 ft. instead of 4s.—and that the company fit, maintain and light the said lanterns. A member said the whole thing seemed to be resolving itself into a question of gas *v.* electricity, and it looked as if the ratepayers would have to pay more, while another member said the resolution to give the Gas Co. notice was come to too hurridly, and he gave notice of motion to rescind it. In view of this, the acceptance or otherwise of the Committee's recommendation, and the offers by the two companies was deferred.

Derby.—At a meeting of the T.C. last week, Ald. A. Butterworth stated that there had been a profit of £1,770 on the electric lighting undertaking, in addition to paying the whole of the interest and £11,900 to the sinking fund. For the first time for three years there was a small increase on the private lighting account.

Dover.—As the result of experiments with an electric cooker, the T.C. has decided to endeavour to engage a *chef* to give a public demonstration. The cost, compared with gas cooking, is stated to be 25 per cent. more in Dover, but there is greater cleanness and convenience, and the less shrinkage of joints with electrical cooking makes the increased cost only about 15 per cent.

The War Department has approached the T.C. for a supply of current for searchlights on the Southern Breakwater, and the Kent Collieries Co. has inquired if the Council is prepared to undertake the supply of current for power at different points. Both these matters are under consideration.

Edinburgh.—The Corporation Electric Lighting Committee recommends a further reduction in price to users of power in the form of discounts according to the amount used. The Committee also recommends a reduction for private lighting from ½d. to 2¾d. per unit.

Folkestone.—An agreement is to be entered into with the Folkestone Electricity Supply Co., Ltd., as to the lighting of the roads on the West Cliff Estate. The company is to supply, maintain, and light the lamps at £3 15s. per lamp per annum when the total does not exceed 20, and £3 10s. per lamp per annum when the total exceeds 20.

Glasgow.—The annual financial statement and accounts of the T.C.'s electricity department have just been issued. It is explained that the gross revenue amounted to £260,526, and the working expenditure to £109,547, leaving £150,979, out of which the Committee has to meet the following statutory requirements—(1) Interest on loans £58,605, and (2) sinking fund £41,141, which left a balance on the year's working of £51,233. £44,552 went in depreciation written off the capital account, and in a contribution to the sinking fund, and the surplus on the year's operations. £6,680 had been transferred to the reserve fund account, which now amounts to £27,468. The revenue has increased on the year by £14,566, while the working expenses, including distribution and management expeuses, only increased by £4,108. This was considered gratifying as 5,826,409 units more were generated than in the previous year. The average cost per unit had been reduced from 1·3309d. to 1·2304d. last year. The valuation of the undertaking for the year now amounts to £100,737, the capital expenditure came to £80,833, and the total capital expenditure as at May 31st, 1911, less depreciation written off stood at £1,889,715. The quantity of electricity sold to private consumers during the year was 39,063,540 units, compared with 34,742,853 units in the previous year, and the number of consumers was 21,166, an increase of 1,677. The total number of motors in use and supplied off the Corporation mains as at May 31st, 1911, was 5,375, with a total h.p. of 36,831, as compared with 4,851, with a total h.p. of 32,918 at May 31st, 1910. The number of units consumed for power purposes was 23,523,863, of which 6,021,982 were sold at 1½d. per unit, 1,326,324 at 1d. per unit, 9,154,415 at ¾d. per unit and 7,021,142 at ½d. per unit. The total number of arc and incandescent lamps erected and in regular use in the streets as at May 31st, 1911, was 861, the same number as in the previous year. The quantity of electricity consumed for street and stair lighting was 1,759,550 units, as compared with 1,736,390 units during the preceding year. The Committee is directing its attention to improving the street lighting, and has already arranged with the Watching and Lighting Department to replace ordinary lamps with 200 flame arc lamps of much higher candle-power. The maximum load made upon the generating stations during the winter was 23,824 kw., an increase of 8·31 per cent. For the year 1909-10 4·15 lb. of coal were used per unit generated, and this year the figure was 3·47 lb., which, on the output of units generated for the year 1910-11, was equivalent to a saving of 14,910 tons of coal.

Gloucester.—The T.C. has altered the scale of charges for energy for motive power to 1½d. per unit for the first 500 units; 1d. per unit for the next 1,000; and ¾d. per unit beyond.

Hendon.—The agreement between the R.D.C. and the North Metropolitan Electric Power Supply Co. for electrically-lighting High Street, Edgware, as amended, has been sealed by the Council. It was pointed out by the Clerk that the company had given an undertaking to install the light in October, and notice had been given to the Harrow Gas Co. to terminate its contract at that period. The U.D.C. has under consideration quotations from the Gas Light and Coke Co., and the Hendon Electric Supply Co., for lighting the hospital with gas and electricity respectively.

Higham Ferrers (Northants).—The T.C. has received an intimation that a prov. order for E.L. is to be applied for by Messrs. F. Thornton and Brook Sampson, of Northampton, and Mr. John Clark, of Rushden. The Higham Ferrers, Rushden and Wellingborough District E.L. Order, 1906, has been revoked by the B. of T.

Hitchin.—The U.D.C. has accepted the offer of the Electric Supply Corporation to equip two sample lamps for street lighting for inspection. The Electric Supply Corporation offers to supply current for street lighting, on a five years' contract, to lamps within 15 yd. from the mains, at 2½d. per unit for lamps extinguished before midnight, and 2d. per unit for all-night lamps.

Hornsey.—At the last meeting of the B.C. it was resolved on the recommendation from the Electric Supply Committee, that an electrical engineer be instructed to advise the Council as to the type of new plant to be adopted for electric lighting, having regard to the existing plant, the circumstances of supply, and the relative advantages of steam engines and Diesel engines.

Keynsham.—The P.C. has decided to accept the tender of the Keynsham E.L. Co. for electric lighting in the streets at £265.

Leigh.—The T.C. is applying to the L.G.B. for sanction to borrow £6,300 for extensions to the electricity works, an inquiry to be held by Mr. T. C. Ekin, M.I.C.E., being fixed for yesterday.

London.—Marylebone.—The whole of the public lamps in the borough have now been converted to electric light. The Electric Supply Committee reports that, subject to notice, the period of the Council's agreement with Mr. Arthur Wright, consulting engineer to the Council, terminates at the end of March next. It has decided (subject to the usual sanction) that notice be given to Mr. Wright accordingly. The Committee points out that the Council will still be open to continue to have the benefit of Mr. Wright's advice in a consultative capacity, if desired.

Poplar.—The electrical engineer reports, in regard to mains extensions during the current year, that three of the feeders from Glengall sub-station are fully loaded. The demand in this area is rapidly increasing, and it is desirable to supplement two of these feeders for next winter's heavy load. The estimated cost is £1,280. There will also be extensions to distribution and Orchard Place extensions, making the total normal extensions for the year £6 635

Monk Bretton (Yorks.).—Recently the Council asked the Yorkshire Electric Power Co. to supply particulars and prices for a supply of electricity for lighting purposes to Monk Bretton. The company stated that 6 miles of cable would have to be laid at a cost of £200 per mile, and there would be 75 lamps to erect, each costing £2 6s.; by taking a supply in bulk for the whole of Monk Bretton, the cost of the installation, allowing £100 for redemption, and the money to be repaid within 30 years, would be no more than £1,576. The company was prepared to erect, supply and maintain the lamps for £2 6s. per lamp per annum, the hours of lighting to be as at present; the Council to enter into an agreement for 15 years, but after seven years the company would be prepared to consider a revision of charges. At a Council meeting it was stated that with 75 lamps the cost of maintenance, &c., at present was £233, and the cost of electrically lighting the township would be £172, which would mean a direct saving of £60 per annum. The Council is to ascertain how it stands with the Gas Co. before accepting the proposals of the Power Co.

Newcastle-under-Lyme. — The T.C. has appointed Messrs. Lacey & Sillar, of London, at an inclusive fee of 50 guineas, to report on the proposed extension of the plant at the electricity works.

Ald. Hyott, presenting the report, said the gas works had not been able to provide so much for the rates during the past year as they had previously, but the electric light department was improving every year. Last year they made a profit of £83, whereas this year they had made a profit of £441.

Oulton Broad.—The U.D.C. has decided, by 7 votes to 6, to accept the offer of the Electricity Co. to sell to the Council the undertaking, with the goodwill and plant as fixed outside the power station, for £1,300, free of incumbrances. This is subject to a loan being secured.

Perth.—At a meeting of the Corporation Electricity Committee, the convener and the manager submitted a graduated scale of charges to be made for the supply of energy, and it was stated an offer had been made to the railway companies which was likely to result in securing them as important users of Corporation electricity.

The Electricity Committee is to equip another boiler with Babcock mechanical stoking plant. The plant already in use is proving highly satisfactory.

Rotherham.—The B. of T. has issued an order under the provisions of the Electric Lighting Acts, 1909, giving the Council power to supply electrical energy in Greesborough.

St. Anne's.—On the recommendation of the Electricity and Lighting Committee, it was resolved to authorise the engineer to convert four arc lamps in St. Anne's Road West to metal-filament lamps, and also to convert the remaining arcs as renewals became necessary.

Sheffield.—The T.C. has been recommended to sanction a further scheme for extensions to the electricity plants and works at a cost of £61,000. The scheme includes boilers and accessories, £16,800; economisers, £2,500: pipework, £3,800; 4,000 to 6,000-KW. turbo-alternator, £20,000; switchboard, £4,600; machine cables, £980; and buildings, £9,275.

Mr. Fedden, the manager, points out that there is an annual increase in load of 2,000 KW., and he anticipates that the new plant now being erected will be fully loaded before long.

South Africa.—The popularity of the metallic-filament lamp progresses in South Africa. Durban street lighting is being improved by the installation of new 400-C.P. metallic lamps in place of the old enclosed arc lamps; for the principal streets flame arcs are proposed, and in the suburbs 32-C.P. Osram metallic lamps are to take the place of the present 10-C.P. carbon lamps.—*British and South African Export Gazette.*

Teignmouth.—At a meeting of the U.D.C., Messrs. J. W. Purves (Exeter) wrote notifying the Council of their intention to apply to the B. of T. for a prov. order to enable them to supply electricity within the district of Teignmouth; the Gas Committee recommended that the Council should oppose the application.

Torquay.—A L.G.B. inquiry was held on July 4th into the application of the T.C. for a loan of £5,000 for additional plant for the electricity works. The new plant will include a turbine with a 350-KW. alternator, and a 350-KW. tramway generator, and, it is estimated, will effect a saving of about £380 per annum. There was no opposition.

Turton (near Bolton).—The B. of T. has consented to the construction of overhead transmissions from the transforming station to Bradshaw Road, and along Bradshaw Road from Bradshaw Works to the Red Lion Inn at Walves.

Application is to be made to the L.G.B. for sanction to borrow £4,500 for the purposes of the electricity undertaking.

Weaverham.—We are informed that the Weaverham and District E.L. Co., Ltd., has been formed with a capital of £5,000; Mr. A. J. Leigh is consulting engineer, and Messrs. Douglas, Callow & Co., of Liverpool, have obtained the contract for the power station, 4½ miles of overhead mains, the public lighting, and wiring of houses in the district.

West Ham.—The annual report of the electrical engineer, Mr. H. H. Conzens, states that the units sold during the year ended March 31st numbered 22,690,000, as against 19,156,000 in the preceding 12 months. This showed an increase of 18·4 per cent., the increase being for private lighting, 15·6 per cent., power and heating, 24·2 per cent., traction, 7·6 per cent., public lighting, 5·4 per cent. The revenue was £93,235 as against £79,262 12 months before. The total revenue showed a slightly lower rate of increase than the output due to the higher increase in the proportion of the power units. The increased sale for private lighting constitutes a record, and is particularly gratifying in view of the great reduction due to metallic-filament lamps, showing as it does that the use of electric lighting is increasing more rapidly even than appears on the face of the figures. The total cost per unit sold decreased from 0·93d. to 0·88d. This decrease took place although there was a slight increase in the cost of coal, due to several causes. There was a great improvement in the results of the sales department, which would have been even better had it not been for the heavy burden imposed by the capital charges. Eliminating the charges referred to, there is a profit for the year of over £1,000 after charging the whole cost of business getting (excluding only certain publicity charges, which apply to the main undertaking) as well as rents, rates and establishment charges. The arc lamp hiring scheme shows a great improvement, and may now be regarded as on a sound basis. The motor-hiring scheme, due to the increased capital charges, shows a small loss. The period allowed for the repayment of capital is very short. The gross profit on the undertaking amounts to £38,000, while the surplus on the year's working is about £4,000. This is to be transferred to the special writing-down of the battery rectifiers and 300-KW. set at the generating station. Altogether, Mr. Conzens estimates that the improvement over the previous year's working was about £8,223.

Whitby.—The U.D.C. has applied to the B. of T. for permission to use overhead wires for the transmission of energy at a pressure of 460 volts to Ruswarp, Cross Butts, and other outlying portions of the district.

Wimbledon.—Negotiations are proceeding between the borough electrical engineer and the surveyor to the trustees for the debenture-holders of the Polytechnic Estate, Ltd., as to the terms upon which the trustees would sell to the Corporation a site for an electric transformer sub-station in Quintin Avenue, Merton, and the electric supply cables laid on the estate.

Wolverhampton.—There was a gross profit on the electricity undertaking for the 12 months ended March 31st last of £20,637, as against £20,059 in the previous year. The net balance was £5,230, as against £5,297 last year. The percentage of profit to average capital showed a slight falling-off, principally attributable to the fact that the new 2,000-KW. generating set, which should have been completed and ready for operation in October last, is not yet ready. During the winter months the whole plant had to be run heavily over-loaded and on uneconomical conditions, and there was an abnormal expenditure under the heading of repairs and maintenance. The expenditure on fuel also was considerably higher than would have been the case had it been possible to run the station with a reasonable margin of spare plant. During about nine months the undertaking was without the service of two 500-KW. converters, both of these having been lent to Messrs. Bayliss, Jones & Bayliss pending the rebuilding of their own power station. Another cause which had an adverse effect on the net profit was the concession made to the tramways undertaking in reducing the price of energy. The reduction under this head came to £800. There was a remarkable increase in the sales of energy for lighting purposes (£14,816, as against £13,460 in the previous year). The receipts for power were £22,070, as against £17,160, but a portion of this increase is accounted for by the fact that during nine months the Corporation was supplying the whole requirements of Messrs. Bayliss, Jones & Bayliss.

The borough electrical engineer (Mr. C. E. C. Shawfield) has submitted to the Committee a lengthy report, suggesting the expenditure of an additional £19,700 on the works in order to deal with the present and future requirements of the generating station and with a view to providing accommodation in the way of workshop and store-room facilities, which are urgently necessary for the satisfactory and economical working of the station.

The scheme contemplated includes new buildings, £4,900 electrical machinery and switchgear, £3,000; overhead travelling crane and steel work for sub-station, £540; workshop equipment £400; fittings, &c., £700; and storage battery, £10,000.

The T.C. on Monday adopted the recommendation of the Electricity Committee.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The T.C. has approved of a report by the Tramways Committee resolving, by way of experiment, to grant free passes to blind people over the whole tramway system for 12 months, the Corporation to be under no responsibility for injury or damage to the blind or their property while entering or leaving or travelling in the cars.

Chile.—A decree has been granted to Senores Juan Bersano and Natalio Farinelli, for a 10 years' concession for the construction and working of an electric tramway in Valdivia. Work must be commenced within six months and completed within one year from the date on which permission has been given to the concessionaires to occupy the necessary territory.—*Board of Trade Journal.*

Bradford.—The new railless trolley system of cars recently inaugurated in Leeds and Bradford is giving satisfaction in both cities. In Bradford there are indications that considerable patronage is being missed through the service being, as yet, too limited, and it has been decided to, as soon as possible, add to the number of cars on the Sticker Lane route. The tramways manager has also received authority to make inquiries into the prospects of paying lines being instituted between Laisterdyke and Bolton Road, Bankfoot and Dudley Hill, Forster Square and Bolton Woods, and Odsal and Oakenshaw.

The Corporation has been asked to extend the electric tramways from the Allerton terminus to Wilsden, and the city engineer has been instructed to prepare plans and estimated costs for the guidance of the Tramways Committee, which is considering the matter.

It has been decided that the price of electric current supplied for tramway purposes for the present financial year should be 1d. per unit.

Dewsbury.—According to the tone of the speeches at a meeting of the T.C. last week, it was evident that the members are not at all pleased with the attitude of the Yorkshire (West Riding) Electric Tramways, Ltd., towards the suggested tramway to Dewsbury Moor. Some quite strong things were said at the meeting when it was discovered, on the reading of a letter, that the company were not a charitable society working "for the public good," but simply "looked upon the scheme from one motive only—that of commercial enterprise."

Douglas (I. of M.).—A tramway strike occurred during the week in connection with the Bay tramways; the men have now returned to work.

Dundee.—The T.C. has adopted the Tramway Committee's recommendation to erect telephones in the tramway waiting rooms, the members being convinced that the installation would be of considerable advantage, not only to the people in the vicinity, but also to the tramway department in the event of a breakdown after the public call offices were closed.

Dunfermline.—The Tramway Committee of the T.C. at its meeting last week, considered what action should be taken with regard to the contemplated application by Dunfermline and District Tramway Co. for an extension of the period of provisional order. Power was given to the Committee to negotiate with the company on the understanding that no agreement would be entered into unless they were absolutely unanimous. The Committee is hopelessly divided, however, the vote resulting in an equality of three, and the decision as to whether the order be opposed or not will now fall to be made by the T.C.

Fleetwood.—The purpose of a ratepayers' public meeting on July 6th was unique in local government. Its object was "To ascertain the views of the ratepayers regarding a proposed payment by the Fleetwood Urban District Council, to the Thornton Urban District Council of a further contribution toward the costs incurred by the latter Council in carrying to the House of Lords the appeal in regard to the assessment of the Blackpool and Fleetwood Tramroad." The purpose of the meetiug was to enable Fleetwood Council to apply to the Court of Chancery to secure the dissolution of an injunction given three years ago by which the Council was prevented from making a money contribution towards the legal expenses of Thornton Council in carrying forward, to a final decision, the appeal of the Blackpool and Fleetwood Tramroad Co. to be rated the same as a railway, namely, at one-fourth. After appeals to the Local Government Board and other authorities, the Attorney-General was recently consulted, and his decision was that the consent of the ratepayers of Fleetwood must be obtained to the application for the dissolution of the order, Mr. Drummond consenting to this course.

The chairman said the total costs of the action were £1,123, which would be shared by the following districts:—Thornton, £167; Fleetwood, £515; and Bispham, £541. The chairman said it was true they lost the appeal, but they had a good fighting case.

Mr. E. Lowther said it was an illegal meeting, for no proper notice had been given of it. He objected to the payment of this money. Before entering into this legal action the Council should have taken the ratepayers into their confidence.

A vote of the meeting was taken, and it was announced that 36 had voted for the payment of the money, and only two against. Mr. Lowther thereupon demanded a poll of the ratepayers.

Glasgow.—Great dissatisfaction is being expressed by the motormen and conductors in the employment of the T.C. at that body not acceding to their demand for a 48 hours' work, and 14 days' holiday with pay per annum, and at a mass meeting by the men a resolution was passed affirming that the "least that will be acceptable to the men is a 51 hours' week, seven days' holiday per annum, and that the proposed advance of 1s. per week include all men who are entitled to holidays; and, failing a satisfactory answer within 14 days, the district secretary proceed to prepare ballot papers with a view to taking a ballot of the men to ascertain whether or not they are in favour of ceasing work." The Tramway Committee, on a vote, decided to leave the matter in abeyance, but, at the T.C. meeting, Bailie Alston proposed that the whole matter be remitted back for further consideration, arguing that there could be nothing more undignified than a great Corporation at loggerheads with its employés, and by its attitude practically inviting a strike. Councillor Murray, on the other hand, pointed out that instead of municipal undertakings being run by the electors' representatives, they were faced with the prospect of seeing them controlled by such organisations as the Municipal Employés' Association, to which the tramway men were attached.

Morley.—The new tramway between Churwell and Morley, linking up the latter town with the Leeds system, was opened on July 4th, the first car being driven by the Mayor. The scheme cost about £35,000, and consists of a single line with turnouts, in connection with which signalling apparatus is to be installed. The line has been constructed under the supervision of Mr. J. B. Hamilton, general manager of the Leeds Corporation tramways, which concern will operate it.

Sheffield.—The T.C. is recommended to obtain Parliamentary powers for railless traction in the suburbs of the city.

Wakefield.—The Wakefield and District Light Railway is to transfer its undertaking to the Yorkshire W.D. Tramways Co. It is understood that the latter concern holds the greater part of shares in the Wakefield company, so the transference is only a formal one.

Scarborough.—At a meeting of the Streets and Buildings Committee, the estimate of the borough engineer (Mr. W. H. Smith) for taking up the tramway rails and reinstating the streets was approved, and the engineer was instructed to forward the estimate to the Trackless Tramways Co., which is negotiating with the tramways company as to taking over the tramway service. The sum is stated to be about £6,000.

South Africa.—The Pretoria municipal authorities are considering extensions to the tramways at a cost of £12,500.—*British and South African Export Gazette.*

Wallasey.—The Corporation has issued invitations to the Tramways and the Road and Improvements Committee of the Birkenhead Corporation, to a conference on the improvement of means of communication between the two boroughs, including the question of linking up the two places by an electric tramway system.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephony.—Successful experiments have been carried out by the Post Office engineering staff in speaking between Aberdeen and Edinburgh and Paris over the new loaded cable; the greatest distance covered was 910 miles, and conversation was easily carried on, the engineers being thoroughly satisfied with the result. It is understood that, on the completion of the tests, the important centres where satisfactory communication has been effected will be provided with facilities for the public use of the telephone to Paris.

Automatic Telephony.—It is stated that the Austrian Siemens & Halske Co., of Vienna, has received an order from the Austrian Government for the establishment of a semi-automatic telephone exchange in the Zollergasse, Vienna, this being the first step towards the introduction of automatic telephones into that country. Orders have also been placed with the firms of Czeija, Nisse & Co. and the Berliner Telephonfabrik, of Vienna.

An automatic exchange is to be installed by the Post Office at Epsom, as an experiment, in addition to the one in the General Post Office. Provision will be made for 500 lines.

Glasgow.—Correspondence has been in progress for some time between the town clerk of Glasgow and the Postmaster-General, in connection with the latter's remarks to a recent deputation from local authorities as to the financing of the Glasgow T.C. telephone undertaking, the wages paid to operators and the charge to subscribers. In his latest communication the Postmaster-General deals with the questions of the depreciation funds and the Corporation telephone system, the charging of terminal fees, the deficiency which had to be made good from Corporation funds after the sale of the telephone undertaking, the question of operators' wages, and the allegation of unjust competition in the matter of rates permitted to the National Co. by the Post Office. In a concluding sentence the letter states:—"On a revision of the whole of the circumstances the Postmaster-General sees no reason to modify his view that experience has shown that the grant of a flat rate of £5 5s. for unlimited service by the Corporation of Glasgow is an example which cannot be followed if the national telephone service is to pay its way on a commercial basis." In his reply, the town clerk contends that the observations of the Postmaster-General do not prove that the telephone system of the Corporation was brought to an end by any insufficiency in the tariffs, for financial reasons or through any technical inferiority.

Hong Kong.—Business firms in the Colony, says the *Indian and Eastern Engineer*, are impatient for the erection of a powerful wireless station, which they say is an absolute necessity.

Imperial News Service.—At a meeting of the Empire Press Union recently, the improvement of communication between Great Britain and the Dominions was discussed, and the high cable charges evoked strong comments. It was resolved to endeavour to obtain a reduction of the Press rates by the Pacific Cable from 9d.

to 6d. per word, and by the Eastern Companies to India, South Africa and Australasia in a corresponding degree. It was agreed also that a reduced rate for deferred Press messages to India and the Far East was desirable.

Porterage on Telegrams.—The Postmaster-General has decided that the charges for additional porterage for the delivery of telegrams from a more distant office, when the usual delivery office is closed for a weekly half-holiday, shall cease forthwith.

Steering by Wireless.—A demonstration is reported to have been given on the Wannsee, Berlin, of the capabilities of a boat devised by Christian Wirth, of Nuremberg, which is steerable by means of wireless transmission. After the boat had been towed out far into the lake, and it had been ascertained that no one remained on board, the inventor manœuvred the boat by means of transmitting apparatus arranged on a terrace on the shore of the lake, where many spectators were present, including representatives of the army and navy.

Wireless Patents.—It is reported that proceedings for infringement of patent rights have been instituted by Marconi's Wireless Telegraph Co., Ltd., against the Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd., and by the latter against the Marconi International Marine Communication Co., Ltd.

Wireless Telegraphy.—The Post Office department has issued a circular drawing attention to the facilities provided by the department for the transmission of private "radiotelegrams" through Post Offices to ships at sea, and to the scale of charges.

The German Government has under consideration the question how far the compulsory introduction of wireless telegraph installations is desirable in the interest of the navigation of merchant vessels, and especially for the safety of the passengers and crews. A conference on the subject took place recently in Berlin in the presence of representatives of the Government and of the shipping interests, the idea in the first place being an amplification of the regulations for the prevention of accidents to the sea-faring profession.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 15th. 80,000 insulators, and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" June 30th.

Adelaide.—August 30th. Deputy P.M.G. 6,400 porcelain insulators, 6,500 copper bindings, 1,000 jointing sleeves, 6,500 copper tapes, and 38½ tons of h.d. copper wire. Specifications, &c., High Commissioners' Office in London.

South Australia.—August 9th. (*a*) Letter-box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" to-day.

New South Wales.—August 9th. P.M.G. Letter-box fronts. See "Official Notices" July 7th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 16th.—Cable, conduits, cast-iron pipes, iron poles, insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" July 7th.

Tasmania.—July 31st. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

Victoria.—August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" July 7th.

Bacup.—Tenders are to be invited for the electric wiring and fitting of premises in Henrietta Street belonging to the General Works Committee of the Corporation.

Belfast.—July 17th. Circulating water and motor-driven air pumps, for the Corporation Tramways and Electricity Committee. See "Official Notices" June 30th.

Belgium.—October 8th. The municipal authorities of Mons are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town. The full specification can be obtained for one franc, and tenders are to be sent to Le Collège des Bourgmestres et Echevins de la Ville de Mons, Hotel de Ville, Mons.

Bradford.—July 25th. Two water-tube boilers, stokers and superheaters, and one 12-ton electrically-operated overhead travelling crane, for the Corporation. See "Official Notices" to-day.

Dundalk.—July 24th. Buildings, plant and materials for the electric lighting of the Urban District for the U.D.C. See "Official Notices" July 7th.

France.—July 18th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of four lots of rubber-insulated electric cable.

Ilford.—July 15th. Wiring and fittings for the electric lighting of Cleveland Road School, for the Education Committee. See "Official Notices" July 30th.

London.—Poplar.—July 15th. Overhead coal bunker, coal conveyor, and extension and modification of existing conveyor, at the B.C. electricity works. See "Official Notices" July 7th.

L.C.C.—July 19th. Electrical installation at the Hamond Square elementary school. See "Official Notices" July 7th.

The Fire Brigade Committee recommends that tenders be invited from selected firms for the supply of one electrically-driven motor turn-table long ladder for use in the fire brigade.

The Committee is recommending also that fresh tenders be invited for the electric wiring and fitting of Kennington fire station; Messrs. W. Leonard & Co., whose tender was accepted on May 31st, withdrew on June 13th, saying that "owing to unforeseen circumstances they were unable to undertake the work." The Committee recommends that the firm's name be put upon the list of firms from whom the Council will not receive tenders.

Hammersmith.—The Electricity Committee is inviting tenders for Welsh steam coal for 12 months. With regard to the coal supply for the mechanical stokers in course of erection, the Committee is to make a series of experiments upon different classes of fuel, and report.

Pontypridd.—July 18th. Additional unit at the Treforest refuse destructor, for the U.D.C. See "Official Notices" July 7th.

Russia.—October 14th. The municipal authorities of Sysran are inviting tenders for the concession for the electric lighting of the town, and also for the construction and working of an electric tramway.

Salford.—July 17th. One water-tube boiler with superheater, for the Corporation Electricity Department. See "Official Notices" June 30th.

Spain.—Tenders have lately been invited by the municipal authorities of Gallego de Arganan (Province of Salamanca) for the concession for the electric lighting of the town.

July 20th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the establishment and working of a telephone exchange in the town of Villfranca de la Panaste (Province of Barcelona).

July 21st. The municipal authorities of Sallent (Province of Barcelona) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Swinton and Pendlebury.—The Secretary to the Education Committee has been instructed to advertise for tenders for lighting the new Council school by electricity.

Walthamstow.—July 21st. Feeder cables and stoneware conduits for the U.D.C. See "Official Notices" July 7th.

Wolverhampton.—Buildings and plant for a 1,000-kw., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" to-day.

York.—July 17th. 2,000 yd. high-pressure three-phase underground cable for the City Electricity Department. See "Official Notices" July 7th.

July 17th.—Battery room at the electric light station, for the T.C.; F. W. Spurr, city engineer (returnable deposit of £1 1s.).

CLOSED.

Ashton-under-Lyne.—The Corporation has placed a repeat order for "Triumph" stokers, for the electricity works, with the Triumph Stoker, Ltd., of Leeds.

Australia.—According to the *Australian Mining Standard* the following contracts have been placed:—

Sydney City Council.—Australian General Electric Co.—Three transformers 3,200 kw., £665.
British General Electric Co., Ltd.—Circuit breakers, £602.
Union Electric Co.—Lighting at Glebe.—Arc lamps (40), 8-ampere a.c. single carbon "Excello," £256.
Noyes Bros.—Contact and suspension gears, for lighting at Glebe, 50 of type D, made by the London Electric Co., £115.

New South Wales.—P.M.G.'s Department:—
Western Electric Co. (Australia), Ltd., Sydney.—Two miles cable, telephone, switchboard, silk and cotton-insulated, and light lead-covered, at £201 per mile.
Gibbs, Bright & Co., Sydney.—Paper-insulated, lead-covered cable, 12½ lb. conductors, to Specification 369.

Bath.—The E.L. Committee has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for one 300-k.v.a. motor alternator, at £1,140.

Belgium.—Ten concerns, one Belgian and nine German, submitted tenders last week to the municipal authorities of Jumet (Hainaut) for the supply and laying of the armoured cables required in connection with the extension of the electric lighting undertaking. The lowest offer was that of the Société des Ateliers de Constructions Electriques de Charleroi.

(*Continued on page* 65.)

A SUSPENDED RAILWAY TO THE AIGUILLE DU MIDI.

By Dr. ALFRED GRADENWITZ.

A suspended railway, mainly based on the same principle as the cableways which have long been used for the transport of coal, ore, &c., is been installed between Chamonix, at the foot of the Mont Blanc range, and the Aiguille du Midi, and will be inaugurated in the course of the present year. Apart from being more independent of the configuration of the ground, which allows of their installation in otherwise impracticable country, these aerial railways are incomparably cheaper in first cost than the ordinary rack railway.

In its original form the scheme provided in the lower section—as far as the Bossons Glacier—for a stationary rack railway. This project was, however, discarded, two suspended cableway sections on the Ceretti and Tanfani-Strub system being installed from Chamonix (at 1,000 m. altitude) as far as La Para and thence to the Bossons Glacier at 2,500 m. above the level of the sea. The first section, of 1,870 m. horizontal distance, reaches a vertical height of 750 m., while the second section climbs to the same height over a horizontal distance, of 1,190 m. The mean gradients thus are 40 and 63 per cent. respectively. The track of the cableway follows as closely as possible the configuration of the country, the driving and supporting cables being carried by substantial iron trestles placed at 40-90 m. apart (with the exception of two spans of 200 m. each). The third and fourth sections of the suspended cableway lead as far as the Col du Midi (3,500 m.), and the fifth and last section to the terminal station, the summit of the Aiguille du Midi (at 3,850 m. above the level of the sea). In the last section, owing to the increasing gradient, higher cable tensions had to be used.

This suspended railway is constructed with three cables, viz., the supporting cable serving as runway for the truck carrying the car, the endless driving cable, 12 mm. diameter, situated underneath, and a braking cable of the same size. The last two cables pass at the lower station over two vertical guiding pulleys, and thence over return pulleys : at the upper station where the driving gear of the section is installed, they are carried over the driving and return pulleys. All the cables and accessories have been calculated for a tenfold factor of safety.

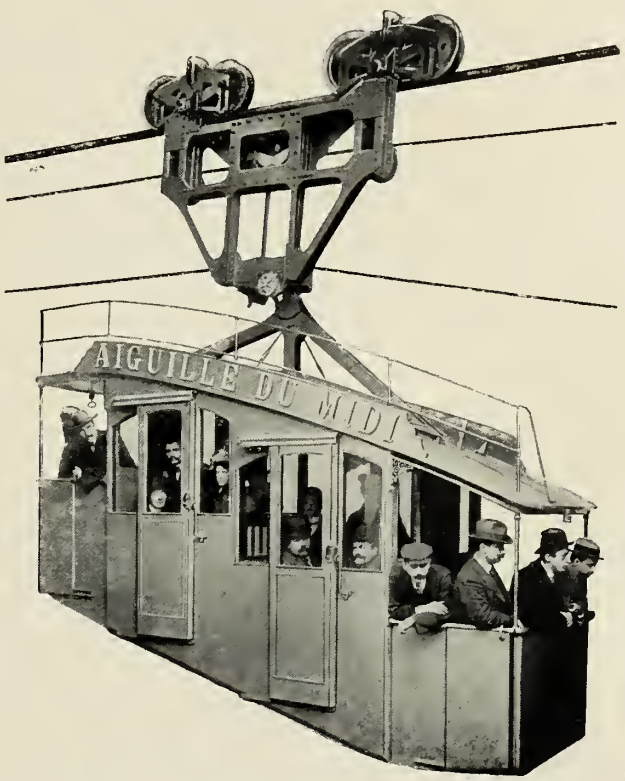
The cars (provisionally two in each section for simultaneous uphill and downhill travel) readily accommodate



Alpine Suspended Railway to the Aiguille du Midi.

20-24 passengers (with 18 seats) ; their weight with full load is 4 tons. They consist of the car body and the truck from which the former is suspended. The two trucks each have two driving wheels. In case of rupture of the driving cable, the braking cable, owing to the weight of the car, operates automatically, being pressed immediately against the car. The brake can also be actuated by the driver of the car.

Apart from this brake, there are provided at the driving station, self-acting brakes for stopping the driving cable and



View of Car and Suspension Gear, Aiguille du Midi Suspended Railway.

the car ; and the first intermediary shaft behind the motor carries the pulleys of a hand brake. The automatic brake comes into action in the following cases :—(*a*) If the car at the end of its journey passes beyond a given position ; (*b*) if the speed of travelling exceeds a given limit ; (*c*) in case of interruption of the electric current ; and (*d*) voluntarily as a hand brake.

By actuating the brake, the supply of electricity is interrupted automatically. A gauge placed within reach of the driver keeps the latter informed at any moment as to the actual position of the car.

The electric motors for driving the cableway drive direct on to a horizontal shaft with speed-reducing gear, from which power is transmitted by a second pair of gear wheels to a second intermediary shaft and by bevel wheels to the main shaft carrying the driving pulleys.

All signals relating to the service of the cableway are given by electric bells ; a comprehensive telephone system connects the stations among themselves and with the car.

Immediately below the summit there will be erected, at 3,800-m. altitude, on the rocks of the mountain a fine hotel, surmounted by the summit proper as though by a belvedere 50 m. in height. A small lift will thence be installed downward to the Vallée Blanche, with its level glaciers and snowfields (at 3,564 m. altitude), which has so far been absolutely impracticable in winter, and accessible in summer only by 8 hours' dangerous climbing.

ELECTRICAL POWER DISTRIBUTION ON THE NORTH-EAST COAST.

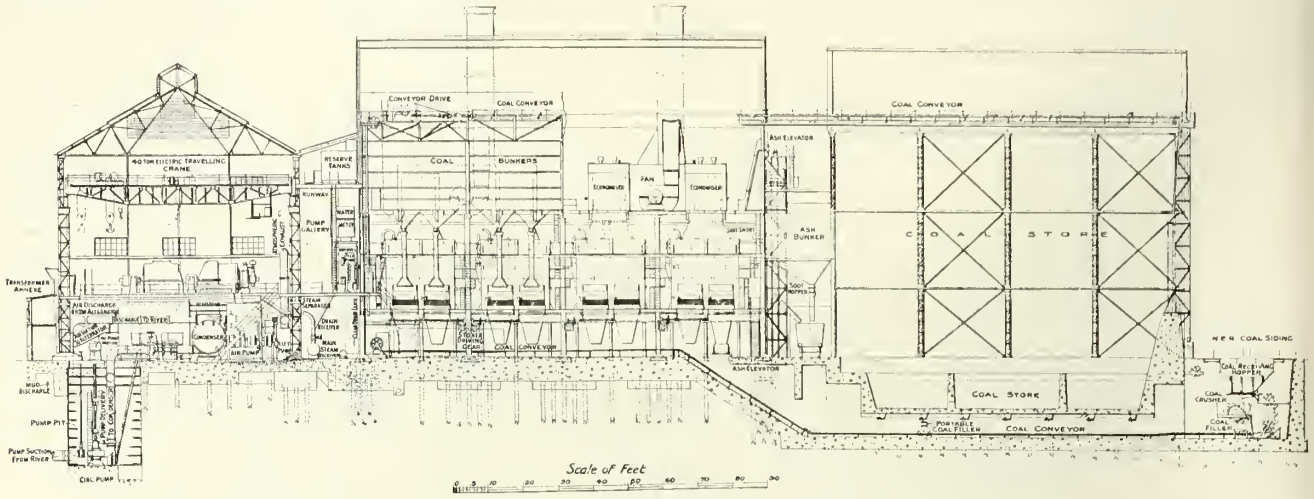
The New Generating Station at Dunston-on-Tyne.

(*Concluded from page 22.*)

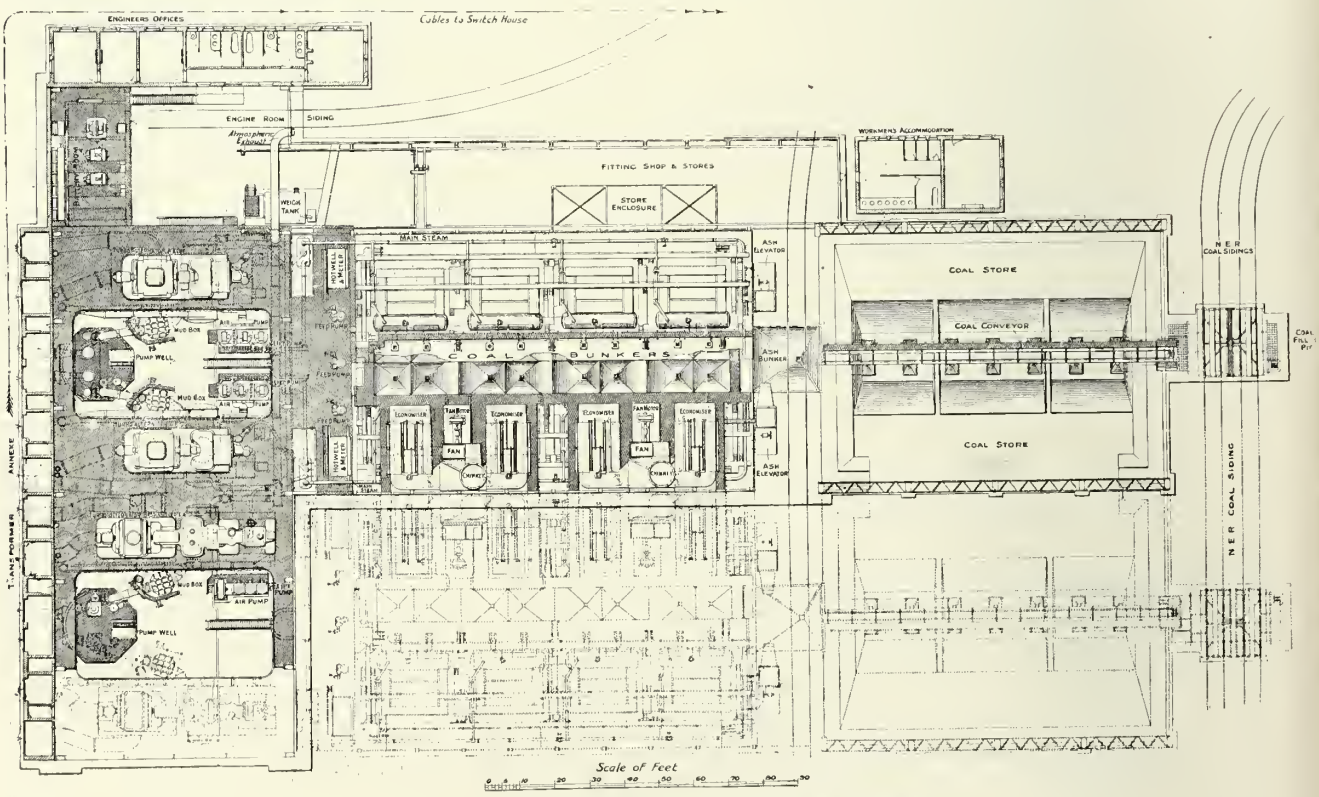
The existing turbine room, which has been built to accommodate four turbines, has a railway siding running into it under the overhead crane, which is capable of dealing with loads up to 40 tons. Adjacent to the siding is a large space situated at ground-floor level, which can be used for the accommodation of the different parts of a turbo-alternator during repairs or overhaul. This space also communicates by means of a smaller overhead crane with the fitting and repair shop, which is erected parallel to the first boiler house. Adjacent to these shops are offices, mess room, and lavatories for the mechanical engineers in charge of the station, and the engine-room staff. What has been aimed at in the design of the engine room itself is to have as compact an arrangement of machines as possible, so as to facilitate their operation, but at the same time to have everything, including all the auxiliary machinery, accessible to the overhead crane. This even applies to the circulating water sumps, of which there will eventually be three, one for every two units. These circulating water sumps are situated in the engine room, midway between each pair of turbines, and go down to a depth some 30 ft. below the engine-room floor level. In each circulating water sump there are two main centrifugal pumps, one for each generating unit, and situated at such a depth that they are drowned at all states of the tide.

The pumps have vertical spindles, and are driven by electric motors installed on the engine-room floor level. The suction of each circulating pump communicates by a 24-in. cast-iron pipe direct with the intake sumps at the river. The intake sumps are provided with suitable gratings, to prevent the introduction of foreign matter into the circulating system and in order to avoid blocking the condenser tubes, and additional self-cleaning screens are provided for each condenser. One salt-water pump is also installed in each sump for supplying water for general cleaning purposes.

Contrary to Continental practice, which, in general, adopts a basement design of engine room with tile or brick floors round the turbines, at Dunston the necessary access to the turbines themselves is secured by means of open-work cast-iron floor plates and galleries. The whole appearance of



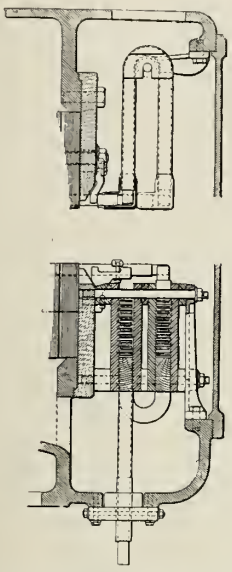
Vertical Section of Engine-room and Boiler-house.



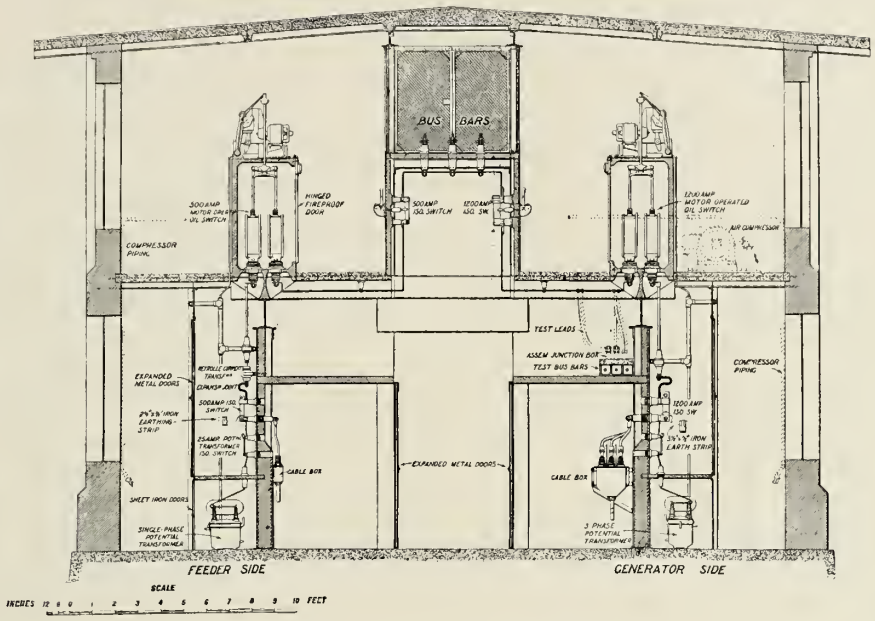
Plan of Generating Station, Dunston-on-Tyne.

the engine room, lighted as it is by both roof lights and large windows running the whole length of the north side, is light in the extreme. Behind the turbines on the same level, and between them and the boiler house, are the feed pumps, hot-

The alternators are designed to stand the severest short-circuits which are likely to come upon them in practice. The exciters are arranged on the ends of the alternator shafts. Special mention may be made of the ventilation, for



Details of End-connections of A.E.G. Alternator.



Section through Switch-house.

wells, water meters, &c., these being arranged to be operated by the turbine drivers. Beneath this pump gallery are various smaller pumps, &c., and on the same basement level are the condensers and electrically driven air-pumps. The

alternators running at the high speed necessary for direct coupling to the turbines are so comparatively small for their output that special means have to be taken to ventilate them. The arrangement adopted in many stations has been to



Feeder operating switchboard.

Interior of Control Room.

Generator operating switchboard.

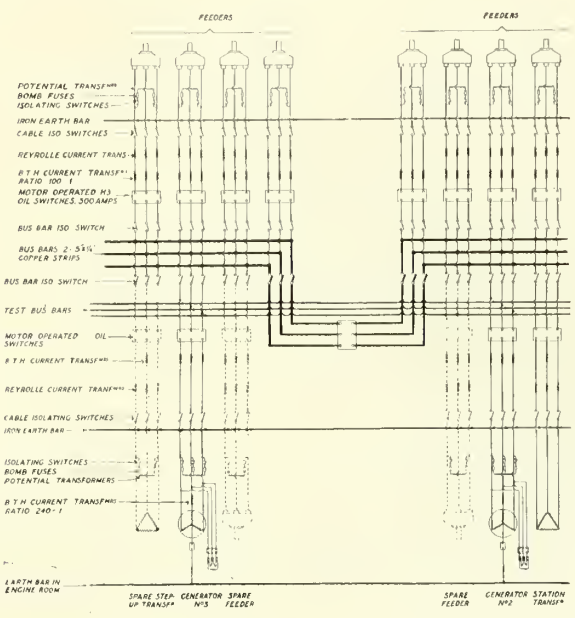
feed pump exhausts can be taken either to the hot-well tanks or to the water softener, or direct to atmosphere.

Two of the turbo sets at present installed are of the Allgemeine Elektricitäts Gesellschaft's impulse type, and one is of the two-cylinder Brown-Boveri-Parsons type.

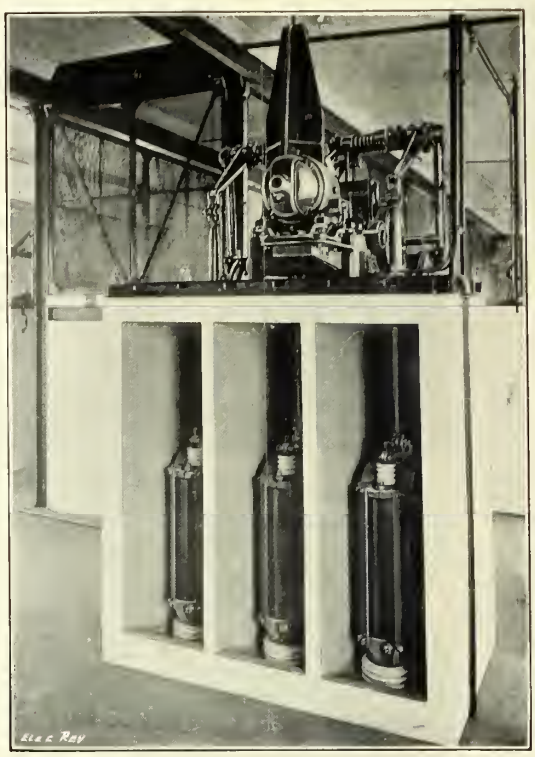
install fans specially drawing in the air from outside the building, so as to ensure at all times a supply of cold air. This is the arrangement at Carville. At Dunston, however, the fans are on the alternator-rotors themselves, but the air is drawn in through special filters, there being a separate duct and

filter for each alternator. Further, at Dunston, the outlet air ducts from the alternator are so arranged that the hot air can be discharged either directly outside the building or into the engine room, thus making it possible to control the temperature of the engine room at will.

Three-phase current is used at 440 volts throughout the station for motive power; the motor-driven auxiliaries belonging to each unit are normally fed from a separate 500-KW. "unit" step-down transformer installed in a fire-proof compartment opposite each alternator. The primary of the transformer is directly connected, through switches, to the main terminals of its own alternator, so that the auxiliaries are supplied even if the main alternator switch be off. In addition to these separate three-phase circuits, for each unit, there is a common L.P. three-phase system fed from the main H.P. bus-bars in the switch house through two 500-KW. three-phase step-down transformers, which supply a set of L.P. bus-bars placed in an enclosed gallery in the engine room. A supply can be given for starting up from these bus-bars to the auxiliaries belonging to each unit; normally these bus-bars only supply the motor-generators, rotary converter and isolated motors, such as crane motors, throughout the works. The fields of the exciters can be separately excited. Two 50-KW. motor-generators provide a supply of direct current at 100 volts for lighting the station and charging the station battery, which is kept in circuit to ensure an absolutely independent supply of lighting. A smaller motor-generator is also used for charging two control batteries used for operating the H.P. switchgear. There are three batteries in all, the larger for lighting, giving 1,000 amperes for one hour, and the two smaller ones 100 amperes each. A 250-KW. rotary converter supplies the power for the electric locomotives.

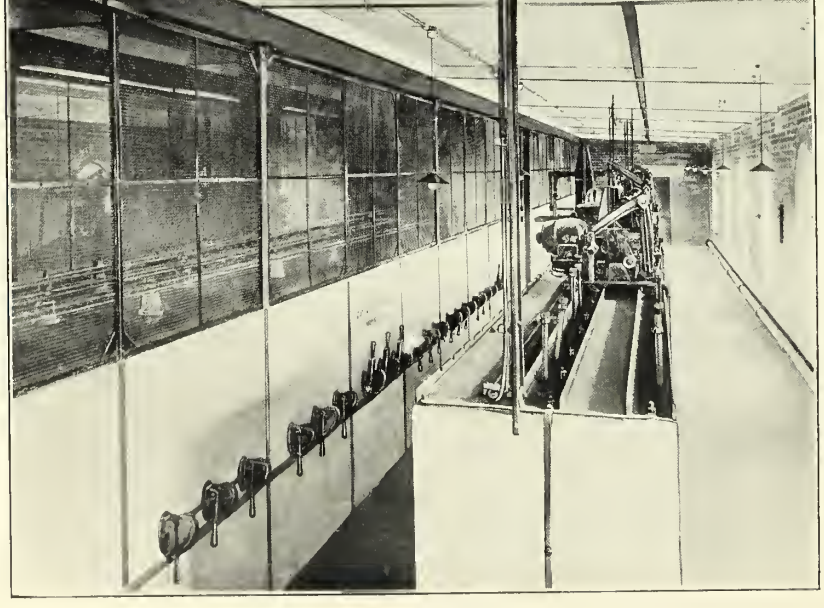


Connections of Some of the Generators, Feeders, &c., and Bus-bars.



B.T.-H. 30,000-KW. Bus-bar Sectionising Switch.

The switchgear arrangements at Dunston are, perhaps, the most interesting part of the station, showing, as they do, a distinct advance upon previous practice. Instead of the usual elaborate switchboard, which forms a striking feature of most power-house engine rooms, as at Carville, for example, the Dunston engine room contains practically no H.P. switchgear or electrical instruments at all. With the exception of certain unobtrusive H.P. panels of "ironclad" type controlling the "unit" transformers which supply the auxiliaries belonging to each generating unit, and an indicating wall ammeter for each generator, the H.T. gear and instruments are installed in a separate switch-house 150 yards away from the engine room, where are placed both the main switches themselves and the operator and board controlling them.



E Extra-high-pressure Switches and Bus-bars.

There is, however, in the engine room near each generator a set of emergency gear for tripping the main H.T. generator switches in the switch house, with which is interlocked a field switch. Apart from these and the direct-current gear for motor-generators, there are practically no electrical connections for cables visible at all, proper ducts, &c., for the whole of the main cable wiring having been provided for in advance and so hidden. The switchgear may be conveniently separated under the following heads:—

The Control Boards in the control room for operating the H.P. switchgear in the switch house and engine room.

Main H.P. Switchgear.—In the switch house controlling

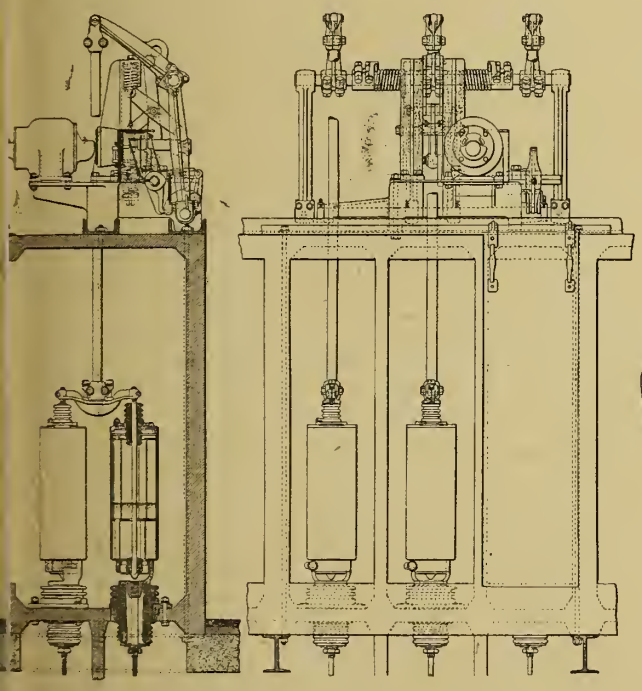
ıe generators, feeders, main bus-bars, and the station power ad lighting transformers.

H.P. Switchgear.—In the engine room for controlling the unit" transformers there.

The low-pressure three-phase gear in the engine room con- olling the auxiliaries, and D.C. switch gear for exciting, ghting and battery charging and locomotive driving.

The switch-house is a building with a concrete roof, 135 ft. ng × 33 ft. broad × 32 ft. high. It has two floors, and divided into two divisions. The front of the building ntains on the ground floor the offices, lavatories, &c., r the control-room engineer, the control room itself, con- ining the operating boards, being on the first floor in this rt of the building. The back part of the building, shut off iron doors, is devoted to the switch-gear, the main oil-break itches and bus-bars being on the upper floor, and the isolating itches, current and potential transformers, &c., in e brickwork cells on the lower floor. The bare H.P. con- ctions between main switches and bus-bars, &c., are on ıe underside of the roof of the lower room, in full view and cessible from the lower room with ladders, but absolutely t of reach of accidental contact.

The control room is a well-lighted apartment, 40 ft. × ft., with part glass roof. It is mainly occupied by the



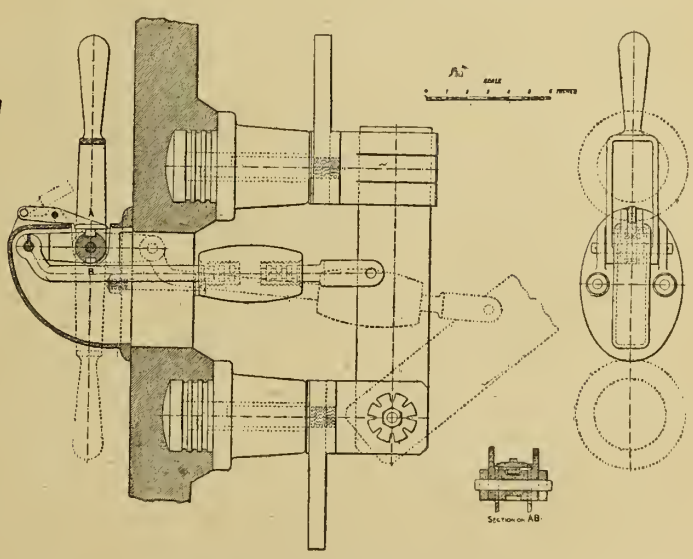
AILS OF BRITISH THOMSON-HOUSTON E.H.P. OIL-BREAK SWITCH.

e i-circular operating switchboard (for feeders) and the ller board for generators. The operating board of k slate is divided into sections, the generator and trans- ner panels and bus-bar switches being placed separately n those controlling the feeders. With a view to sim- lity and facility for extensions, the various operating els are arranged so that it may be possible at any time to nge the particular feeder controlled by any individual ating panel. The control gear is operated by means of ct current at a pressure of 100 volts from two small eries specially used for this purpose.

Each generator panel has a main ammeter and voltmeter, er-factor indicator, indicating wattmeter, field ammeter, grating wattmeter, &c. It has also a switch for con- ling the governor of the turbine and a rheostat hand- el in front, as well as a telegraph to each generator. At a end of the generator board is a synchronising panel ı rotary synchronoscope. Each feeder panel on the er control board has a separate set of instruments and t of synchronising and voltmeter plugs for synchronising machines at Dunston with any other generating station. feeders are protected with Merz-Price balanced protec- gear. Both the feeder and the generator panels have chop- control switches arranged to make or break the main break switch immediately contact is made. The position of the main oil-break switch is indicated by the lighting of a red or blue lamp, and the operation last performed is automatically indicated by the position of a small coloured pin on the switch handle.

The switch room itself has two storeys ; access is obtained to the upper storey through an iron door leading from the control room, and to the lower storey from the passage under the control room. The bus-bars and main oil-break switches are in the upper storey, the connections and isolating switches and current and potential transformers in the lower storey. The cables from separate generators or feeders are brought up through the ground into separate brickwork cells opening on to the central passage-way in the lower chamber, by an expanded metal door. From the three-way dividing boxes the three single connections pass through the wall to a brickwork cell on the other side, which is accessible, by means of expanded metal doors, from the outer passages running the length of the lower chamber. Each of these latter cells contains three single-pole main isolating switches as well as isolating switches for the potential transformers, which are placed on the ground below in a small brick cell, protected by sheet-iron doors. From the main isolating switches the three connections are taken up through expansion joints and current transformers to the bottom connection of the main oil-break switch in the ceiling, the switch itself being placed in the upper storey.

In the upper room three moulded stone tables run parallel to each other along the room, being continuous except for a division of some 6 ft. or 7 ft. in the middle. The main 6,000-volt bus-bars rest upon insulators on the central



DETAILS OF ISOLATING SWITCH.

table, which is 5 ft. high, and is protected by expanded metal screens running up to the ceiling for the whole length, thus forming a cage in which the bus-bars are placed ; they are visible for their whole length, but are inaccessible until the screens are removed. The bus-bars are divided in the middle of the room by means of a main oil-break switch, capable of carrying 20,000 KW. continuously, and opening under any load likely to be met with. On the two side tables are fixed the oil-break switches, the left side of the room being entirely devoted to feeders. As stated above, the three connections from an oil-break switch to the bus-bars are carried along the ceiling of the chamber below, and are brought up through three separate bus-bar isolating switches underneath the bus-bar table to the lower side of the bus-bar holding-down bolt. The main oil-break switches are of the British Thomson-Houston Co.'s type. Each of the three cylinders containing the actual switch is in a separate cell, and in front of each cell is a hinged "uraolite" door, to allow of the escape of hot air, &c., when necessary. The motors operating the switches are arranged to wind up a spring immediately the switch has operated, so that the make or break is instantaneous on the closing of the control switch on the control board. Each oil-break switch can be made "dead" by means of isolating switches, there

being one set for isolating it from the bus-bar and one for isolating it from the incoming cables. The bus-bar isolating switches are situate under the bus-bar table in the ceiling of the lower chamber, but the handles operating them are in the upper chamber, on the side of the bus-bar table, each one being exactly opposite its own main switch.

As stated, the isolating switches for cutting off the main switch from the cables are situate in the lower chamber. All the high-tension panels are provided with balanced protective gear. There is compressed-air piping throughout the switch house for cleaning purposes.

In addition to the switchgear already described, there is in the engine room a neutral isolating switch for each generator and a set of emergency tripping gear, by which, in case of urgent necessity, the main generator oil-break switch in the switch house can be operated from the engine room. On the wall of the engine room, opposite each generator, there is an ammeter, and each generator also has its own "unit" transforming set in the transforming annexe. The leads for these transformers do not pass through the switch house, but are taken directly from the generator terminals through ironclad switchgear of the Reyrolle type, which is placed in chambers on the northern side of the engine room.

The direct-current switchgear principally consists of a 500-volt traction board, and a 100-volt power and lighting board, as well as the main lighting distribution fuseboard. The main direct-current switchboard with the motor-generators is situate in a corner of the engine room.

The following is a summary of the plant, with the names of the respective contractors :—

The contractors for the boiler-house equipment were Messrs. Babcock & Wilcox, Ltd., who supplied eight boilers, with superheaters, fans, economisers, ash and coal conveying plant, &c.; the three steam feed pumps were made by Messrs. Clarke, Chapman & Co., Ltd. Of the main generating plant, the A.E.G. supplied two alternators and turbines, the latter being of their impulse type, with A.E.G. condensers and air pumps, and Sulzer circulating pumps: the third alternator was supplied by Messrs. Brown, Boveri and Co., with a two-cylinder reaction turbine of the Parsons type, made by Messrs. Richardsons, Westgarth & Co., who also supplied the Contraflo condenser and Edwards air pump with Parsons augmenter, the circulating pump being by Messrs. Greenwood & Batley. The main high-pressure switchgear was made by the British Thomson-Houston Co., Ltd., with their instruments, the Chadburn Ship Telegraph Co.'s telegraphs, Messrs. A. Reyrolle & Co.'s balanced protective gear, and Messrs. Alfred Graham & Co.'s loud-speaking telephones. The traction rotary converter was supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.; it is fitted with ball bearings, and is self-starting.

THE VISIT TO DUNSTON POWER STATION.

At the invitation of the chairman and directors of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the County of Durham Electric Power Supply Co., an inspection was made, on July 5th, of the new generating station at Dunston-on-Tyne, by a large party of gentlemen interested in the various uses of electrical energy for industrial undertakings. The party travelled by special steamer from Newcastle Quayside to Dunston, and, after the inspection, proceeded by the steamer down river to Wallsend, where the Carville station also was seen; thence the party proceeded by special train to Newcastle, where luncheon was served. Dr. J. T. Merz received the guests at Tilley's Rooms, where the repast was served in the King's Hall. There was a large gathering of guests, including Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers.

The Chairman (after the loyal toasts had been duly honoured), introduced Mr. de Ferranti. In doing so, he said that the inroad of Italian thought and genius into Western civilisation and all English-speaking countries was felt all along the line, and in all phases of human activity. Ten years ago they had a similar day's proceedings to those of that day, when the power supply of Tyneside was inaugurated. Mr. Ferranti had devoted his life more than had anyone else to solving the difficulties of the transmission of electricity over long distances. He hoped Mr. Ferranti would be able to say that he saw in the system he had that day inspected, some realisation of what he had been thinking and dreaming of for years.

Mr. de Ferranti proposed the toast of "Electric Power Supply." He said it seemed to him strange to think that it was only 10 years ago since that great man of electric science and its application, Lord Kelvin, was in Newcastle when that business was at its beginning. So much had happened since then that it certainly seemed to him as if it must have been many more years ago. In going round with them that day he had seen what immense development had taken place. To think of nearly 200,000 H.P. being connected to the mains of that company, and being supplied from them! When the present demand was met, that supply would be greatly exceeded. When looking over the district of the Tyne, and seeing hardly a single smoky industrial chimney, they had seen the signs of what he believed was the greatest of the industrial developments that had taken place in any country since the beginning of the factory system. It was impossible to say how that development would ultimately affect the country; what great changes would be brought about all over the land, when other parts followed up what had been done so thoroughly here, and became more electrified. To a large extent they had to thank Mr. Charles Merz. The benefit of that undertaking to the community of that district was very great, but it did not stop there. It was a model to the rest of the country of the way in which they should go in their industrial and commercial development if they wished for the best possible result. It was curious to think how much the Newcastle district had done for the success and the making possible of that undertaking. It was interesting to look at what that district had done in many ways. The Newcastle business was originally started for the manufacture of electric light. A man they knew very well—Sir Joseph Wilson Swan, whom he was happy to say he saw well a few nights ago at the Royal Institution—was practically the maker of modern electric light. It was almost impossible to estimate or conceive the results of the work of that Newcastle citizen. Then they had another celebrated name there in Newcastle, that of Sir Charles Parsons. What he had done in regard to the propulsion of ships they all knew, and the speaker thought he might almost say that he had done more in respect of the generation of electricity, which had had far-reaching effects. He might say that that company's undertaking could not have grown had it not been for the wonderful work done in the development of the turbine. Starting, as he had said, for the supplying of electric light, the Newcastle Supply Co. had developed into one for the supply of electric power. That had a far greater meaning than the making of electric light pure and simple. The electric power might enter into any and every business, and into all and every domestic requirement for which they at present used coal directly or gas as fuel. In that district electric power supply had developed to a greater extent, perhaps, than in any other, and he felt sure that what they were supplying now was only a small proportion of what they would supply some years hence. They knew how electricity had altered the country in regard to manufacturing science. The great development at present was in its application to mining. That was essentially a mining district, and they would find the application of electricity to the mine of the greatest possible advantage and benefit. They knew at one time, in the days of ordinary steam engines, it used to be everybody's business to put down a boiler and engine—or power plant—and make their own power. Later had come the idea of turning that power into electricity on the spot. That was a great advance in the transmission of power, but it involved each manufacturer or industrial company in having an extra business, which was actually no part of their own proper legitimate business. It meant that these things had to be done separately; they had to have a specialist in the difficult problem of the utilisation of power. Now that great company had come in, and so specialised the generation of electrical power that it was hardly worth the while of any manufacturing people in the district to make power for themselves. There had also been brilliant work done in the commercial development of the country by the scientific combination of the various existing concerns. There was spare power available—he referred to the waste heat, to the exhaust steam and power from the coke ovens, and from coal which was not suitable for conveyance by the railways. The electric supply company had acted in what he called a brilliant manner by devising means of bringing together the men who wanted electricity to run their businesses, and the men who had spare power and no market for it. The utilisation of the waste heat of the district would accomplish a great deal in the future that would have a far-reaching effect on the problems of industry. The developments which had taken place, notwithstanding their greatness, were really only at their beginning, and in regard to this aspect of the question, the speaker referred to the marked increase in the use of electrical power for winding at collieries. There was also the domestic question, where the use of electricity would come in very largely, and he felt sure that every application of electricity in their homes would add to their comfort and diminish the difficulty of the labour problem which now existed.

The Chairman replied, and said that of 184,000 H.P. supplied from the stations they had inspected, 66,000 was connected with collieries. Of that, 6,000 was used for ventilation, 7,000 for winding, 9,000 for pumping, and the remaining 43,000 for haulage, &c. In proposing the toast of "The Mining Industry," he said they were connected with that industry in three ways. First, the mines supplied them with coal for fuel; secondly, they supplied the mines with energy; and, thirdly, they took from some of the collieries their waste heat.

Mr. Arthur Pease, in replying, said he did not think those engaged in mining appreciated how much they benefited by the application of electricity in the mines. He did not think it had thrown any men out of work, and when electrical supply companies provided power they had to pay for the coal they used, an

that came into the "ascertained selling price," whereas if the colliery used the coal themselves to produce their own energy or steam power, it was charged as colliery consumption, and did not affect the selling price, therefore the whole of the men of Durham and Northumberland benefited by the supply of electricity to the mines in that way. Referring to the electrification of railways, he said sometimes the North-Eastern Co. was referred to as being rather backward in not having electrified the lines on the south side of the Tyne. The matter had been under consideration, and it was all a question of density of traffic. So soon as the traffic was large enough to pay it as against steam, they might electrify the lines.

MR. FRANK PRIESTMAN proposed the health of "The Chairman," and this having been honoured, the proceedings terminated.

CONTRACTS CLOSED.

(*Continued from page* 58.)

Birkenhead.—The Electricity Committee has accepted the tender of the Hulton Colliery Co., Ltd., of Liverpool, for a year's supply of coal.

Blackburn.—The T.C. has sanctioned the following contracts for the electricity works :—

John Stirk & Sons, Ltd.—Lathe.
Yates & Thom.—Boiler.
British Westinghouse Electric & Manufacturing Co., Ltd.—2,000-KW. turbo-generator and two rotary converters.

Bradford.—The Tramways Committee has accepted an offer of Walter Scott, Ltd., for the supply of 50 tons of special steel rails for curves, for £362 10s.

Canterbury.—The T.C. has accepted the tender of Mr. S. Terry, of Canterbury, for electrical engineer's work for six months.

Cheltenham.—The T.C. has accepted the tender of Messrs. Cory & Sons, Ltd., of London, for a year's supply of Cannop coal for the electricity works, at 9s. 3d. per ton.

Chester.—The T.C. has accepted the tender of Messrs. W. Geipel & Co., for the supply of carbons, and of Messrs. Venner and Co., for the supply of meters, during the ensuing 12 months.

Dartford.—The U.D.C. has accepted the following tenders for coal for the electricity works :—

E. J. and W. Goldsmith, Ltd.—2,090 to 2,400 tons of anthracite rubbly culm, 12s. 9d. per ton.
Beadle Bros., Ltd.—1,000 to 1,200 tons of South Hetton rough, 13s. 2d. per ton.

Doncaster.—The Electricity Committee has conditionally accepted the tender of Messrs. Willans & Robinson for a steam generating set for the electricity works.

Dudley.—The T.C. has accepted the tender of Messrs. Belliss & Morcom, Ltd., for an engine, at £675, plus £30 for alterations to existing base.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows :—La Société des Anciens Etablissements Houry et Filleul Brohy, of Paris, 20,000 metres of lead-covered telephone cable with 28 pairs of conductors, and 15,000 metres ditto with 15 pairs of conductors ; and Messrs. Geoffroy & Delore, of Clichy, 15,000 metres ditto.

Glasgow.—The T.C.'s Tramways Committee have had under consideration the offers which have been received for new turbo-generators for Pinkston power station, but they have decided that before making any recommendation, Bailie Russell and Councillor Nelson, along with the general manager, the chief engineer, and the electrical engineer of the department, should visit the works of several makers of turbo-generators on the Continent and in England, and report. The T.C. has approved.

The T.C.'s Tramways Committee on Works have accepted the following :—

Section pillar switches.—Estler Bros.
Trolley wire.—Fredk. Smith & Co., Ltd.
Lead-covered cables.—British Insulated and Helsby Cables, Ltd.

Gloucester.—The T.C. has accepted the tender of Messrs. Siemens Bros. for feeder and distributor cables, at £1,211, and that of the B.I. and Helsby Cables, Ltd., for similar cables, at £817, and distribution pillars, at £199.

Grimsby.—The T.C. has accepted the tender of Messrs. Hewins & Goodhand for a dust catcher for the power station, at £300, and that of the Stirling Boiler Co. for a boiler, at £183.

Hull.—The Tramways Committee has accepted the following tenders :—

Brush Electrical Engineering Co., Ltd.—18 or 24 car bodies, £347 each, and trucks, £37 10s. each.
Siemens Bros. Dynamo Works, Ltd.—18 or 24 pairs of 33 H.P. motors, £180 per tram, and controllers, £49 10s. per tram.
John Baker & Co.—Wheels and axles, £10 10s. per pair with axle.
Brecknell, Munro & Rodgers.—Trolleys, £6 5s. each.
W. Boydell & Son.—Resistances, £9 5s. per pair.

India.—Messrs. W. T. Henley's Telegraph Works, Ltd.' according to the *Indian Textile Journal*, have received the order for all the electric cables required in connection with the electrification of the Empress Mills at Nagpore.

London.—WOOLWICH.—The B.C. Electricity Committee have received the following tenders for "Association" grade small wires for installation puposes :—

Glover & Co.	£1,452
Baxendale & Co.	1,452
Siemens Bros.	1,416
New Gutta-Percha Co.	1,231
Sun Electrical Co.	1,183
Macintosh & Co.	1,097
Liverpool Electric Co.	1,074
General Electric Co.	(accepted) 908
Geipel & Co.	892
Aubert, Grenier & Co.	836
Pirelli	827
Adnil Electric Co.	739

The Committee stated that the tenders related to 13 sizes which might be ordered in quantities as required from time to time, the prices being based on lengths of one mile each. It was not possible to state their definite requirements, but, having regard to the tenders as a whole, they were of opinion that that of the General Electric Co. was the most advantageous in relation to the sizes the Committee were most likely to have to purchase, and they therefore recommended that the tender of the General Electric Co. be accepted for the supply of wires, as required, to a value of £1,000. This was agreed to.

HORNSEY.—The B.C. has accepted the tender of Messrs. E. Lawrence & Sons, Ltd., for contract works Nos. 1 and 2, at £1,376 and £2,137, respectively, in connection with the extension of the electric lighting station in Tottenham Lane.

The City of London Guardians have accepted the tender of Messrs. Pinching & Walton for six dozen "Z" lamps, 50-C.P., 240-volt continuous, at 36s. per dozen ; also six dozen "Z" lamps 16-C.P. 240-volt continuous, at 39s. per dozen.

STEPNEY.—The following tenders were received by a B.C. Committee for electric light wiring installation at St. George's Town Hall :—

Barlow Bros. & Co.	£319
Electrical Installations, Ltd.	352
Smeeton & Page	432
Sweet Bros.	357
Tilley Bros.	529
Ward Bros.	335
G. Weston & Sons, Ltd.	(accepted) 272

L.C.C.—The Stores and Contracts Committee has considered 10 tenders submitted for the supply of steam coal to the Greenwich generating station, and recommends for acceptance that received from Messrs. Gardner, Locket & Hinton, Ltd., for 150,000 tons of washed small nuts from the Grangerigg Coal Co.'s pits, Lanark, Lothian and Fife, at 10s. 11d. per ton with demurrage at the rate of 4d. per ton for each day after two days. A member has notified his intention to move that the recommendation be referred back with instructions to report with a view to the acceptance of the tender of Messrs. Wm. Cory & Sons, Ltd.

The tender of Hadfield's Steel Foundry, Co., Ltd., for an additional cross-over on the Victoria Embankment, at £564, has been accepted.

The following tenders were received for four car traversers for use at the Cressy Road, Streatham (extension), Camberwell (extension), Hammersmith (third section), car-sheds :—

Brush Electrical Engineering Co., Ltd.	(recommended) £2,297
Dick, Kerr & Co., Ltd.	2,452
Hurst, Nelson & Co., Ltd.	2,525
Cowans, Sheldon & Co., Ltd.	2,592
S. S. Whiteley & Co.	2,768
S. H. Heywood & Co., Ltd.	2,780
Heenan & Froude, Ltd.	2,962
Stothert & Pitt, Ltd.	3,822
Chief Officer's estimate	2,900

For weighbridges for (*a*) Greenwich Road permanent way depôt, and (*b*) Old Kent Road central stores depôt, the tenders were :—

	(*a*)	(*b*)
Ashworth, Son & Co., Ltd.	£133	£130
W. & T. Avery, Ltd.	142	122
Day & Millward, Ltd.	140	145
H. Pooley & Son, Ltd.	154	140
Bartlett & Son, Ltd.	155	139

Messrs. Ashworth are recommended for (*a*) and Messrs. Avery for (*b*).

Mossley. — The tender of the Lancashire Electrical Engineering Co., Ltd., has been accepted for electrical work at the new territorial drill hall at Mossley.

Richmond.—The T.C. has accepted an estimate submitted by Messrs. Jas. Simpson & Co., Ltd., for providing and erecting a duplicate electrical pumping plant at the Petersham Well for £124.

St. Helens. — The T.C. has accepted the following tenders :—

Ferranti, Ltd.—Switchgear for 2,000 KW. turbo-alternator.
Babcock & Wilcox, Ltd.—Steel chimney stack.
John Rothwell & Sons.—Extension of engine house.

Stockport.—The T.C. has accepted the tender of Walter Thorp & Co., for supplying 70 tons per week for a year of Denby nutty slack for the electricity works, at 8s. 7d. per ton ; that of J. and R. Higginbotham, for a similar quantity of Pilsley hard slack, at 8s. 6d. per ton ; and that of McClure & Whitfield for alterations to the electric light installation at Hollywood Park Schools.

Torquay.—Subject to a loan being secured, the T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £4,600, and that of the British Electrical Co., at £295, for additional plant for the electricity works.

Walsall.—The T.C. has accepted the tender of the Rees Roturbo Manufacturing Co., Ltd., at £1,295, for supplying and erecting pumps, motors and electrical equipment required at the sewage disposal works at Brockhurst Farm. Nine other tenders were received.

West Ham.—Mr. H. H. Couzens, the electrical engineer, reports having obtained competitive schemes and prices from four firms for the extension of the E.H.P. switchgear, comprising the following :—One bus section cubicle, one 5,000-KW. generator panel and three 3,000-KW. feeder panels. Of the schemes, the best, in the engineer's opinion, were those submitted by the British Thomson-Houston Co. and the British Westinghouse Co. The engineer then asked these two firms to quote for an extended scheme. The quotations received are as follows :—British Westinghouse Co., £1,885 ; British Thomson-Houston Co., £2,031. In the engineer's opinion the tender of the British Thomson-Houston Co. should be accepted. He also suggested that a provisional sum of £150 be included in the firm's contract to cover the cost of adding "arresters," &c., subject to the settlement of detail, such sum to be deducted in whole or part if not expended. These recommendations were agreed to by the Council. The tender of F. Smith & Co. has been accepted for the supply of trolley wire, &c., required in connection with the Prince Regent Lane tramway, at £3 11s. 2d. per cwt., less 2½ per cent.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following Orders are issued for the next few weeks :—

Headquarters will he open from 10 a.m. to 4 p.m. from Monday, July 17th, to Friday, July 21st.

Saturday, July 22nd.—The Sheerness detachment will parade at headquarters at 3 p.m. Dress:—Service dress, drill order, with waterbottles and haversacks. Arms will he issued before this parade.

Headquarters will he open from 10 a.m. to 4 p.m. from Monday July 24th, to Friday, July 28th.

Saturday, July 29th.—Falmouth Detachment will parade at headquarters at 8.30 a.m. Weymouth Detachment will parade at headquarters at 11 a.m. Dress for the above detachments will he :—Service dress, drill order, with waterbottles and haversacks. Arms will he issued before each parade.

Headquarters will open from 10 a.m. to 4 p.m. from Monday, July 31st, to Friday, August 4th.

Saturday, August 5th.—Falmouth Detachment (2nd party) will parade at headquarters at 8.30 a.m. Weymouth Detachment (2nd party) will parade at headquarters at 11 a.m. Dress for the above detachments will he :—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Coronation Electrical Illuminations.—Since writing on this subject last week, we have had the pleasure of seeing a number of further photographs showing how excellent were the results obtained by those responsible for electrical illumination schemes in different parts of the country. At York, the Electric Lighting and Tramway Department, under Mr. J. W. Hame, the city electrical engineer and tramways manager, had an opportunity which was not to be despised. There were finely draped and electrically illuminated tramcars, named "King George" and "Queen Mary," running over the routes, but the picturesque Bars of the City Walls (Walmgate, Bootham, Monk and Micklegate) gave excellent scope for artistic electrical outlining, and the effect was indeed beautiful. The Mansion House, too, was outlined, and round many of the windows and some of the doorways electric lamps were effectively arranged. The Electrical Co.'s parallel strip was used on the Mansion House and Bars, and their "Striplite" with 2-C.P. lamps was used for illuminating the cars. At Croydon, the Electricity Department, under Mr. Cramb, had a fine piece of work to its credit in the illuminations of the Town Hall. The entire scheme included 3,500 lamps, and one of the chief features was an electrically-illuminated Union Jack, in which the electric lighting variations were so arranged as to give the effect of a flag rippling in the breeze. The whole of the Katharine Street elevation of the building was outlined with electric lamps.

Inquiry.—A correspondent asks for the name of makers of "Viaco" insulators.

The Electrical Trades Benevolent Association.—The following list of subscriptions and donations covers the period from May 31st to June 30th, 1911 :—

	Subscriptions.	Donations.
Fletcher, J. Y.	£1 1 0	—
Eckstein, Heap & Co.	—	£5 5 0
Brook, Hirst & Co.	1 1 0	—
Grevener, J. & H.	—	3 3 0
Mumby, J. W.	—	0 6 0
Lotery, H., & Co.	—	2 2 0
Gillespie & Bealcs	—	1 1 0
Smith, Frederiek, & Co.	2 2 0	—
Lenoh, T. W., Ltd.	—	2 2 0
Morgan Crueihle Co., Ltd.	—	1 1 0
Brown, Bayley's Steel Works, Ltd.	—	1 1 0
Kearsley, Rohert, & Co., Ltd.	—	1 1 0
Yates, J., & Co., Ltd.	—	1 1 0
Vaeuum Oil Co., Ltd.	—	1 1 0
Breeden, Joseph, & Co., Ltd.	2 2 0	—
Martin Earle & Co., Ltd.	—	3 3 0
Scott, Walter, Ltd.	—	2 2 0
Broeknell, Munro & Rogers, Ltd.		1 1 0
Lynen, R.	1 1 0	—
Pritehetts & Gold, Ltd.	1 1 0	—

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of the above Association was held on Wednesday, 5th inst., at the offices of the London United Tramways, Ltd., High Road, Chiswick, W., when there were present Messrs. A. H. Stanley, managing director, London Electric Railways and London United Tramways, chairman of the Association, Coveney (Erith), Mittelhausen (Bexley Heath), Schofield (Leyton), Ullmann (East Ham), Murray (Walthamstow), Balfour (Dartford), Hammond and Pott (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), hon. secretary. The party travelled in the company's parlour car to Isleworth, where they inspected, and were much interested in the Falk system of rail welding, which is now being extensively carried on. On returning to the Chiswick depôt, and after tea had been partaken of, a business meeting was held, and various matters were discussed. Following an inspection of the repair shops and carsheds, concerning which information on many points was given by Messrs. Knapp and Rosier, the party journeyed to Hammersmith, and entrained for Earl's Court station, where they were afforded the opportunity of inspecting the work in progress, in connection with the movable staircase which is being constructed for the London Electric Railways. After an amount of careful stepping and ladder climbing, the party proceeded to the Welcome Club at the Earl's Court Exhibition, where they were entertained to dinner by Mr. Stanley, and where also they were joined by Mr. James Devonshire, managing director of the Metropolitan Electric Tramways, Ltd. Mr. Devonshire proposed a hearty vote of thanks to Mr. Stanley for his hospitality. Mr. Stanley, in replying, said he was always glad to meet the members of the Association, and hoped they might profit from the inspection that had been made that afternoon. He understood that that was the last meeting at which they would have the pleasure of having Mr. Balfour (Dartford) with them, he having accepted another appointment, and he desired to convey, on behalf of the members, their hearty good wishes for his future success. Under the guidance of Messrs. Knapp and Rozier, the party subsequently made a tour of the Exhibition, visiting many of the side shows, &c.

Turbine Accident.—According to reports in the daily Press, three officials lost their lives while testing some turbine machinery at Grimethorpe Colliery, near Barnsley, early on Tuesday morning. The machinery, which had been fixed by Messrs. Vickers, of Sheffield, was set to work, and all went well for a few moments, when one of the steam valves burst. The three men were in the engine bed at the time ; two of them met their deaths instantaneously, and the third on admission to the hospital. The deceased are Mr. Frank Green, chief engineer to the colliery company, and Messrs. J. Allen and F. Duckworth, of Sheffield, representing Messrs. Vickers.

Annual Outing.—The staff and employés of the Tunbridge Wells Corporation Electricity Works paid a visit to Margate on July 5th, together with representatives of the local wiring contractors, those present including Mr. J. W. Beauchamp, the borough electrical engineer. Bathing was indulged in, and afterwards dinner was served at the West End Hotel. Mr. J. W. Beauchamp, the resident electrical engineer, thanked the Outing Committee for making the arrangements for the day, and cordially welcomed the visitors. Mr. C. M. Strange replied on behalf of the latter In the afternoon a sea trip, tea and various amusements were indulged in.

Tramway Sports.—The employés of the Bath Tramways Co. went by motor-bus recently to Bristol, where a pleasant afternoon was spent. In the afternoon a cricket match took place between the Bath and Bristol Tramways Companies. Bristol won in a low scoring match by 34 runs to 19.

Appointments Vacant.—Additional commercial assistant for Battersea Electricity Department (£2 + commission) ; electrical fitters for Devonport Dockyard (36s.) ; supernumerary switchboard attendant for Devonport Dockyard ; lecturer in electrical engineering at the East London College (£180). See our advertisement pages in this issue.

Paris Strike Organiser Resigns.—The *Daily Graphic* states that M. Emile Pataud, famous for the strikes he has organised among the Paris electrical workers, who at his orders have on several occasions suddenly stopped work and left Paris in darkness, has resigned his position as secretary of the National Syndicate of Electrical Workers.

The Telephone Transfer.—The Bill providing for the execution of the agreements between the National Telephone Co. and the Post Office has been issued. The first part deals with the method by which the money required for the purchase of the company's plant, and for future extensions, is to be raised; a portion of the purchase price is to be paid in cash, partly by utilising a sum due from the company of about £1,600,000 in respect of subscriptions paid in advance, and partly by terminable annuities, the loan for which must be repaid within 20 years, while the remainder will take the form of terminable annuities caloulated to repay the amount owing in 20 years, or of Exchequer bonds, which must be paid off within that period. The second part relates to the pension rights of the company's employés on their entering the service of the Government. The Treasury is also authorised to provide an amount not exceeding four millions sterling out of the Consolidated Fund, as required, for the extension of the telephone system.

An official memorandum has also been issued, dealing with the conditions under which the staff of the company will be transferred to the service of the State. The whole of the staff with two years' service (except those receiving over £700 a year) will be taken over unconditionally; those with less than two years' service will be admitted subject to proof of conduct and efficiency. The employés will be placed in the same classes as Post Office servants doing similar work, and the initial rates of pay will be not less, but in many cases greater, than those paid by the company. Service with the company will count as Post Office service as regards seniority, annual leave and sick pay. The bulk of the members of the company's pension fund, as well as many thousands who are not members of the fund, will be placed on pensionable classes in the Post Office, and all the officers of the company will count the last two years of service with the company for the application of the Superannuation Acts.

Alternatively, those who assign their share in the pension fund to the Postmaster-General will be allowed to count the whole of the period of their membership of the fund towards superannuation. Original members who assign will count the whole of their service with the company, and will receive pensions at the age of 65 not less than two-thirds of the salary they were receiving on January 1st, 1896. Those members of the fund who are not placed upon a pensionable class will receive monetary compensation in the shape of increased salaries. Other provisions are also explained in the memorandum.

Under the agreement arrived at between the P.M.G. and the National Co. at the conclusion of the hearing, the Post Office agreed to take over all the plant of the National Co., the only question left open for consideration being that of price.

Electrical Fatalities.—No fewer than three electric shock fatalities occurred on Tyneside during the past week-end—two at Jarrow, and one at Swalwell Garesfield. On the evening of the 7th inst. James Byers, aged 19, an apprentice driller, living at Jarrow, was drilling a plate on a table, when he received a shock, caused, it is reported, by a wire falling on to the handle of the drilling machine. Several workmen went to his assistance, and one named Atkinson, was seriously injured. The current was switched off, but Byers was dead.—On Saturday afternoon, the 8th inst., Mr. Robert Cragg, an electrician employed at Swalwell Garesfield Colliery, proceeded into the pit to inspect an electric pump; while he was examining the plant near the switchbox he received a shock which terminated fatally. The deceased was only 22 years of age. The third fatality occurred at the Jarrow substation of the Durham County Electric Power Distribution Co. on the 10th inst., when Robert Anderson, a young man who was working there, received an electric shock which proved fatal.

At the inquest held on Monday, July 10th, on James Byers, it was stated by John George Atkinson, of South Shields, that he saw Byers lying on the handle of the electric drilling machine, and he asked him what was the matter. He got hold of him, and was instantly held by the current. He reached to a plank with one foot, and was relieved and thrown from Byers. He then lost his senses.—Alfred Baker, foreman electrician, of Jarrow, stated that he had been unable to find the cause of the accident. There must have been an intermittent contact somewhere.—Mr. Lauder, Factory Inspector, suggested that if the motor and machine had been earthed it would have been impossible for the accident to occur.—The Coroner: This Regulation was not complied with?—Witness admitted that in this case it was omitted; he agreed that earthing was necessary under such circumstances.—The jury found that deceased met his death accidentally through the motor frame and machine not being earthed in accordance with the Regulations. Atkinson was complimented on his endeavour to save Byers.

The Walk to Brighton.—We are informed that some satisfactory inquiries have already been received for the London-to-Brighton Walking Race open to the electrical trades, which takes place on July 29th, starting from Westminster Bridge at 5 a.m. Entry forms for the event are now printed, and may be had on application to Mr. S. C. Haynes, May-Oatway Fire Appliances, Ltd., 92-4, Paul Street, E.C. Intending competitors should apply at once for entry forms, as the number and value of the prizes offered depend entirely upon the amount of financial and competitive support accorded this effort to promote athletics for those connected with the trade. Arrangements can be made for intending competitors to train on Tuesday and Thursday evenings, and Saturday afternoon or evening, in the neighbourhood of Clapham Common, and those desiring to avail themselves of this should communicate with the secretary. More cyclists are needed to accompany the competitors on the day, and they will oblige by sending in their names at once. Entries finally close on July 25th, but it is very important that they should be in as much before this date as possible.

"Electricity in Mines" Rules.—The Home Office has issued a circular, dated July 5th, in which it is stated that the Secretary of State has received a number of objections from owners of mines under the Coal Mines Regulation Acts, to the new special rules relating to the installation and use of electricity which have been proposed to them. It has consequently been necessary for the Inspector of Mines in charge of each district to appoint an arbitrator in the matter, in pursuance of the provisions of the Coal Mines Regulation Act, and each of the Inspectors has accordingly appointed Mr. James Swinburne as arbitrator in the matter of objections to the rules received in respect of mines in his district. The Secretary of State trusts that it may be possible to settle the matter without an arbitration, but as objection has been formally made to the rules, it is necessary under the Act that an arbitrator should be appointed.

Electrical Business in Ottawa.—A Canadian correspondent writes:—"In no department of trade and industry is there greater activity than in the general electric business of Ottawa. The electrician and the dealer in electric fixtures and supplies are taxed to their full capacity in keeping up with the growing requirements and the many things that are new in electric uses. The many new inventions of practical application in electrical science are being rapidly put into practical use. Only lately Ottawa dealers have begun exploiting numerous household appliances such as the sewing machine motor, cooking utensils, laundry appliances, &c. The electric kitchenette is becoming very general. These various appliances in electricity have given an impetus to the trade, which formerly was confined largely to lighting, electric bells, and their repairing and installation."

An Australian Electrical Employers' Association.—The Electrical Employers' Association of New South Wales held its annual meeting in Sydney on May 30th. The financial statement for the year, as submitted, showed an income of £250, including £165 special levy, and the balance brought forward was £78, the total being £328. On the expenditure side, out of a total of £293, £230 was absorbed by legal expenses, and the balance now carried forward is £35. Among other matters coming before the meeting was a report on the conference with the Electrical Trades Union regarding dirt money and the payment of wages.

Institution Notes. — Institution of Municipal Engineers.—The annual meeting of the Eastern District will be held at Yarmouth on July 22nd.

There will be a meeting at Edinburgh on July 29th for the formation of the Scottish district of the Institution and election of officers.

Society of Engineers (Inc.).—The third vacation visit of the present session took place on Friday last, when a number of members and their friends visited the Swanscombe Northfleet Cement Works.

Electrical Combination.—We are informed that a powerful combination of financiers, contractors, and electrical engineers has been effected to undertake the finance, design, construction, and operation of large electrical works in all parts of the world. Among those interested are leading French and English institutions. The London board of management consists of:—J. Norton Griffiths, M.P., President, E. P. Powles, R. D. McCarter, and J. Kerr Bock. The name of the company is Griffiths Electric Contractors, Ltd. The London agents are at Griffiths House, London Wall, and the company will have branch offices in East and West Canada, South America, Australia, New Zealand, South Africa, Spain, Turkey, &c.

Olympia Electrical Exhibition.—Electrical Supply.—We are informed that the Committee has been able to make arrangements whereby in addition to the meters and maximum demand indicators, the main switches and fuses referred to in Clause 2 of the Regulations for Electrical Supply, will also be supplied to exhibitors free of all charge, so as to save exhibitors the expense of providing these. It is necessary that no other meters, indicators, switches or fuses be used, except those supplied by the management as indicated above.

Will.—Mr. Edmund Boulnois, chairman of the Central Electric Supply Co., Ltd., and a director of the Westminster and Calcutta Electric Supply Corporations, who died on May 7th, left estate gross £55,157, net personalty £43,941.

The Rand Water Board.—We have received a copy of the report of the Rand Water Board for the year ending March 31st, 1911. This undertaking is similar in character to the Metropolitan Water Board, and supplies water to the towns and mines on the Rand in the Transvaal. In the various extensions which are being made, we notice that the substitution of electrical for mechanical methods takes a prominent place. For instance, two electrically-driven high lift centrifugals, each to raise 2½ million gallons of water per day, are to be installed at Zuurbekom, while the pumping station at Braamfontein has been fitted with electricity-driven machinery. It is interesting to note that the electrical plant at Zwartkopje has had to be stopped 45 times during the year for an aggregate period of 43 hours on account of thunderstorms. The lines are overhead, and it is found to be safer and better to stop the machinery during these heavy storms than to run the risk of serious breakdowns

NEW COMPANIES REGISTERED.

Titan Trackwork Co., Ltd. (116,457).—This company was registered on June 20th, with a capital of £5,000 in £1 shares, to carry on the business of tramway and railway track manufacturers, layers and maintainers of permanent ways, points, crossings, switches and rails, &c. The subscribers (with one share each) are :—W. McKennel, Tapton House Road, Sheffield, director; E. Parry, Rossmore, Newbold Terrace, Leamington, civil engineer. Private company. The directors are to number four; the first are S. Osborn, J.P., and W. McKennel (appointed by Samuel Osborn & Co., Ltd.), and E. Parry and L. W. Costa (appointed by Railway and General Engineering Co., Ltd.); remuneration as fixed by company. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Switch-on-Gas Lighting Syndicate, Ltd. (116,586).—This company was registered on June 30th, with a capital of £1,100 in 1,000 ordinary shares of £1 each, and 2,000 deferred shares of 1s. each, to take over from A. H. Nicholson, A. W. Brooking and C. Isaac the benefit of two inventions for improvements in electrically-operated valves, and to carry on the business indicated by the title. The subscribers (with one share each) are :—A. W. Brooking, Devonia, Slough, Bucks, tea broker; C. Isaac, 31, Budge Row, E.C., company director. Private company. The number of directors is not to be less than two or more than seven; the first are A. W. Brooking and C. Isaac. Remuneration, £50 each per annum and a percentage of the profits. Registered by E. E. Hargraves, 52, Coleman Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Particulars of a series of debentures, created by resolutions of July 3rd, 1900, and May 6th, 1904, to secure not more than the amount of the share capital for the time being issued and paid up, covered by trust deeds of August 3rd, 1900, and June 3rd, 1904, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). Trustees: H. R. Beeton, 18, Austin Friars, E.C., and W. R. Davies, 10, Moorgate Street, E.C.

Torquay Tramways Co., Ltd. (96,012).—Issue on May 24th, 1911, of £60,000 debentures, part of a series of which particulars have already been filed.

Adelaide Electric Supply Co., Ltd. (84,209).—Trust deed dated May 25th, 1911, to secure debenture stock not exceeding half the subscribed capital, constituting a floating charge on the company's undertaking (excluding sums placed, or to be placed, to dividend equalisation account, and investments representing same). Holders: Debenture Corporation, Ltd.

Suffolk Electricity Supply Co., Ltd. (58,665).—Issue on May 16th of £325 debentures, part of a series of which particulars have already been filed.

Reason Manufacturing Co., Ltd. (64,701).—A memorandum of satisfaction to the extent of £250 on August 14th, 1909, of charge dated January 15th, 1900, securing £1,200, has been filed. (Notice filed June 9th, 1911.)

Barbados Light Railway, Ltd. (84,394).—Issue on May 31st, 1911, of £200 debentures, part of a series of which particulars have already been filed.

English Electrical Co., Ltd. (112,639).—Issue on June 21st of £750 debentures, part of a series of which particulars have already been filed.

Cleveland and Durham Electric Power, Ltd. (89,539).—Issue on June 19th, 1911, at 10 per cent. discount, of £36,500 debentures, part of a series of £75,000, particulars of which have already been filed.

Cape Town Consolidated Tramways and Land Co., Ltd. (89,037).—Particulars of £50,000 prior lien debentures, created May 30th, and secured by trust deed dated June 13th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued; and ranking in priority to debentures secured by trust deed of August 14th, 190-. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: L. Breitmeyer, 1, London Wall Buildings, E.C., and F. R. Harris, 101, Mount Street, W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Tynemouth Corporation has appointed MR. W. B. PURVIS to the position of installation engineer and canvasser, recently advertised.

MR. C. W. SALT, the electrical engineer of Torquay, has been appointed hon. consulting electrical engineer to the Torbay Hospital.

The Beckenham U.D.C. has decided to increase the salary of MR. TAPPER, resident electrical engineer, from £300 to £350 per annum.

The Electricity Committee of the Dover T.C. has increased the salary of MR. L. WOODMAN, resident electrical engineer, from £425 to £475 per annum; that of MR. HARPUR, mains superintendent, from £200 to £225; and that of MR. SMITH, works superintendent, from £200 to £225.

Tramway Officials.—The recommendation of the Halifax Tramways Committee to increase the salary of MR. J. W. GALLOWAY, tramways engineer, from £250 to £275 per annum, mentioned in the last issue of the ELECTRICAL REVIEW, was, on July 5th, by 34 votes to 16, deleted from the minutes.

General.—MR. H. W. ERBY, of the St. Marylebone Electric Supply Department, has accepted the post of electrical manager to Messrs. Williams & Bach (Aladdin's Palace), 17, Princes Street, Hanover Square, W., and will take up his duties on 17th inst.

MR. VAL. A. FYNN, who has spent the last three winters in developing new types of single-phase motors, the U.S. patents for which have been acquired by the Wagner Electric Manufacturing Co., of St. Louis (to which firm he is permanently attached as consulting engineer), has just returned to this country. The most interesting feature of his new designs is a compensated S.P. motor which is self-starting, and has either unity power-factor, or, if desired, a leading power-factor, not only at full load, but at no load. The cost of the motor is no greater than that of a D.C. motor, and as it naturally is of great assistance to supply companies, the motor has attained a wide vogue already. Mr. Fynn has completed his European patents also, and intends to develop the manufacture here and on the Continent: his numerous patents cover adjustable-speed motors for both single-phase and polyphase circuits, self-starting squirrel-cage motors, and other new designs. His London address is 18, Blessington Road, Blackheath.

The directors and staff of the Brush Electrical Engineering Co., Loughborough, have presented a gold hunter watch to MR. J. J. STEINITZ, joint manager of the works, on his departure to become manager of the Gloucester Railway Carriage and Wagon Works; to Mrs. Steinitz was given a gold bangle watch.

According to the *Indian and Eastern Engineer* MR. J. G. HANSCOMBE has been covenanted by the Mysore Government to succeed Mr. Gibbs as chief electrical engineer to the State, when the latter officer retires in July, to take up his appointment as general manager of the Tata Hydro-Electric Supply Co., Bombay.

MR. ARTHUR W. GEATON, assistant electrical engineer, North British Railway Co., has been presented with a cutlery cabinet and tea kettle and stand, by the staff and employés of the electrical department on the occasion of his marriage to Miss E. Decima Troughton.

MR. RICHARD THOMPSON, electrical engineer at the Solway Ironworks, Maryport, was married at Dearham, on July 1st, to Miss Florence A. Nixon.

Obituary.—We regret to record the death, under distressing circumstances, of MR. P. J. TUNLEY, M.I.M.E., representative for Southern India of Messrs. Siemens Bros. Dynamo Works, Ltd. Mr. Tunley had just returned to India after six months' furlough, but he was taken very ill and receiving a bad report from the doctor he resolved to return home, but his death occurred at sea on June 28th on the ss. *Golconda* when a few hours out from Madras. The burial took place at Colombo. The deceased gentleman was only 35 years of age.

We tender our sincere condolences to SIR JOSEPH SWAN in the death, on 7th inst., of his youngest daughter, at the age of 29 years.

CITY NOTES.

Electric Construction Co., Ltd.

THE directors' report to be submitted at the meeting on Thursday, July 20th, at Winchester House, E.C., states that the net profit for the year, after payment of £7,613 for debenture interest, and crediting £5,000, as formerly, to depreciation account, is £15,042. The sum brought forward from last year is £6,416, and the amount available for distribution is therefore £21,458. The directors recommend that this amount be appropriated as follows :—Dividend as the rate of 7 per cent. per annum on the preference shares, £4,395; dividend at the rate of 2½ per cent. per annum on the ordinary shares (both payable on July 31st), £5,605; transfer to general reserve fund (which will then amount to £25,000), £5,327; balance carried forward, £6,131. The directors are pleased to report a better demand for electrical machinery, and a marked increase in net profit during the past year. Little improvement has taken place in prices, but, in consequence of the increased volume of business, the cost of production has been reduced, and, if the present demand be maintained, the directors view the future with confidence. During the year a portion of the company's holding in the Madras Electric Tramways (1904), Ltd., has been disposed of, and part of the proceeds has been applied in redeeming (1) the balance of £10,000 of the second mortgage debenture stock, and (2) £17,300 of the first mortgage debenture stock. The net deficit arising from these transactions has been debited to the general reserve fund. The reduction of the debenture stock, besides strengthening the financial position, has affected a considerable saving in standing charges.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors announce an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the half year ended June 30th.

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent. for the quarter ended June 30th, 1911.

Fraser & Chalmers, Ltd.—The directors have declared interim dividends of 3½ per cent. on the ordinary shares, free of income-tax, and 7½ per cent. on the preference shares, less income tax.

Marconi's Wireless Telegraph Co., Ltd.

THE directors state that during the year ending December 31st, 1910, the business of the company has shown considerable extension, the gross trading profit for the year having amounted to £127,453, and the net profit carried to balance-sheet to £60,513. These figures necessarily imply a very considerable increase in the gross receipts, but the directors do not think it prudent to continue to set them out in the form submitted in the profit and loss account for the year ending December 31st, 1909. The balance-sheet shows that the large sum due from the Canadian company remains to their debit. The arrangements contemplated this time last year which would have enabled the Canadian company to liquidate its indebtedness, were deferred owing to the prosecution in the United States of directors and officers of the United Wireless Telegraph Co., which for the time being disturbed the financial atmosphere in all matters concerning wireless telegraphy throughout the North American continent. This prosecution recently concluded with the conviction and sentence of the accused. The total par value under the heading "patents and shares and debentures in associated companies" stands, in comparison with last year, at a reduced figure. This is accounted for by a reduction in the face value of the shares in the Marconi Wireless Telegraph Co., of America; the number of shares, however, remains the same, and this company's interest in the American company is therefore unchanged. The amounts appearing in the balance-sheet at the end of the year under "loans from bankers and sundry creditors" have since been mostly, and are about to be entirely, paid off except as regards current trading accounts. The successful working of the transatlantic service has demonstrated beyond question the great practical value of wireless telegraphy for long-distance telegraph service. Application has been made by Commendatore Guglielmo Marconi on behalf of this company for patents for a new and what is believed to be a very valuable invention, consisting of a new duplex system adapted to wireless telegraphy. This invention has been submitted to a practical and thoroughly successful test at the Clifden trans-Atlantic station. In the early part of the year 1910 the directors resolved that it was time there should be an end to the infringements of the company's patents. An action was accordingly commenced against one of the infringing companies, resulting in a declaration of the validity of the company's Patent No. 7,777. This patent is of paramount importance, embracing syntonisation, and with it dated the real practical commercial utility of wireless telegraphy. The directors are advised and believe that no wireless station of any practical utility can be erected without infringing this patent. It will be the policy of the directors rigorously to maintain the company's rights both at home and abroad. As a result of this action substantial benefit accrues to the company in the form of compensation and in other ways. Shareholders will have appreciated the significance of the resolution adopted at the Imperial Conference to construct an Imperial chain of wireless telegraph stations. The business of the Associated Companies continues to show marked improvement, and will continue to develop with the ever-increasing application of wireless telegraphy. An important contract has been entered into with the Canadian Government, by which the Canadian company will work under a considerable subsidy a large number of coast stations in Canada and be entitled to retain also the whole of the telegraph receipts therefrom. The Argentine Co. will now proceed with the erection of a long-distance station to communicate with Europe, and every endeavour will be made and all assistance given by this company to assure its early completion. It is confidently anticipated that the large sums of money which in the past have been expended by this company in experimenting and developing long-distance wireless telegraphy will be well rewarded. This company alone has succeeded in erecting long-distance stations able to conduct day and night commercial wireless telegraph service. The future policy of the company lies mainly in this direction, and negotiations of an important nature are pending to erect and work, or be interested in the working of a chain of wireless telegraph stations around the world. Numerous negotiations are pending with Governments, and some important agreements have been entered into; the directors consider, however, that it would not be in the interests of the company to give further information upon this subject at this moment. The Belgian Co. has declared and paid dividends for the year ending December, 1910, amounting to 50 fr. per capital share (10 per cent.) and 24 fr. per founder share. The French company has declared and paid a dividend for the past year at the rate of 5 per cent. per annum. The Marconi International Marine Communication Co., Ltd., whose business also is growing extensively, has declared for the year ending December 31st, 1910, its first dividend at the rate of 5 per cent. It will be observed from the balance-sheet that this company owns 200,182 fully-paid shares in that company of a total capital issued of 204,056 shares. Owing to the strenuous competition and other circumstances which obtained in Germany, an agreement has been entered into by the Belgian company, with this company's consent and approval, under which all the mercantile vessels in Germany flying the German flag, fitted with either the Telefunken or Marconi system, were transferred to a new company entitled the Deutsche Betriebsgesellschaft für Drahtlose Telegraphie m.b.H. Neither this company nor the Telefunken Co. will in future fit any mercantile vessels flying the German flag; this business will be carried on exclusively by the new company, who now hold the licences from both the Telefunken and Marconi Companies for this purpose; the system installed will be known as the "Debeg." The arrangement embraces the German Mercantile Marine only. This company's Belgian and the Telefunken Companies hold the shares of the "Debeg" Company, and the board is composed of members of those two companies and includes Commendatore Guglielmo Marconi and Mr. Godfrey C. Isaacs. The company's business generally continues to show substantial increase, and the directors recommend the payment of the cumulative 7 per cent. dividend upon the preference shares to the end of December, 1910, which will absorb the sum of £16,600. There will thus remain to the credit of profit and loss account the sum of £49,119, which will allow of, and the directors will recommend, the declaration of a dividend upon the ordinary shares. Subject to the approval of the general meeting of the payment of dividend upon the preference shares above recommended, it is the intention of the directors to immediately declare an interim dividend upon the preference shares for the half-year ending June 30th inst. at the rate of 7 per cent. per annum. Since the last general meeting, Commendatore Guglielmo Marconi has resigned his position as joint managing director of the company, and Mr. Godfrey C. Isaacs has been appointed sole managing director. The lamentable death of Sir Charles Euan-Smith left a vacancy on the board. Mr. Hammersley Heenan retires by rotation, but his business occupations at a distance from London do not allow of his devoting such time to the company's business as he would desire; he, therefore, does not offer himself for re-election. Col. Albert Thys and M. Maurice Travailleur, for years intimately associated with the company's business, have been elected members of the board.

United River Plate Telephone Co., Ltd.—The directors' report for the year ended March 31st last, states that the gross receipts in sterling for the year in the River Plate were £401,307, against £336,422 for last year. Deducting expenses in Argentina and London, debenture interest, dividend on preference shares, and interim dividend on ordinary shares, and adding interest on investments, transfer fees, &c., there remains (says a financial contemporary) a profit of £96,604, to which must be added £4,633 brought forward from the previous year, making an available balance of £101,237. The provision for renewal of plant chargeable against revenue has this year been estimated and included in the item maintenance, instead of being treated as an appropriation of profit as in former years. A further appropriation for the renewal fund is proposed, as the directors, after careful inquiry, are of opinion that, owing to the increase in the plant, the fund requires strengthening. After making the proposed appropriations the directors recommend that a final dividend of 5 per cent. be paid on the ordinary share capital, making, with the interim dividend paid on December 31st last, a return of 8 per cent. for the year, free of income-tax, and that the balance of £5,392 be carried forward. The continued, rapid, and profitable expansion of the company's business, both in Buenos Ayres and the provinces, calls for fresh capital, and it is intended to make an issue forthwith of 40,000 ordinary shares to the ordinary shareholders at par.

Stock Exchange Notices.—The Committee has appointed as a special settling day, Thursday, July 20th—Bell Telephone Co. of Canada, Ltd.—$850,000 5 per cent. bonds, 1925, Nos. 7,151 to 7,550 of $500, 4,901 to 5,500 and 6,001 to 6,050 of $1,000 each (London issue).

Application has been made to the Committee to appoint a special settle day in and to grant a quotation to—Adelaide Electric Supply Co., Ltd.—£100,000 5 per cent. debenture stock.

City and South London Railway Co.—The directors announce that the accounts for the half-year to June 30th show a balance, after providing for the debenture stock interest, the payment of a dividend on the 5 per cent. preference stock, 1891, 1896, 1901 and 1903, and the transfer to the renewal fund of £1,500 and £800 for general purposes, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of 1¾ per cent. per annum, carrying forward a balance of £2,798. The dividend for the corresponding period last year was at the rate of 1¼ per cent. per annum, carrying forward £1,634.

The *Times* states that Mr. J. F. S. Gooday, the late general manager of the Brighton and Great Eastern Railways, and now a director of both those companies, has been elected a director of the City and South London.

Direct United States Cable Co., Ltd.—The board have resolved upon the payment of a final dividend of 2s. per share, together with a bonus of 1s. per share, both free of income-tax, such dividend and bonus to be payable on and after the 31st inst., making, with the three interim dividends already paid, a total distribution of 5 per cent. for the year ending June 30th, 1911. The transfer books are closed from July 11th to 25th.

Dublin United Tramways Co.—The directors have declared a dividend for the half-year ended June 30th at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares, after setting aside £4,000 for the renewal of cars and £2,000 for accident insurance reserve. £9,564 is carried forward.

Continental.—FRANCE. — The balance-sheet of La Société Francaise des Cables Telegraphiques, of Paris, for the last financial year shows a profit of £17,376, as compared with only £8,216 in the preceding 12 months.

La Société Francaise des Accumulateurs Paul Gouin is the name of a new company which has just been formed in Paris (107, Rue Saint Lazaire) with a capital of £24,000.

ITALY.—La Società Elettro-Dinamico is the name of a new company which has lately been formed in Milan with a capital of £6,000 to exploit the Brown-Boveri electrical productions in Italy.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	July 5	3,252	+ 355	5	8,049	+ 615	..	..
†Ayr	„ 1	275	— 57	7	2,033	— 116	8	..
Bath	„ 5	1,984	+ 276	27	21,382	+ 659	..	..
Belfast	„ 7	8,892	+ 657	14	64,364	+ 8,381	40	3
Birkenhead	„ 9	2,508	+ 148	14	16,610	+ 729	13·7	..
Birmingham Corp.	„ 1	15,133	+1,544	13	96,741	+ 7,113	56·8	..
Blackburn	..	..	..	..	..	..	..	..
†Blackpool Corp.	„ 6	1 916	+ 466	..	16,233	+ 3,131	..	..
Blackpool-Fleetw'd	„ 8	2,144	+ 97	..	..	..	..	..
Bolton	„ 2	5,891	+ 669	14	34,709	+ 2,990	26	..
Bournemouth	„ 5	3,785	+ 90	14	24,389	+ 1,161	22	..
Bradford	„ 1	11,976	+1,610	13	74,917	+ 6,904	56	1·2
Brighton	„ 9	2,200	+ 212	14⅔	14,755	+ 1,356	9·5	..
Bristol	„ 7	13,836	+1,506	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	June 30	447	— 12	26	5,610	— 19	3·65	..
Barnsley	„ 30	386	+ 53	„	4,671	+ 276	..	..
Barrow	„ 30	784	+ 47	„	6,895	+ 434	5·37	..
Devonport	„ 30	987	+ 130	„	11,915	+ 1,287	8·85	..
Gateshead	„ 30	2,297	+ 64	„	26,459	+ 1,409	11·25	..
Gravesend	„ 30	494	+ 39	„	5,200	+ 107	6·5	..
Greenock	„ 30	1,654	+ 183	„	17,780	+ 2,350	7·25	..
Hartlepool	„ 30	653	+ 51	„	6,359	+ 497	6·72	..
Kidderminster	„ 30	269	+ 23	„	2,708	+ 186	..	..
†Leamington	„ 30	403	+ 8	„	4,004	— 7	..	..
Merthyr	„ 30	438	— 81	„	5,218	+ 81	2·9	..
Metropolitan	„ 30	19,492	+3,333	„	219,957	+32,782	22	..
Middleton	„ 30	664	— 49	„	8,441	+ 562	8·5	..
Mid. Joint Com'tee	„ 30	12,424	+ 654	„	151,786	+ 8,433	..	..
Oldham—Ashton	„ 30	1,105	— 81	„	14,467	+ 407	9·13	..
Peterborough	„ 30	290	+ 36	„	2,953	+ 205	5·31	..
Potteries	„ 30	3,927	+ 234	„	49,698	+ 4,830	29	..
Rothesay	„ 30	158	— 73	„	3,071	— 143	2·75	..
Southport	„ 30	679	— 11	„	7,279	+ 2 0	8·17	..
S. Metropolitan	„ 30	1,977	+ 194	„	21,190	+ 670	..	..
Swansea	„ 30	2,432	+ 132	„	28,508	+ 1,891	12·5	..
Tynemouth	„ 30	715	— 199	„	5,465	+ 84	8·75	..
Weston-s-Mare	„ 30	410	— 26	„	2,315	+ 109	3	..
†Worcester	„ 30	701	+ 73	„	7,162	+ 339	5·75	..
Wrexham	„ 30	206	+ 14	„	2,513	+ 62	..	..
Yorks. Wool. Dist.	„ 30	2,181	+ 204	„	26,719	+ 1,890	17	..
Miscellaneous	„ 30	466	— 55	„	5,553	+ 272	..	..
Burnley	July 8	2,640	+ 155	..	..	..	11·7	1
Burton-on-Trent	„ 9	620	+ 72	14	4,181	+ 383	6·6	..
Bury	„ 9	2,620	+ 194	14⅞	17,173	+ 1,408	22·5	..
Cardiff	„ 8	4,986	+ 253	14	35,666	+ 3,587	..	..
Chatham and Dist.	„ 6	1,828	+ 142	27	21,9 2	+ 61	14·98	..
Cork	„ 6	1,124	+ 47	27	12,942	+ 212	9·9	..
†Croydon	June 23	2,167	+ 3·3	..	22,662	+ 1,774	11·25	..
†Darlington	„ 24	286	+ 75	13	2,827	+ 340	..	..
†Darwen	„ 30	250	+ 3	13	3,616	+ 341	4·36	..
†Dover	July 1	315	+ 97	13	3,282	+ 574	4·75	..
Dublin	„ 7	13,381	+1,584	..	..	..	54·25	..
Dundee	„ 5	2,467	+ 6	7⅔	8,875	— 81	15	..
East Ham	„ 8	2,193	+ 112	14	15,685	+ 991	7·87	1
Exeter	„ 7	698	+ 34	14	4,892	+ 379	5·5	..
Glasgow	„ 8	58,551	+3,418	..	..	..	98	·75
Hastings	„ 6	2,137	— 15	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 8	5,471	— 65	14	40,490	+ 2,084	14·5	..
Ilkeston	„ 6	277	+ 16	14	1,818	+ 96	..	..
Ipswich	„ 8	935	+ 64	14	6,345	+ 637	10·5	..
Kilmarnock	„ 8	322	+ 17	8	1,250	+ 54	4·25	..
Lancashire United	„ 5	2,850	+ 130	27	35,496	+ 852	39	..
Leeds	„ 8	15,232	+1,055	14	108,016	+ 8,624	108	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 8	1,329	— 16	7⅝	5,251	+ 225	3·72	..
Liverpool	„ 1	25,841	+ 408	26	295,459	+10,399	116	2·5
†L.C.C.	June 28	97,852	+11,531	..	577,261	+39,706	141	9
London United	July 8	14,839	+1,685	..	172,403	+ 6,435	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
Manchester	„ 8	32,934	+ 979	15	232,888	+14,391	183	..
Newcastle	„ 8	8,082	+ 548	..	61,794	+ 4,462	14·5	..
Newport	„ 1	1,551	+ 185	13	9,765	+ 735	14·5	..
Oldham	„ 9	3,901	+ 206	15	30,203	+ 1,692	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	„ 5	1,613	+ 118	14	11,121	+ 881	..	..
Salford	„ 8	9,808	+ 339	13⅞	66,638	+ 3,882	..	..
Sheffield	„ 11	12,911	+ 856	..	97,656	+ 6,631	40	..
Southampton	„ 5	2,941	+ 729	14	16,976	+ 2,004	..	..
†Southend-on-Sea	June 21	664	— 8	12	7,314	+ 1,105	..	..
South Shields	July 8	1,197	+ 50	14⅛	9,067	+ 1,238	..	..
Swindon	„ 5	364	+ 92	14	2,201	+ 288	..	..
Tyneside	June 28	2,059	— 142	26	19,549	+ 788	..	..
Wallasey	July 8	2,321	+ 307	14½	16,102	+ 2,828	..	..
Walthamstow	„ 8	1,551	+ 153	14	11,447	+ 1,180	9	..
West Ham	June 29	5 841	+ 482	13	36,109	+ 3,912	15·25	..
Wolverhampton	July 6	2,129	— 222	14	13,958	+ 1,039	25	..
†Cen. London Rly.	„ 1	5,988	— 81	26	138,645	— 9,125	6·82	..
City & S. Lon. Rly.	„ 9	6 891	+ 501	..	..	..	7·26	..
Dublin-Lucan Rly.	„ 7	298	— 25	..	..	..	7	..
G.N. and City Rly.	„ 8	3,009	+ 188	..	..	..	3·5	..
L'pool Overh'd Rly.	„ 9	3,110	+ 239	..	..	..	6·8	4·8
Llandudno-Col. Bay	„ 7	772	— 7	31½	6,287	+ 251	..	..
London Elec. Ry. Co.	„ 8	28,815	+1,980	..	..	..	21·25	..
Mersey Railway	„ 8	3,905	+ 14	..	..	..	4·5	..
Metropolitan Rly.	„ 9	86,568	+1,110	..	..	..	24·5	..
Met. District Rly.	„ 8	25,200	+2,121	..	..	..	24	..
Anglo-Argentine	„ 8	94,791	+4,425	..	1,328,374	+184,235	..	..
§Auckland	June 2	17,089	+2,289	..	192,840	+20,285	23·3	.6
Bombay (B.E.T.)	„ 9	5,602	+ £08	23	65,816	+ 3,600	..	..
Brisbane	May	21,099	+2,609	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	July 8	7,686	+ 835	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	May	3,529	..	..	16,815	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	June 30	1,340	+ 169	..	17,420	+ 1,281	..	..
§Montevideo	June	21.752	+1,376	34	204,245	+11,495	..	..
Perth (W.A.)	July 7	3,068	+ 101	..	43,774	+ 2,230	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Stock Exchange markets have assumed a more settled aspect under the influence of quieter politics abroad and fewer domestic broils at home. The echoes of the Moroccan affair, however, are still heard, though but slightly, and the cause of unrest has shifted once more to Mexico, where there seems to be some sort of mob rioting which at present is not very serious, but in which the Stock Exchange, with its usual sense of discounting, sees a possible cause of more grave trouble.

The tendency in the upward direction which the Electrical Supply market has lately developed is continued in a few cases, and it is noticeable that where rises have been secured recently, they are maintained in most instances. The only feature of weakness is Metropolitan Electric Supply Ordinary, the price of which has come down another ⅛, leaving the middle quotation 3⅞. Edmundson's Preference are also ¼ lower on the report which appeared a few days ago. It would seem hopeless to expect anything of practical benefit from this company until reorganisation of the capital has been carried through. Naturally, all companies are very averse to rearranging their capital accounts, and will put off the evil day as long as they possibly can in the Micawber-like hope of something turning up to save, after all, the necessity for such unpleasant action; but proprietors of electrical issues can, in only too many instances, point to examples of companies that would have been all the better for reorganisation long ago, and, in 99 times out of 100 nothing much is gained by delay. City of London Ordinary have risen again, and County Preference are up a similar amount. The Debenture stocks are all unchanged, with the exception of Metropolitan First Debenture, where the widening of the quotation gives a nominal rise of a point.

Amongst Colonial and Foreign Electric issues, Mexican Light and Power Common and Preferred shares have both fallen slightly by reason of the disturbances reported from the country, but the 5 per cent. First Mortgage Gold bonds are a point higher, these being in considerable demand from investors. Northern Light and Power bonds continued their fall with another drop of 6 points, and it is high time that the reason for the perpetual dwindling away should be explained, as it is exercising a very bad effect upon the market. The Canadian issues are hardly as firm, Canadian 7 per cent. Preferred, and Shawinigan Capital stocks having given way a little, while one or two of the other bonds are also a trifle lower.

Mexican Trams are quite unaffected by the rumours already referred to, and the prices of all the three issues have improved. Rio Trams also are better, and there has been a steady demand for most of the stocks in this department. Brisbane Trams Debenture recovered the dividend deducted last week, and Calcutta Debentnre regained 1 of the 2½ interest deducted last account day. Havana Fives are ½ higher, and in several other cases similar improvements have occurred. Anglo-Argentine Trams have been subject to realisations said to be on behalf of a deceased account. Sao Paulo Trams rallied sharply after having given way.

The Telegraph market is steady, without much material change. Westerns have risen a little, but Anglo-American Preferred and Deferred both eased off. Eastern Telegraph Preference hardened a little, and the Prior-Charge stocks have been in demand.

The feature of this department is the wild speculation which has been taking place in Marconi shares. Up to 49s. 3d. the other day, they dropped to 41s. 3d. on Monday, recovering to a small extent in the afternoon of that day. The gambling was concentrated upon what the report might contain, and few documents have been awaited with such eagerness this year as that from the Marconi Company. Upon its appearance the price fell still further to 39s., disappointment being expressed at the absence of an announcement of any dividend on the Ordinary shares. The question of a distribution is to be postponed for consideration at the meeting, and the price rallied to 42s. on the hope of a declaration being made then. Meanwhile, the report is certainly a very encouraging document.

National Telephones have come down upon the uncertainty which is still felt regarding the arbitration proceedings. Movements are wild and irregular, but the net balance leaves a fall of 2 in the Deferred stock on the week, while the Third Preference are ⅛ down. New York Telephones are a good market, but United River Plate Telephone Preference are a shade off.

The Home Railway division is enjoying rather more favour. Liquidation on behalf of the weak holders has stopped for the time being, and this has had a strengthening effect upon most prices, while the virtual settlement of the seamen's strike formed another favourable factor. So far as the Undergrounds are concerned, the improvement has hardly extended to their issues. In fact, Districts are 1¼ down on the week, although Metropolitan Consolidated rose ¼. A few Great Northern and City Preferred came in, with the result that the price eased off to 17s. 6d.

Electric Tramways are so quiet as to be almost stagnant. There was an acute fall in London General Omnibus stock upon the rumour that its competitor was to be revived; but although this was subsequently denied, and 'Bus stock recovered, it had no effect in restoring the 5s. loss suffered by London United Tramways Preference shares, which are down to 3⅞, the Debenture stock also being a point easier. British Electric Traction Ordinary are hardly so good, losing part of their gain of last week, while the 5 per cent. Debenture fell 1.

The Manufacturing department is exceedingly quiet. Electric Construction Preference have improved on an excellent report. The Ordinary shares return to the dividend list after an absence of seven years. Castner-Kellner are ⅛ up. On the other side of the shield, Aron Ordinary and Preference are both lower.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 11th.	Rise + or Fall —	Present Yield £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102 xd	..	4 8 3
Brompton & Kensington, Ord.	5	10	10	8 — 8⅝	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼ xd	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4'	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100 xd	..	4 10 0
City of London, Ord.	10	7	7	11⅞ — 12⅜	+ ⅛	5 13 2
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123 xd	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103 xd	+1	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½ xd	..	5 9 3
County of London, Ord.	10	5	5	7⅝ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	11⅛ — 11⅝	+ ⅛	5 3 3
Do. 4½ % Deb.	Stock	4½	4½	110 —112 xd	..	4 0 4
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	9/16 — 13/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 2¾	— ¼	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4⅛ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7¼	..	6 11 0
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1¾ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅝ — 3⅞	— ⅛	6 9 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝ xd	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105 xd	+1	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84⅛ — 87½ xd	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 — 99 xd	..	5 1 0
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7¼	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9⅜	..	5 5 3
Do. 7 % Pref.	5	7	7	6⅜ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½ — 86½ xd	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2 1/16 — 3 3/16	..	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½ xd	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3¾	⅛ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3¾	2⅜ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord,	5	10	10	7⅞ — 8⅜	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜ xd	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅝ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97	+ ½	5 3 1
Canadian Gen. El. Com.	$100	6	6	108 —111	..	5 10 1
Do. 7 % Pref.	$100	7	7	120 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	..	6	1⅜ — 1⅝	..	6 8 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½ xd	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83 — 85	..	5 17 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	..
Do. 6 % Pref.	1	6	6	29/32 — 1 1/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½ xd	— ½	4 16 7
Madras, Ord.	5	Nil	Nil	2⅜ — 3⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 87½ xd	..	5 14 3
Mexican Lt. & Power, Common	$100	4	4†	82 — 84	— ½	4 15 3
Do. 7 % Cum. Pref.	$100	7	7	105½ —107½	— ½	6 10 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95¼ — 96¼	+1	5 3 11
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	..	8	173 —177	..	4 10 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	46 — 48	—4	10 8 4
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½ xd	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	119 —122	..	4 2 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109 xd	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½ — 93½ xd	..	5 6 11
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1 xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100 xd	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	141 —143	—2	5 11 11
Do. Collat. Trust	$1000	4	4	94 — 96 xd	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3¾	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113 —114	— ¾	5 5 3
Do. Def.	25/-	30/-	26 — 26¼	— ¼	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 — 7½	..	5 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½ xd	..	4 9 5
Cuba Telegraph	10	6	6	10 — 10½	..	5 11 7
Do. 10 % Pref.	10	10	10	17¼ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅞ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101 xd	..	4 9 1
Direct United States Cable	10	4	5	7½ — 8	+ ⅛	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136½ —139½	..	5 0 4
Do. 3½ % Pref. Stock	Do.	3½	3½	84½ — 86½	+ ½	4 0 11
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13⅜ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞ — 11⅜ xd	..	5 3 3
Do. 6 % Pref.	10	6	6	13 — 13½ xd	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	— ¼	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4¼	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 1/16 — 2 3/16	— ⅛	Nil.
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	104½ —105½	..	5 13 9
Do. Def.	Do.	6	6	114 —118	—2	5 1 8
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5⅜	— ⅛	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100 xd	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100 xd	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	101⅜ —102⅝	+ ⅜	4 7 7
Oriental Telep. and Elec.	1	8	6†	1 9/16 — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅝	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½ xd	+ ½	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101 xd	..	3 19 3
Reuter's	8	5	5	8⅜ — 9½ xd	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100 xd	—2	4 10 0
United River Plate Telephone	5	8	6†	7 9/16 — 7 13/16	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜ xd	— 1/16	4 10 11
West Coast of America	2½	2½	2½	1⅞ — 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½ xd	..	4 0 5
West India and Panama Teleg.	10	Nil	2	2⅛ — 2⅜	— ⅛	8 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅝ — 10⅞	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103 xd	+1	4 17 1
Western Telegraph, Ltd.	10	7	7	13½ — 14	+ ¼	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99⅜ —102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— 5/16	.	Nil
Do. 5 % Pref.	1	5	5	⅜— ¼xd	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/16— 1/2	1/16	Nil
Do. 6 % Pref.	10	3	3	3¾— 4¼xd	..	7 1 2
Do. 5 % Deb.	100	5	5	95 — 98	1	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	70 — 72	..	4 3 4
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	55 — 57	..	3 10 2
Do. 4 % Deb.	100	4	4	104 —106	..	3 15 6
City & South London, Ord.	100	1½	1½	31½— 32½	..	4 12 4
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	..	4 12 7
Do. Do. 1901	100	5	5	104 —107	..	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12¼— 13¼	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	¾— 1	⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2¼— 2¾	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82 xd	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82 xd	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98 xd	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3⅜— 4⅛	— ⅛	Nil
Do. 4 % Deb.	100	4	4	71 — 77 xd	—1	5 3 11

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1	1⅝	47½— 48	+ ¼	2 17 3
Do. Surplus Lands	100	2¾	2¾	68 — 70	..	3 18 7
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	27¾— 27⅞	1/4	Nil
Do. 6 % Deb.	100	6	6	145 —147 xd	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98 xd	..	4 1 8
Do. 4 % Prior Lien	100	4	4	101 —103	..	3 17 8
Do. 4½ % First Pref.	100	..	3¾	88 — 90	..	3 12 3
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	2/16— 1/2	..	5 6 8
Do. Def.	1	Nil	Nil	1/16— 1/16	..	Nil
Do. 5 % Pref.	1	5	5	2/16— 1/2	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99½—101½ xd	— ½	4 8 8
Do. 5 % Deb.	100	5	5	102½—104½	+ ½	4 15 8
Potteries, Ord.	1	2	..	1/16— 2/16	..	..
Do. 5 % Pref.	1	5	5	13/16— 14/16	..	7 13 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	..	2/16— 2/16	..	..
Do. 4 % Deb.	100	4	4	73 — 78 xd	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100⅛—101⅛	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	10/-	65 — 67	..	0 14 11
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/16— 3/16	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛— 2⅜	..	..
Do. 4½ % Deb.	100	4½	4½	82 — 85 xd	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5¼	— 1/16	4 15 3
Do. 2nd Pref.	5	5	5	4 13/16— 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	93½— 95½	— ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	99 —101	— ½	4 9 1
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104 xd	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞— 11⅛	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½— 98½ xd	..	5 1 6
Brisbane Trams Invt., Ord.	5	8½	8†	6¼— 6⅜	..	6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105 xd	+3	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	146½—150½	+ ½	5 6 4
Do. Pref. Ord.	100	6	6	128 —130	—1½	4 12 4
Do. 5 % Pref.	100	5	5	111 —113	..	4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —106	+1	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5⅝— 6⅛	..	4 0 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	101 —104 xd	+1	4 6 7
Cape Electric Trams	1	Nil	Nil	1/16— 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅝— 5⅞	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97 xd	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	+1	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—103½	+ ½	4 16 7
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92 — 95	+ ½	5 5 3
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	5/16— 3/16	..	8 0 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101 xd	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	..	5	95 — 98 xd	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90½— 93½ xd	..	5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½	..	4 18 6
Mexico Trams Com.	$100	6	7	122 —124	+1	5 12 11
Do. Gen. Con. 5 % Bonds	..	5	5	95½— 96½	+ ½	5 3 8
Do. 6 % Bonds	100	6	6	99½—101½ xd	+2	5 18 3
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5¼— 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1/16— 1/16	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	101½—103½ xd	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝— 5⅞ xd	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100 xd	..	4 10 0
Rio de Janeiro Trams	$100	2	5	114¼—115⅛	+1	4 6 7
Do. 1st Mort. 5 % Bonds	..	5	5	100⅜—101½ xd	+ ⅛	4 18 6
Do. 5 % Mort. Bonds	100	5	5	96¼— 97¼	+ ⅛	5 2 10
Sao Paulo Tram, Lt. and P.	$100	10	10	182 —185	+1	5 8 1
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 —100	— ½	5 0 0
Un. Elec. Trams Monte Video	5	7	7	5⅛— 6⅜ xd	..	5 9 10
Do. 6 % Pref.	5	6	6	4⅜— 5⅜ xd	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106½—108½	+ ½	4 2 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	3/16— 3/16 xd	..	8 0 0
Do. 6 % Pref.	1	12	12	1/16— 1/16 xd	..	7 7 8
Babcock & Wilcox	1	24	20†	5⅜— 5½	..	4 5 4
Do. Pref.	1	6	6	1⅜— 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅜— 7⅜	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅜	..	4 12 4
Do. Deb.	100	4½	4½	100 —102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32— 1/32	— 1/32	Nil
Do. Deb.	100	4	4	59 — 62 xd	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	0 — 1/16	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	1/16— 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/16— 1/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44 xd	..	10 4 6
Callender's Cable	5	15	10†	8⅜— 9⅛	..	8 2 2
Do. Pref.	5	5	5	4⅞— 5⅛ xd	..	4 17 7
Do. Deb.	100	4½	4½	101 —103 xd	..	4 7 5
Castner-Kellner	1	17½	7½	3 7/16— 3 9/16	+ 1/16	4 18 3
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/16— 3/16	..	Nil
Do. Deb.	100	5	5	57½— 67½ xd	..	7 8 2

Dick, Kerr	1	5	6	13/16— 15/16	..	6 8 0
Do. Pref.	1	6	6	1 3/16— 1 5/16	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	2/16— 1/16	..	Nil
Do. fully paid	5	Nil	Nil	1⅛— 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71 xd	—1	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	13/16— 15/16	..	Nil
Do. Pref.	2	7	7	1 13/16— 2 1/16	+ 1/16	6 15 9
Greenwood & Batley, Pref.	10	7	7	10¼— 10⅜	..	6 10 3
Do. Deb.	100	5	5	102 —103⅜	..	4 16 7
General Electric, Pref.	10	5	5	8½— 9 xd	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12⅛— 12⅞	..	5 16 6
Do. Pref.	5	4⅜	4½	4⅞— 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3 4
India-Rubber, G. & T.	10	10	10	11⅛— 13½	..	7 8
Do. Pref.	10	5	5	10⅞— 10⅞ xd	..	4 15 3
Telegraph Construction	12	17½	20	36½— 38½	..	6 5 0
Do. Deb.	100	4	4	99 —101 xd	..	3 19 8
Willans & Robinson	1	Nil	Nil	⅛— ⅜	..	Nil
Do. Pref.	5	3	Nil	½— 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

The Central-Station Engineer and Internal Combustion Engines.

Two papers before the I.M.E.A. meeting at Brighton on the internal combustion engine (the one by Mr. R. M. Carr, of Leek, upon the gas engine *cum* producer plant system, and the other by Mr. H. L. Howard on engines working upon the Diesel principle) have afforded both subject matter for present discussion and food for subsequent thought. From the internal combustion engine much is hoped for—from its high thermal efficiency reduced fuel costs are anticipated by those who favour its adoption, while the manufacturer of generators cannot but look favourably upon a prime mover running at far lower speeds than turbines, and therefore requiring a proportionately larger capital expenditure upon the plant made at his works.

Dealing with Mr. Carr's paper first, he takes the case of stations of 500-KW. capacity and under, and adduces figures showing lower capital outlay on the station itself as compared with steam stations of 500-KW., in the ratio per KW. of £55·1 steam to £40·0 gas. These figures might have been more exact: as, on the one hand, the figures for gas-driven stations are mostly, but not all, of the suction type, while the majority of the steam-driven stations are running non-condensing. As regards stations between 500 and 1,000-KW. capacity, actual figures are taken for the steam-driven stations, but the figures for the gas-driven stations are estimates "based chiefly upon manufacturers' quotations." Here the ratio per KW. rated capacity are £37·9 steam to £33·4 gas, and for stations between 1,000 and 2,000-KW. capacity, the ratio is £29·5 steam to £30·5 gas. Compared with the extravagantly optimistic prophesies of half a decade ago, which we can now regard with the wisdom which comes *after* the event, Mr. Carr is to be commended on his frankness. This also is a feature of his treatment of running costs. He warily disarms criticism of the fact that he has put forward lower costs for repairs and maintenance of gas stations than for steam stations by pointing out that his figures relate to new stations. Further on, he points out the need of proper handling of producers, default in regard to which has been the root cause of many failures.

Passing next to Mr. Howard's paper, its salient feature is the comparison of the probable capital outlay of a central station whose generators are driven by engines of the Diesel type, as against producer gas-driven sets and as against the Southwick power station at Brighton. These estimates afford ground for a very pretty little statistical quarrel (we say "quarrel," of course, in the sense of implying a purely technical disagreement) between Mr. Howard and Mr. Carr, for Mr. Howard puts the estimated capital outlay on a producer-gas station at less than the capital outlay for a large steam-driven station. Of the alternative figures, we prefer those tinged by Mr. Carr's caution.

Another point of speculative interest lies in Mr. Carr's suggestions as to the employment of Diesel engine sets in place of motor-generators or rotary converters, on the ground of (*a*) continuity of supply, and (*b*) provision for peak loads. But why, if logic is at all commendable, should not Mr. Carr's converts—if he makes any—go a stage further and establish a school of linked small multiple station enthusiasts?

Such a school of enthusiasts, by pointing to the successful inter-linking of widely separated steam-driven power stations in large industrial areas, can make many interested friends, the transformer maker perhaps excepted. Separate generating stations would mean the supply of more plant by engineering manufacturers, and the increased staffs required would tend to reduce unemployment generally, and brighten the prospects of third-year students.

We do not wish to be regarded as in any degree adverse to the internal combustion engine, which has done much, and will do vastly more for engineering progress before it reaches its zenith. Our readers will know of many cases in which extra plant is necessary for central stations, and where space, being scanty, internal combustion engines have been put down to deal with increased demands with excellent results. They will know also of troublesome gas-driven stations in the past, and of the optimism which accompanied their installation, also they will recall certain litigation in regard to alleged nuisance from the operation of another electric lighting gas-driven station. Mr. Carr treats the question of liability to create a nuisance somewhat lightly. It is not sufficient "to avoid a residential neighbourhood," for the owners of an empty row of cottages make very pertinacious litigants. Mere silencing of the exhaust is not enough. Vibrations due to air waves accompany quite silent exhausts. The exhaust boiler, excellent though it is, does not always go far enough in breaking up the blasts of exhaust gases. In conjunction with other devices a successful exhaust arrangement can be attained, but very often through the costly means of trial and error.

Internal Combustion Engines Working on the Diesel Principle.

By Henley L. Howard, Chief Electrical Engineer, Barking.

(*Abstract.*)

The internal combustion engine working on the Diesel principle has, during the past few years, received considerable attention from engineers in charge of power stations, and although at the moment only sets of moderate size are at work or in course of construction (sets from 1,600 B.H.P. downwards), the great economy that has been obtained where they have been adopted has interested engineers connected with the larger undertakings to such a degree that within the next few years there will undoubtedly be some striking developments in the installation of high-power Diesel engines. Although very fine generating cost figures are being put forward for both steam and gas plants, in the author's opinion these can be greatly improved upon by the adoption of Diesel plant.

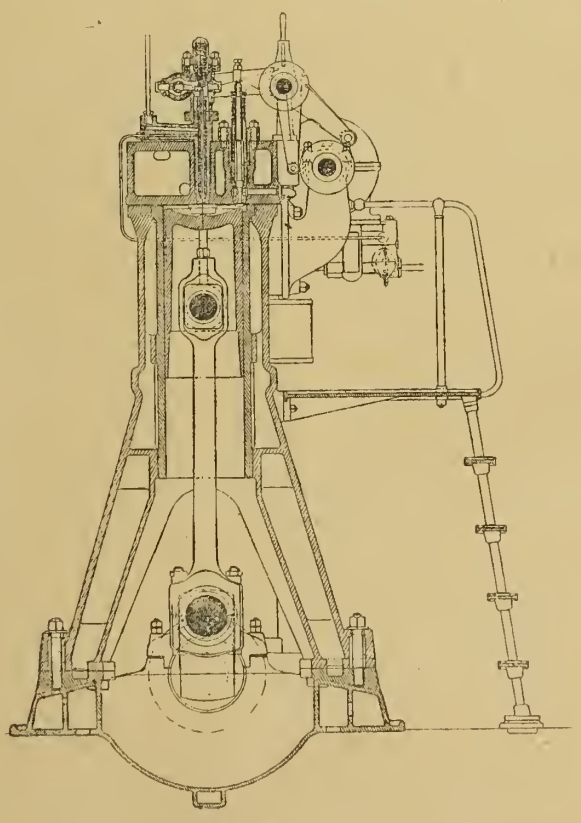


Fig. 1.—Section of Standard Diesel Engine.

The fuel cost accounts for a very large percentage of the works costs, and it is the only item that is capable of being materially reduced.

The standard Diesel engine of to-day is a single-acting four-cycle engine—that is, every fourth stroke is a working stroke.

Unlike the gas engine, the Diesel engine is not an *explosion* engine, for at every working stroke the fuel burns steadily as long as it is injected into the cylinder—every globule of the oil being surrounded by the air which atomises it. No explosive mixture exists in the cylinder before the beginning of the working stroke, the compression in the cylinder being that of air alone. The volume of air drawn in is constant, and is always sufficient to burn completely the maximum quantity of oil required at full load.

The quantity of fuel injected varies with the load, and is delicately regulated by the governor.

The Diesel engine has no extraneous igniting device, and pre-ignitions and misfires are an impossibility. Fig. 1 is a section of the standard slow-speed type of engine.

The compressed air used for the injection of the fuel oil is stored in a steel air-bottle, at a pressure of about 800 lb. per sq. in., which is kept automatically charged with air by means of a two or three-stage compressor, worked direct from the crankshaft. There are also two other air-bottles used for starting the engine.

The engine put upon the market by the Nederlandisch Fabrik, of Amsterdam, is fitted with a cross-head and guide, and has a comparatively short piston. It is also provided with a distance piece between the cylinder and the crank chamber. The makers claim several points in its favour, and, in the author's opinion, for high-power vertical engines it is the line that will eventually be followed.

One of the most interesting examples of high-power Diesel engines is the installation at Halle, where two 1,600-B.H.P. sets of the horizontal double-acting, four-stroke type, constructed upon the lines of the Nuremberg gas engine, have recently been started up.

As petroleum is found in so many parts of the world, and as many new oil-fields are being opened up, the price of oil cannot vary over very wide limits, and any such variation should compare favourably with the variations in coal. The oil fuel most generally used is the residue from crude petroleum, after the lighter spirits and oils have been distilled, and is commonly known as "petroleum residue." This oil runs about 240 gallons to the ton, and is generally either Texas or Roumanian oil. As regards price, the author has recently fixed up a contract on behalf of his Council, for a supply up to January 1st, 1913, at 37s. 6d. per ton delivered into tanks at the electricity works, Barking.

Another factor in the fuel oil question is the possibility of using the by-products from the gasworks, viz., gas oil tar and gas tar oil. The former is the by-product from carburetted water gas plants, where gas oil is used to enrich the gas for illuminating purposes. It has a calorific value of about 16,500 B.TH.U. per lb., and is being extensively used on the Continent. The latter is the by-product from the distillation of gas tar. The author recently made a careful inspection of some plants using gas oil tar, including a large double-acting tandem four-cycle engine, and a twin-cylinder horizontal two-cycle engine, the sets working with a 10 per cent. addition of crude petroleum—and was perfectly satisfied as to the practicability of using such fuel; so much so, that a 600-B.H.P. engine is now being built to his specification by the Diesel Engine Co., Ltd., to run on either petroleum residue or gas oil tar, and will be in commission this autumn.

In dealing with fuel costs it will be well, perhaps, to first take the actual guaranteed consumption of the 600-B.H.P. engine mentioned above, using petroleum residue having a calorific value of 18,000 B.TH.U., at 37s. 6d. per ton.

TABLE I.

Engine load.	Fuel consumption in lb., per hour. B.H.P.	KW.	Fuel cost in pence, per hour. B.H.P.	KW.	Dynamo efficiency, per cent.
12½ per cent. over...	0·40	0·58	0·080	0·112	93
1/1	0·40	0·58	0·080	0·112	93
¾	0·42	0·61	0·084	0·122	92·5
½	0·47	0·69	0·098	0·132	92
¼	0·66	1·01	0·132	0·202	88

Table II gives some details of Diesel plants that have been in operation some years.

Referring to Table I, it will be seen that the engine maintains its high efficiency until well below half-load. An examination of the fuel consumption curves of other types of engine will at once show the marked advantage of the Diesel engine in this respect. Unfortunately in the majority of power stations the average load upon the engine is somewhere between half and three-quarters of the full load. The Diesel fuel consumption is independent of the time during which the engine is run, being the same for half as for 24 hours per day. There are no stand-by losses whatever.

The engine can be started with absolute certainty by means of compressed air within a minute of entering the engine room, even after a lengthy period of rest. Again, the fuel costs are in no way dependent upon any other factor than that of the price of fuel and the guaranteed consumption per K.W.H.

The amount of cooling water used is extremely small. It is circulated round the cylinders at the rate of about 4 gallons per B.H.P.-hour, the outlet temperature not exceeding 120° F. The make-up water should in no case exceed 2½ per cent. This is a most important consideration to those engineers who, like the author, have to take town water from the main.

The Diesel engine is entirely automatic in its action, preparing its own fuel, stoking itself, and rejecting the waste gases. No highly-skilled labour is required, the services of a machine-minder or engine-driver being sufficient. One man per shift (exclusive of switchboard labour) can easily do all that is necessary in a Diesel power station, up to 1,000 KW. capacity.

The expenditure under the heading of repairs and maintenance, &c., is found to be very small, although those interested in other types of engine often state that the reverse is the case. Taking an actual case of three power stations, having installed 1,500 B.H.P., a sum of £117 was expended between them during the last completed year, some of these engines having run practically continuously. This sum corresponds to 1s. 6d. per B H.P. per annum, which the author considers a very liberal allowance indeed, and it is certainly much too high an average for large sets.

The lubricating oil records of several years' working of engines under various conditions show a consumption not exceeding 4 grammes of oil per unit generated, which at 1s. 8d. per gallon amounts to 0·019d. per unit.

There is no auxiliary apparatus, and the cost of engine room stores is considerably less than with either steam or gas plant.

There appears to be a feeling amongst engineers that, although the Diesel engine can compete with other forms of prime mover for small outputs, it is quite out of the question when large power stations are under consideration. That this is an entirely erroneous idea will be seen by the following comparison.

The Brighton works is taken as an example of a large steam-driven station, and one of equal output for both Diesel and gas plant respectively is compared with it. The output in each case is 10,800,000 units generated, 9,000,000 units sold, with a load factor of 21·8 per cent. and a maximum load on generators of 5,900 KW.

The present capacity of the Brighton works is 10,200 KW.

The approximate area occupied by the existing plant is 31,000 sq. ft., and the capital cost of the buildings and foundations was £109,300.

This sum covers buildings sufficient to house plant up to 30,000 KW. capacity, although at present only 10,200 KW. is installed. For the purpose of comparison, therefore, a proportionate amount of the capital to the plant installed is taken, although the foundations for the extension plant should be added.

Buildings and foundation to present analysis ...	£37,162
Boilers, pipes, economisers and accessories ...	48,000
Turbo-alternators	72,000
Switchgear, &c.	42,000
Total capital cost	£199,162
Floor space per KW. installed	3·04 sq. ft.
Capital cost per KW. installed	£19·52 per KW.

Works cost :—	*Sold.*	*Generated.*
Coal	0·40d.	0·333d.
Oil, waste, water and engine room stores	0·01d.	0·008d.
Wages	0·15d.	0·125d.
Repairs and maintenance	0·14d.	0·117d.
Total works cost	0·70d.	0·583d.

Capital charges :—

Interest and sinking fund—8 per cent., on £199,162 £15,928
On 10,800,000 B.T.U. ... ... 0·354d. per unit.

Therefore total costs, exclusive of management and administrative charges, and outside department costs, are as follows :—

Sold.	*Generated.*
0·70d.	0·583d.
0·424d.	0·354d.
Total costs 1·124d.	0·927d.

To obtain approximately the same capacity as the above, it would be necessary to install seven Diesel sets, each of 1,450 KW. capacity, making a total of 10,150 KW.

The area occupied would be 17,699 sq. ft.

TABLE II.

Name of undertaking.	Period covered. Months.	Capacity of Diesel plant, KW.	Max. load.	Load factor, per cent.	Average cost of fuel per ton.	Lb. of fuel per KW.-H.	Units generated.	Works cost. Fuel.	Lubricating oil.	Engine room stores.	R. and M.	Wages.	Total.
Letchworth	5	135	90	27·2	43/6	0·655	95,169	0·153	0·027	0·015	—	0 160	0·355
Fareham	12	200	85	14·0	49/-	0·92	143,545	0·32	0·021	0·026	0·023	0·435	0·825
Daimler Motor Co. ...	12	436	495	46·0	53/4	0·621	1,887,200	0·1782	0·0188	0·0145	0·0233	0·0638	0 2986
Wakefield and District Light Railways ...	12	400	350	30·66	57/6	0·76	743,658	0·160	0·015		0·057	0·162	0·894
Leatherhead	12	160	—	18·5	—	—	—	0·226	0·025		0·038	0·289	0·578

Capital cost :—

Seven sets—engines, dynamos, sole plates, filter tanks, air bottles and piping	£98,000
Seven intermediate tanks, each 1,000 gallons	200
Two fuel pumps	100
Two air compressors	1,000
Seven circulating water pumps	700
	£100,000
Switchgear, seven generators, six feeders	£9,000
Piping	500
Main storage reservoir (250,000 gallons)	3,500
Buildings, engine room—74 × 190 × 28′ to eaves	30,000
Foundations	3,000
	£146,000
Cost per KW. installed	£14·38
Floor space per KW. installed	1·6 sq. ft.

Details of works costs :—

Fuel, 10,800,000 units generated at 0·66 lb. per unit—equals 3,200 tons per annum at, say, 37s. per ton	£5,920
Lubricating oil at 2 grammes per unit, at 1s. 8d. per gallon	440
Engine room stores	200
Repairs and maintenance, 7 × 2,080 B.H.P. at 1s. 6d. per B.H.P.	1,090
Wages	2,177
	£9,827

Works cost per unit.	*Units sold.*	*Units generated.*
Fuel	0·158d.	0·132d.
Oil, waste, water, &c.	0·017d.	0·014d.
Repairs and maintenance	0·029d.	0·024d.
Wages	0·058d.	0·048d.
Total works cost	0·262d.	0·218d.

Capital charges :—

Interest and sinking fund—8 per cent. of £146,000—equalling 0·259d. per unit generated ... ... £11,680 per annum.

Total costs on same basis as steam-driven plant :—

	Units sold.	*Units generated.*
	0·262d.	2·218d.
	0·311d.	0·259d.
Total costs	0·573d.	0·477d.

The same number and size of sets have been taken for the gas plant as for the Diesel plant, viz.: seven sets, each of 1,450 KW. capacity, making a total of 10,150 KW. The particulars, costs, and other details for gas plant, have been taken from the paper of Messrs. Andrews and Porter, read before the Institution of Electrical Engineers in November, 1908.

Area occupied, 53,500 sq. ft.

Capital Costs :—

Seven sets engines, dynamos and all auxiliaries complete	£98,000
Four ammonia-recovery producers and all auxiliaries complete	18,490
Duplicate blower, washer, and centrifugal cleaners	3,780
Four non-recovery producers	10,340
Steam-raising plant	4,850
Cooling towers, &c.	1,990
Buildings and foundations	24,275
Crane	1,250
Steel structural work, &c.	6,150
Switchgear, battery, exciters, &c.	7,750
Total capital cost	£176,875
Capital cost per KW. installed	£17·68
Floor space per KW. installed	5·2 sq. ft.

Details of Works Costs :—

14,000 tons of coal at 12s. per ton	£8,400
Lubricating oil at ·37 gallon per 1,000 H.P.-hours, at 1s. 6d. per gallon	400
Oil for auxiliary plant	100
Engine room stores at ·002d. per unit	90
Repairs and maintenance at 0·046d. per unit	2,070
Wages	3,029
Total works cost	£14,089

Works cost per unit generated :—

Fuel	0·186d.
Oil, waste, water, &c.	0·013d.
Repairs and maintenance	0·046d.
Wages	0·067d.
Total works costs	0·312d. per unit generated.

Capital charges :—

Interest and sinking fund—8 per cent. on £176,875, which equals 0·292d. per unit	£14,150 per annum.
Total costs on same basis as steam plant	0·604d. per unit generated.

SUMMARY OF COMPARISON BETWEEN STEAM, DIESEL AND GAS PLANTS.

	Steam.	*Gas.*	*Diesel.*
Floor space per KW. :—			
Area occupied :—			
Capital cost	£199,162	£176,875	£146,000
Capital cost per KW. installed	£19·52	£17·68	£14·38
Works cost per KW.-hour generated	0·583d.	0·312d.	0·218d.
Total cost per KW.-hour	0·927d.	0·604d.	0·477d.

It is a matter of some surprise that the Diesel sub-station has not been more extensively adopted. A central station, with sub-stations, is entirely dependent upon one main station for continuity of supply, and a total or partial shut-down is disastrous in any town of importance. Again, what is the over-all efficiency? At Brighton, where there is one large sub-station, the maximum load on the turbines was 5,900 KW., the maximum load on the sub-station being 4,727 KW., or an efficiency of about 80 per cent., which figure, the author believes, is somewhat above the average.

In the author's opinion, for any new scheme involving the supply of energy over a large area, by means of a central station and sub-stations, there is no question but that Diesel sub-stations would be the correct scheme to adopt. There is in London a 100-B.H.P. set in the basement of one of the largest drapery establishments in Oxford Street, also a 1,100-B.H.P. sub-station in the City at Cannon-Street, and a still larger one at Charing Cross. There is also another large one in course of erection at Lambeth.

In a large city with 1,000-KW. sub-stations, the capital cost of a complete sub-station would be about £20 per KW. installed, including buildings, &c.

So far, only large size units have been considered and those with moderate load factors. Some comparative results of the three systems on a 100 per cent. load factor, which is admittedly entirely in favour of steam and gas plants, have been compiled by the Maschinenfabrik Augsburg-Nuernberg Co. upon the conditions appertaining to South Wales, which show that, even under these favourable conditions, both the steam and gas plants cannot compete with the Diesel sets.

The plant consists of one M.A.N. 600-B.H.P., and one 150-B.H.P. engine in each case, with all accessory apparatus; the capital cost is: Diesel, £6,815; steam, £6,650; gas, £9,250: these figures including cost of transport, erection and foundations. Taking the price of liquid fuel at 40s. per ton, coal at 9s. per ton, and coke, &c., for the producers at 8s. per ton, the cost per B.H.P.-hour is estimated at: Diesel, 0·1635d.; steam, 0·173d.; gas, 0·178d., including interest and depreciation, maintenance, wages, oil and waste.

Some results on smaller sets with varying load factors obtained on the Continent show that the average works cost on these small plants is approximately 0·36d. per unit.

Gas Engines and Producer Plants for Power Stations.

By R. M. CARR, Chief Electrical Engineer, Leek.

(*Abstract.*)

IN this short paper the author proposes to confine himself entirely to gas engines and producer plants, and to deal more particularly with stations of comparatively small capacity. The ever-increasing demand for cheap units makes it absolutely necessary that some steps should be taken to reduce the works costs, and with a steam plant it is almost impossible for a small undertaking to cater successfully for a heating and power load. This is felt most keenly in small manufacturing towns, where there is a good demand for power, and the average price obtained is so low that it is an extremely difficult matter to make both ends meet.

The price of a gas-driven generator against a steam unit of the same capacity is undoubtedly higher, even in the case of very small units, and when the size of the unit contemplated warrants the consideration of a steam turbine, the gas engine is a long way out of the running. But it is found that, below a certain capacity, the gas driven station costs less than steam, while, as the capacity increases, the figures are reversed.

The figures given below are the averages of the actual costs of a number of stations up to 500 KW. capacity of both steam and gas :—

STATIONS UNDER 500 KW. CAPACITY.

Steam, total per KW.	£55·1
Gas, total per KW.	£40

STATIONS BETWEEN 500 AND 1,000 KW. CAPACITY.

Steam, total per KW.	£37·9
Gas, total per KW.	£33·4

STATIONS BETWEEN 1,000 AND 2,000 KW. CAPACITY.

Steam, total per KW.	£29·5
Gas, total per KW.	£30·5

In the case of stations between 500 and 2,000 KW. the figures given for the steam stations are the averages of the whole of the stations whose figures are published, but those of the gas stations are estimates, based chiefly upon manufacturers' quotations.

The station at Leek, which the author is in charge of, is entirely gas driven. The station is of 420-KW. capacity, and the costs are as follows :—

Engines and dynamos		£6,567
Producers and cooling and cleaning plant, including pipe-work		2,070
Switchboard and electrical auxiliaries		1,392
Accumulators		719
Travelling crane		189
		£10,937
Per KW. installed	£26	
Land, buildings and foundations		£5,413
Per KW. installed	£13	
Total cost per KW. installed ...	£39	

The gas plant is of the "Wilson" pressure type manufactured by the Horsehay Co., Ltd., and consists of two producers, each nominally of 300-B.H.P. capacity, but which are capable of 25 per cent. overload. Water bottoms are provided for continuous running. The gas passes from the producers through an omnibus main into four dust-catchers, which are merely cylindrical boxes, where the greater part of the dust is deposited. The cooling operation is carried out by means of a series of double tubes, fitted concentrically, the gas passing between the outer and inner tubes, a large cooling surface thus being obtained. The cooled gas is then washed, the tar which is extracted flowing into a tar separator, and the gas passes through sawdust purifiers, leaving the last of the tar in the process. The purifiers are connected in parallel in order that one may be cleaned without shutting down.

A small holder is provided, merely as a mixer and governor, but is not intended as a reservoir. From the holder an 18-in. main is provided and separate services connected to the various engines.

The generating plant consists of two horizontal, Otto cycle, single-cylinder gas engines, each of 100 B.H.P., one four-cylinder vertical engine of 200 B.H.P., and one Körting, two-cycle engine of 275 B.H.P. Each engine is coupled direct to a D.C. generator.

The station is further equipped with a 400 ampere-hour battery and the usual balancer, boosters and other accessories.

For purposes of comparison, the author has taken the figures of three municipal undertakings, each entirely gas driven, also the averages of several other undertakings, gas driven, and compared these with the average of all the municipal undertakings of a capacity of under 1,000 KW.

TABLE I.—Comparison between Gas and Steam Stations under 1,000 KW. capacity.

	Averages of municipal gas undertakings.	Averages of other gas stations.	Averages of steam stations.
Capacity in KW.	314	632	600
Units sold per annum ...	299,210	874,720	502,980
Costs per Unit Sold.			
Fuel	·28d.	·26d.	·53d.
Oil, waste, water and stores ...	·06d.	·04d.	·06d.
Wages of workmen	·26d.	·16d.	·30d.
Repairs and maintenance ...	·19d.	·22d.	·28d.
Total works costs ...	·79d.	·68d.	1·17d.
Rent, rates and taxes	·10d.	not available	·12d.
Management and establishment charges, insurance, &c.	·41d.	not available	·34d.
Total costs	1·30d.	—	1·63d.

The average price for fuel in the municipal stations quoted is 11s. per ton delivered, either coke or bituminous coal being used, and at this figure similar fuel should be obtained in most parts of the country. It will be noted that the repairs and maintenance item for the gas stations is not so high as that for steam.

Regarding the general running of producer plants, a great number of the failures one hears about are attributable to lack of knowledge and experience on the part of the attendants. For this manufacturers are somewhat to blame, as the rosy picture often presented of a suction plant, which takes care of itself, requiring only a few buckets of coal per hour, is not often realised. All gas plants require constant attention if reliable and steady running is to be obtained, and it always pays in the long run to employ attendants who have had some experience rather than accept the assurance of some makers that a labourer can easily look after the plant.

The secret of success in producer gas plants is systematic cleaning, particularly in bituminous plants. Most of the stoppages are due to neglect of this important point, and unless the plant is kept thoroughly clean, not only is the gas of an indifferent quality, but considerably more fuel is used for a given load.

Suction plants, burning anthracite and coke, up to, say, 200 or 300 H.P. are now an acknowledged success where ordinary care is taken, and some thousands of H.P. are now in successful operation, but except in case of very small plants, they are not very desirable for central station work. A suction plant is not very suitable for the sudden variations in load often experienced in central station work, and for a station of over 300 or 400 KW. capacity, a pressure plant with a small holder is preferable.

On a fully loaded suction plant 1 lb. of anthracite would be required per B.H.P.-hour, which at 30s. per ton would cost for, say, a 300-H.P. engine, 4s. per hour for fuel, while a pressure plant burning bituminous coal would require 1½ lb. per B.H.P.-hour, which at 10s. per ton for the same size of plant would work out at 2s. per hour. When installing suction producers a separate plant should be installed for each engine, but with a pressure plant the producers can be connected in parallel through an omnibus main in the same way that boilers and steam engines are connected, and the various engines can be started up or shut down as required without affecting the producer plant, and this is really the only way to cope successfully with the varying load of a central station. The holder ensures a comparatively even quality of gas, which is absolutely essential, as a varying quality means miss firing, indifferent governing, and all the attendant evils at a time when steady running is most necessary.

The author has recently met with opposition from the County Council as to the effluent from the washer finding its way into a stream, but is getting over the difficulty by treating it with lime. This throws down the sulphur compounds in the form of mud, and only a very small quantity of the treated liquor will be allowed to flow into the drain from time to time.

In dealing with the tar the author has not met with much difficulty. The tar is sold in barrels, the net price obtained being from 6s. to 11s. per ton, varying with the percentage of water found in the tar. The sawdust scrubbers are cleaned every week and the tarry sawdust, which usually extends to a depth of three or four inches, changed for clean. The tarry sawdust is burned under the vertical boiler, and with the addition of about 1 ton per week of coke breeze dust, is sufficient to raise all the steam required for the blower engine and the producers.

An excellent way of silencing the exhaust is by means of exhaust boilers, where the plant is large enough to warrant this. These boilers are not expensive, and besides acting as silencers, they are able to raise sufficient steam for all purposes required on the producer plant.

The author deprecates the silencing of the exhaust by means of water in the exhaust pipes. The sulphuric acid formed by the mixing of the water with the sulphur in the gas causes rapid deterioration of the exhaust pipes, necessitating their complete renewal after a few years.

A matter in which manufacturers are open to criticism is the rating of these engines. Owing to the keen competition and the expense of manufacture, the temptation is to overrate them, and to engineers accustomed to the elasticity of steam engines regarding overload, this often leads to disappointment and dissatisfaction, especially after the engine has been running for some time, and, owing to wear, the compression has dropped slightly. A gas engine cannot be overloaded, and it is as well, when deciding the size of engine to put down, to specify a plant rather larger than is really required.

It must not be understood that the author is of opinion that gas engines as a whole are unsatisfactory for generating stations. There are engines which have been running for years and giving great satisfaction.

In conclusion, the author proposes to draw up a statement of the capital and running costs of a gas-driven station of 1,000-KW. capacity. The proposed plant consists of three producers each of 500-B.H.P. capacity, and capable of 20 per cent. overload for two hours, complete cleaning and cooling plant, a gas holder, three engines of 450 B.H.P. each and one of 150 B.H.P., coupled direct to three D.C. dynamos each of 300-KW. capacity and one of 100 KW. A boiler is provided in the exhaust of each engine which will generate the steam required for the blower engine and for use in the producers, tar separating and other purposes. A cooling tower, for cooling the engine circulating water, and the necessary pumps are also provided. The station is further equipped with switchboard, 1,000 ampere-hour battery, boosters, balancers, and the usual offices, workshops, &c.

The complete cost of this plant, based upon manufacturers' quotations, is as follows :—

Producer plant, cooling and cleaning plant, blowers, spare boiler and pump. Total, 1,500 B.H.P.		£3,330
Engines and dynamos, air compressors, cooling tower		13,100
Exhaust boilers		990
Switchboard, accumulators, boosters and balancers		3,000
Workshop equipment		200
		£20,620
Contingencies		500
Per KW. installed ...	£21·1	£21,120
Land, buildings and foundations...		9,500
Per KW. installed ...	£9·5	
Total		£30,620
Total cost per KW. installed	£30·6	

Assuming a load factor of 20 per cent. and the annual sales to be 1,000,000 units, the maximum load would be 570 KW.

Taking the fuel consumption at 2·25 lb. per unit generated, and adding 10 per cent. for stand-by losses, and assuming the station efficiency, *i.e.*, units sold to units generated, to be 80 per cent., then 1,326 tons of coal would be consumed per annum, which, at 11s. per ton, would cost £729.

The water required for the gas plant would be 2,000 gallons per day, or 730,000 per annum. For engine cooling purposes 4 gallons per B.H.P.-hour is necessary, and, allowing for 5 per cent. loss, this amounts to 1,051,000 gallons per annum, or 1,781,000 gallons altogether.

The cost of oil, waste and engine room stores should not exceed £200 per annum.

Estimated Works Costs Per Unit Sold for 1,000-kw. Gas-Driven Station.

Fuel :—1,426 tons of bituminous coal at 11s. per ton	£729	·174d.
Water :—1,781,000 gallons at 6d. per 1,000	45	·058d.
Oil, waste and engine room stores ...	200	
Wages	1,183	·283d.
Repairs and maintenance...	520	·124d.
	£2,677	·64d

Discussion.

A joint discussion took place on Messrs. Howard and Carr's papers.

Mr. C. Day (Mirrlees, Bickerton & Day) referring to the Diesel engine, complimented Mr. Howard on his paper. He (the speaker) had averaged out the fuel savings of a number of stations where the Diesel engine was in use, and found a saving of 40 per cent. over steam; the worst case showed a 30 per cent. saving. Averaging in the same way for gas engine stations, he found the Diesel stations were better by 60 per cent. in fuel costs, and there were savings in other directions. In the matter of lubrication, excessive oil consumption, due to the oil burning in the cylinder, had been got over, and the Diesel now compared with good steam plant. It was often difficult to guarantee a saving by the Diesel over other plant, although there was a saving in practice, for the reason that test figures for steam and gas plant were much less than the average, while the Diesel results did not vary. As regards large units, with steam the increase in size reduced the average cost, and gave better efficiency, but the reverse was the case for the internal combustion engine, in which gross cost went up as size. The larger sizes with above 150 h.p. per cylinder, needed water-cooled pistons and introduced mechanical complications and increased repairs. The price of the Diesel engine, no doubt, seemed high, but his firm, for instance, paid no royalties, and yet didn't average 2 per cent. profit, so that it could not be claimed that their charges were unduly high. He thought there was not the slightest chance of any scarcity of oil fuel for some years, and looked forward to great developments with the Diesel engine.

Mr. Leonard Andrews thought no engineer would accept Mr. Howard's figures either for steam or gas engines, the cost of generating being stated in the latter case as 30 per cent. higher than with Diesel plant. Mr. Howard's estimates, although based on the I.E.E. paper of Andrews and Porter, were not a fair deduction. He had reduced the 21 million units in that paper to 11 millions and calculated on 14,000 tons of coal used; but almost any engine builder would guarantee the same output on 11,000 tons of coal, showing a saving of £1,800. If to this were added the sale of ammonia, say, £3,600 per annum, which should be credited, as the cost of the recovery plant was included, a saving of at least £5,400 on the author's estimate was obtained, which brought the cost below that of the Diesel plant. Taking Mr. Howard's figures for oil fuel consumption and others for a good gas engine, fuel costs in the two cases were equal at half load—oil at 40s. per ton and coal at 10s. per ton. At full load the gas engine was the better, while the Diesel gave the better result below half load. During a recent visit to the Colonies, he found there was some uncertainty as to the price of oil in the future; he had seen many Diesel engines running abroad and admittedly giving satisfaction. As regarded the rating of the gas engine, it was necessary to know the mean effective pressure in the cylinder, in order to estimate its capabilities. A maximum of about 70 lb. per sq. in. was good practice. He could not agree with the previous speaker that the proportionate cost of the internal combustion engine increased as the size; the efficiency certainly improved.

Mr. G. Seaton said the small station used to be the objective of the gas-engine man. Now the attraction was the large station; Mr. Pearce had considered the gas engine—"Manchester was holding out the carrot to the donkey." One could not get any reliable figures for the big gas engine, until a recent paper on the gas engine was read in Manchester. The room was full of gas engine makers, and he had no idea there was so much trouble with the gas engine, as was shown in the subsequent discussion. The gas engine users were absent, they had pressing engagements.

Mr. Horace Boot said a few years ago he had put down a Diesel plant for Chichester, without a battery, relying on the maker's figures, and had found some difficulties. The engine was a good one, but he thought it would be found to have been adopted in places where it was unsuitable. He was afraid Mr. Howard had adopted fancy figures in his estimates, and time would show their accuracy. The fuel costs with the Diesel engine were excellent, almost always near the guarantee, but he found that skilled attention and repairs ran up the cost The Chichester figures for the first year were: Fuel, ·291d.; wages, ·543d.; repairs, ·214d. per unit at the station. There was plenty of oil to be had, no doubt, but the difficulty was the shipping facilities. In Mexico, an oil country, where oil burning locomotives were generally used, the latter were being refitted for coal burning, owing to the uncertainty of the oil supply. There were special conditions in connection with the Brighton plant which made it unsuitable for comparison with Diesel figures. If oil engines were adopted, special storage facilities were required, and calorific tests of the oil should be made; in any case, the makers' rated output would not be obtained continuously.

Mr. G. Wilkinson (Harrogate) asked why Mr. Carr had not taken advantage of by-product recovery; sulphate of ammonia sold for £13 per ton. In 1902 they had put in a 40-h.p. Diesel engine for sewage pumping at Harrogate, and the oil cost £4 7s. 6d. per ton delivered on the site. Running 16 hours a day, for seven days a week, on three-quarter load, the repairs cost in round figures £50 per annum, as compared with Mr. Howard's figure of 18d. per h.p., or about £3 in this case. The fuel cost was ·287d. per unit, while the cost of the lubricating oil was very high, it being found that it was being burnt in the cylinders. The engine was, of course, not a modern one. He read out a lengthy list of parts required for repairs, principally springs. He suggested that the marine type Diesel was worth attention by engineers.

Mr. Mulholland (M.A.N. Co.) said in connection with engines of 1,000 b.h.p. and upwards, his firm were adopting the double-acting four-cycle principle, and in the end he thought the horizontal pattern would be adopted, as it was easy to get at. As regarded oil supply, in 1908 the total production of crude oil was 38 million tons, of which only 76,000 tons were required for Diesel engines. Germany produced 300,000 tons of gas tar oil, which would do equally well, and was much more than sufficient for present needs. The experience of his company, building all classes of steam, gas, and oil engine plant, was that Diesel engine repairs were no more than for good gas or steam engines.

Mr. Kaula referred to a two-cycle high-speed Diesel engine built by his firm (Willans & Robinson), which was in operation at the Royal Agricultural Show.

Mr. Blackman (Sunderland) judged by the construction of the Diesel engine that it was subjected to very heavy stresses, while he thought Mr. Day's remarks were sufficient to deter anyone from using it in large sizes. No doubt the higher temperatures would introduce lubrication difficulties, as had been found in steam practice. The Brighton costs, ·583d. per unit generated, taken by Mr. Howard, did not represent what could be done with steam plant. At his own works, with a similar output and five-year-old turbine and reciprocating plant, the works cost were ·21d. per unit. Moreover, as regarded capital cost, modern steam plant can be obtained for £12 ·5 per kw., and allowing for financial charges —a further ·185d.—a total of ·395d. per unit resulted, showing some £3,000 a year saving on the author's estimate. With modern turbine plant it should be possible to improve on the Diesel figures by at least £4,600 a year. It had to be remembered, in addition, that there was no comparison in overload capacities.

Mr. H. L. Dickson (Leatherhead) gave as his five years' experience of Diesel plant, that there were scarcely any repairs; the most expensive item was a new liner every seven years. His fuel cost was ·22d. per unit, and the engine took ·7 lb. oil per unit over the whole year, as against the maker's figure of ·68 lb. The price of oil had steadily gone down from 77s. to 48s. per ton, the price he now paid. He came to the conclusion that it would pay to give away many small steam sets and install Diesel engines.

Mr. Pickyance (Wrexham) said attention had been given to the high-speed vertical gas engine, but he thought the slow-speed horizontal type would give more satisfaction.

Mr. S. E. Fedden (Sheffield) strongly criticised Mr. Howard's estimates for capital and running costs; his own turbine plant, some years old now, only cost £13 per kw., and the coal costs were coming down to ·15d. per unit. The gas engine man always stipulated for underloading; he said with top load there would be trouble. Mr. Dickson had put his repairs at £2 a year, but that was explained by his very poor load factor. He instanced the substantial proportions necessary for the marine oil motor, which had to run on a steady full load.

Mr. L. V. Robinson said his firm (Richardsons, Westgarth) had a marine Diesel engine in hand of 1,000 h.p. operating on the four-cycle double-acting principle, and if it gave satisfaction they would turn to the land engine. The Diesel engine was excellent for the small station, but in large power plants he still considered that a gas engine should be put in for the steady load, and a steam turbine for peak loads, as it was the cheaper plant for such use. There was a possibility in the future that large Diesel engines, up to 6,000 b.h.p., would replace the gas engine. He mentioned that his firm had put in a 4,000-h.p. gas engine plant in four units, which operated on ·9 lb. Chinese coal per b.h.p., and the repairs were on quite a reasonable basis.

Annual Report, 1910-11.—This shows that the membership stands at 407, a decrease of nine on the previous year's figures, which is attributed to members leaving municipal employ and to L.G.B. restrictions. Financially the year left a surplus of £157, and there is a total surplus of assets of £642.

The report touches on publicity work and the new wiring rules, which are recommended as a basis for standard practice.

A comprehensive report on charges for energy for traction purposes from combined stations is now being considered by a Committee of the Council, previously to its being submitted to a Joint Committee of the M.E.A. and M.T.A.; the lamp standard sub-Committee has investigated the question of radiator lamps, and it is hoped to produce a lampholder which will be satisfactory with currents up to 2½ amperes.

In connection with the I.E.E. revision of model general conditions for contracts, the Council strongly urges the amendment of the clause appointing the engineer (of the local authority) sole arbitrator in cases of dispute; as the amendments suggested have not yet been adopted, the subject is only briefly touched on.

Among other matters which are engaging the attention of the Council, are the suggestion for the establishment of an information bureau, and the desirability of enlarging the Counoil with a view of securing wider representation of the smaller undertakings.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Lightning Griller.

The Suffolk Electricity Supply Co., of Stowmarket, has recently introduced an ingenious 400-watt griller which possesses several features of interest. Reference to our views, which illustrate the apparatus in use and dismantled, show that it consists of a top heater, which fits over a frame, with an internal cooking grid, standing in a bottom pan.

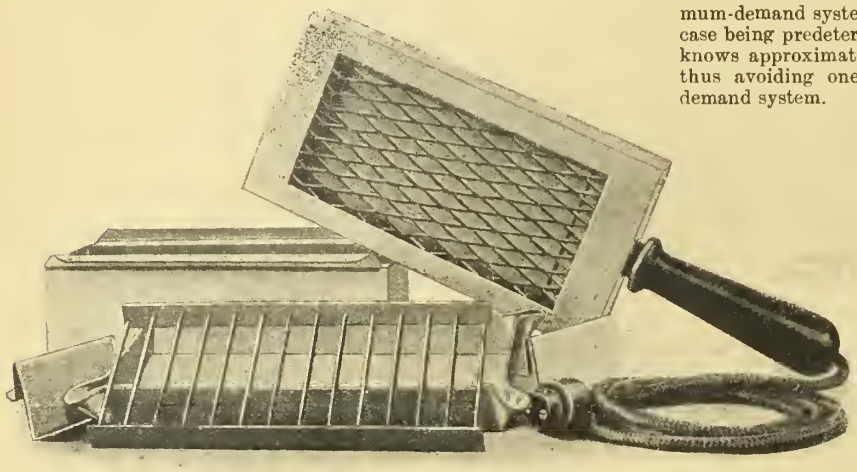


Fig. 1.—Lightning Griller, Showing the Separate Parts.

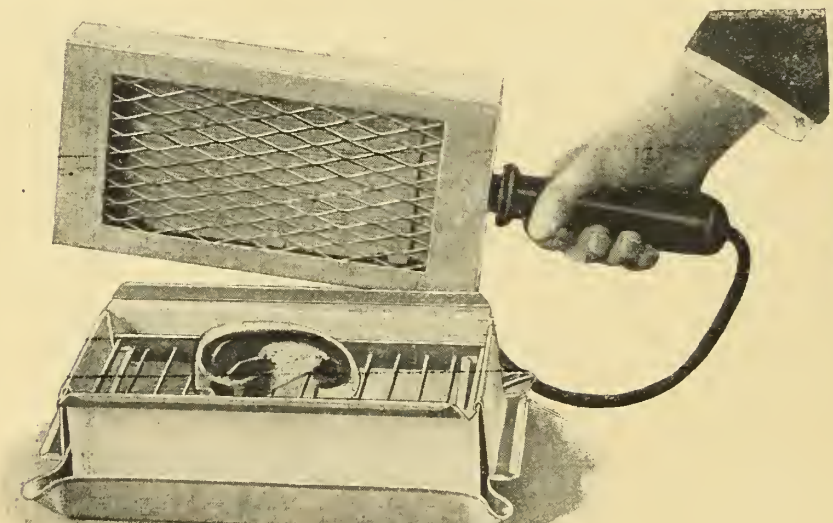


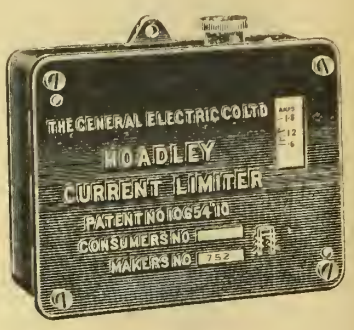
Fig. 2.—Lightning Griller Ready for Use.

The heater consists of an aluminium or copper frame, carrying Constantan or Concordia heating wires, which are kept taut by means of springs, and, therefore, have no tendency to sag when hot. A uralite backing is provided, and the front is protected by an expanded metal screen. The cooking grid, by means of the end supports, can be placed in four different positions relatively to the heater, so as to accommodate articles of food of varying thickness; the bottom pan collects any gravy. The griller itself (without handle) measures about 13 in. × 6 in. × 5 in. deep, and will comfortably take chops, steaks, cutlets, small fish, &c., but it is particularly recommended as a rapid toaster. We can verify, from some months' practice, the fact that the first two pieces of toast can be made in five minutes (using $\frac{1}{10}$th unit), and succeeding pieces in very much less time, of course, when fully heated up.

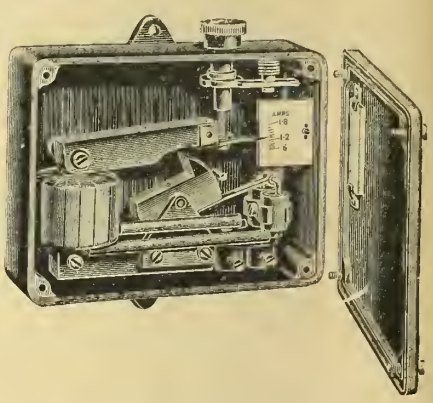
The apparatus is exceedingly light and portable, and efficient as a heater, due to the absence of metal to conduct the heat away from the heating wires, and the large surface of the latter radiating heat on to the grid; moreover, its price is quite moderate.

The "Hoadley" Current Limiter.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have introduced a new form of current limiter under this title, which possesses novel features; for example, the consumer can himself increase the number of lamps to be paid for, without sending to the works, but the number cannot be lowered except by the supply authority; the number of lamps to be paid for can always be seen by the consumer; the instrument has a long range, gives a very decided flicker and cannot be tampered with. The mechanism, fig. 4, consists of a laminated electromagnet with one pole-piece pivoted, and adjustable by a screw with a milled head; the coil is in series with the consumer's lamps and a mercury switch, the latter consisting of a Z-shaped armature carrying contacts which dip into mercury cups. When the current exceeds a predetermined limit, the armature rotates and interrupts the circuit at the mercury cups, causing a flicker which compels attention. By turning the milled head, the air-gap can be increased, so that a larger number of lamps can be lighted without causing a flicker, but the screw cannot be turned so as to reduce the number of lamps. A pointer attached to the pole-piece indicates on a scale the maximum current or number of lamps for which the instrument is set. It is pointed out that the limiter can be used either with a fixed charge per lamp, or on a modified maximum-demand system with a meter, the maximum-demand in this case being predetermined and definitely fixed so that the consumer knows approximately what his quarterly account will amount to, thus avoiding one of the drawbacks of the ordinary maximum-demand system.



Closed.



Open.

Figs. 3 and 4.—"Hoadley" Current Limiter.

New Testing Sets.

Messrs. Elliott Bros., of Century Works, Lewisham, have recently placed on the market the "C.W." testing sets for A.C. measurements, or for both A.C. and D.C.; these are of the dynamo-



Fig. 5.—"C.W." Testing Set.

meter pattern, and are made in several combinations, of which we illustrate one, consisting of an ammeter and a voltmeter in one case. The instruments are practically independent of wave-form and frequency, and free from temperature errors ; the movements are spring-controlled and balanced, with dead-beat action, and are provided with clamping devices to render the instruments portable ; a zero-adjusting device is fitted. The instruments are of high accuracy, and are made up in sets of two or three, consisting of any combination of ammeters, voltmeters and wattmeters.

New Heating Element.

A new element for electric heating and cooking apparatus—one of those simple devices that strike one as obvious and absurdly simple, after someone else has invented them—has been introduced by Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts. It consists in the use, in conjunction with their ordinary type of container with expanded metal grid, of a wire upon which beads are threaded, like the flexible conductors used in arc

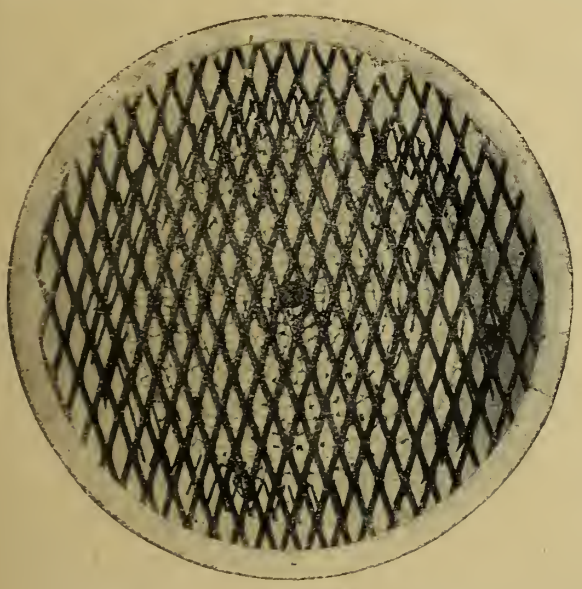


Fig. 6.—The "Bead" Element for Heating and Cooking Apparatus.

lamps, &c. The heater is practically unbreakable, unaffected by liquids spilt upon it, and of long life. The accompanying illustration, fig. 6, shows the "bead" element as adapted for use in the Economic stove, for which Messrs. Siemens Brothers Dynamo Works, Ltd., are the selling agents ; with the new element the efficiency of the Economic stove is greatly increased, and the device appears likely to be of great service in various applications.

The "Fortiter" A.-H. Meter.

An ampere-hour meter from the works of the makers of the "Excello" arc lamp has been placed on the market by the Union Electric Co., Ltd., of Park Street, Southwark, S.E., under the



Fig. 7.—"Fortiter" S.A.K. Meter with Cover Removed.

name of the "Fortiter" S.A.K. meter. The instrument is of the motor type, with disk armature and permanent magnets, and is, therefore, a D.C. meter ; the moving element, complete with coils, disk, commutator, &c., weighs only 40 grammes, and does not require locking for transport. The bottom pivot jewel, which is of sapphire, is subjected only to a very light pressure, but provision is made for its easy renewal without affecting the calibration of the meter. The commutator consists of silver strips, with which phosphor-bronze brushes, faced with gold wire, make contact, giving a practically constant resistance, and the registering mechanism is of the cyclometer type. The torque is high, the meter starting with less than 1 per cent. of the full load, and the loss in the series resistance is 1 to 1·2 volts at full load. The meter is adjusted to olosest accuracy at about one-tenth of the full load, but the error is very small at any load. Fig. 7 shows the meter with cover removed.

Relay Panel.

The accompanying illustration, fig. 8, shows back and front views of one of the series relay automatic self-starting motor panels made by the Adams Manufacturing Co., Ltd., 106, New Bond Street, W. As will be readily understood, the connections involved in the

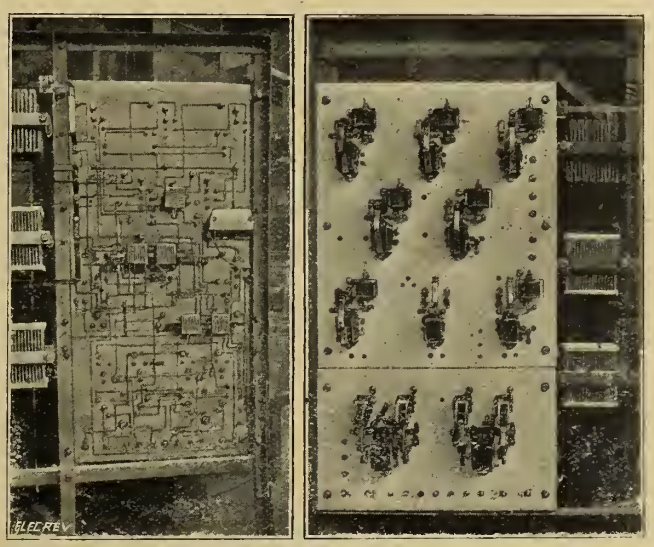


Fig. 8.—Front and Back of Automatic Starting Panel.

design of these boards are extremely numerous and complex, rendering careful design necessary in order to prevent the juxtaposition of wires at widely different pressures. The figure shows how the connections of the panel have been planned and laid out so as to produce a neat and workmanlike result, while avoiding all dangerous crossings, and making all the connections readily accessible. The panel is mounted on an iron framework, which also carries the resistances, some of which are shown beside the board.

New Decorative Device.

Messrs. Phillips & Kahn, of 108, Strand, London, W.C., have recently brought out a new floral device for use with electric lamps for decorative purposes. The idea is roughly shown by the accompanying fig. 9, but this by no means does justice to the device, with
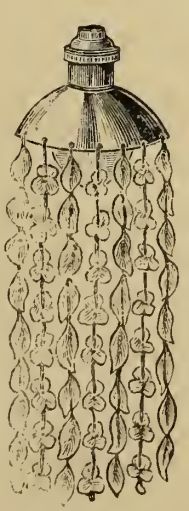


Fig. 9.—Floral Decorative Device.

which a variety of natural tints can be obtained, giving very pretty coloured results both by day and by night. This device is best seen lighted up, and arrangements have been made for this to be done at the firm's showrooms in the Strand, but a card printed in colours gives a fair idea of it.

Photographic Arc Lamp.

The Globe Electric Co., Ltd., of 11, Farringdon Avenue, E.C., have introduced a new arc lamp outfit, called the "Photolumen," for the use of photographers; the appearance of the apparatus is shown in fig. 10. The lamp is provided with automatic carbon feed, easily manipulated, and gives the required results with a short exposure: the light is diffused by an adjustable screen, is rich in

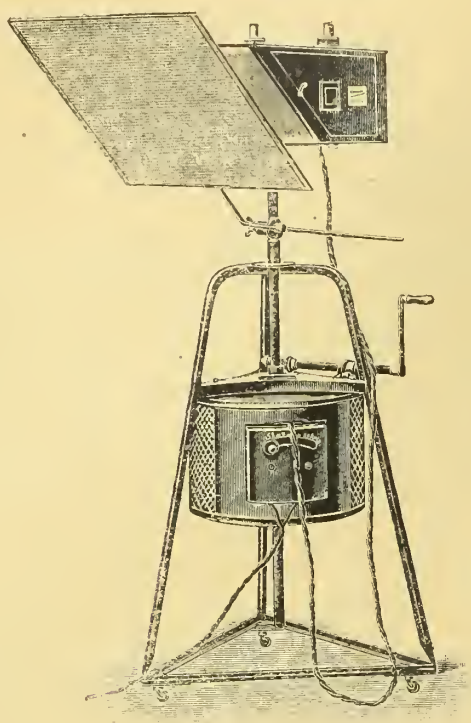


Fig. 10.—Photolumen Outfit.

actinic rays, and can be regulated by means of a rheostat to five degrees of intensity. The outfit is mounted on a portable tripod, and is self-contained, the lamp being also provided with means for rotating it with the screen. The outfit here illustrated works with an open arc, behind a frosted glass window, but an enclosed-arc pattern is also made, which is richer in chemically active rays, and is more suitable for high voltage. Both patterns are made for use on A.C. and D.C. circuits, and are suitable for all photographic purposes, including industrial uses, such as copying, &c. Various other types of lamp for photographic purposes are supplied by the company.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,802. "Antiseptic telephone caps." E. F. Farmer and G. B. Ramsey. June 26th.

14,803. "Fusible cut-outs for controlling electric circuits." V. Hope. June 26th.

14,812. "Electrical circuit breaker." Veritys, Ltd., and P. A. Hirsch. June 26th. (Complete.)

14,825. "Gas controllers, electric time switches and other timing devices." G. O. H. Horstmann, E. H. Horstmann and W. T. Edgar. June 26th.

14,866. "Portable electric lamps." B. Pordes. June 26th.

14,867. "Controllers for use in connection with electric motors." Electric and Ordnance Accessories Co., Ltd., and J. R. Garner and M. R. H. Mceller. (Divided application on 17,349 of 1910.) July 21st, June 26th.

14,882. "Trolley pole retaining apparatus for electric cars." J. T. Sweeting and H. W. East. June 26th.

14,887. "Telephone system." F. Schulz. June 26th. (Complete.)

14,888. "Elastic pedal crank for cycles." A. Walter. June 26th. (Complete.)

14,912. "Apparatus for sterilising liquids by means of ultra-violet rays." Soc. Angn. Francaise dite Banque du Ranium. (Convention date, June 27th, 1910, France.) June 26th. (Complete.)

14,942. "Single-phase alternating-current motors of the commutator type." M. Milch. (Convention date June 27th, 1910, Austria.) June 26th. (Complete.)

14,959. "Attachment in telephone mouthpieces." A. E. Bradshaw. June 27th.

14,994. "Means and apparatus for duplex wireless telegraphy." T. Mc C. de Bingham. June 27th.

14,999. "Experimental apparatus for intuitive electric instruction." G. Bache. June 27th. (Complete.)

15,008. "Shade-holders for incandescent and electric lights and the like." J. Watkinson and A. E. Payne. June 27th.

15,010. "Apparatus for sterilising liquids by means of ultra-violet rays." Soc. Anon. Francaise nite Banque du Ranium. (Addition to 14,912, 1911. Convention date, Octobor 15th, 1910, France.) June 27th. (Complete.)

15,038. "Dynamo-electric machines." A. H. Midgley and C. A. Vandervell. June 27th.

15,039. "Automatic switches or cut-outs for use in charging secondary batteries from dynamo-electric machines." A. H. Midgley and C. A. Vandervell. June 27th.

15,052. "Electric signalling apparatus." R. B. Ransform. (S. P. Thrasher, United States.) June 27th. (Complete.)

15,054. "Electric heating apparatus." J. Denissel. June 27th.

15,085. "Electrical switch fuses." H. C. Heath. June 28th.

15,086. "Thermo-electric generators." W. P. Perry. June 28th.

15,087. "Combined boiler and thermo-electric generator." W. P. Perry. June 28th.

15,090. "Friction permeameter for testing magnetic materials." W. H. F. Murnoch. June 28th. (Complete.)

15,091. "Terminals for insulated wires." A. Morgan. June 28th. (Complete.)

15,126. "Recording counter for telephonic conversations and similar purposes." Association des Ouvriers en Instruments de Precision. (Convention date, July 1st, 1910, France.) June 28th. (Complete.)

15,129. "Registering circuits from automatic telephone exchanges." Siemens Bros. & Co., Ltn. (Siemens & Halske Akt.-Ges., Germany.) June 28th. (Complete.)

15,130. "Telegraph instruments for receiving messages by perforating strips and at the same time reproducing them in typo-printed characters." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 28th. (Complete.)

15,133. "Telephone systems." W. H. Derriman. (Automatic Electric Co., United States.) June 28th. (Complete.)

15,149. "Eleotric current controlling device." A. E. Berdon. (Convention date, July 5th, 1910, United States.) June 28th. (Complete.)

15,155. "Wheel rim." C. C. Parrott. June 28th. (Addition to 4,760, 1910.)

15,157. "Telephone lock." C. Sanny. June 28th.

15,165. "Apparatus for indicating earth leakage in electric current, and or to cut-out a leaky circuit in an installation." S. Williams and J. McCallum. (Addition to 11,270/11.) June 28th.

15,169. "Electrical accumulators." W. P. Perry. June 29th.

15,216. "Electric traction." H. W. Lane. June 29th.

15,217. "Lamps with parallel electrodes." R. W. Jones. (Ges. für Verwertung technischer Patent m.b.H., Germany.) June 29th. (Complete.)

15,219. "Electric ignition fuses." K. Schaffler, recte Glossl and D. Weiss. June 29th.

15,225. "Electrical resistances and methods of making same." British Thomson-Houston Co., Ltn. (General Electric Co., United States.) June 29th.

15,226. "Method of and apparatus for cooling multi-stage compressors and the like." British Thomson-Houston Co., Ltn. (Allgemeine Elektricitats-Ges., Germany.) June 29th. (Complete.)

15,231. "Method of and means for regulating electrical heating apparatus." E. C. R. Marks. (J. Roberts, Natal.) June 29th.

15,232. "Electrically-driven percussive tools." R. S. S. Bellamy. June 30th.

15,248. "Apparatus for controlling electric arcs." W. P. Thompson. (Soc. la Radio-Electricite, France.) June 30th. (Complete.)

15,249. "Antennæ for the transmission and reception of Hertzian waves." W. P. Thompson. (Soc. la Radio-Electricite, France.) June 30th. (Complete.)

15,270. "Exhaustion of incandescent electric lamps." K. M. E. S. van Strijen. June 30th. (Complete.)

15,302. "Electric water-heating devices." H. Löfquist. June 30th. (Complete.)

15,318. "Telephones." B. Gwozdz. (Convention date, June 6th, 1911, Germany.) June 30th. (Complete.)

15,322. "Electric motor control systems and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 30th.

15,340. "Means for increasing the E.M.F. of rotary converters for battery charging and the like." A. M. Taylor. July 1st.

15,390. "Apparatus for generating electricity." J. S. Priestley and H. Aldred. July 1st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Distributors for Electric Accumulator Ignition Gear. F. R. Sims. 1,898. January 25th. (July 25th, 1910.)

Electric Detonators for Blasting. R. D. Harris. 10,717. May 2nd. (Patent of Addition not granted.)

Method of Increasing the Safety of the Operations of Hoisting and Lowering with Induction Motors. H. J. S. Heather. 11,336. May 7th.

Lamp Bulbs, Globes and the like. S. O. Cowper-Coles. 13,282. June 1st. (Addition to 16,301 of 1909.)

Starting Devices for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 13,335. June 1st.

Electric Controlling and Regulating Apparatus. R. Hankin. 13,468. June 3rd.

Electric Switches. W. McGeoch and William McGeoch & Co. 13,476. June 3rd.

Prevention of Sparking in the Control of Electric Circuits. W. A. Price. 14,380. Juue 14th.

Alternating Current Commutator Machinery. Akt.-Ges. Brown-Boveri et Cie. 14,391. June 14th. (June 17th, 1909.)

Means for Locking Electric Incandescent Lamps to their Holders. J. R. Halliwell and J. D. Jeremiah. 14,429. June 15th.

Detachable Power Handle for Controllers on Electric Cars, Cranes and the like. W. R. Shaw and G. H. Green. 16,017. July 5th.

Apparatus for Electroplating Small Articles. R. Blasberg. 19,296. August 16th.

Electric Lighting of Motor Cars, Cycles, and other Vehicles. J. W. Esser and C. Hodgkinson. 19,532. August 20th.

Apparatus for Supporting and Raising and Lowering Lamps. City of London Electric Lighting Co. and Peard. 19,795. August 24th.

Electric Voltage Regulation. British Thomson-Houston Co. (General Electric Co.) 21,041. September 9th.

Electrones for Arc Lamps. Gilbert Arc Lamp Co. and Dowdell. 21,157. September 12th.

Fire Brigade and like Electric Alarms. J. D. Williamson. 22,642. September 30th.

THE
ELECTRICAL REVIEW.

VOL. LXIX. JULY 21, 1911. No. 1,756.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
J. A. BERLY'S).
1911 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C

THE LITHARGE TEST FOR FUEL.

ONE of the most interesting discussions at the recent Brighton meeting of the I.M.E.A. was that on the purchase of fuel, with which fuel testing is intimately connected.

That fuel should be purchased on some defined basis connected with the cost of generating electricity is obvious —in these days the "cheap" unit leaves no alternative. But whether extremely accurate calorific determinations of fuel value are a necessity, whether it is possible in practice to obtain uniform accuracy in testing, and even if obtained, whether the practical station test does not in any case form a much safer and more reliable guide to the fuel purchaser, must be left to the experience of the engineer.

For the latter, there are other important factors to consider, such as the cost of carriage and the type of furnace in use, which influence the class of fuel adopted. If a rough and ready calorific test is required, there seems to be no reason why the Berthier litharge method used at Lot's Road power station, to which attention was drawn in the M.E.A. discussion at Brighton (see page 118), should not be more generally adopted.

The method of testing fuel by means of litharge resolves itself into a change of base of chemical compounds. Just as, in thermit welding, metallic iron is produced from iron oxide by the greater affinity of oxygen for aluminium than for iron, so in the litharge test metallic lead is produced when lead oxide or litharge is heated with carbon, the latter robbing the lead oxide of its oxygen.

Lead forms four oxides—the little-known black oxide Pb_2O, PbO, PbO_2 and Pb_2O_3. The red oxide, or litharge, is the protoxide or PbO. The atomic weight of lead is 207; that of oxygen, 16; that of carbon, 12.

So long as sufficient litharge is used, the actual weight employed is not of moment, for the duty of the litharge is to supply oxygen to a small weight of fuel which is made up of carbon, hydrogen and certain oxides, of which one may be that of hydrogen.

With an ample supply of oxygen, carbon will always oxidise to CO_2. Let it be assumed that a weight of 20 grains of fuel is employed. Each grain of carbon will absorb 2·667 grains of oxygen. Each grain of oxygen absorbed will represent 207/16 = 12·94 grains of lead. Therefore, each grain of carbon oxidised will represent 12·94 × 2·667 = 34·5 grains of metallic lead.

This metallic lead appears as a button in the closed crucible in which the reaction must be carried out. Thus, if the button of lead is found to weigh 345 grains, there must have been 10 grains of carbon converted into dioxide. But this litharge test does not tell how much o the oxygen absorption is due to the uncombined hydrogen.

It does tell, however, what proportion of a sample of fuel is combustible. Again, it does not tell the exact calorific power of the fuel, for this will vary with the composition of the hydrocarbons in the coal.

The litharge test is based on Welter's formula, and this supposes, but inaccurately, that the heat of combustion is proportional to the consumption of oxygen.

The Welter formula for the heat of combustion (N) is—

$$N = 26{,}880 \left(\frac{C}{3} + H\right),$$

where C and H are the weights of carbon and of hydrogen in a kilogramme of the fuel. Thus, it is necessary to know how much of C and of H are present in a sample, and the method ceases to be a rapid one, though it may be used for finding the ratios of combustible in different samples. But these ratios are not necessarily correct indications of the calorific value, for Scheurer-Kestner showed that not only did the formula above give inaccurate results, but it might even reverse the relative values of two fuels. He mentions a case where two samples tested by calorimeter gave 8,813 and 8,750 cals. respectively, whereas the litharge formula gave 7,547 and 7,977, results not merely under value but reversed. Thus the litharge test can only be used for very crude results.

At the same time let it not be forgotten that the coal with the highest absolute calorific value is not of necessity the best coal in a particular furnace. It may clinker badly, or may burn into holes on the grate and admit too much useless air.

But if coal is to be only approximately tested, not even the litharge test need be employed: let 1 oz. of coal be weighed and then powdered and dried thoroughly. Weigh again; the difference is moisture. Burn gently away to ash; what disappears by burning is approximately combustible. This method ignores that there may be oxygen and combined hydrogen in the proportions to form water and yet that drying will not volatilise it.

Coal is too complex a substance to be accurately treated by any rough method. The accurate method by the Berthelot-Mahler bomb is too delicate for the ordinary man to use, for it involves too many corrections. Quite probably the litharge test will give fair comparative values as between coals of a given district, but not as between, say, Lancashire and Durham, or Yorkshire and Dean Forest.

In place of litharge, white lead or $PbCO_3$ has been employed. Here metallic lead is formed, and CO_2 is driven off with the rest of the CO_2 formed by the one freed volume of oxygen.

Berthier recommended the Welter formula and litharge method, but his own results did not show that the method was other than an approximation.

Brighton Pioneering.

In the Presidential Address recently delivered by Mr. J. Christie, engineer and manager of the Corporation Electricity Department, at Brighton,* many interesting facts connected with the progress of electric lighting in that town are given; but a correspondent reminds us that Mr. Christie has omitted to refer to much earlier pioneering work, both in connection with electric lighting and traction, which should not be overlooked in dealing with the history of the industry.

It was due to private enterprise that the first practical scheme of electricity supply for towns was carried out.

Mr. Christie alludes to the installation of six arcs in Madeira Road, Brighton, in 1891, as being regarded as one of the wonders of the age; but he ignores the far more important and interesting undertaking carried out by the South-Eastern (Brush) Electric Light and Power Co., Ltd., at Colchester, *seven years before*, viz., in 1884. The system was that known as the B.T.K., the object being to supply electricity to houses as gas was supplied, the current being generated at a central station and distributed to the residents of the town from storage batteries.

After supplying numerous houses, shops, hotels, &c., for about twelve months, a large company was invited to inspect the system, and among others who attended were the *Mayor of Brighton* (Dr. A. H. Cox), several representatives of the City of London Commissioners of Sewers, the Mayors of Colchester and Dudley, besides gentlemen from Eastbourne, Hastings, Wolverhampton, and many other places. The Duke of Sutherland, Sir Wm. Preece, and many others interested, from all parts of the country visited what was really the pioneer town lighting in this country, and the only works carried out under powers granted under the Electric Lighting Act of 1882.

The engineer and inventor of the system was the late Mr. Frank King, who subsequently became connected with the E.P.S. Co. and patented improvements in their batteries.

The general manager of the South-Eastern (Brush) Electric Light and Power Co., who organised the Colchester undertaking, was Mr. George Offor, who is still actively engaged in connection with the electricity supply industry.

Mr. Christie claims that Brighton was the starting place for the first electric railway, the invention of his enterprising townsman, Mr. Magnus Volk; this little line was started in 1883, and is still among the attractions of Brighton; but in connection with electric traction, earlier work should not be overlooked. The first electric railway in England was that which was constructed by the International Electric Railway Co., and ran at the Crystal Palace, at Sydenham, in 1881, the inventor being Mr. Henry Binks, among whose employés was one John Burns, now President of the Local Government Board.

The history of the Brighton electricity undertaking is of great interest, marking the progress of the business in a purely residential town, under the able management of an enterprising engineer.

Brighton is an exceptionally favourable town for an electric supply undertaking: a wealthy residential community, magnificent hotels and boarding houses, numerous places of amusement—in fact, a vast combination of an all-the-year-round pleasure resort with an attractive residential district for Londoners by the sea.

With respect to the important matter of how to get business, Mr. Christie appears to rely upon friendly co-operation with the wiring and fitting firms, rather than upon pushing sales by means of direct application to possible customers, and he appears to be in hearty accord with the Electricity Supply Publicity Committee for printed matter for canvassing purposes.

Upon this essential branch of the commercial management of the business of an electric supply undertaking we may refer Mr. Christie to our article upon "The Art of Canvassing" (May 26th, 1911), especially to the advocacy of *local pamphlets*, with testimonials from consumers, who thus become the most efficient canvassers. The public will believe what their disinterested neighbours tell them, while they receive *cum grano*, or with indifference, the statements of those directly interested in obtaining their custom. Mr. Christie's claim that the supply authority should have the power to sell and hire out motors, &c., applies, of course, only to public bodies trading at the risk of the ratepayers, private companies being at liberty to adopt all such means of facilitating business. This is one of the difficulties of municipal trading.

* Electrical Review, June 30th, 1911, page 1027.

The Diesel Engine and the I.M.E.A.

We do not suppose that the missionaries of the internal combustion engine who listened to the discussion on Messrs. Howard and Carr's papers at the Municipal Electrical Convention were seriously disturbed thereby. Opportunities for using large gas engines in connection with municipal electrical supply are rare, and not such as allow of favourable comparison with large gas-engine installations in private works; moreover, the average station engineer is justifiably in love with the steam turbine, and though he may admire the modern gas engine, his admiration does not extend to chemical manufacturing. On the other hand, the

large Diesel engine exists principally on paper, although its day is fast approaching. Mr. Howard mentioned that two horizontal engines, each of 1,600 B.H.P., are installed at Halle; these are of the twin-tandem double-acting four-cycle type. The Nuremberg Co. have in hand a 1,000-H.P. double-acting two-cycle engine, one of a pair for a twin screw cargo steamer, and Messrs. Sulzer are building two 1,500-H.P. engines for a similar purpose. In this country Messrs. Richardsons, Westgarth have a 1,000-H.P. marine type engine in hand.

The German Admiralty is supposed to be building two six-cylinder engines of 6,000 H.P., or 1,000 H.P. per cylinder, and higher cylinder powers have been talked of. Evidently Mr. Howard's proposed 10,000-KW. Diesel plant (in seven 1,450-KW. sets), which he compared with the Brighton turbine plant, is within the range of possibility.

Reverting to the discussion which took place at Portsmouth on Mr. Howard's estimates, while we have no wish to detract from the excellent results obtained with turbine plant, it seems rather unsportsmanlike to dismiss his comparison on the ground that lower costs are being obtained with other turbine stations situated almost next door to the coal pit.

The Brighton works were taken to illustrate the case of a large steam-driven station, and are a fair example of an all-turbine plant running on sea-borne coal (costing 13s. per ton), and such as an oil fuel plant might reasonably be expected to compete with, if competition were possible.

In deference to the turbine man's ideal, the capital charges on the steam plant might be decreased to £13 per KW., or, say, ·24d. per unit generated, making with ·58d., the actual works costs, a total of ·82d. per unit generated for a turbine plant under Brighton conditions.

Turning to Mr. Howard's figures for the Diesel plant, they seem scarcely justified if the costs published by him for five small stations are any guide. The average works costs of the latter per unit generated amount to ·49d., with fuel averaging 51s. per ton, as against an estimated ·218d., with fuel at 37s. per ton.

Admitting the possibilities of a big output, for the sake of argument, it would be safer to double his figures, giving ·43d. per unit, and if we accept his estimated capital costs, a total of ·69d. per unit generated results. On this basis there would be a saving of ·13d. per unit generated, or over £5,000 a year, by the use of Diesel plant.

We quite recognise, of course, that with more efficient steam plant this margin would probably disappear, and there is, for instance, a large margin between the $3\frac{3}{4}$ lb. of coal per unit sold at Sunderland and the $5\frac{1}{4}$ lb. required at Brighton, with a practically similar load factor; on the other hand, one can only surmise that a saving in wages should result from the use of the Diesel engine instead of steam plant, which is not apparent in the figures we have taken.

The Salt Test for Priming.

The salt test for steam dryness seems to be much on a par with the litharge test for coal in regard to its uncertainty. In this test a certain quantity of common salt is pumped into a boiler, and is, perhaps quite properly, assumed to produce an equal degree of salinity throughout the whole body of the water in the boiler. There is very little doubt indeed that in a boiler with fair circulation such will be the case. It will almost certainly be the case throughout the upper few inches of the water in a boiler of the shell type, though, unless the circulation is good, the water at the bottom of the boiler will differ. The moisture in steam is, for the purposes of the salt test, assumed to arise entirely from priming. This, to begin with, is a somewhat doubtful assumption. The priming is assumed to consist of the average water in the boiler carried up in the steam. Then, if the steam be condensed, the resulting water will contain the salt which has risen with the priming. If this condensed steam were then found to contain one-tenth of a grain of salt per gallon, and a sample of the boiler water drawn from the water gauge cock were found to contain two grains per gallon, the assumption would be that the ratio of 1 : 20 thus found represented the ratio of priming, the steam being 5 per cent. wet. In this test there is thus first the doubtful assumption that the moisture found in the steam arises entirely from priming, and not at all from loss of heat through the boiler crown, or through the stop-valve body, or through the steam pipe. Then it may be doubted if the priming is not in large part scum with, perhaps, more salt in it than in the body of the water; and the sample of comparison drawn from a gauge cock may also be wrong, for in the very moment of drawing out of a boiler under pressure a considerable proportion must pass off as non-saliferous steam as soon as it escapes to the lower external pressure of the atmosphere. There appear to be too many doubts and assumptions already for any reliance to be placed on such a test. Finally, there still remains the fact that no man has yet had wit enough to devise any method of taking a truly representative sample of steam out of a pipe of flowing steam. Nobody knows how the steam and water comport themselves in a pipe, and nobody can fix pipes and nozzles that will abstract true samples that can be positively or even with good reason declared to be true. This uncertainty has condemned all calorimeter tests of steam dryness, and it would be fatal to the salt test were this not already rendered valueless by other doubtful assumptions.

The Telephone Transfer.

Both the Post Office Department and the National Telephone Co. are to be congratulated upon the rational and business-like compromise which has been arrived at, as the outcome of the recent contests before the Railway and Canal Commissioners. In the course of the last arbitration the Postmaster-General recognised that his position of objection to telephone cables carried along electric railways was wholly untenable in the face of the overwhelming evidence of engineering experts of the first rank to the contrary, and by his surrender on this point the great advantage to the telephone system of the use of these valuable routes was retained. The final decision to allow the whole of the plant of the company to be placed upon the inventory is one which appears to meet the demands of equity, and to be in accordance with the views of the experts who gave evidence before the Commissioners. The testimony of Mr. Hayes, one of the most eminent authorities on telephone practice, was especially worthy of notice; he regarded the scrapping of existing telephone equipments, in good working order, as little short of a crime, and pointed out that in the United States the supply of apparatus from superseded exchanges in the large cities was insufficient for the smaller centres, so that new local-battery equipment has actually to be manufactured for that purpose in large quantities at the present day! Undoubtedly, as the value of all the plant will have to be appraised on a commercial basis, with appeal, if necessary, to the Commissioners, the Post Office will secure the older apparatus at bargain prices; so much the better for the service in the future. There is no indignity in using second-hand plant, and the capital outlay will be reduced.

The Postmaster-General and the employés of the National Telephone Co. are also to be congratulated upon the final settlement of their differences, which, we hope, will make for the efficient working of the system under the Post Office. We only hope that the excellent proposals of the Postmaster-General as regards the future administration of the service will be duly carried out, and that there will be an end of the telephone muddle which has perplexed the country for the past decade.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

(*Continued from page* 47.)

At the second day's joint meeting of Sections II and III, the chairman, Dr. W. C. Unwin, F.R.S., introduced the subject of the Conference, remarking that it was now agreed that engineering training should include scientific instruction and practical and commercial experience, but very divergent views were held as to the relative importance of the different components of such a training, and as to the order and duration of each. No system of engineering training could be arranged to meet all special demands, and it was the object of the Conference to find out what was most essential in all courses of training and what modifications were practically possible to meet different cases. At the outset, a professional career was aimed at, and the system of engineering education must be arranged to meet that condition. It was only by educating many that the few could be found who had the capacity and character necessary to achieve considerable advances and to do the work of national importance. Very few young men at 18 could foresee into what line of employment they might be driven, and consequently the first, or undergraduate stage of education must be broad, so as to fit students for widely different spheres of work. Perhaps the greatest defect of engineering education at present was the want of more provision for the higher, and more specialised education of the few students of real capacity, discovered in the sifting process of an undergraduate course. A certain jealousy of college education was still obvious in some practical engineers. While conceding in words that some scientific education was necessary to an engineer, they would, in fact, confine it to very elementary matters. He believed the idea that a college course unfitted a man for practical work was a wholly mistaken one. An employer who took into his works college students was often disposed to expect from them an immediate availability, which was unreasonable. The college course must contemplate the fitting of a student for his whole career, and provide him with an intellectual equipment which would only gradually become useful as he rose to higher rank in his profession. The view of the employer who looked only to the immediate usefulness of the student was a short-sighted one. Nevertheless, a college course was an unpractical and badly designed one if, at the end of it, a student was not more capable and useful from the first, in any type of workshop, than a lad without such a training. The college discipline was bad if he had not much more character and energy than the raw lad. His training had been a failure if he did not pick up the specialised details of any business to which he might be put far more rapidly than an untrained lad. Those practical engineers who were implicitly, if not openly, hostile to college training, exaggerated the value of such workshop experience as an ordinary appentice got. In general, apprentices were left to pick up what knowledge they could with very little help, and in many cases a good deal of their time was absolutely wasted. The engineer worked with his head, not with his hands, and manual skill was of use to him only in very exceptional cases. The knowledge which came to those in responsible positions was not open to the ordinary apprentice, and he learnt slowly, if at all, unless he brought to the works such a knowledge of principles and methods that he could interpret for himself what he saw. No system of workshop apprenticeship could be considered satisfactory unless someone was specially charged with care of the apprentices, whose duty it should be to make sure that they had an opportunity of seeing a great variety of work, and to help them over their difficulties. He believed employers would find—some of them had found already—that they owed a debt to the college, and that the college-trained student would prove, with a minimum ef special experience, a valuable assistant, and in some cases the originator of a real advance in practice. In return, the employer might be a little more ready to give college students a year or two years' run of the works, either without remuneration or with a small remuneration, just enough for disciplinary purposes.

Prof. J. E. Petavel, who followed with his paper on "The Relation of Engineering Employers and Colleges from the Point of View of the Practical Training of College Students," considered that the partial employment system, whereby a student spent part of the year at an engineering works and the remainder in attending college classes, had as its most serious objection the fact that it upset the routine of the works. The university should endeavour to provide sufficient facilities for acquiring the requisite education, being there for that purpose, and for the use of the student, not the student merely as a support to the university. If the system pursued by the authorities in teaching engineering was such as to separate out the students so as to form them, as it were, into a separate section or class, they began to lose the advantages of the corporate life of the university. Properly speaking, they should be on precisely the same footing as the rest of the students. With regard to laboratories, the difficulty was more obvious, as it was undesirable to have workshops at a university, and yet something of that nature could not be wholly dispensed with. He would emphasise the fact that the laboratory course and practical training were not mutually interchangeable. It should not, however, be necessary to send a student to the university to become acquainted with the use of file, hammer and lathe. The kind of laboratory which was essential was one containing examples of typical modern machinery.

Mr. J. W. Horne then read his paper advocating an arrangement whereby employers of labour should be asked to give facilities for the training of the most suitable students. Engineering firms in this country had developed a very keen interest in the better education of the ordinary apprentice, who started apprenticeship at 16 years of age. Every encouragement was given them to attend continuation classes, and several firms allowed the best of them to attend classes one or two afternoons a week. He suggested that such apprentices should be benefited by a scheme by which the best of them would be afforded the advantage of systematic scientific education in the daytime, at one of the fully equipped colleges.

Mr. Alexander Siemens wished to consider the subject from an employer's point of view. He attached particular importance to the fact that it was frequently impossible for manufacturers to take students independently of vacancies. They were, of course, perfectly willing to do so when the vacancies were there. Referring to Mr. Horne's suggestion, to allow apprentices to take time off for outside classes was impracticable. When admitted to the works they must keep the regular working hours. If absent for an afternoon a week, they might as well stop away altogether. He referred, as a Commissioner of the '51 Exhibition, to the system which was one of the fruits of that educational revival, whereby lads who displayed exceptional ability could qualify for annuities of £100 to £150 per annum.

Prof. Gisbert Kapp said that Mr. Horne's suggestion was at present being carried out in Birmingham for clever boys from the secondary schools. The University authorities were eager to assist boys in securing education, and the City of Birmingham had so increased its grant to the University that it was possible to give maintenance and scholarship allowances to a certain number. Personally, he believed in the utility of the sandwich system, but, as often worked, the "slice" was too thin. University vacations lasted nominally from three to three and a-half months, and of this three weeks should be real holiday. Many employers had inquired for the best class of student to work under them for the long vacation, and the results were most satisfactory. In Scotland longer time could be spent at the works, but this was not so in England, were the arts, science and technical students all worked together. His suggestion was four years under professors and three years at works. Why not divide into slices of one year each, *i.e.*, one year at college, then 14 months in the shops; followed by another year at college and 14 months at the same works, and finally a year at college?

Mr. Franz zur Nedden said that in Germany the whole subject was under consideration by joint committees of all the leading engineering institutions. Their recommendations were:—

1. By unanimous resolution of all the leading Universities, that no young man should be allowed to enter as a full student who had not passed 12 months in the workshops of an industrial works or repairing shop.

2. A code of rules as to the conduct of the training by those responsible for the management of these works. These nearly coincided with the rules of the Institution of Civil Engineers of 1906, and were still adhered to after 12 years of experience in working.

3. An official list of leading firms declaring themselves willing to accept students under these rules, compiled for general information.

The general opinion was that one year in the works was not sufficient, and an extra year after, or small periods sandwiched in between University courses, were suggested in addition. The principal difficulty was to ensure freedom from loss to the industrial firms taking students. Whereas Universities had plenty of money to spend, industrial concerns had no fund to pay for education in their works. The manager must necessarily look to his dividends and to immediate results, not to the benefit of the next generation. It was suggested that manufacturers should be allowed to take a premium from the students, and should be obliged to allocate a certain percentage of this to the payment of a special official as teacher, or to provide a good library. It would probably be best for working-men students to participate in the benefits derived from the expenditure of this sum. Students should do all their practical work in one factory, and put in a final six months after completing their college course. This would assist in promoting works *esprit de corps*.

Mr. J. F. C. Snell said that it was an undoubted fact that the student was unsuited to proceed to the works direct from school. Personally, he believed in completing the technical training before going into the works. He deprecated the 12 months' break in theoretical work as bad for the student. The sandwich system could only be regarded as a compromise. The best system appeared to be to go from school to college, and then, at some such age as 22, to enter the works to learn the essentials of engineering. The college-trained student was of more use to the employer after the college course than immediately after leaving the public school. He would emphasise the value of the drawing-office training. This should be brought out more clearly. His final suggestion was that the Institution should appoint a sectional Committee of their body, which, in conference with educational authorities, and the heads of the great engineering firms of this country, might watch over the education question and do much in future to aid the student and, through him, the profession in general.

Mr. B. Hall Blythe said that, as a civil engineer, he was far from objecting to the college course, but he did object to the theory that students who had completed such a course were fitted at once to become wage earners. It was obvious that, even at the end of a four years' apprenticeship, the student had still much to learn.

Prof. J. Wertheimer considered that very few people really held the view which the last speaker had criticised. The Massachusetts Institute of Technology at Boston turned out several hundred engineering graduates annually, considerably older than the British graduate. They were able to boast that

each one of these found employment at a small commencing salary. This was not the case in this country, and it would be interesting to inquire into the reason. The works here necessarily wanted the best young men they could get. Years ago in Bristol it was very difficult to find posts for men leaving, but the works now wrote asking for a similar man to the one they had already from the same institution. As a general rule, colleges were not sufficiently stern in weeding out unsuitable students. At the University of Bristol they got rid of a considerable number, who showed in the early stages of the work that they were unfitted for the profession, by advising their parents to withdraw them, thus retaining only those who would ultimately derive benefit from their studies, and be useful members of the profession. As regarded evening-school students, the very capable artisan to be found therein was provided for in Bristol, by being allowed to take his degree by a long course of study. Also a limited number of scholarships for the artisan student were in existence, and it was desirable that these should be extended so as to include an allowance for maintenance, as at present very few young men were able to take them up, owing to the necessity of providing for themselves during the period of study.

Sir William White said that, with reference to the comparison made by Principal Wertheimer. it must be borne in mind that conditions in England and America were fundamentally different. So far as the value of education with reference to obtaining employment was concerned, young men trained here also got work in the United States and Canada. Cases had certainly come to his knowledge in which the college-trained men displayed so superior an attitude towards possible employers as to render their engagement extremely unlikely. He also would like to protest against the assumption that any young man could be made into an engineer by merely undergoing a college course. It was highly desirable that the aptitude of the student should be ascertained as early as possible. He thought Mr. Snell had misapprehended the proposal. In any case, instruction must be paid for, whether at college or at a works. The employer could not keep his office going as a philanthropic institution.

Mr. H. J. Spooner warmly approved Mr. Horne's note on united action between the Imperial College of Science and the polytechnics. Personally, he would welcome such action. He joined issue with Prof. Petavel on the subject of college workshops. A great deal of work could be done there most efficiently. For instance, many workshop tools could only be handled by technically-trained workers. College workshops could instruct as to the handling of these tools.

Prof. Silvanus P. Thompson ventured to differ from the chairman in the matter of the attitude of employers towards college-trained men. His experience was that firms were eager to get them, though possibly more eager to employ than to pay. He would also differ from Mr. Snell in his proposition to defer the workshop course until the technical training was completed. Experience in the shops rendered the college training much more real and beneficial to the student. As regarded the difficulties of combining the two, he agreed with Prof. Kapp that, though desirable, it was not possible to bring English college courses into synchronism with the Scotch. At Finsbury College the two years' course could easily be taken between school and workshop, or it could be taken between the ages of 21 and 22 years by those who had served an apprenticeship on leaving school. The question of degrees was another consideration not necessarily involved.

Mr. W. H. Patchell thought that if the colleges could alter their terms so that they extended over the 12 months in the same way as the works year, it would simplify the carrying out of the sandwich system. It should be possible for college systems to give a regular supply of boys, and these should be employed in the regular work of the industries to which they were to be attached. Supernumerary work was bad for the boys, especially as an initiation. The way in which expenditure was made on education was at present unsatisfactory. Too much was spent on all boys, and too little on those who showed especial aptitude for the profession.

Time did not admit of the authors replying to the various points in the discussion.

In Section II, on the second day, a paper on "The Value of a University Degree in Engineering Science in Relation to Professional Competence," was read by Prof. S. M. Dixon, who said the competent engineer was one who could deal effectively with materials and men. The theoretical part or basis of the engineer's education was that which was more or less complete, as far as most men were concerned, when they received the degree in engineering. The practical part of his education, beginning at college, should continue as long as the engineer remained in practice.

The work carried out for the degree must deal mainly with principles, and should be as broad as possible. Details of current practice would be noticed only as illustrations of principles.

A liberal education was essential: literature, history, philosophy should be studied, and this was even more necessary in the case of engineering students than in the case of those who intended to follow other professions, for, owing to the nature of his employment, the engineer frequently had for several years few opportunities for reading outside his work. The general culture which came from college life as well as from college study was an asset in the engineering profession, not to be despised and not easily obtained.

While in other professions, a University degree was regarded as the first requisite, and so led directly to employment, there was still a feeling in some quarters that the University graduate was rather in the way in an engineer's office. Matters, however, in this way were improving. Once engineering firms recognised the advantage of having assistants thoroughly trained in the principles underlying practice, and whose training also specially fitted them for adopting new ideas rapidly, they would be only too glad to co-operate with the Universities in completing the education of the engineer. The greatest gainers in the end will be the employers, while at the same time the status of the junior engineer will be greatly improved.

Dealing with the same subject, Prof. C. F. Jenkin said that engineering education should consist of three parts: a basis of general scientific study; a middle structure of applied science, that is of science specialised, extended and adapted with a view to its bearing on professional practice; and, lastly, that kind of knowledge of practice which could be gained only by coming directly in contact with it. The last could only be obtained by an apprenticeship or its equivalent. A degree was a very much better proof of the possession of a good theoretical training than any examination could be. The degree course contained much that could not be included in the examination at all. The value of laboratory training, which could only be obtained in a college, was very great. The teaching in the drawing office in the preparation of actual designs, and the field course of surveying were all applied in the degree, but it was almost impossible to take any account of them in an examination. To spend some years at a university was an education in itself, and would be a permanent asset in the boy's life. If the engineering profession was to be brought under State control, as medicine was, and also the law, it would appear to be wise to make the basis of qualification as broad as possible by recognising the engineering degrees of the universities as a necessary qualification.

In opening the discussion, Mr. W. H. Maw said he did not agree that possession of a University degree should entitle its holder to higher remuneration than would be given to one who had not a degree. He admitted that a well trained man with a degree might be expected to advance comparatively rapidly in his work.

Prof. J. A. Fleming said his view was that the value of a degree at present was very small. The vice of the present system was that the examination was largely if not entirely written. Sufficient attention was not given to practical work. The best kind of memory was that which enabled a man to recollect where he could find information on any particular subject. The engineering profession was analogous to the medical profession in that what a man knew was not so important as what he could do. Reliability, resource, and accuracy were essential; and they were only to be got by experience. The whole system of examination must be entirely altered, and practical and *viva voce* examination must be substituted for the present system of written examination. He would prefer seeing the degree abolished and replaced by a diploma.

Mr. Dugald Clerk, speaking as an employer, said he found that men with a degree were not so inefficient as Prof. Fleming's remarks might lead them to expect. In his office he had five B.Sc.'s of Cambridge, Glasgow, Manchester and Cardiff. They had had practical as well as scientific education, and he was quite sure they could all give a vocal account of the second law of thermodynamics. He thought that Prof. Fleming's system of teaching must be wrong. He would admit that in works such as those of the National Gas Engine Co., where they had 1,500 hands, a B.Sc. degree was not of any great value; but he was convinced that scientific education saved much bungling experiment. He quite agreed with the authors as to the value of a science degree; but he had found some Oxford men were extremely conceited, and laid down the law on entering the works, and tried to teach the employers their business.

Mr. A. P. Trotter said his view was that a degree should not be given by any university in connection with the engineering profession. He maintained that the underlying principles of the sciences affecting engineering should be taught at universities and colleges. The enormous amount of money spent on engineering education in America had resulted in a large crop of swelled heads, but matters in that respect were now improving. He trusted that teachers would add to the proper foundation of the science rather than to details, for correct principles were unalterable, but the design of a switchboard would be out of date in a few years.

Col. B. R. Ward expressed the view that a sound general education, including the literary side as well as the scientific, was most valuable, because the literary subjects brought one into touch with life, and enabled one to deal with men and affairs, and of such subjects the chief were history and general literature. A man who had not so studied might be able to deal with engineering, but mere ability to carry out engineering work was only half the engineering profession, and the ability to deal with men and matters was the other half.

Mr. Jas. Glover urged that universities should impart general principles and avoid the technical details of engineering. His experience was that the difficulty lay in the lack of knowledge of theoretical principles, and not of practical application. He thought it best that a man should acquire only the general principles before entering an office or a workshop, and advocated the replacement of the present system of apprenticeship by direct remuneration, which should be increased as a man's aptitude for his work progressed.

Prof. Silvanus Thompson said that the desire to put a string of letters after one's name was becoming a serious national failing. At present they were suffering from the curse of running after those degrees; and men studied only for the degrees, and had no time to digest the information which they acquired only for the examination. They thought more of getting the degree than they did of the actual

work; and the harm which was being done at the present time to the cause of higher education could not be expressed in a few brief sentences. It was a curse that men ran after the hallmark and ignored the substance. There were many employers who would look favourably on a B.Sc. degree, but not on an A.R.S.M.; but he was strongly of opinion that the A.R.S.M. or the diploma of the Central Technical College should carry far more weight than the B.Sc.

(*To be continued.*)

LEGAL.

The National Telephone Transfer.

(*Concluded from page 52.*)

Mr. S. Z. de Ferranti was next called.

Mr. Danckwerts, K.C.: Speaking generally, what do you say with regard to the suitability of the plant which has been objected to?—The plant which has been objected to seems to me to be suitable for at least two reasons. The first is that the plant which is now being used to serve the public cannot fail to be of very great advantage if used in connection with the unified system, to come into being at the end of this year, if it is used for the purpose of bringing about a gradual change. Secondly, the whole plant seems to be useful, because where plant and apparatus is taken out of certain exchanges it can undoubtedly be used again in smaller exchanges in progress of being carried out, or which will be carried out, in different parts of the country, to take care of the growing business. For these reasons I think all the plant is suitable.

Witness said he had visited the Avenue exchange and spent some time there. He was particularly struck by the fact that this exchange, which was said to be an old one and obsolete, gave such admirable results and such a quick service. It did this at a cost in wages which could not be considered as other than satisfactory, considering the service given. The plant was in good repair, and there was nothing to suggest that it was becoming obsolete or was unsatisfactory for the purposes of the telephone service. There were a number of pieces of plant there which were perfectly good for the purpose of taking out and applying somewhere else.

You notice the objection which has been taken to the placing of telephone lines "across, along, &c.," electric railway lines?—Yes; that seems a most peculiar and quite unreasonable objection, in my opinion. There are now only comparatively few electric railways, but the number and extent of them will grow enormously, and electric power cables for railways and for other purposes will be placed all over the country in every direction. It will be impossible, therefore, to avoid laying cables for telephonic purposes and electric power cables in close proximity with one another. The country will be so covered with them that it will not be possible to keep them apart. I see nothing from experience to justify the contention that the close proximity of these two kinds of cables means danger to life and property or unsuitability of working.

On railways themselves are the telephonic lines used for the purposes of the railway companies?—Yes, a good case was given by the last witness of the telephonic lines along the Central London Railway system. There are also a considerable number of telephonic cables laid along the District Railway system, and these cables are well placed and satisfactory. The time has already come, or nearly so, when every available telephone route through London should be used and made the most of; therefore, the cables through the District Railway should not be abandoned, as they are very valuable for the telephonic needs of London.

The underneath parts of the streets of London are full of all sorts of pipes and plants abandoned and not abandoned?—Yes, they are full to an extraordinary extent; to an extent which no one who has not had the difficulty of finding routes can possibly appreciate. And the abandoned plant is the most serious. When I, myself, have been engaged in dealing with plant in the Strand, I have taken up disused mains belonging to five different companies, and in doing so have broken into a live main. The congestion underground in London streets is far more serious than the congestion above ground.

Do not the electric railway companies in London use the telephone system?—Yes, they are obliged to in order to carry on their business; the telephone is an absolute necessity for them, and it is a convenient thing to lay the telephone lines along with the power lines. This practice has been so successful that it is now generally adopted. Provided this work is properly done, and reasonable provision made, there is no danger in the proximity of telephone wires to power lines. Only yesterday I had a test made to see the effect of short-circuiting a 400-volt power supply into a model telephone exchange. I had the experiment repeated a number of times, and in every case the protection devices acted perfectly. The fuses cut off the wires without any apparent disturbance and no difficulty. If telephone exchanges are fitted with modern protective apparatus, there can be no trouble or danger arising from the telephone wires coming into contact with high-power circuits. The accident which occurred at the Bank exchange when the District Railway was being converted, has been mentioned during the course of this case; may I state that had these methods of protection been fitted at the time, that fire at the Bank would never have happened. But, of course, it has been explained that the work was not completed, and there was a misunderstanding.

Is it a perfectly safe method to lay high-power cables and telephone wires in the same duct or trough?—Oh, yes; I have had a large experience of cable-making and laying, and that is very often done. To-day high-power cables and telephone cables are to be found running together in numerous cases, and they are wanted together.

Is it reasonable to suggest that merely because wires for telephonic purposes run along or across railways they should be scrapped as unsuitable?—I think it is a most unreasonable thing to suggest, unless it can be shown that any particular wire has done badly or involved some risk which was not covered by the general principle.

The Attorney-General, cross-examining: If it were left to you and another reasonable engineer you could arrive at a quick method of arranging all these matters?—I should select people most competent for the work, and then I should trust them.

I understand you to say that the company's plant in use is suitable for the purposes of the Post Office? Do you mean that only the plant you have examined is suitable?—Witness said that he meant that taking the plant he had examined as a fair example of the company's plant as a whole, then all the plant was suitable.

Sir Alexander Kennedy was then called, and said he did not consider there was any separability in the National Telephone Co.'s wiring system.

Cross-examined by Sir Rufus Isaacs, Witness said there was no difficulty in connecting the wires to one exchange and disconnecting them from another.

Witness was answering further questions by the Attorney-General with regard to the objections taken to parts of the wiring system of the company and their separability from suitable plant, when

Mr. Justice Lawrence asked Mr. Danckwerts what position exactly the company took up in the matter.

Mr. Danckwerts said the company were going to ask the Court to say that the whole of the Postmaster-General's notices covered suitable plant, and none of the exchanges of the company should be condemned.

His Lordship: We are in a difficulty. It seems to me that until we know what the Post Office scheme is, it is impossible for us to come to a decision upon the matter. He intimated that he did not think Sir Rufus Isaacs should delay in bringing the case for the Post Office before the Court at the earliest possible moment.

A discussion followed on the question of the private wires. Sir James Woodhouse said, in his opinion, private wires must be taken over as a whole on the terms of the agreement—that was, so far as they were suitable for the actual requirements of the Post Office service.

The Attorney-General said he objected to the contention that if a cable contained one private wire and 599 other wires the Post Office must take over the whole cable, whether the 599 other wires were good or bad. If he would meet the difficulty the Postmaster-General was prepared to pay for the private wire on its value, or such wires in a cable which were good.

Mr. Danckwerts said that would not meet the difficulty.

The Attorney-General submitted that the objection which referred to suitability had nothing to do with the private wires. The only thing the Court had to deal with was whether the plant objected to was suitable for the Post Office or not. He submitted that the Court could not say that a cable with one good wire and 99 bad ones was a cable suitable for the Post Office service.

Asked if it were possible to separate good cables from bad ones, Sir Alexander said it was not. There was no question of unsuitability.

Mr. Hammond V. Hayes was next called, and said he carried on business as a telephone engineer at Boston, Mass., U.S.A. He had been actively engaged in telephone work for the last 26 years. Witness became employed by the American Telephone and Telegrapb Co., in 1885, and until 1907 he carried out their experimental work and scientific investigation.

Mr. Morton, K.C.: Some of the well-known improvements in telephony which are now in universal use throughout Europe originated, I believe, from you and your assistants?—Yes; we invented and developed much of the telephone apparatus now in general use.

For instance, one of your improvements is what is known as the the solid-back transmitter?—Yes; that is a standard transmitter now in general use.

You are also, I believe, the originator of the central-energy or common-battery system?—Yes; it originated in my department and was developed under my direction. Since 1907 witness had been in private practice, but he still retained connection with the American company as general expert.

Mr. Morton: Is there any difficulty whatever in working the combination of underground cables with overhead wires?—None whatever; on the other hand, we consider it a standard system.

Questioned as regarded the common-battery and magneto system, Witness said that in America the number of switchboards with local battery installations were diminishing in the large and crowded areas of the United States; in fact, in such areas the local battery exchange had practically ceased to exist. This was due to the very large increase in the number of subscribers, and the economy of time which might be effected in operation under the central-battery system.

Do you say that the introduction into the exchange of a common-battery system involves scrapping of the existing local battery in that exchange?—It consists of taking out the local battery exchange, and putting the apparatus in a smaller exchange elsewhere. We have never scrapped any serviceable apparatus. Within the last five years there has been more local battery apparatus manufactured and installed in the telephone service than ever before, even in the days when the local battery was the only system in use. The reason of this is that the business of telephony has

developed in the outlying small towns and areas to such an extent that we not only need all the local-battery apparatus which we set free from the large exchanges to supply these small towns, but we also have need to manufacture a great deal more of it.

For small exchanges in outlying districts the local-battery system is more suitable than the common-battery system?—Yes, in the small offices we use it practically exclusively.

Mr. Morton: Do you think it economical to effect a substitution from the local-battery system to the common-battery system in the London exchanges at one time rather than to do it gradually?

Sir Rufus Isaacs submitted that this was not relevant to the point which the Court had to consider. It was not a question of what was the most economical system.

His Lordship: But is that not one of the elements which we have to take into consideration when deciding the question of suitability? Surely commercial suitability is a thing which comes into the matter?

The Attorney-General submitted that it was not relative to the consideration of the Court. The question was not what commercial men would do under the circumstances of the amalgamation of two companies. That was an entirely fallacious way of approaching the case now before the Court. The only question really was whether the Postmaster-General was justified in the opinion he had formed that the plant in question was not suitable for the actual requirements of his service on a certain date.

His Lordship thought that surely the question of economy was one which the Postmaster-General must properly take into consideration before making up his mind.

Witness continuing, said that in his opinion, it would be an extremely wasteful and almost wicked thing to scrap apparatus which was useful and could be used in connection with the service, simply because it did not happen to be wanted at a particular time.

Counsel was proceeding to question witness with regard to the suitability of telephone lines in the close proximity of high-power cables when,

The Attorney-General said he did not propose to contend that that particular objection was one which could be maintained. Subject to the condition that proper precautions for protection were taken, he did not think the objection could be insisted upon. He would suggest that if any difficulty arose between the parties afterwards as to whether or not any particular cable was properly protected, some engineer agreed upon between both sides should view it and decide the matter. This would be a simpler way of dealing with the question than producing a great deal of evidence and argument before the Court. The Postmaster-General's attitude was that he was bound to take precautions to ensure that any plant which he took over was properly and sufficiently safeguarded. If that were done he was perfectly satisfied, and would not raise any further point about cables or wires laid along, over, &c., electric railway lines and other electric power systems.

Some discussion ensued on this matter, and eventually Sir Rufus Isaacs suggested that the Court should make a declaration in the form that all telegraph lines in the proximity of high-power cables were suitable, leaving it to the Postmaster-General to point out any specific cases which might arise in which he was not satisfied with the precautions taken. Eventually this course was agreed upon, it being left to the parties to decide the actual terms of the declaration.

Mr. Hayes, further examined, said that in America they had overhead trolley tramway systems throughout the country, and in connection with their telephone system they had to make frequent crosses over the bare traction wires in order to get their telephone wires from one side of the street to the other, &c. To avoid the risk of contact with the high voltage traction wires, they covered their telephone wires with rubber, and their cables where they crossed the traction line were supported in such a way that the probability of contact was reduced to a minimum. They also had protectiug apparatus identical to the one used in this country installed in the exchanges, and that afforded a complete protection against an outside current causing injury to the switchboard or telephone apparatus. He knew of no case where this protective apparatus had failed in its function.

Cross-examined by the Attorney-General, Witness said that in America they used the underground system for the main arteries in crowded areas, and distributing wires to the subscribers were overhead.

Have you seen the Avenue exchange, and its system of overhead wires?—Yes.

Have you anything like that in America?—Not now, but we had when I began business.

How long ago is that?—Twenty-two years.

His Lordship: I gather there is a city ordinance against the use of overhead cables in the crowded centres of America?—Yes, that is so.

Further cross-examined, Witness said that for their overhead distributing service they used lead-covered cables for the most part. It was true they also used india-rubber cables, which were just as satisfactory as lead-covered cables for short lengths. Their overhead lead-covered cables were identical with the cables used for their underground system.

Continuing, Witness said that he did not agree that rubber-cased cables were more dangerous, owing to fire, than lead-cased cables.

Questioned with regard to wayleaves and ducts, Witness said that in the American cities, generally speaking his company obtained these free of charge. The people were only too glad to get the telephoue system laid on. The only reservation was that the company had to reserve one duct for the nse of the city authorities.

Further cross-examined, the Witness said that all the telephone exchanges in New York were on the common-battery principle. He thought the last one was converted about four or five years ago.

Re-examined, the Witness said that so far as he knew the powers of the telephone company in New York to carry on its business there was unlimited. Taking the affiliated systems of witness's company, he should say they had about 10 million subscribers' stations.

Mr. James Swinburne, consulting electrical engineer, was next called, and said he did not think it was possible to make a sudden change-over from the Telephone Company's system to that of the Postmaster-General. It was difficult enough to do it in the case of a large exchange, but when it was proposed to do it in the case of all the exchanges, the difficulties were increased enormously. To carry out such a change properly, some time must be taken over the process.

After a three hours' consultation, the Attorney-General stated that the parties had agreed upon the form of the declaration to be made. It would not be necessary to trouble the Commissioners with the details, but the Court would be asked to make a declaration on the form agreed by the parties. That would dispose of everything before the Court that had to be dealt with preparatory to valuation being made at the end of the year.

As to the degree of suitability under Clause 4 of the purchase agreement, that point was still open to be taken before the Court.

Sir Alfred Cripps said he understood the arrangement was that they should leave Clause 4 as it was. It did not affect the agreement. The terms, it was hoped, would enable the matter to be worked out on a strictly business basis.

Mr. Justice A. T. Lawrence said there would be an order on the terms drawn up.

Hartlepool Electric Tramways Co., Ltd., and Others *v.* West Hartlepool Corporation.

An application with reference to the hearing of an appeal in this case was made last week in the Court of Appeal, before Lords Justices Vaughan Williams, Fletcher Moulton and Buckley.

Mr. McCardie, for the defendants, said the action was brought against the Corporation (for whom he appeared) to recover in substance £12,000, which the plaintiff company alleged was due from the Corporation upon the purchase of a tramway undertaking. The matter was decided a short while ago by Mr. Justice Bray, who gave judgment against the Corporation. His Lordship, however, granted a stay on condition that application was made to the Court of Appeal to expedite the hearing of an appeal, notice of which had since been given by the Corporation. That was the present application. Mr. Jutice Bray expressed the view, added counsel, that the appeal ought to be heard before the long vacation. The question involved was as to whose were the tramways at the present moment; and the company naturally wanted their position defined as soon as possible.

Lord Justice Buckley: Every litigant is more or less in the same position.

Mr. Tyldsley Jones, for the company, said that the position was a little more complicated than that. The Corporation gave notice of purchase under Sec. 43 of the Tramways Act of 1870 upon the promoters of two lines of tramways in West Hartlepool, and before Mr. Justice Bray they raised the point that owing to the way in which tramways were constructed—that inasmuch as the lines were not constructed by the promoters themselves, they, the Corporation, were not bound to pay for them. The point, therefore, was this: Whether the company were working the tramways illegally, in which case they would be liable to an indictment. The company did not care to be in the dubious position of trespassers on the one hand, or unpaid vendors on the other. If the Corporation were right the company ought to stop working immediately, and the public would in that case be deprived of the use of the tramways. The Corporation had called upon the company to do certain repairs to the roadway. The company replied that having regard to the curious position which they were in they could not do the repairs, and the result was that until the appeal was heard the roadway would not be properly repaired, and should an accident occur who would be responsible he (counsel) did not know.

After further discussion, their Lordships decided to place the appeal on the list for hearing on 17th inst.

Actiengesellschaft Mix & Genest *v.* Hermann Oppenheimer.

On Friday, July 14th, in the Chancery Division, before Mr. Justice Eve, this case was heard on motion by the plaintiffs.

Mr. Danckwerts, K.C., in opening, said the plaintiff company and the defendant entered into an agreement in September, 1905, under which a certain electrical supplies business, which was being carried on at Salusbury Road, Kilburn, under the name of the International Electric Co., was declared to be the property of the plaintiffs. The defendant was to act as manager, and the plaintiffs were to furnish all materials with which the business was to be carried on. It was also agreed that any disputes should be settled according to German law in the German Courts. There was also a provision that if the profits in any two years did not exceed 20,000 marks, the agreement should be determined. At the beginning of the present year the agreement was determined, and the *status quo* kept up for a short time by agreement. In February last the plaintiffs began an action in Chancery to get possession of the premises in London and the assets, and an injunction to restrain

the defendant from preventing the plaintiffs entering the premises. The defendant retaliated by moving that the action should be stayed pursuant to the agreement. Plaintiffs had no reply to that, and the only thing left for them to do was to protect the property in the interim. That was recognised by counsel, and an order was agreed in February last by which a Receiver was to be appointed and all further proceedings stayed, defendant undertaking to carry on the business with due diligence, and to give plaintiffs access to the premises. Mr. Pixley was appointed Receiver. Eventually an action was begun in Germany by Oppenheimer, and plaintiffs there asked for an interim order in the Lower Court, which was refused, but it was granted in the Appeal Court. What he (counsel) now asked for was a parallel order to that granted in the German Court for the purpose of carrying out the German order that the business was the property of the plaintiffs, subject to certain deposits. He could not have brought independent action, but only put it forward as an interlocutory matter to say that the German Courts were those which the parties by agreement had said should settle all disputes. The German Court found that the defendant did not deny that the assets of the London firm belonged to the plaintiffs, and that the defendant set up that the goodwill of the International Electric Co. belonged to him. He would point out that Mr. Pixley asked £150 a month for remuneration, while if plaintiffs' nominee was appointed there would be no expense.

In answer to his Lordship, Mr. Danckwerts said he asked the Court to discharge Mr. Pixley and to appoint one of the plaintiffs' directors, who was now in London. The German action was now proceeding on the point as to whether the defendant was the owner of the goodwill of the business.

Mr. P. O. Lawrence, K.C., for the defendant, pointed out that up to the present the German proceedings were merely interlocutory, and that there were no pleadings. The appointment of a Receiver was left to the Master in Chambers, and he had appointed Mr. Pixley. He submitted that no grounds had been shown for going behind that appointment. He did not admit that the capital of the International Electric Co. belonged to the plaintiffs. He said the defendant had a substantial interest in it.

In giving judgment, his Lordship said he was impressed with the fact that the continuance of Mr. Pixley's receivership would involve a claim for remuneration, but, on the whole, he did not think the circumstances warranted him in acceding to the motion, which would be dismissed with the usual consequences—costs.

Leave to appeal was granted.

Globe Electric Co., Ltd., *v.* A. H. Brooking & Co.

In the City of London Court on Friday, before his Honour, Judge Rentoul, K.C., plaintiffs sued Messrs. Brooking, electrical engineers, of Richmond Road, Exeter, for £12 15s. 8d., for six Santoni "Luxrae" arc lamps supplied to them for use at the Carmarthen Skating Rink and the baths at Paignton. Mr. G. S. Stone appeared for the plaintiffs, and Mr. Pratt for the defendants. The order was given on July 22nd of last year, it being marked "urgent."

The defence was that the lamps were never accepted, and never answered the description required, burning only intermittenly.

Mr. Stone observed that the defendants kept the lamps for four months before rejecting them.

Mr. Pratt pointed out that the defendants had no opportunity of testing the lamps until four months after delivery. Carmarthen had no electrical installation until then: so they could not be tested.

After further evidence had been called, Judge Rentoul said that keeping the lamps for four months was fatal to the defendants. He found for the plaintiffs, with costs.

Smith *v.* Clothier.

The hearing was concluded at the Liverpool Assizes on Wednesday, July 12th, before Mr. Justice Horridge and a special jury, of an action claiming damages for libel, brought by James Smith, electrical engineer, formerly employed by the Bootle Corporation as a switchboard attendant. against Mr. Clothier, borough electrical engineer, the libel complained of being contained in a report by defendant to the Electricity Committee. In this, Mr. Clothier attributed a defect, which occurred on November 9th, to a fault on plaintiff's part, and as a result Smith ultimately lost his employment.

Mr. Miller (counsel for plaintiff) said the defence was that the report was not detrimental; further, that it was true, and written without malice, and was privileged. On the last plea, he was not going to contend that the occasion was not privileged, but he would submit that the report was not written in an honest straightforward manner, stating all that the writer knew of the breakdown of November 9th, but that it was written by defendant putting the blame upon Smith in order to shield the management of the electrical department. The report was actuated by a desire to explain the breakdown, and at the same time to protect Mr. Clothier from inconvenient questions.

Plaintiff, in evidence, denied that he had been negligent in not taking steps to remedy the breakdown. He admitted in cross-examination by Mr. Rigby Swift, that Mr. Clothier had reprimanded him on other occasions. On January 16th, he told defendant he would make revelations, but did not intend it as a threat.

Jas. B. Hudson, deputy electrical engineer at the Bootle power station, said that at the time of the breakdown the condition of the switchboard was not good.

By Mr. Swift: If the breakdown had been threatening, then plaintiff had not done all he ought to have done.

Alfred John Leigh, consulting electrical and mechanical engineer, was of opinion that the readings of the records gave no indication of any impending breakdown.

Cross-examined, Witness said that assuming the fault was indicated at 2 o'clock, there was nothing wrong in the report, and further, that on the information Mr. Clothier received, and if his experience coincided with the information, he would be justified, in fact, would be called upon by duty, to make the report.

Mr. Rigby Swift having addressed the Court for the defence,

The Jury intimated that there should be a verdict for defendant.

His Lordship thereupon gave judgment for defendant, and on the question whether he should certify that the report was written by defendant in the execution of his duty, his Lordship said there never was any question on the point, for in his opening Mr. Miller said it was a privileged occasion.

Electrician's Compensation Claim.

At the Todmorden County Court on the 13th inst., before his Honour Judge Gent, an interesting case under the Workmen's Compensation Act was heard, in which the applicant was Shaw Gledhill, an electrician, of Knott Wood, and the respondents were Simpson Bros., Ltd., electricians, of Hapton.

Applicant was represented by Mr. Watson, barrister, Leeds; and the respondents by Mr. J. C. Waddington, Burnley.

It appeared that Gledhill was working for the respondents doing electrical work at Messrs. Wilson Bros., Bobbin Works, Cornholm, Todmorden, on October 13th, 1909, and he met with a serious accident, by which his left forearm was broken. His left arm became entangled in an electrical wire, and he received a fracture of the lower arm and injury to the museles. His average wages were 32s. per week.

Respondents alleged that applicant was not totally incapacitated, and that he was able to follow some business.

Applicant said he was 22 years old, and married. He served his apprenticeship with Messrs. Adamson, electrical engineers, Rochdale, and afterwards became engaged to the firm of Messrs. Simpson Bros., of Hapton. He was putting in electric light installation at Messrs. Wilson Bros.' works at Cornholme Bobbin Works, and was working on some scaffolding that had been erected over some shafting. While engaged in wiring, a part of the cable was caught by the shafting and was coiled round his left arm and twisted round the shafting. The engine was stopped. For 17 weeks he had his arm in splints. His wages were 32s. per week, and from the third week after the accident until May 27th of the present year. the respondents had paid him 16s. a week. Since the accident he had done no work.

Dr. John Stephenson said respondent was not able to do the work of an electrician, as the muscles of the left arm were very much wasted.

Mr. Simpson, managing director to Messrs. Simpson Bros., Ltd., said applicant was engaged by the job at 7½d. per hour, and that case would not have arisen if the orders he gave to his foreman not to work over moving shafting, had been observed.

Dr. Sinclair, Burnley, said he had examined the applicant, and he thought he could do the work which Mr. Simpson had offered him.

Mr. Simpson said the applicant could go as an assistant.

Dr. Sinclair said, if the applicant tried his best, he thought he could do anything that an electrician was called upon to do. If he did not use his arm it would get worse.

It was decided that applicant should return to his work on the 17th inst., and do reasonable work, and that the case be adjourned to the October Court.

His Honour said they would find out whether the applicant would be able to go as a first-class man or as an assistant. He thought he was entitled to the costs of the application, and that he ought to be paid compensation up to the time he resumed work.

The case was then adjourned to the October Court.

Electricity in Silica Working.

In the Chancery Division on Monday, July 17th, Mr. Justice Swinfen Eady heard an action brought by the Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, against Silicaware, Ltd., Upper Thames Street, London, in which plaintiffs asked for an injunction against the defendants for an alleged infringement of letters patent for an improved electro-chemical plant for working silica.

Mr. Walter, K.C., with Mr. A. B. Shaw appeared for plaintiffs, and Mr. Bousfield, K.C., and Mr. Colefax were for the defence.

Defendants denied infringement, and pleaded prior knowledge.

Mr. Walter, in opening, said the letters patent, dated 1904, related to improvements in the manufacture of silica. Silica was a body very difficult to fuse, and until some time in the thirties or forties no one had been able to do so. Mixed or combined with potash of soda or lead, it had been known for years in the form of silicates as in ordinary glass. The fusing point of glass was 800° C. In the working of silica the material was worked at 1,800° C., and the workmen had to be enveloped in asbestos. It was impossible to work silica by the same process as that used in glass manufacture. Silica had to be worked immediately, because it solidified 16 times more rapidly than glass. When it was in a soft condition, it skinned over almost immediately. The patentees of plaintiffs' device were Dr. J. T. Bottomley, a well-known scientist, and nephew of Lord Kelvin and Mr. Arthur Paget, now Sir Arthur Paget. After many

experiments they discovered a method of working silica commercially as follows :—They mounted a carbon rod between two electrodes of an electric furnace. This was surrounded by sand. By working to a temperature rising to 1,800° C., a melting action took place which eventually formed a cigar-shaped piece of silica round the carbon resistance of the furnace. It was here that the gases which were thrown off by the process were used in a curious manner. As they were thrown out from the carbon core, they formed an envelope between the core and the silica enabling the former to be withdrawn. No one hitherto had believed that this material, except in the furnace flame could be dealt with, because, as he had said, the heat disappeared with enormous rapidity, and a skin formed immediately. The patentees, however, discovered that when sufficient force had been used to break this outer skin there remained underneath a plastic mass, which could be easily worked like glass. This was what plaintiffs' patents embodied, and counsel produced great vessels which, as the result of this discovery, had been blown in silica and were specially suitable for the storage of strong acids; also silica tubes, beakers, mortars and pestles, &c. The current used in the process, he said, was, roughly, 1,000 amperes at 15 volts for half-an-hour. The result of the discovery had been to reduce the price of silica from £20 to 1s. per lb. Defendants were a company who were manufacturing similar articles in silica abroad and were selling them on the English market. From inquiries, &c., they had made, plaintiffs had come to the conclusion that defendants were infringing their process.

Mr. Dugald Clerk then gave evidence. He said he had examined the plaintiffs' plant, and had examined the past history of silica working. He was convinced that there was nothing in earlier specifications similar to the plaintiffs', which was undoubtedly a useful invention.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Enclosed Switch Fuse.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.E., have brought out a new totally enclosed D.P. switch fuse, of which we give an illustration in fig. 1. This switch fuse is totally enclosed, and can be made gas and water-tight; Koolark patent cartridge fuses are employed. For above 50 amperes

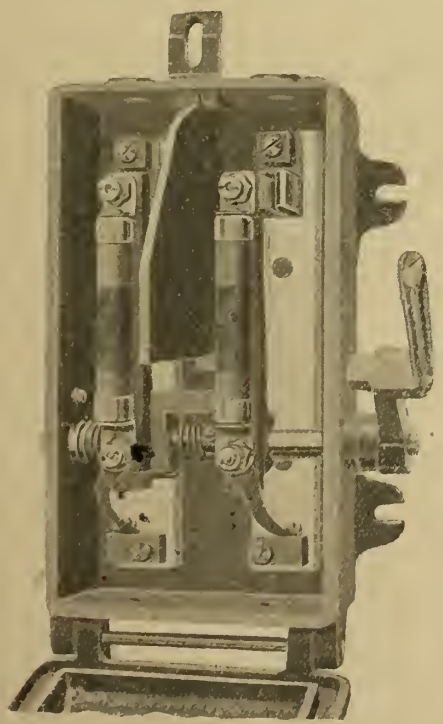


Fig. 1.—Enclosed Switch Fuse.

capacity no other insulating material except mica is used—that is to say, the switch is composed of metal and mica only. All switches are suitable for a 600-volt circuit, and are asbestos lined throughout. The switch is of simple and robust construction, with quick make and quick break, and is interlocked with the cover so that the case cannot be opened when the switch is closed.

Adams "Igranic" New Patent Starter and Regulator.

The combined starter and regulator illustrated in fig. 2, is fitted with a speed limiting device, and is suitable for shunt or compound wound motors. For controlling motors driving machine tools, when shunt field regulation is employed, it is desirable to have a ready means of limiting the highest speed attainable during any given operation. In these starters the field resistance contacts are inter-connected with a supplementary field regulator, which is mounted on the starter front. When starting up a motor by one of these starters, the handle is always moved right over into engagement with the hold-on magnet, the amount of resistance inserted in the shunt field circuit being predetermined by the position of the supplementary regulator handle.



Fig. 2.—Combined Starter and Regulator.

The regulator is readily set for any desired speed, and when once set, the speed attained by the motor in repeating any given operation will be the same every time it is started up.

The overload release (when fitted) and the no-voltage release are always in operation, and the motor always starts on full field. The illustration shows a combined starter and regulator fitted with overload and no-voltage releases. The apparatus is made by the Adams Manufacturing Co., Ltd., of 106, New Bond Street, W.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cheap "Stannos" Wiring.

I should be glad of your indulgence for a few remarks anent the correspondence in last week's issue under the above heading.

I am in the employment of a firm of electrical contractors, and it is part of my duty to prepare estimates, and dissect the costs of the varied work carried out by the firm. I am deeply interested in the remarks and figures of your correspondent, and have accordingly endeavoured to analyse the figures given from the information contained in his article, and beg to state that I cannot accept them as accurate.

I give below an amended cost, from which you will observe that the prices of the wire have been altered, and the cost per point is thus brought above the average of 8/2 previously quoted :—

Cost of wiring premises of Mr. S—— (butcher) for 10 points.

Labour, 16 hours at 1s. 2½d.	£0	19	4
Wire, 110 yd., 1/18 "Stannos"	1	15	7
„ 6 yd., 3/20 „	0	2	6½
Fittings, switches, fuses, shades	0	14	6½
Lamps, 10 at 1s. 8d. each	0	16	8
Cast-iron "Z" house fuse-box...	0	2	8
Sundries	0	3	0
Total	£4	14	3
Per point	0	9	5·1

It is apparent that a main switch has not been included in this cost.

The labour works out at 2d. per yard of wire, including the erection of fittings, and this low cost suggests that obstacles in the form of 29-in. stone walls and lack of plant, were not encountered in this instance.

The circuit wire per point works out at 83 ft., a large amount for a small shop on the concentric system, and suggests that a fair number of branch switches were installed. This would account for the low cost of labour per yard of wire to some extent, as a large portion of the wires would be bunched and the labour entailed in cleating up several wires would be little more than that of cleating up one. I would here point out that where a number of switch wires have to be brought back to one position, the material cost of "Stannos" wiring is not economical on account of the

high price of the wire, and I have in mind such instances where the cost have been decidedly in favour of casing and even tubing with 600 Ω class V.I.R.

The average price given by Mr. S. C. Hughes is for jobs with an average of seven lights, where all the lights can be connected on one circuit, and where the mains usually are a negligible quantity, and it is an open question whether these small jobs could or could not have been carried out as cheaply with other systems of wiring. I am dealing purely with the question of initial cost, as the system of wiring to be adopted also depends upon the nature of the business and the construction of the building where the installation is to be erected.

Engineer.

New Heating Element.

We notice in your issue of July 14th a description of a new heating element, consisting of a wire upon which beads are threaded like flexible conductors used in arc lamps, &c.

You characterise it as "a simple device, which strikes one as obvious and absurdly simple, after some one else has invented it." Whilst fully endorsing this view, will you permit us to point out that we used this identical type of element in our electric water-heaters or geysers more than 10 years ago, but have practically discarded it now in favour of some other and better type of heater, so that the "new element" is, after all, of respectable age—measured by the rate of electrical progress.

Isenthal & Co.

London, W., *July 14th*, 1911.

REVIEWS.

Motion Study. By Frank B. Gilbreth. London: Constable & Co., Ltd. 1911. Price 4s. 6d. net.

At the first glance the title and contents of this book appear to advocate the scientific investigation of matters for which much simpler treatment would suffice. Further perusal quickly removes this impression, whilst a careful study convinces the reader that he has stumbled upon one of the most important developments of recent years. The "motion" referred to is that of the workman or labourer when doing his work, and although appliances and tools have an important bearing upon this subject, it is found that the actual motions may often be modified, altered in sequence or reduced in number with greatly increased results.

Mr. Gilbreth applied his principles first to bricklaying as being one of the oldest and simplest industries in existence, and he has been able to treble the outpnt of the best bricklayers by reducing the work to the fewest and most effective motions in conjunction with improved appliances.

Although the principles put forward are particularly applicable to handwork as distinguished from machine minding, the latter duty involves a great many human motions, and these occur largely between actual cutting operations, hence "motion study" should and does enable us to increase the output of the machines by simplifying the operations of the minder.

It is not contended that "motion study" has been hitherto entirely ignored, but the results obtained through its agency in the most up-to-date undertakings have proved the need for further investigation.

The following excerpts will perhaps give a better idea of the scope of this work than any abstract of the contents:—

"A bricklayer can stoop over and pick up anything from the floor with one hand with much less fatigue if he has a place to rest his other hand while he is stooping."

"Under scientific management. . . . When a man is prevented by causes beyond his control from doing his regularly assigned work, he is told to use the opportunity for rest, not to take such rest as can be obtained by making slow and useless motions, that will give him an industrious appearance to the casual observer, but to rest the 100 per cent. kind of rest."

"There are cases where chairs and reading tables have been provided with beneficial effect for workers to occupy when delayed for a few minutes. They get the rest, and their presence at the table acts as a danger signal to the management."

Under the heading "Nutrition," the author says:—"This is a subject that has been investigated much more scientifically with regard to horses and mules than with regard to workmen."

"Provide something to lean his shovel against . . . when he (the labourer) is alternately shovelling and wheeling, to cut down time and to reduce the fatigue of stooping over and picking up the shovel."

"No worker should ever be obliged to furnish his own tools . . . (due to their having too much thrift, lack of money or fear of having them stolen, they usually use one size only of the same kind of tool). Again . . . they use them after they are too much worn."

"One sees occasionally a machine that can have any and every lever operated without the operator taking a single step; but comparatively few machines are constructed with this in mind."

"The average machine to-day is designed for a short demonstration of quick output, with less regard for the least percentage of rest required for overcoming fatigue due to continuous operation."

Mr. Gilbreth contends, with some reason, that every trade must be reclassified with a very careful separation of the motions requiring skill from those needing strength only. He also maintains that apprentices are taught wrongly by being urged to make a good job first of all followed by efforts to do the work quickly, his system being to teach the most effective motions to begin with, the quality of the results being reserved for improvement after the correct movements have been acquired. This system has always been pursued in the training of soldiers and athletes; in fact, it is doubtful whether any other method would be effective, yet no attempt is made to instruct the workman in the most effective motions for doing standard repetition jobs. It may be contended that a good workman will naturally adopt the quickest ways of doing his work, but abundant evidence is given by the author to disprove this contention, the best results being only obtained by the careful timing and study of a trained scientific investigator.

The aim of "motion study" is to augment the output of the workman without involving any increase of bodily effort; hence this innovation should be welcomed by the trade unions when its effects are understood.

"Motion study" is applicable to every industry involving a repetition of human movements; hence this subject should receive careful attention in almost every concern where labour is directly employed.

Public Ownership of Telephones on the Continent of Europe. By A. N. Holcombe, Ph.D. London: Constable and Co., Ltd. Price 8s. 6d. net.

This treatise is an unbiased statement of the principles, facts, methods and results of telephone administration and development on the Continent of Europe. The author—the Instructor in Government at Harvard University—has spared no pains in the preparation of his work, and has been fortunate in securing the assistance of authorities connected with the commercial, technical, administrative, labour and social phases of telephone working.

The book is divided into four main parts; in the first three German, Swiss and French telephones are considered in 188, 52 and 84 pages respectively, while in the fourth section "other European countries" are dealt with, and various comparisons and conclusions are presented. For most purposes, the book may be regarded as a complete survey to date of all other than purely technical telephone matters in Germany, Switzerland and France. The treatment given to "other" European countries is derived from secondary sources, and is less valuable than the remainder of the treatise, though a considerable amount of information is compressed into the 38 pages devoted to these countries. Why our own telephone system should be omitted from all but digressory treatment in such a work (though England is certainly not *on* the Continent) is a matter for wonder and

regret. In any case, Russian telephones are surely worthy of some mention.

The development of telephone administrative bodies, the evolution of rates and the conflict between telephone and heavy current electrical interests in Germany, Switzerland and France are very fully considered. There are copious digests of various official reports, and though some of this matter may prove of limited utility to general readers, its value as a historical record of fact is enormous and its authority appears unimpeachable.

Technical progress is dealt with only so far as concerns its general nature and significance in various areas, and there appears room for a rather more detailed review of technical matters in future editions. Also, the author should remove such blemishes as "a power of not more than 500 volts" (p. 327) and "the rate of change of the force and direction of a current is more significant than its quantity so far as concerns the phenomena of induction" (p. 310).

Speaking broadly, the author is strongly in favour of public ownership of telephones, though, true to his consistently unbiased attitude, he is careful to point out the numerous defects to which it is liable. Monopolistic control tends to avoid duplication of plant and suicidal rate-cutting as well as to provide the best interconnection of subscribers. Unrestricted competition may lead to a distribution of economic interests unfavourable to the community as a whole, but monopoly, in such a field, must be thoroughly controlled by public authority or it may become unreasonably burdensome to its customers. In almost every European State it has been the previous public ownership of the telegraph which has compelled the telephone monopolist also to be the State. The users served and the services rendered are the same in both cases and permanently independent control of the two means of communication has generally proved impracticable. It is a notable fact, however, that private ownership under proper public control has never been given fair trial.

Public bodies differ much less than would at first sight appear from private bodies, so far as concerns telephone administration; but it is always necessary to replace the pecuniary self-interest stimulating the private telephone company by a suitably organised public control over official administrators. Rightly enough, Mr. Holcombe has nothing but praise for the admirable arrangements in Germany and Switzerland, whereby the wishes of customers are speedily brought to official notice, and, as far as reasonable, readily enforced. The success of the German and Swiss methods are, however, largely dependent on the characteristics of these nations as a whole, and it is the idealistic, unpractical and anti-co-operative temperament of the French which is chiefly responsible for the deficient past and present administration of their State telephones. In Switzerland, the organisation of telephone administration is efficient technically and commercially, is thoroughly democratic, and gives a cheaper and wider service than could be conceived under any form of private ownership. Contrast this, then, with the chronic state of affairs in France, where the bungling State policy has cast a heavy financial burden on subscribers, greatly impeded general development, and actually necessitated the maintenance of an abnormally high rate for some 10 years to prevent the rapid accession of subscribers which would have followed immediately on the reduction of rates to a more reasonable level.

In the author's opinion, free competition between telephone undertakings, though conducing to rapid initial development, is quite impossible as a permanent condition of working; ultimately it must give way to a State-licensed monopoly or to public ownership outright, and which of the latter is better depends upon local conditions—topographical and industrial—and upon national characteristics of temperament and mode of life.

Governmental control is no security against mistakes in policy, but it does, in a well organised State, enable the latter to be corrected as expeditiously as possible. The benefits of explicit State accountancy, liberal capital expenditure and consistent framing of policy to meet future as well as present needs, cannot be over-estimated.

Chapter VIII—considering what constitutes a "reasonable" rate under various conditions of cost and utility of service, number of subscribers and prevalent competition or monopoly—is specially valuable, and should assist many a harassed rate-designer; the latter is indeed an unfortunate individual, for, as the author drily remarks, "No system of rates can give universal satisfaction," and "Telephone users always consider all rates exorbitant!"

Two striking features of Continental telephone development are: (1) The important part played by telephony in the extension of rural telegraph facilities, and (2) the acute conflict between telephone and power circuit interests (especially in Germany in both cases).

As regards the general arrangement of the book—sectional headings within the various chapters are badly needed (those adopted in the list of contents would do admirably). To cite only one example, the general conclusions on pages 393-5 should certainly be separated from the sectional heading "Spain" under which they now appear. There is too great a tendency to "postpone judgment to a later chapter"; at least, some indication of the ultimate conclusions should be given after many of the lengthy considerations of facts and influences and, from one so much at home with his subject, we should have welcomed a greater number of general conclusions than are actually given.

Few books on telephone policy are free from bias, and the author of the present volume is to be congratulated on the vast amount of authentic and pertinent matter which he lays before his readers in such form as to enable its unprejudiced application to the particular circumstances of their own cases.—S. M. P.

BUSINESS NOTES.

Westinghouse Contracts.—Among important orders recently received by the British Westinghouse Electric and Manufacturing Co., Ltd., are the following:—

N.E.S. Co., for Bradbury, Williams & Co.—Three 157-kw. rotary converters, transformers and switchgear.

Tyneside Electric Development Co., Horden and Shotten Colliery.—Three 400-kva. rotary converter sets.

John Summers & Co., Ltd.—One 500-kw. rotary converter and switchgear.

Greenock Corporation.—Two 450-kw. rotary converter sets, d.c. switchgear, &c.

Admiralty, Devonport.—Fourteen motors, 2½ to 40 h.p., 440-volt d.c., control gear and spares.

Sir Wm. Arrol & Co., for Admiralty, Portsmouth.—Eight motors, 5 to 50 h.p., 440-volt, type A, control gear and spares.

Cowans Sheldon, for Imperial Japanese Navy.—Three 60-h.p., one 25-h.p., 220-volt, 500-r.p.m. G motors, control gear and spares; three 60-h.p., one 25-h.p., 220-volt, 500-r.p.m. G motors, control gear and spares.

R. H. Barker & Co.—One 5, four 40, one 50, one 100-h.p., 440-volt, two-phase 60-per. a.c. motors and control gear.

Holders Brewery, Ltd.—Twelve motors, 1 to 35 h.p., 440-volt, three-phase 25-per. sq. cage, and starters, and one M.G. set, 440-volt a.c., to give 9 amps. at 110-volt d.c., and one 150 kva., one 25-k.v.a, three-phase, 25-per. transformers and switchgears.

Wellman, Seaver & Head, Ltd.—Eleven motors, 5 h.p. to 100 h.p., 460-volt.

Ransomes & Rapier, Ltd., for Admiralty, Devonport.—Eight motors, 2 h.p. to 20 h.p. 440-volt, control gear and spares.

B.A.G.S. Railway Co., Ltd.—Four 20-h.p., 440-volt, 1,450/1,500 r.p.m., three-phase, 50-per. 50 c.p., and starters, one 25, three 15, three 10, one 5-h.p., 550-volt, 950 r p.m. G motors and starters.

Cjers, Mills & Co., Ltd.—One Westinghouse-Rateau blower, to deliver 25,000 ch. ft. free air per minute against terminal pressure of 6½ to 8 lb. per sq. in., direct driven by 900 h.p. 3,000 r.p.m. single velocity wheel turbine.

Manchester Corporation.—Fifty magnetic brakes.

Blackburn Corporation.—One 2,000-kw. 3,000 r.p.m. a.c. turbo-generator set, with surface condensing plant, &c.

County Borough of Blackburn.—One 800-kw. rotary converter.

South Shield Corporation.—One 1,500-kw. high-pressure turbine (impulse type), coupled to one 1,000-kw. d.c. generator and one 1,100 a.c. generator in tandem with surface condensing plant, Lea recorder and Brown, Boveri regulator.

East Indian Railways Co.—Two 400-kw. d.c. turbo-generators, &c.

Strain & Robertson, for Alienza Co., Ltd., Oficinia.—One M.G. set, 13 motors, 200-volt, three-phase 50 per, main switchgear, control gear and spares.

J. Howden & Co.—One 1,000-kw. turbo type alternator.

Randfontein Mines.—One 265 and one 40-b.h.p. a.c. motors.

La Plata Trams.—Ten 200 t.c. equipments.

The Cremation of King Chulalonkorn.—We are informed by the General Electric Co., Ltd., that the funeral rites for the late King Chulalonkorn were conducted in the light of Osram lamps, and that upwards of 100,000 c.p. of illumination was displayed. The Eastern agents of the G.E.C. state that the Siamese papers referred to the brightness of the scene as indescribable.

The Wholesale Hardware Club.—We have received a copy of the prospectus and list of members of this club, whose registered offices are at Royal London House, 14, Finsbury Square, E.C. Mr. Chas. Churchill is president, and Mr. Reginald Cooper secretary. Several firms in the electrical trade have representatives on the current year's honorary council. The booklet contains photographs of the president and past presidents, and officers, also of the rooms, a note of the charges, and the various departments in which the interests of the members are cared for. A form of application for membership is an appeal to other firms in the electrical trade to identify themselves with the club.

Book Notices.—*Handbook on Electroplating, Polishing, Lacquering, Burnishing and Enamelling.* Birmingham: W. Canning and Co. 1911.—This is the fourth edition of Messrs. Canning and Co.'s excellent handbook, which has been much improved in several of the sections. It is an essentially practical work, and though it applies especially to the apparatus made by the firm, the instructions given are of general application. Naturally, electricity dominates the work, and we are pleased to notice that apart from its employment for the deposition of metals, its immense advantages for motive power are recognised and insisted upon by the authors in preference to gas or steam power. Electrical practice in this branch of the industry differs widely from that to which we are accustomed in other directions, the currents used being so large and the pressures so small; consequently, the apparatus and methods employed are quite special, the latter being, in fact, largely empirical. This book, therefore, which embodies the fruit of long experience, should be found of great utility to all workers connected with the various arts named in the title. As often happens in books written by practical workers, its composition and diction are not always above criticism, but the wording is simple, and it is claimed with justice that the book can be read by the novice as well as by the expert.

The "M.C.C." Chart of the Elements. London: Metallic Compositions Co. Price 5s. (mounted on linen, 8s. 6d.).—This work is primarily intended as a guide to the metals, but also covers the non-metallic substances; it is based upon the Periodic Law, and shows the relationships existing between the various elements by means of a systematised classification and arrangement of them upon a large folding chart, the production of which must have involved a vast amount of labour. The chart, it is claimed, is of direct interest and utility to electrical engineers, the positions of the metals and other elements on the chart giving, by inspection, information as to their electrochemical behaviour; the chart thus enables an investigator to take a bird's-eye view, so to speak, of the properties of the metal he is dealing with in relation to the properties of other metals, and guides him at once to the correct processes to employ. Not only are the known properties of materials thus indicated, but also many properties which have not yet been definitely investigated can be inferred from the position of the element on the chart in relation to the positions of elements of which the properties are fully known; thus, for example, in conducting a research upon electric lamp filaments, the user can readily see what elements are likely to be worth trying, and what difficulties may be anticipated in dealing with them. An explanatory introduction is provided with the chart, to facilitate its use by those unversed in chemistry and unacquainted with the Periodic Law: in the second part of this booklet the author, inspired by his subject, treats of the relation of the Periodic Law to speculative thought and the problem of life. The work is decidedly interesting, and should prove very useful.

The Motor Boat Manual. London: Temple Press. Price 1s. 6d. net.—This is the fourth edition of a work compiled by the staff of *The Motor Boat and Marine Oil and Gas Engine*: it contains little of professional interest to electrical men, beyond a section on electrical ignition, which is very fully covered, all the usual devices and systems being well described and illustrated. Those, however, who are interested in the design and building of motor boats, and their management, will find in this manual a wealth of practical information. Unfortunately the electric launch is not included within its scope, though for smooth and silent running, and for pleasure purposes on inland waters—within range of charging stations—there is nothing to beat it.

Spons' Architects' and Builders' Pocket Price Book and Diary. 1911. Edited by C. Young and S. M. Brooks. London: E. & F. N. Spon. Price 2s. 8d. net each part.—This year, owing to important additions to the memoranda section, the work has been divided into two parts sold separately—the Memoranda Section, and the Prices Section, the latter being combined with a diary for pocket use. The former is arranged alphabetically, and contains notes and information of a general character, including an electrical section dealing briefly with electric lighting, heating and cooking, and a specification for a complete electric lighting installation. There are also in the Price-Book Section a few pages devoted to "Electrician," giving prices for work and materials in brief. As a rule the prices are on the high side, and although metal-filament lamps are dealt with, the particulars mainly apply to carbon lamps, whereas these should now be regarded as the exception and the tables made out for the former. There is a great deal of information in these two volumes that should be of direct utility to contractors and others who come in contact with building work, and they are most handy for the pocket.

We have received a copy of the first number of *Chemical Engineering and the Works Chemist*, a monthly shilling publication for chemical engineers, works chemists and chemical manufacturers. It is the official organ of the Association of Chemical Technologists, which was formed in March last, and is published at 144, Snargate Street, Dover. This number (May) contains articles on the following and other matters:—"Technical Chemistry and the Chemical Technologist," "The Status of the Working Chemist," "Crossley Ammonia-Recovery Gas Plant," "A Rapid Analysis of Phosphor Bronze," "Worthington Steel Cooling Towers and Condensers," "The Need for Reform in our System of Chemical Training."

"*Bulletin* de la Société Internationale des Electriciens." Vol. I, No. 6. June, 1911. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"The Post Office Electrical Engineers' Journal." Vol. IV, Part 2. July, 1911. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, Part 4. May, 1911. Johannesburg: The Institute. Price 2s.

"The Design of Static Transformers." By H. M. Hobart. London: Constable & Co., Ltd. 1911. Price 6s. net.

"Illumination: Its Distribution and Measurement." By A. P. Trotter. London: Macmillan & Co., Ltd. 1911. Price 8s. 6d. net.

"Annales des Postes, Télégraphes et Téléphones." No. 4. June, 1911. Paris: A. Dumas. Price 7 fr.

The current number of the *I.C.S. Student* gives an account of the great "Festival of Empire" students' demonstration at the Crystal Palace on July 17th. Nearly 5,000 students took part in the function, at which Lord Desborough presided. The chairman expressed his deep interest in the work of the I.C.S., which he regarded as in no way prejudicial to that of the technical colleges, but on the contrary, as most beneficial to them and to the nation. Sir Joseph Ward, addressing the meeting, said that there were 160,000 I.C.S. students in the Empire—100,000 in Canada, 42,000 in the United Kingdom, 6,000 in India and the Crown Colonies, 7,000 in New Zealand and 5,000 in Australia. The Postmaster-General of the Commonwealth of Australia had urged his officers to join the I.C.S., and on his return to New Zealand he would do likewise, as he was firmly convinced of the value of their work. Mr. G. H. Roberts, M.P., also spoke at some length.

Catalogues and Lists. — The Electrical Power Engineering Co., Stechford, near Birmingham.—Leaflet showing and giving prices of their dust-proof ball-bearing polishing motors of ¼, ½, 1 and 2 B.H.P., which they are just placing on the market.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 50 containing illustrations, brief particulars and prices of their 50-ampere watertight wall plugs, the design of which is in accordance with the Home Office regulations regarding the earthing of portable apparatus.

Mr. James Hendry, 252, Main Street, Bridgeton, Glasgow.—Effective showcard representing one of the firm's new patent flexible laminated leather belts in use.

Messrs. R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—24-page catalogue of new and second-hand machinery for sale or hire.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C. — 4-page leaflet illustrating a number of artistic designs of window signs, intended to combine both a lighting and an advertisement fixture, which they are making up in their works in various metals and finishes according to requirements, also two typical examples of signs actually installed. The various methods of using the lamps and installing the signs are illustrated. New list of "Spookie" shades for candles, pendants, table lamps, &c. Several new designs are included. The firm have been appointed sole selling agents for these shades for Great Britain, Europe, British Empire and the Argentine. Contractors can have copies of the list printed with their own names and addresses.

Messrs. Foster Engineering Co., Ltd., Morden Road, Wimbledon, S.W.—New leaflet illustrating and describing their electric furnace transformer and regulating transformers; also a copy of the latest edition of their "Foster" metal lamp list showing the various shapes in which these lamps are made. The manufactures are all produced at the Foster works at Wimbledon.

Messrs. Carney & Pearn, Ltd., Nutsford Vale Works, Longsight, Manchester.—List No. 102 containing a description, with tabulated sizes and prices, of their "C. & P." silent auto-transformers.

The Unbreakable Pulley and Mill-Gearing Co., Ltd., West Gorton, Manchester.—20-page pamphlet containing numerous illustrations with description, tabulated sizes, prices and dimensions of the Benn patent friction clutch, and clutch actuating gears.

Bamberger Industrie - Gesellschaft m.b.H., Bamberg, Bavaria.—Leaflet relating to fittings and accessories for wiring with conduit, Edison screw switchboard elements, &c.

Mr. R. E. Steel, 794, Salisbury House, London Wall, E.C.—Full list describing, and tabulating sizes, speeds, prices, &c., of, the Beedle patent electric ventilating fans for C.C. and A.C.; also a 4-page list dealing with the Beedle patent impellers for ventilating fans; and one describing distilling apparatus for producing pure distilled water for laboratories, storage battery installations, &c.

Messrs. Schiersteiner Metallwerk G.m.b.H., Berlin W. 57.—Leaflet relating to cyclometer parts for meters.

New Electrical Showroom.—On Friday last the Poplar B.C. Electricity Committee opened a new showroom at 121, East India Road, E. The premises, although not extensive, have been very effectively arranged. The exterior is illuminated by three metallic-filament lantern fittings, whilst the window contains a good display of ornamental fittings, radiators, fans, &c. The interior has been set out as an inquiry office, with a representative selection of pendant and wall fittings, radiators, fans, domestic appliances, &c., and an illuminated sign set in a niche announces a cheap power rate. A small room at the rear has been utilised as a kitchen with "Tricity" apparatus, the advantages of which, as compared with the gas or coal fire methods of cooking, were most admirably demonstrated by Mr. F. S. Grogan. We may remark, in passing, that periodical demonstrations will be given with this apparatus. Above the kitchen is a very tastefully decorated dining room, one side of which is open to the inquiry office, being separated therefrom by an open balustrade. This room contains a number of table, wall and pendant fittings. The Council, in opening the showroom, hopes to get into closer touch with every class of consumer, and we have no doubt that it will assist greatly in increasing both the day and night loads. With regard to contractors who may establish themselves in the borough, the undertaking will be in no way a competitor to them

Bankruptcy Proceedings.—Thomas Charles Francis, electrical engineer, Liverpool Road, Stoke-on-Trent.—At a meeting of the creditors on July 12th, accounts were presented showing gross liabilities amounting to £524 and unsecured liabilities totalling £513; assets, £11. Debtor, who attributes his failure to his expenses being in excess of his income, commenced business in 1904 with a borrowed capital of £400. Two years later he was joined by two partners, but a deed of assignment and dissolution followed. Debtor was in private employment from 1908 to 1910, when he again resumed business with only £10 capital. The estate remains in the hands of the Official Receiver for realisation.

Edward James Crosier (Crosier, Stephens & Co.), Newcastle-upon-Tyne.—Some particulars have already been published. At the Newcastle-upon-Tyne Bankruptcy Court on 13th inst., bankrupt came up for his first public examination. He said he started business in partnership in 1891 as an engineering agent and merchant. He gave particulars of his different partnerships and of surpluses and deficiencies in different years. He continued trading because several gentlemen offered to put money into the business, and apart from those offers, he thought he would recover his business by leaps and bounds. Nearly all his trade debts had accrued since 1908. He complained that his assistants were at one time disloyal, and that affected his business. In January, 1911, a company was formed, called the Cromil Engineering Co., Ltd., for the purpose of selling Cromil specialties. Debtor received 3,000 £1 shares, and was appointed manager at £6 per week. In reply to Mr. J. A. Dixon, debtor said that assistants had put into the business sums of money as loans, as a consideration for them learning debtor's business. In answer to Mr. R. E. B. Lisle, his solicitor, debtor said he had taken over new agencies to try and improve his business. The examination was adjourned.

Alfred Sitch, metal worker and electrical engineer, 77, Brecknock Road, London.—Receiving order made July 10th on creditor's petition. First meeting, July 26th; public examination, September 5th—both at Carey Street, W.C.

W. H. Ridpath (Ridpath & Wells), electrical engineer, Ilkeston.—Receiving order made on debtor's petition, July 14th.

W. H. Illingworth, electrical engineer, &c., Halifax and Leeds.—Last day for receipt of proofs for intended dividend, August 2nd. Trustee, W. Durrance, 12, Duke Street, Bradford.

Condensing Plant Contracts.—The following are among the orders for condensing plant which have recently been received by the Mirrlees Watson Co., Ltd., of Glasgow:—

Surface Condensing Plant—

Two sets for Stoke on-Trent Electricity Works, per Messrs. Jas. Howden and Co., Ltd.
Three condensers for Messrs. Gwynnes, Ltd.
Plant for the Torquay Corporation Electricity Works, per the British Thomson-Houston Co., Ltd.
A repeat order for the Govan Corporation, per Messrs. Jas. Howden and Co., Ltd.
Plant for Messrs. Bolckow Vaughan's Steel Works, South Bank (ninth set).

Jet Condensing Plant—

Plant for St. Croix.
Plant for Waleswood Colliery, per the British Thomson-Houston Co., Ltd.
Plant for St. Helens Corporation (repeat order).
Plant for Messrs. Bolckow Vaughan, Leasingthorne Colliery.
Plant for the Lancashire and Yorkshire Railway, Formby Power Station, per the British Thomson-Houston Co., Ltd.

Australia.—The Australian Customs authorities have lately given a decision to the effect that "Holders, brush, for dynamo-electric machines," are to be classified under No. 177*a* of the tariff, the duty being at the rate of 20 per cent. *ad valorem* on both British and foreign goods.

Annual Holidays.—The General Electric Co., Ltd., Witton, Birmingham, announce that their works will be closed from 12.30 p.m. on Saturday, August 5th, until 7.30 a.m. on Monday, August 14th, 1911, for the annual holidays. Goods will not be dispatched between these dates, but a small staff will attend to deal with matters of extreme urgency.

Sales Managers' Association.—The members of this Association were to meet yesterday (Thursday) evening, July 20th, at 6.15 p.m., at Holborn Restaurant, for their monthly business dinner and discussion. The first of a series of discussions on (1) Selecting and engaging salesmen, (2) Methods of training salesmen, (3) Managing salesmen, had been arranged for, the talk being opened by Mr. R. A. Learned, of the International Multigraph Co. We are asked to state that any business manager or sales manager who desires to attend the next meeting of the Sales Managers' Association, or who desires further particulars as to the aims and scope of the Association, is invited to communicate with any of the members mentioned above, or with the hon. secretary, Mr. F. R. Jones, Audrey House, Ely Place, E.C.

Preston Semi-Convertible Car.—The United Electric Car Co., Ltd., of Preston, Lancs., have sent us a copy of a pamphlet just issued by them, describing and giving a number of photographs of their Preston semi-convertible tramcar, as recently supplied to the Blackpool Corporation. The car combines their patent system of side windows, and an additional means of exit from the car. The side windows give a clear opening, when both windows are lowered, of 3 ft. 9½ in. A special feature of the body is the width over corner pillars of 7 ft. 6 in., which is a great advantage where cross seats are used, as it allows a comfortable seat for two passengers on each side of the gangway. The width of the gangway in the Blackpool car is 1 ft. 5 in. The seats are of the rattan spring reversible tilting type. The lighting of the car is by a neat four-light fitting in the centre, and four single-light fittings. The blinds are of a special leather cloth pattern, and the inside ventilation is of the latest Preston type. The length of the platforms is 6 ft., or 9 in. longer than the recognised standard, a special feature being a clear and wide entrance or exit under the staircase to facilitate loading and unloading at the end of a journey. The staircase is very wide and easy to descend or ascend, and it follows the sweep of the dash. On the upper deck the seats and backs are also of rattan, and the increased width of the car makes it very commodious. The side windows are of plate glass and without frames; they operate independently with the aid of lazy tongs. The car is mounted on the Preston patent flexible axle yoke type truck with a wheel base of 8 ft. 6 in. Some of the advantages claimed for this truck, a large number of which are now in operation, are its ease in negotiating sharp curves, long spring base, even wear on tires, and longer life for tires and axles. The seating accommodation of the car is 28 inside (lower saloon), 20 inside (upper saloon) and 18 under the canopies—66 in all. The semi-convertible type of car is regarded as the ideal car for seaside towns, and for all towns where there are pleasure routes running out into the country.

Trade Announcements.—Mr. William Brickett, for many years manager for Messrs. J. & G. Pearce, of 2, George Street, Richmond-on-Thames, who are giving up business, has commenced business as an electrician at 6, King Street, Richmond.

Messrs. Frederick Ryman & Co., manufacturing electrical engineers, ask us to state for our readers' information, and to save further delays of correspondence, that their correct address is 116 Livery Street, Birmingham (not Cox Street, St. Paul's Square).

"Stannos."—We are informed by Messrs. Siemens Bros. & Co, Ltd, Caxton House, Westminster, S.W., that, owing to increased manufacturing facilities and the reduced price of rubber, they have increased the discounts off the price of "Stannos" wire and fittings as from 17th inst. Particulars will be supplied on application.

Demand for Engineering Appliances in Canada.—Our contemporary, *Canada*, states that Mr. Leonard Andrews, M.I.C.E., managing director of the Key Engineering Co., London and Manchester, has recently returned from a business tour on behalf of his company through Canada, Australia, New Zealand and India. He tells us that he was particularly impressed by the demand for engineering appliances in all parts of Canada. Since his return to England, he has been urging British manufacturers to pay greater attention to this market, and he has been giving them such enthusiastic reports of the industrial developments of the country, and the consequent ever-increasing demand for engineering appliances of every description, that he has been commissioned by several of the largest engineering manufacturers in Great Britain to pay a further visit to Canada for the purpose of making fuller investigations as to the best means of catering for this demand. Mr. Andrews left Liverpool on Thursday, last week, and expects to be staying for a short time at the Windsor Hotel, Montreal, before leaving for the West.

Holiday Literature.—Other official publications, similar to those mentioned last week, have been received, dealing with the attractions of Swanage, Southwold, and Southend and Westcliff-on-Sea.

Dissolutions and Liquidations.—Acoustic Patents, Ltd.—A petition for winding up this company, presented by Siemens Bros. & Co., Ltd., creditors, is to be heard on July 25th.

Bombay Hydro-Electric Syndicate, Ltd.—This company is winding up voluntarily, with Mr. F. J. Horne, 214, Gresham House, E.C., as liquidator. A meeting of creditors is called for July 24th at 208, Gresham House. Creditors should send the usual particulars to the liquidator by August 14th.

W. M. Ryan & Son, electrical engineers, 2, Church Lane, Leytonstone, and 16 and 17, Devonshire Square, E.C.—Messrs. E. Ryan and G. Bristow have dissolved partnership. Mr. Ryan will attend to debts and continue the business.

Batley Electric Carbonising Co., Ltd.—This company is winding up voluntarily, with Mr. H. Appleyard, Prudential Buildings, Market Place, Dewsbury, as liquidator. A meeting of creditors is called for July 27th.

J. G. Childs & Co., Ltd., Willesden Green.—First meetings of creditors and contributories, August 1st, at 11.30 a.m. and 12 noon, both at Carey Street, W.C.

The Aluminium Industry.—As previously mentioned in this journal, attempts have been made since the collapse of the former international aluminium syndicate, to bring about a fresh understanding, the efforts being put forth first by one group of interests, and then by another, but all endeavours to arrive at a world convention have been in vain. The only result has been a combination of the French producers, who transferred their production to the Frankfort Metal Co. The negotiations for a new international understanding have never been formally broken off, but have often remained at a complete standstill. It is now stated that discussion has recently taken place in order to prepare for a new agreement of an international character.

LIGHTING and POWER NOTES.

Aberystwyth.—The T.C. has decided, by 7 votes to 4, to support the Bill being promoted to give powers to local authorities to sell electrical fittings and undertake wiring work.

Altrincham.—A conference of local authorities is to be held to discuss the proposal of the Altrincham Electric Supply Co. to apply for an order to extend its authority to the Bucklow area and the Hale urban districts.

Australia.—The annual returns of the Melbourne Electricity Department show a gross revenue (to February 28th) of £120,363, as compared with £113,579 in the previous year. The gross profit was £63,934, and the net balance, after meeting interest and sinking fund and depreciation charges, £19,532. The Council is to install a large battery in a central site at an estimated cost of £21,000. The total units sold during the year were nearly 9,000,000, power and heating accounting for one-third.

Early in June a 1,500-KW. turbo-alternator at the Richmond works of the Melbourne Electric Supply Co. broke down, and a second 1,000-KW. machine also failed when called upon. As a result, many factories had to cease work, and some of the street lighting was affected, until the Melbourne City Council came to the company's aid with an emergency supply. The company had a new 2,000-KW. machine on order, which should have been delivered from England before the mishap.

Ardsley.—The Council has consented to the Electrical Distribution of Yorkshire, Ltd., applying for a prov. order to supply the township.

Batley.—The B. of T. has communicated its decision in reference to the dispute between the Corporation and the Yorkshire Electric Power Co. The Board states that the company shall be allowed to extend its mains from Thornhill to Pudsey *viâ* Mirfield and Spen Valley, and for that purpose to lay its cable under Bradford Road, a course to which the Corporation raised strong objection. The condition is imposed, however, that the work must be carried out within 12 months.

Barnsley.—A prov. order for E.L. in the area of the R.D.C. is being applied for by the Yorkshire Power Co.

Biddulph.—Mr. Robert Heath has laid before the ratepayers an E.L. scheme for the town, the idea being for the U.D.C. to take current in bulk from Messrs. Heath, who are bringing electric power from Kidsgrove to Black Bull. The firm offer current to the Council at 1½d. per unit. At present gas is supplied at 3s. 8d. per 1,000 cb. ft. The matter is to be dealt with by the Council.

Buckingham.—The T.C. has accepted the tender of the E.L. Co. for street lighting for five years at £140 per annum.

Canada.—The Ontario Government claims the right to power developed from Dominion canals, and proposes to press for compensation to the extent of $100,000 a year. The Ontario Government, while admitting the possibility of Federal authority to take water from lakes and streams for navigation purposes, insists that any power incidentally developed by the construction of dams shall remain under Provincial jurisdiction. Therefore, while the Dominion may construct the works necessary for navigation purposes, it is not entitled to any revenue from any water-power that may have been even temporarily developed.

The plant of the Canadian Light and Power Co., at St. Timothé and Valleyfield, Que., is nearing completion. Three wheels and one generator are installed, and construction on the intake and the tail-race is about completed. The immediate supply of power will be 21,600 H.P., the contemplated output being 75,000 H.P., which is expected to be available for transmission by next fall to Montreal. The company has already disposed of all the power that will be available for the next few months.

Carlisle.—A net profit of £3,346 has been made on the Corporation's electricity undertaking during the past year.

Continental Notes.—AUSTRIA.—Plans are being prepared in respect of a projected electricity generating station near Pettau, utilising the water-power of the River Drau. It is estimated that about 34,000 H.P. is available. The Siemens-Schuckert Co., of Vienna, and the Ganz Co., of Budapesth, are interested in the scheme.

FRANCE.—La Société Electrique de la Vallee de l'Yonne is the name of a new company which has just been formed at Pont-sur-Yonne, with a capital of £18,000, to establish a small electric lighting station in the town.

GERMANY.—The A.E.G. is in negotiation with the municipal authorities of Altona with reference to taking over the electric lighting station and undertaking in the town. It is proposed to form a separate company, with a capital of £325,000, to carry on the undertaking, in which the municipality will take shares to the value of £175,000.

SPAIN.—The municipal authorities of San Juan de la Abadese (Province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Clayton.—A prov. order for E.L. is being applied for by the Electrical Distribution of Yorkshire, Ltd.

Doncaster.—On July 12th a L.G.B. inquiry was held into the application of the T.C. for a loan of £12,000 for electricity purposes, a portion being for excess expenditure. The other items were: Boiler, £940; new offices, £638; fan, £163; alteration to flue, £150; 500-KW. turbo-generator, £3,900; alterations to bunkers and coal-handling plant, £1,200; mains, services and meters £2,350; switchboards, &c., £250; foundations, £155; feed-water heaters, softener tanks and alterations, £355. There was no opposition, but the inspector (Mr. T. C. Ekin), referring to the excess expenditure, intimated that the Council would probably receive a strong letter from the L.G.B.

Douglas (Isle of Man).—On the 12th inst. the T.C. received a memorial from tradesmen asking that electric light should be provided by the borough, and a special Committee of the Council was appointed to report on the question of the feasibility of establishing an electric light undertaking.

Durham.—For installation at one of the pits of the Consett Iron Co., Messrs. Ernest Scott & Mountain have in hand two of their latest type of centrifugal pumps, each pump being of the seven-stage type and arranged to deliver 250 gallons per minute against a total head of 445 ft., and to be driven by a three-phase 625-volt, 50-cycle squirrel-cage motor. The same firm has recently completed at the Eldon Colliery of Messrs. Pease & Partners, a double-drum main haulage gear of 150 to 250 H.P. capacity, fitted with drums 4 ft. diameter by 2 ft. wide, and 5 ft. 8 in. diameter over shield-boards. There is also a main and tail-haulage gear of 200 to 400 H.P. capacity fitted with drums 5 ft. diameter by 2 ft. 6 in. wide, and 7 ft. 6 in. diameter over shield-boards. This gear is driven by means of a three-phase motor working on 2,750 volts, 40 cycles, the motor driving the gear through a single reduction of machine-cut helical gearing.

For one of the pits of the Lambton Collieries they are supplying two three-throw pumps, delivering 400 gallons against a total head of 700 ft., and driven from the motor through gearing.

Ealing.—The charge for electric current for power, heating and cooking has been reduced to 1d. per unit.

Eccles.—The new weaving shed of the Eccles Industrial Manufacturing Society, Ltd., is now completed. The looms and preparation machinery are driven by single motors, and, according to a textile correspondent, the new system of driving is giving every satisfaction. The motors are by the Schorch Electrical Co.

Epsom.—The U.D.C. has decided to supply current for lighting the premises of the Conservative Club. for £30 per annum.

Guisborough.—The U.D.C. has been served with a petition from over 400 residents expressing the opinion that the time has arrived for steps to be taken to obtain an electric supply for the town. A special meeting of the Council is to be held to consider the matter.

Hastings.—After years of deficits it is satisfactory to note that there now seems every promise that the Corporation electric lighting undertaking is on the road towards prosperity. At a L.G.B. inquiry a few days ago into an application for the borrowing of money for extension of mains, the Inspector expressed satisfaction that the undertaking had "turned the corner," and added: "You appear to be wiping out liabilities at the rate of £1,000 or more a year." The electricity department, in common with the other municipal departments, has just undergone an inquiry by a special committee, which has this week presented a report highly complimentary to the electrical engineer (Mr. Russell Ferguson).

Ilford.—The U.D.C. has received the sanction of the L.G.B. to a loan of £8,070 for mains, meters, switchboard, &c.

Leigh (Lancs.).—The extension of the electricity undertaking formed the subject of a L.G.B. inquiry by Mr. T. C. Ekin on July 13th, in connection with a loan of £5,300. It was stated by Mr. A. T. Smith (borough electrical engineer) that the existing plant was capable of an output of 760 KW., not taking into account the accumulators, which were capable of supplying 220 KW. for one hour. The present consumption stood at a maximum of 500 KW., and additional applications had been received by the Corporation for lighting and power, which would give a maximum load of 600 KW. In order to meet this demand it was proposed to put in a 500-KW. set, with a condenser capable of dealing with 1,600 KW., and additions to switchboards and buildings. Included in the £5,300 were the following amounts:—£2,310 for engine and dynamo; £1,926 for condenser; £163 for switchboard; £115 for steelwork; £889 for buildings and foundations; and £104 for alterations to engine room. There was no opposition to the scheme.

Luton.—A L.G.B. inquiry was held on July 11th into the application of the T.C. for a loan of £13,497 for electricity purposes. There was no opposition.

Portishead.—The Bristol T.C. having arranged terms has withdrawn its objection to the granting of the Portishead E.L. order. The promoters agree not to give a supply of current within the city area without the Council's consent; not to erect overhead wires in roads in Portishead where the Council is inter-

ested as owners, but to lay compulsory mains in such roads, while the Council is to have the power to purchase any portion of the undertaking which is in future included in the city boundary. The area of supply contemplated is Portishead, Portbury, Easton-in-Gordano, North Weston and Abbot's Leigh, Flax Bourton, Long Ashton and neighbouring parishes.

Ramsbottom.—The U.D.C. has asked the Lancashire Electric Power Co. to quote terms for public lighting at Summerseat.

Rishton (near Blackburn).—Mr. J. W. Speight, of St. Anne's-on-Sea, has notified the U.D.C. of his intention to apply to the B. of T. on behalf of a new company, to be called "The Rishton Electrical Supply Co., Ltd.," for a provisional order for the urban district.

Rugeley.—The U.D.C. has decided to consider the question of lighting the town by electricity, presumably with a view to the Council applying for a prov. order.

Sheerness.—The U.D.C. has sealed an agreement with the Electric Power and Traction Co., Ltd., for lighting by electricity West Street, High Street, Broadway, Edward Street and Marine Parade. A year is to be allowed to carry out the work.

South Africa.—Cape Town.—The illuminations in connection with the local celebration of the Coronation were both pretty and effective. Although the Government buildings were not nearly so extensively illuminated as on the occasion of the opening of the Union Parliament by the Duke of Connaught and the street illuminations did not have the imposing outlines of the triumphal arches, yet the simpler festoons of lamps along the principal streets and the outlining of the chief business places, had a very pleasing effect, and were very generally admired. Free current was given by the Corporation for the night of the Coronation, and this was taken full advantage of. The load on the Corporation supply was on that evening nearly 1,500 kw.

Oudtshoorn.—A movement is on foot for the acquisition of the electric light undertaking of the local company, as a municipal concern.

Southport.—The T.C. has applied to the L.G.B. for a loan of £1,500 to meet the cost of a duplicate cable to the sewage works at Crossens.

Sunderland.—At a meeting of the T.C. on July 13th, when the annual report of the Electricity Committee was moved, Mr. Hartley French moved an amendment that an item of £12,402 set down as interest on mortgage debt should be so altered as to show that £404 of this was interest on bank overdraft.—Mr. T. S. Lawson seconded, and said that bank charges for overdraft were quite illegal, and after the West Ham and Tottenham decisions in Court, he protested against such charges being put into the accounts of the Committee in an underhand way.—Mr. F. Nicholson pointed out that the amount of the bank overdraft was plainly set out in the balance-sheet immediately below the accounts.—The amendment was lost, and the report, after discussion, carried.

Swinton and Pendlebury.—A letter has been received by the local D.C. from the Lancashire Electric Power Co. concerning the proposed supply of electricity to the Broad Oak Park area. Mr. W. L. Miller, electrical engineer, has been engaged to report on the proposals.

Truro.—Messrs. J. W. Purves & Co., of Exeter, have informed the T.C. that they intend applying for a prov. order for E.L.

Wakefield.—The T.C. has applied to the L.G.B. for a loan of £5,540 for mains, sub-stations and transformers.

Weymouth.—The electricity undertaking of the T.C., which some years ago was the subject of a searching L.G.B. inquiry, has turned the corner, and at the last meeting of the Council, the Electricity Committee was able to report a remarkable year's progress. There was an increase of 3,636 lamp connections during the year, and the gross receipts amounted to £7,011, and the gross expenditure to £3,133, leaving a gross profit of £3,877, which, after paying interest on loans and repayment of moneys borrowed, means a profit on the year's working of £387. There were more new consumers during the past 12 months than in the whole of the three preceding years, and the actual commercial result of the year's work would enable a company to pay a dividend of 5 per cent., and place £1,200 to reserve.

Whitworth.—The U.D.C. has applied to the B. of T. for an extension of time for carrying out the E.L. order.

Winchcombe.—The R.D.C. has assented to the application of the Cheltenham T.C. for a prov. order for E.L. in the rural district.

Wombwell (Yorks.).—A special meeting of the Council has been held to reconsider the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order. The clerk was instructed to ask for an interview with the company, and to promise that there would be no opposition to the application if provision was made for necessary protective clauses.

TRAMWAY and RAILWAY NOTES.

Australia.—The Tasmanian Parliament last session discussed a proposal to lay an electric railway line from Hobart to Huon, the power to be supplied by the Complex Ores, Ltd. The Parliamentary Committee estimated that the line would open up an area of approximately 100,000 acres of Crown land suitable for settlement. The estimated cost of construction was £223,000, the estimated expenditure per annum £19,362 (including interest), and the revenue £26,280. A steady growth of 5 to 10 per cent. on these figures, it was thought, might be expected. Arrangements have been made for Mr. W. G. T. Goodman to report on the scheme. —*Engineering and Electrical Record.*

According to the *Australian Mining Standard*, the Hobart Municipal Council recently deferred consideration of a report on the purchase of the Hobart electric tramways pending the return of the manager.

The same paper prints a report of the Railways Standing Committee of the Victorian Parliament on the proposed duplication of the Caulfield and Camberwell suburban railways. The Committee considers that the £650,000 required for this work would be better expended in the electrification of these routes, and certain others, a matter of 50 miles. A much improved service could be given and more effective competition with the suburban tramways provided.

If the electrification of these lines is not sanctioned, the Committee says it will be necessary to regrade and duplicate them for steam haulage, at a cost of £964,000.

The president of the Australian Tramways Association, after a recent tour in Australia, gave it as his opinion that grave discontent exists among the tramway employés all over the States, and that the employés would strike immediately, if the executive would sanction it.

Birmingham.—According to the *Financier*, the Tramway Committee has decided to recommend the immediate acquisition by the Corporation of the whole lines now within the greater Birmingham area, leased to the British Electric Traction Co., represented locally by the City of Birmingham Tramway Co. The proposed expenditure is £151,000, which includes the purchase of a number of power stations. It is unlikely that the negotiations will be completed before the end of the year.

Cheshire.—Arising out of a letter which Messrs. Forwood & Williams forwarded to the Neston and Parkgate U.D.C., Cheshire, the Council passed the following resolution at its last meeting :—"That this Council is of opinion that an improved railway service would expedite the development of the district, and they urge the Joint Railway Co. to double and electrify the Hooton and West Kirby line, so as to obviate the constant delays of through trains to Hooton."

Continental Notes.—Germany.—A noteworthy agreement of a provisional character has just been concluded between the Berlin City Council, on the one hand, and the Grand Berlin Tramways Co., on the other, including the company's four subsidiaries in the West, the South, the North-East and the Berlin-Charlottenburg tramways. The agreement will put an end to all uncertainty or indistinct legal relations between the two parties, and whilst giving the city the power to supervise the undertaking, it will also enable the company to develop the system on a clear financial basis. In the first place, the city prolongs until 1939 its consent, which now runs to 1919, and has the option of further extending it until 1949, but the company cannot independently propose a prolongation of the working concession granted by the State until 1949, the latter problem having hitherto been a source of dispute between the company and the city. The company agrees to pay the sum of £1,150,000 to the city at once, in return for the latter abandoning its right to take over the tramway tracks in 1919, and a meeting of the shareholders has been convened to sanction this payment and other portions of the scheme. A financial control is accorded in so far that the city will have the right of appointing three representatives on the board of directors, and its sanction will be required to any alterations in the company's statutes in respect of the amount of the share capital, the distribution of the profits, the reserves in redemption or renewal funds, &c. In this way the city desires to protect itself against watering of capital, to safeguard its share in the profits and to prevent the forcing up of dividends at the expense of renewal funds, &c. The company receives 17 additional rights to use streets, and both parties grant the joint use of a number of tracks, whilst the company abandons its claims for compensation on the ground of damages caused by the competition of certain municipal tramways. In return the company secures a monopoly in various parts of the city; has to increase the services at the request of the city, and has to construct new lines in the suburbs. If these lines are worked at a loss, the deficiency is to be borne by the city, which is, however, to be recouped out of subsequent surpluses yielded by these particular extensions. The agreement also provides for a revision of the fares every ten years, and for a conditional augmentation in the city's share in the company's net profits. It likewise contains details of the right of acquisition by the city at various periods during the term of the extended concession, whilst, if the undertaking is not taken over before 1949, the tracks and buildings will then pass into the possession of the city without any payment, only the rolling stock and sites being purchased according to the book value or on the basis of the estimated value.

Sweden.—The power station at the Porjus Falls is of exceptional importance as illustrating the water power-policy of the Swedish

Government. It is situated in the north of the country, and is intended partly for the working of the Ogoten railway, which leads from the iron ore region of Kiruna to the frontier, and is thence continued to Narvik, which is the most northern ice-free port in the world. The station is also for the purpose of providing power in connection with the working of the iron ore mines of Kiruna and Gellivare. According to Otto Kahn, the Porjus station possesses noteworthy peculiarities, as the engine room is built 166 ft. below the surface in consequence of the extreme cold, and the supply and discharge conduits also pass underground, and thus prevent the water from freezing. The engine room is artificially ventilated and lighted, and the switchboard apparatus and transformers are arranged in a special building on the surface, whence the machines are controlled by means of cables which are carried in a tunnel to the underground machinery room. The railway line from Gellivare to the Porjus Falls, which is to make this Polar power station accessible, is of importance from another point of view, inasmuch as it forms the first link in the great inland railway which is to proceed from Sveg, the most northern point of the railway network in Dalarne, to Gellivare and Porjus, a distance of over 400 miles. This scheme is connected with the water-power policy of the State, and the working of the railway by electricity is held in prospect. The electric locomotives for the Lapland railway are being supplied by the Siemens-Schuckert Works, whilst the A.E.G. is carrying out the electrical equipment for the Rjukan railway in Norway.

Italy.—The Rome municipality is to consider a scheme for the construction of an underground electric railway in the Eternal City, embodying the best features of such lines already in existence in London and Paris.

Dunfermline.—The T.C. has withdrawn its opposition to the application of the Dunfermline and District Tramway Co. for an extension of time under its provisional order, which expires this year. At a previous meeting the Council decided to oppose the application because of the failure of the company to run cars to the Milesmark district of the burgh. The extension of time is being limited to two in place of four years.

Dundee.—The local Trades Council is determined to have the question of the recent revision of the car fares opened up. The members have unanimously agreed to forward to the town clerk a resolution protesting against the action of the tramway convener in refusing to hear a deputation on the question of the abolition of workmen's cars, and as to the "absurd" alteration on the halfpenny stages. The electors are also being urged to make the matter a "burning question" at the next election.

London. — The report of the East London Railway directors states that, owing to unavoidable delay, the lessee companies have been unable to arrive at a final decision as to electrification in time for the report; it is hoped that a statement may be made at the meeting.

Manchester.—The *Financial Times* says, in regard to to the Manchester South Junction and Altrincham Railway, which has recently been the subject of considerable discussion owing to the rumour that the railway was to be electrified, as a preliminary, if successful, of a comprehensive scheme of electrification on the North-Western and Great Central local lines in the Manchester district, that no actual decision has yet been arrived at in the matter, which is, however, still pending, and has by no means been abandoned. Should electric traction eventually be introduced, the railways entering Manchester will be provided with a most valuable object-lesson as to the adaptability or otherwise of electrical operation in that congested district. The M.S.J. and A. Railway is a joint undertaking, owned by the London and North-Western and Great Central Companies.

Milnrow.—The U.D.C. has authorised the Rochdale Tramways Committee to act as its agents in the placing of the contract for the cars required to work the Milnrow tramways.

Oxenhope (near Keighley).—The U.D.C. has received a communication from the Keighley Corporation intimating that it is the intention of the latter to seek Parliamentary powers to run motor-'buses and railless trolley vehicles within the Council's area, and asking for the formal consent of the local authority. The Council decided that it was favourably disposed towards giving the necessary consent, but before doing so the Corporation is to be requested to supply further details.

Panama.—According to *Electric Traction Weekly*, Mr. C. G. Young is investigating the practicability of building an electric railway system in the city of Panama and its suburbs, including Balboa. Mr. Young represents a syndicate of New York capitalists, which expects to take over the interests of Mr. Cook, who has a franchise for a street railway in Panama, providing the transfer can be made, and a few minor concessions secured from the City Council to carry out the project on an enlarged scale. Mr. Young is at present consulting engineer in the construction of 150 miles of railroad in Hayti. He will have charge of the Panama system.

Sunderland.—At a meeting of the T.C. on the 12th inst., Councillor New, in moving the adoption of the annual report on the tramways, said the reserves and renewals accounts now stood at £25,324. In his opinion, it should be maintained at £30,000 for some years to come. The cars were in as good, if not a better, condition than when purchased, and 15 top covers had been added and paid for out of revenue.

U.S.A.—The Piedmont and Northern Railway, a subsidiary company of the Southern Power Co., Charlotte, North Carolina, has ordered from the Westinghouse Electric and Manufacturing Co. all the sub-station and car and locomotive equipment for its 125-mile interurban line, which will be operated with direct current at 1,500 volts. The aggregate cost of the equipments ordered is approximately $100,000. It includes ten 500-kw. motor-generator sets for the sub-stations, 23 quadruple 90-h.p. car equipments, and 14 55-ton electric locomotives, which will be used for hauling freight trains. This new line, which is now under construction, will connect Charlotte and King's Mountain, North Carolina, and Spartanburg and Greenwood, South Carolina. It will have some long steep grades, but each of the locomotives is to be of sufficient capacity to haul a train of 800 tons, and will be equipped with four interpole motors geared to the axles.

Electrification of the Broad Street terminal line of the Pennsylvania Railroad in Philadelphia is contemplated, according to Press reports. It is proposed that all trains drawn by steam locomotives shall start from the West Philadelphia station where through trains now stop without going into Broad Street. The station at Broad Street will thus become a terminus for a heavy suburban traffic with trains operated chiefly on the multiple-unit system.—*Railway Electrical Engineer.*

The Electric Storage Battery Co., of Philadelphia, has closed a contract for the battery equipment of the 35 new storage battery cars for the Dry Dock, East Broadway and Battery Railroad Co., of New York City, to be placed in service on its lines during the summer. These new cars have been specially designed by the Third Avenue Railway Co.; each car is equipped with two motors, and the batteries are installed under the longitudinal seats. The cars will give a maximum speed of 15 miles an hour on level track, with a schedule speed of 7 to 8 miles an hour, including stops. The battery equipment of each car consists of 58 cells of the "Hycap-Exide" type.

Warrington.—With reference to the renewal of tramway equipment, the tramways manager reported to a meeting of the Electricity and Tramways Committee as follows:—"I estimate the cost of providing new rails, &c., and relaying the track will work out at £3,000 per mile of single track. This means that £200 a year per mile on 8 miles of track should be added to our renewal fund, a total of £1,600 per year." It is understood that the Corporation will accept the report.

Wolverhampton.—The Corporation Tramways Committee has issued an abstract of the accounts of the undertaking for the year ended March 31st. The abstract shows that the gross profit was £20,811, and the net balance of profit has been appropriated for renewals £4,118, reserve £2,022, and to the borough rate £2,125. The sum of £38,454 now stands to the credit of the reserve and renewals fund. The traffic receipts for the year have increased by £4,152, consequent upon having a full year's operation of the Penn Fields section, the last to be opened, and also the extra traffic obtained during the aviation meeting in June and the Charity Carnival in August. The working expenses show a reduction of '268d. per car-mile, the figure this year being 6'155d., as against last year's figure of 6'423d. per car-mile.

York.—The City Council has approved in Committee proposals for tramway extensions involving a total expenditure of nearly £42,000.

TELEGRAPH and TELEPHONE NOTES

Australia.—The Special Commissioner who is testing the Sydney telephone service has apparently found it in a very inefficient condition, for out of 19 calls, 14 were badly served. Delays ranging from two to six minutes were experienced, and almost always there was a lack of supervision at the exchange to see whether he had got through to the called subscriber.

India.—In the annual statement issued from the India Office, it is stated that the telegraph system under the direct control of the Indian Government consists of 72,420 miles of line, 283,374 miles of wire and 327 miles of cable. The principal event of the past year was the promulgation of a scheme for the reorganisation of the upper ranks of the Indian telegraph department, under which the rates of pay of the various grades were considerably improved. A table is given, showing for a period of five years the progress that has been made in extending public telegraphic communication in the Empire. From this it appears that up to the beginning of the year 1905-6 the capital expenditure amounted to £5,824,031; the miles of line to 61,684, the miles of wire to 227,436, the miles of cable to 245, and the total number of offices open to the public to 5,986. At the end of the year 1909-10 the corresponding figures were—capital expenditure £7,264,6[illegible] miles of line 72,420, miles of wire 283,374, miles of cable 327 a[illegible] telegraph offices 7,225. The number of messages in the year 1905-6 was 10,461,117, with gross receipts of £805,748, and net receipts of £206,696, showing a return of 3'33 per cent. on the capital employed. In the year 1909-10 the messages had increased to 12,084,697, but the gross receipts had fallen to £795,828, which was not sufficient to cover even the working expenses, and there was a charge on Government revenues of £179,646. The gross receipts fell short of those for any year since 1904-5. This was due almost entirely to a reduction in inland message revenue, both private and State, consequent on general depression in inter[illegible] trade. Working expenses, on the other hand, continue to increase. In 1909-10 they exceeded those of the previous year by £24,497,

hiefly to an increase of expenditure consequent on the reorganiation of the establishment of that branch, and to the introduction f the new time-scale of pay for superintendents and assistant uperintendents with effect from December, 1909. The number of elegrams decreased during the year by 7·11 per cent., and their alue by 11·65 per cent. The subscriptions to the telegraph epartment for telephone and similar services rendered during 909 amounted to £32,592, being an increase of £5,462 over the igures of the previous year. The average annual subscriptions for he past five years amounted to £22,946. Numerous interruptions ccurred during the year on the lines to foreign countries, notably n the Turkish and Teheran routes to Europe and on the Moulmein-Bangkok and Raheng lines to Siam. New wireless telegraph tations were opened at Bombay and Jask during the year, that at he latter place being subsequently handed over to the Indo-European Telegraph Department.

Japan.—In view of the increasing use of long-distance elephones, the Japanese Department of Communications is conidering the question of erecting additional lines between Tokio, Yokohama, Nagoza, and Osaka, and also between Osaka Kyoto and Kobe. It is proposed to lay the new lines underground instead of overhead as hitherto.

Registration of Telephone Calls.—Mr. Crawshay-Williams asked the Postmaster-General whether the registration of calls on the telephone exchanges is absolutely automatic, or whether snch calls are recorded by the operators, and what guarantee subscribers have as to the correctness of the number of calls registered.—Mr. Herbert Samuel replied that in the large Post Office exchanges where the calls are registered by means of meters connected with the subscribers' lines on central-battery switchboards, no call can be registered on any line unless it is connected with another line. The registration is not entirely automatic, as it does not take place unless the operator presses a key which controls the meter. The objection to an entirely automatic register is that it would not distinguish between calls which result in effective conversations and those which are ineffective, and should therefore not be charged for. Meters of the same forms as those in use by the Post Office are in general use in all the large exchanges in the United States, and the results are considered satisfactory. He is obtaining samples of a device which will register all calls automatically, but will allow the cancellation of ineffective calls, the subscriber being informed of the cancellation at the same time, and if this apparatus proves satisfactory it may be possible to allow subscribers the option of having it fixed on their lines at the small extra cost involved by its use.

The Telephone Service.—In reply to a suggestion put forward by the Liverpool Cotton Association that an advisory committee should be constitnted of representatives of the Chambers of Commerce of the 10 largest cities of the Kingdom, to advise the Government as to the general working of the telephone and telegraph systems, particularly as regards rates, &c., the Postmaster-General pointed out the disadvantages and inadequacy of such a system, and stated that it was his intention to decentralise the administration of the telephone service, entrusting responsible officers in different parts of the Kingdom with a considerable measure of executive control. It wonld be the duty of these officers to keep in touch with commercial bodies and with local authorities in their provinces and districts, and it would therefore always be possible to secure free discussion between representatives of the Post Office telephone service and the bodies who might require special developments of the service to meet their needs.

The Corporation of the City of London has resolved to hold a conference at the Guildhall of representatives of local authorities in the London telephone area in regard to the acquisition by the Government of the National Telephone Co.'s undertaking, and for the consideration of the steps to be taken to obtain a cheaper telephone service.

The Telephone Transfer.—On the Telephone Transfer Bill coming up for second reading in the House of Commons on Friday last, all objections were withdrawn, in view of the settlement arrived at between the Postmaster-General and the company's staff. Mr. Herbert Samuel explained that the company appeared to have supposed that he desired to vary the terms of the agreement of 1905, but this was never his intention, and the wording of the Bill had been amended so as to leave no room for doubt that the Bill tallied with the agreement. Most of the points under discussion with the staff had been satisfactorily settled; as regarded the 12 senior officers receiving salaries of over £700 a year, he hoped to bring some of them into the Post Office; the services of five were required by the company, and some others having nearly attained the age of 60, the ordinary age of retirement of civil servants, it was not desirable to take them over. There was nothing in the Bill to prejudice the position of municipalities which might desire to undertake telephone systems in the future, though his own views and expert opinion generally were adverse to municipal telephony. In reply to a qnestion, he was unable to consent to any concession with regard to payment to local authorities for wayleaves, which the Post Office was entitled to without payment. It was stated that the House would have ample opportunity to discuss the amount to be paid to the company for its plant; it had already been decided that the question should be referred to the arbitrators. The Bill was read a second time.

Wireless Telegraphy.—Permission has been given by the Postal Department to the Australian Wireless, Ltd., to establish a station in Melbourne.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—August 15th. 80,000 insulators, and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" July 7th.

August 9th.—530 A.C. meters, 496 D.C. meters and 133 maximum demand indicators, for the Melbourne City Council. See "Official Notices" to-day.

South Australia. — August 9th. (*a*) Letter-box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 23rd.—Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—August 9th. P.M.G. Letter-box fronts. See "Official Notices" July 7th.

August 8th.—According to an Australian exchangge tenders are invited for electrical generators, storage batteries, and voltmeter, for the Stores Supply Department, 15, Young Street, Sydney. A. Berckelman, executive member.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 16th. — Cable, conduits, cast-iron pipes, iron poles, insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" July 7th.

Tasmania.—July 31st. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

Western Australia.—August 2nd. Telegraph and telephone material for the P.M.G.'s Departemnt. See "Official Notices" July 7th.

Austria.—August 1st. The Austrian State Railway authorities at Stanislau are inviting tenders for the supply of five coutinuous-current electric motors for the railway works at that place.

Birmingham.—July 22nd. The Guardians are inviting tenders for the annual maintenance and renewals of the telephone system at the Dudley Road Infirmary. Master, Mr. T. M. Hardie.

Blackburn.—July 25th. Installation of a 28-point fire alarm, open-circuit system, for the workhouse. C. E. Bygrave, Union clerk, Union Offices, Cardwell Place, Blackburn.

Bradford.—July 25th. Two water-tube boilers, stokers and superheaters, and one 12-ton electrically-operated overhead travelling crane, for the Corporation. See "Official Notices" July 14th.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local repesentation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

September 25th.—All eleotric lighting fittings, fans, lamps, insulated conductors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. "Directoria Geral do Expediente, Ministerio da Viacão e Obras Publicas," Rio de Janeiro.—*Board of Trade Journal.*

Canada.—August 10th. According to the *Canadian Engineer* tenders are invited in connection with the municipal installation at Penticton, B.C., for two 100-K.V.A. three-phase, 4,600-volt, 900 R.P.M., A.C. generators direct oonnected to impulse wheels operating at 2,045 ft. effective head, pressure pipe line of about one mile of 10-in. and one mile of 12-in. pipe, switchboards, transformers, meters, distribution and street lighting system. Specifications to be seen at:—F. H. Latimer, consulting engineer, Penticton, B.C., or at Mather, Yuill & Co., Ltd., Vancouver. Tenders marked "Tender for Hydro-electric Plant," to be sent to the above F. H. Latimer, and to be accompanied by cheque for 5 per cent. of the tender payable to the municipality.

Dundalk.—July 24th. Buildings, plant and materials for the electric lighting of the Urban District for the U.D.C. See "Official Notices" July 7th.

Dundee.—It having been alleged that one of the offers for the work at the Downfield electric station had been lost, the Corporation Electricity Committee has agreed that new tenders be received.

Erdington (near Birmingham).—Construction of 1¼ miles of double track tramways. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switchboard, for the Farnham Gas & Electricity Co. See "Official Notices" to-day.

Frodingham.—August 11th. Poles, lamps, wires and switches for street lighting, for the Brumby and Frodingham U.D.C. See "Official Notices" to-day.

Gillingham.—July 24th. Coal for the electricity department. Particulars from Borough Electrical Engineer.

Hungary.—August 2nd. Electric lighting plant (public and private) for the authorities of the Grossgemeinde Pászto, Komitat-Hevcs, Hungary.—*Board of Trade Journal.*

London.—L.C.C.—August 1st. Electrical installation (250 lamps) at the Gt. College Street Elementary School, N.W. See "Official Notices" to-day.

HAMMERSMITH.—July 26th. High and low-tension feeder cables and stoneware ducts, for the B.C. See "Official Notices" to-day.

Manchester.—July 24th. Cast-iron plates for top of flue dampers, and opening apparatus, for third chimney at Stuart Street generating station for the Corporation Electricity Committee. Specifications, Secretary, Electricity Department, Town Hall. Deposit £1 1s. (returnable).

Pembroke (Co. Dublin).—July 31st. Installation of electric light in new artisans' dwellings and in new streets, for the U.D.C. Deposit 20s. Specifications, &c., J. C. Manly, clerk, Town Hall, Ballsbridge, Pembroke. Irish materials and labour and Dublin standard rate of wages.

Pontypridd.—August 1st. 1,700 ampere-hour storage battery, with motor-driven booster and switchgear, for the U.D.C. See "Official Notices" to-day.

Portsmouth.—July 24th. Supplying and fitting 350 metallic-filament lamps for globes in the large hall and banqueting room at the Town Hall, for the T.C. Borough Engineer, Town Hall.

Swinton and Pendlebury.—Tenders are to be invited for a 12 months' supply of materials required for the electricity department.

Tonyrefail.—August 1st. Mains, switchgear, and street lighting fittings at the Ely Valley Extensions, for the Tonyrefail and Gilfach Goch Electric Light Co., Ltd. See "Official Notices" to-day.

Walthamstow.—July 21st. Feeder cables and stoneware conduits for the U.D.C. See "Official Notices" July 7th.

Winchester.—July 24th. Electric wiring and fittings, for the County Hall, for Hants C.C. County Surveyor, The Castle, Winchester (returnable deposit of £2 2s.).

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

CONTRACTS CLOSED.

Aberdeen.—The D.P. Battery Co., Ltd., have secured the contract for the renewal of the Cults sub-station battery of the Corporation.

Atherton.—The Electricity Committee has ordered four transformers from the the British Westinghouse Electric & Manufacturing Co., for early delivery.

Australasia.—According to the *Australian Mining Standard*, orders have lately been placed as follows:—

NEW ZEALAND (GISBORNE):—

Two 100-KW. Diesel generating sets are now being manufactured for the Council of the Borough of Gisboroe (N.Z.), and an order has recently been placed for a switchboard. The Council has also placed an order for eight sewage pumps to deal with the town's drainage, which will be of the vertical turbine type. The above orders have been secured by the British General Electric Co., Ltd., Sydney.

NEW SOUTH WALES.—P.M.G.'s Department:—

Western Electric Co. (Australia), Ltd.—Telephone apparatus for the Sydney Exchange, £745.

VICTORIA.—Railways Department:—

W. T. Henley's Telegraph Works Co., Ltd.—Lead-covered paper-insulated telephone cable, at £162 per mile.

WESTERN AUSTRALIA.—Public Works Department:—

C. C. Hemsley & Co. (Metropolitan Sewerage Contract).—Electric pumping machinery, contract No. 75, £5,519.

Belfast.—At a meeting of the Tramways and Electrical Committee on 17th inst., tenders for air and circulating pumps for the electricity works were received and referred to the engineer for report.

Bolton.—The Electricity Committee has accepted the following tenders for 12 months' supplies, viz:—

H. Wells, Moscrop & Co., W. Priestley & Co., J. Orrell.—Oil, &c.
G. Reason.—Cleaning waste.
Foster Engineering Co. and W. E. Buroand & Co.—Single-phase transformers.
Ferranti, Ltd., and Westinghouse Co.—Three-phase transformers.
British Insulated & Helsby Cables, Ltd.—Surface boxes, cable boxes, &c.
B.T.H. Co.—Incandescent lamps.
British Electric Cable Co.—Insulated cable.
British Westinghouse Co., Bat Meter Co., Chamberlain & Hookham, Electrical Co., and Bastian Meter Co.—Direct-current meters.
Ferranti, Ltd.—Meter starters.
British Westinghouse Co.—Continuous-current motors.

Dewsbury.—The T.C. has accepted the tender of Messrs. Cowans, Ltd., of Manchester, for a feeder switchboard, and that of Callender's Cable & Construction Co., Ltd., for feeder cables.

Dover.—The T.C. received the following tenders for three new tramcars and electrical equipment:—

CARS.

Brush Electrical Engineering Co., Ltd.	(accepted)	£303
United Electric Car Co.		835
British Thomson-Houston Co., Ltd.	£315 and	£343
Dick, Kerr & Co., Ltd.		341

EQUIPMENT.

British Thomson-Houston Co., Ltd.	(accepted)	£272
Brush Electrical Engineering Co., Ltd.		295
British Westinghouse Co., Ltd.		281
Dick, Kerr & Co., Ltd.		284

Government Contracts.—During the past month the following tenders have been accepted by the Government Departments named:—

WAR OFFICE.

Storage batteries.—Tudor Accumulator Co., Ltd.
Cable.—Western Electric Co., Ltd.
Telephone sets, &c.—Spagnoletti, Ltd., British Insulated and Helsby Cables, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators, &c.—Pritchetts & Gold.
Cells, &c.—General Electric Co.
Switches.—T. Summerson & Son.

CROWN AGENTS FOR THE COLONIES.

Submarine cable.—Telegraph Construction and Maintenance Co.
River cable, &c.—Hooper's Telegraph and India-rubber Works, Ltd.

GENERAL POST OFFICE.

Telephonic apparatus—condensers.—Peel-Conner Telephone Works, Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd.
Switchboards.—British L.M. Ericsson Manufacturing Co., Ltd., British Insulated and Helsby Cables, Ltd.
Loop cable.—Western Electric Co., Ltd.
Paper core cable.—W. T. Henley's Telegraph Works Co., Ltd., Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd., Doulton's, Ltd., Taylor, Tunnicliff & Co., Ltd.
Glow lamps.—Edison & Swan United Electric Light Co., Ltd., Omega Electric Lamp Co., Ltd., Rugby Lamp Co., Ltd., Siemens Bros. & Co., Ltd.
Extra telephone exchange, Victoria, S.W.—Western Electric Co., Ltd.
Equipment, telephone (local) exchange, Attercliffe, Sheffield.—British Insulated and Helsby Cables, Ltd.
Ditto, Bury, Lancs. and Doncaster.—Peel-Conner Telephone Works, Ltd.

Heston and Isleworth.—The Education Committee has accepted the tender of G. N. Virgo for the installation of electric light at the following schools:—Hounslow Town, £38, Grove Road, £41, Isleworth Boys', £14.

King's Lynn.—The T.C. has accepted the tender of Messrs. Coote & Warren for Bestwood nutty slack for the electricity works, at 8s. 4d. per ton.

London.—L.C.C.—For the laying of stoneware cable ducts from Brixton to Herne Hill, tenders were received as follows:—

Dick, Kerr & Co., Ltd.	(recommended)	£2,181
Westminster Construction Co., Ltd.		2,204
J. A. Ewart		2,530
J. Mowlem & Co., Ltd.		2,588
Reid Bros. Engineers, Ltd.		2,688

HACKNEY.—With reference to the recently published list of tenders for 100,000 carbons for the Electricity Department, as the result of correspondence with Messrs. Ship Carbons, Ltd., Underwood (Manchester), Ltd., and W. Geipel & Co., it is now recommended that Messrs. Geipel receive the entire order at £2 15s. per 1,000 pairs instead of £3 which they quoted.

ISLINGTON.—The B.C. has accepted the tender of Messrs. Allen and Simmonds, Ltd., at £124, for supplying new pistons (including boring and fitting) to an engine at the generating station.

STOKE NEWINGTON.—The B.C. has accepted the tender of Messrs. Fryer & Co., Paddington, for the installation of electric lighting, wires and fittings at the Public Library, Church Street, for the sum of £180. The Mayor will personally bear the cost of the work plus £30 for the lamps—£210 in all.

South African Post Office.—The tenders of the South African General Electric Co., and Messrs. Siemens, Ltd., for the supply of dry cells to the department of Posts and Telegraphs, have been accepted by the Tender Board.

Sunderland.—The T.C., on July 13th, accepted the tender of the Albion Clay Co. for stoneware ducts for extensions.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Callender's Cable Co., at £84, for overhead service work.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, July 29th, to Saturday, August 5th. Summer meeting. Visits to works, &c., at Felixstowe, Ipswich, Norwich and Cambridge.
Friday, August 4th. At the University Arms Hotel, Cambridge. Summer dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

ıe following Orders are issued for the next few weeks:—

Saturday, July 22nd.—The Sheerness detachment will parade at headquarters at 3 p.m. Dress:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before this parade.

Headquarters will be open from 10 a.m. to 4 p.m. from Monday July 24th, to Friday, July 28th.

Saturday, July 29th.—Falmouth Detacbment will parade at headquarters at 8.30 a.m. Weymouth Detachment will parade at headquarters at 11 a.m. Dress for the above detachments will be:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

Headquarters will open from 10 a.m. to 4 p.m. from Monday, July 31st, to Friday, August 4th.

Saturday, August 5th.—Falmouth Detachment (2nd party) will parade at beadquarters at 8.30 a.m. Weymouth Detachment (2nd party) will parade at headquarters at 11 a.m. Dress for the above detachments will be:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

(Signed) P. H. Campbell, Capt. R.E.. Adjutant for O.C. London Electrical Engineers.

NOTES.

Society Day at the White City.—It has been decided at Friday next shall be set apart for a Society Day at the ronation Exhibition, Great White City, Shepherd's Bush, W. ıe charge for admission will be 10s. The whole of the proceeds, 'thout deduction, will form part of the Exhibition's contribution wards the King Edward VII Memorial Fund.

International Metal Statistics.—The usual statistics relation to the world's production and consumption of metals ve just been issued by the Metall Gesellschaft of Frankfort-on-ain, for 1910. As far as aluminium is concerned, the return ows a total output of 34,000 tons in 1910, as compared with ,000 tons in 1909, and a consumption of 33,500 tons and 30,800 ns in the two years respectively. The quantity consumed in rmany in 1910 is computed at 10,000 tons as against 9,000 tons the preceding year. The average price amounted to 1·45 mark illing) per kilogramme in 1910 as contrasted with 1·35 mark in 09, 1·65 mark in 1908, and 3·65 marks in 1907. The details in gard to copper, tin, lead and zinc are given below :—

	1910. Tons.	1909. Tons.
Copper.		
Production	877,600	846,700
Consumption	844,900	783,900
Average price	£57 3 2	£58 17 3
Stocks on January 1st, 1911 (tons)	148,500	175,100
Tin.		
Production	111,200	108,600
Consumption	117,900	105,600
Average price	£155 6 2	£134 15 6
Stocks on January 1st, 1911 (tons)	20,300	23,120
Lead.		
Production	1,132,900	1,085,600
Consumption	1,115,700	1,080,500
Average price	£12 19 0	£13 1 8
Zinc.		
Production	816,600	783,200
Consumption	822,900	798,900
Average price	£23 0 0	£22 3 0

The consumption of the four principal metals in the four leading ountries is retnrned as follows for the past two years :—

	1910. Tons.	1909. Tons.
ited States—		
Lead	387,900	334,500
Copper	338,700	316,800
Zinc	245,400	237,300
Tin	49,000	42,800
rmany—		
Lead	208,400	213,200
Copper	199,800	179,400
Zinc	191,500	188,100
Tin	18,100	17,100
ited Kingdom—		
Lead	209,300	202,700
Copper	146,000	108,300
Zinc	177,800	155,500
Tin	21,100	17,800
ance—		
Lead	90,600	102,300
Copper	80,700	73,400
Zinc	56,200	66,900
Tin	7,330	7,300

The increase in the consumption of the metals is attributed to 'e expansion in the electrical engineering industry both in the ited States and Europe; and although lead shows a diminution r 1910 in Germany and France, the actual consumption perienced an advance, as the stocks, which are not included in 'e figures, at the producing works were reduced during the year.

Electrical Power Distribution in Durham County. In connection with the general spread of electrical power dis-bution throughout the Durham coalfields, a number of extensions ve recently been carried out to the sub-stations and mains of 'e Connty of Durham Electrical Power Distribution, Ltd. A w sub-station, built in connection with the supply to the sington colliery and township, is 20 ft. square, having two floors, ck built and concrete roofed. It contains one 700-H.P. transformer, with a ratio of 20,000 to 3,000 volts, of the A.E.G. oil-cooled type. A temporary H.T. switchboard has been installed in order to give a supply to the colliery, but there is no L.T. gear, the cable being connected directly to the transformers. Ironclad switchgear of the Reyrolle type, consisting of two feeder panels of 200 amperes capacity and one transformer of the same capacity, for 20,000 volts, has been provided. At Pelton Fell colliery, a new sub-station has been erected, and the plant here consists of one 700-H.P. three-phase air-cooled transformer of the Brown-Boveri type, with a ratio of 5,500 to 440 volts. The H.T. switchgear is of the Reyrolle ironclad type, with one 6,000-volt feeder panel, and one 6,000-volt transformer panel, while the L.T. Reyrolle gear consists of one 440-volt transformer panel. Balanced protective gear is installed, and there is one H.T. cable. An extension has been made to the South Pelaw sub-station situated between Pelton and Chester-le-Street, which sub-station supplies the South Pelaw colliery at 3,000 volts, and contains one 200-H.P. transformer, with a ratio of 5,500 and 2,750 volts. In this connection, new mains consisting of three-core armoured cables by Messrs. Callender & Co. have been laid from South Pelaw sub-station to the Pelton colliery. Each core is '15 sq. in., running at a voltage of 6,000. The line is partly underground, and partly overhead, wooden "A" poles being used with a normal span of 80 yards, the conductors overhead being '1 sq. in. in cross-section. New mains have also been laid in connection with the Old Ford colliery supply, these consisting of Callender & Co.'s three-core cable, each core being '25 sq. in. in section, running at 6,000 volts, and laid solid in earthenware troughs. A large new sub-station has been erected in connection with the supply to the South Hetton Colliery; the first instalment of new plant consists of one 400-H.P. transformer with a ratio of 2,000 to 500 volts, and two 1,300-H.P. transformers, with a ratio of 20,000 to 2,000 volts, the smaller being of the British Electric Transformer Co.'s manufacture, and the larger by the A.E.G. The 400-H.P. transformer consists of three separate transformers. Reyrolle H.T. switchgear is used, and there are two feeder panels of 250 amperes capacity at 20,000 volts, and two transformer panels of like capacity; the L.T. switchgear is also of the Reyrolle type, with one meter panel and four transformer panels. The sub-station has a total capacity of 2,600 H.P., and supplies 2,000 to 500-volt motors, which have been installed by the consumers. A new sub-station, which has been built by the Easington Colliery, is divided into two portions, the consumers' sub-station and the supply company's sub-station. This building contains combined feeder and meter panels of the Reyrolle ironclad type. The total capacity of the machinery is about 1,000 H.P., and this represents one of the most recent examples of 20,000-volt sub-stations erected in the area of the north-east coast power system.

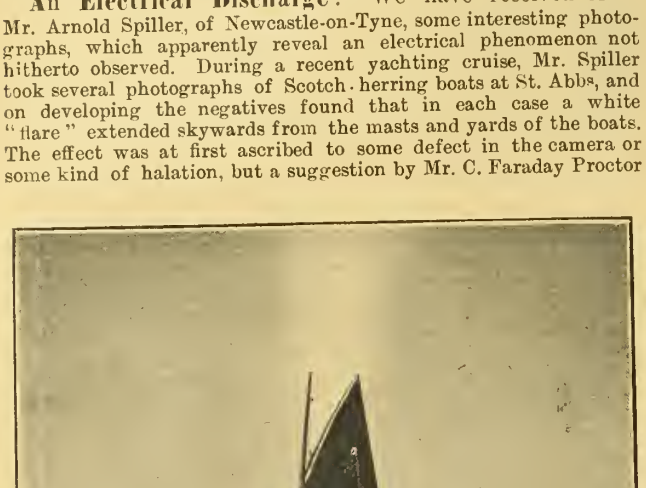
Cooling Towers on Island Power Houses.—Engineers visiting Galveston, Tex., often express surprise at finding cooling towers in use on local power plants, although Galveston is situated on an island in the Gulf of Mexico, with plenty of circulating water available on all sides. Attempts to use sea-water with surface condensers have failed at Galveston on account of the activity of submarine life in the waters of the Gulf of Mexico. In spite of any straining devices that could be employed, eggs and germs of barnacles and shellfish were admitted to the intake pipes, and, adhering to the pipe walls, soon grew to a point where they actually choked up the pipes. Before this action was understood a number of sea-water intakes were installed leading down to the bay, but these, some even 14 in. in diameter, were soon entirely closed by the growth of animal and vegetable life so that they are useless, and cooling of the condenser water by atmospheric evaporation has had to be resorted to.—*Electrical World.*

The Walk to Brighton.—The hon. secretary of this event sends us the following additional information for publication:—"Some further arrangements have now been made by the Committee of the London-to-Brighton Walking Race, which is confined to those engaged in the electrical trades, and will take place on July 29th, starting from Westminster Bridge at 5 a.m. The programme of the event will be published about two days prior to the race, and this will contain all the information concerning the event. A copy will be sent to competitors and to all who are officially connected with the walk, and each competitor, it is hoped, will be provided with at least one cyclist who has offered his services to the Committee to accompany the competitors from London to Brighton. More cyclists, however, are needed for this work and also to act as road marshals, stewards, &c., and they will oblige by communicating at once with the hon. secretary, S. C. Haynes, 94, Paul Street, London, E.C. Arrangements have been made for those who desire to stay on the Friday night close to the starting point, for accommodation at the Abbey Temperance Hotel, 229, Westminster Bridge Road, where each man will have a bedroom, a good breakfast and a cold bath for an inclusive charge of 3s. 6d. Those who can journey to the starting point from their homes on the morning of the race will also dress here. Luggage must be packed in a bag or stout parcel and labelled, so that the railway company can call for it soon after the race and deliver to the Baths at Brighton. More financial support is needed, and the Committee will be greatly obliged for any subscriptions to this end; and also the loan of a couple of motor cars to convey the necessary officials would obviously save the Committee a deal of expense in hiring the same. Entries should be forwarded at the earliest possible moment, and all who desire to avail themselves of the accommodation at the hotel will require to send notice to the secretary, so that this can be reserved. There is a likelihood that the time limit for the certificates will be extended, and that all competitors who finish the walk will receive a memento of their performance."

Electrical Exhibition, Olympia.—Arrangements that have been made by the management for this Exhibition include an elaborate display of cooking demonstrations in the galleries of Olympia. For this purpose, manufacturers who are exhibiting have had space granted to them without rental charge, and with a free supply of energy, on condition that they provide the demonstrations in question during the run of the Exhibition. This arrangement, it is hoped, will help in the stimulation of great public interest. It is also announced that one of the large firms of house furnishers and electrical contractors have already secured a large block of space in the galleries where they are erecting a Model Electrical Home. This, it is understood, will be of a most elaborate description, and will be quite worthy of a great exhibition. It is contemplated to install a garage, electrical laundry, electrical kitchens, country-house lighting, and a series of living rooms, all equipped in such a manner as to show the advantages of electricity in the home.

London Electrical Engineers.—On Saturday last the London Electrical Engineers (Royal Engineers) completed a fortnight in camp at Landguard ; 80 rank and file attended, and enjoyed ideal weather throughout their training.

An Electrical Discharge?—We have received from Mr. Arnold Spiller, of Newcastle-on-Tyne, some interesting photographs, which apparently reveal an electrical phenomenon not hitherto observed. During a recent yachting cruise, Mr. Spiller took several photographs of Scotch herring boats at St. Abbs, and on developing the negatives found that in each case a white "flare" extended skywards from the masts and yards of the boats. The effect was at first ascribed to some defect in the camera or some kind of halation, but a suggestion by Mr. C. Faraday Proctor



that it might be caused by an electrical discharge led to a closer examination of the photographs. We reproduce one of these showing the phenomenon ; others show it even more distinctly, each of five masts in one view having a clearly marked flare above it, though this photograph is less suitable for reproduction. The weather had been thundery during the two previous days, and there was a fresh breeze at the time. The phenomenon is certainly interesting, and we have not met with it before. It has been suggested that the flares are due to the use of a developing tank, but they are so clearly associated solely with the vertical masts and the sails of the boats that we do not think this explanation at all adequate.

New Electric Target.—It is reported that the German military authorities are experimenting with a new electric target, invented by Captain Boehm. It is divided into 12 sections radiating from the centre like a clock, and each section is subdivided by circles into three parts. The exact result of each shot is indicated by two groups of figures.

Enterprise at Ilford.—In connection with the Ilford Hospital Carnival, the Electricity Department entered two pictorial cars, one showing electricity in the cottage and the other its advantages in the mansion. Accompanying the cars were six collectors dressed in costumes representing various makes of lamp. Mr. A. H. Shaw, the Council's electrical engineer, is to be congratulated on having taken such an interesting and successful share in the proceedings.

City and Guilds of London Institute.—In consequence of the rebuilding of Gresham College, the head offices of the City and Guilds of London Institute have been removed temporarily to 3, St. Helen's Place, London, E.C.

New Athletic Club.—We are informed that Electrical Installations, Ltd., of 27, Martin's Lane, Cannon Street, E.C., have recently organised an athletic club for cricket, football, tennis, &c. and have taken grounds at Edmonton, which will be used for practice and matches.

The secretary would be glad to hear from other firms in the allied trades with reference to arrangements for matches, for the present and coming seasons.

The Stalybridge Tramway Accident.—At the resumed inquest into the Stalybridge tramway accident, held at the Ashton Town Hall, by Mr. J. F. Price, County Coroner—

Mr. J. A. Grundy, shed superintendent to the Board, said the car to which the accident occurred contained 34 passengers, and one had died from injuries received. The car had been in use six years. He could not say when he last examined it, but the report book showed that brake troubles were reported on the first two days of June. The defects were attended to, and there were no further reports about the car before the accident. He examined the car immediately after the accident, and found it was foul of the up rails. He found the magnetic brake handle in the proper position, but the operating handle was in the fifth power notch. He could not account for the failure of the brakes, and tar on the rails would not have had any effect on the magnetic brakes.

Wm. Coates, a motor inspector under the Board, said the brakes ought to be tried before the car reached the top of the hill. If the testing of the brakes was left until the top was reached, it might be too late to pull up if anything went wrong. The same handle controlled the power and the magnetic brake. If the driver lost his head on finding the car running away, it was not likely for him to have moved the handle the wrong way, and applied the power instead of the brake, because the handle had to be pushed in the opposite direction for the two purposes. He had known a magnetic brake to fail suddenly.

Ralph Waterhouse, the resident motor inspector, considered Napper a fully qualified driver. He had never known a magnetic brake to fail.

Mr. Robt. Blackmore, engineer-in-chief to the Joint Tramways Board, said he examined the grooves of the rails at the curve, and found nothing in them but loose sand. He found a flat place on the wheels, indicating that skidding had taken place quite recently. There was no tar on the magnetic brake blocks, which were practically new. With Colonel von Donop of the B. of T. he tested the magnetic brakes of the car, and found them in perfect order.

In reply to the Coroner, he said that, so far as he could judge the accident was due to the skidding of the wheels. The magnetic brake would not act when the wheels were stopped, and the car must have got beyond the driver's control. Everything pointed to a bad rail that morning. Napper had told him that on the first journey there was a slight rust which caused a very treacherous rail. It required much nerve to put on more power when a car was travelling 20 miles an hour down hill, but Napper told him that he did it, and he thought he did.

The Coroner remarked that he thought the rails were somewhat worn, but witness said he was convinced from what he saw that the car did not leave the rails before it overturned. He thought the wheels skidded at Daisyfield Terrace, and from there the driver began to lose control.

The Coroner, turning back to the driver's evidence, said it appeared that he did not apply the magnetic brake until he was within 10 yards of the compulsory stop. Addressing the jury, the Coroner said they were as far as ever from knowing the actual cause of the accident. The driver said the magnetic brake had failed to act, but it was apparently all right when examined by the officials.

The Coroner added that he did not think they could get any nearer the true solution if they called more witnesses, or learn whether the accident was caused by the wheels skidding or the driver losing his nerve.

After a short retirement the jury returned a verdict of "Accidental death," and expressed the opinion that the driver was not in any sense criminally to blame. They added the following resolutions to the verdict :—(1) That there should be a compulsory stop at Daisyfield Terrace, where all magnetic brakes should be tested ; (2) if feasible, the radius of the curve at the bottom of Ditchcroft Hill should be enlarged.

A Chichester Introduction : Sequel.—On Monday at Westminster County Court, before Judge Woodfall, Mr. George Bartlett, a Chichester solicitor, sued Mr. Horace Boot, consulting electrical engineer, for £21, as a fee for introducing defendant to members of the Chichester City Council, in connection with the transfer of the electric lighting powers for that city. Defendant denied that there was any agreement to pay plaintiff a fee, but plaintiff said that he offered to transfer to him 20 £1 shares in the company. Judge Woodfall said that there was no evidence of an agreement to pay money, and judgment was given for the defendant, with costs.

Shift Electricians in Australia.—A further application is to be made to the Electrical Trades' Wages Board by the employés' union in the interests of the men employed on private electrical installations. The union has decided to endeavour to have the award of June 15th, 1910, amended by asking that when men engaged on shift work are required to work on public holidays they shall receive two weeks' leave annually on full pay, and when they are required to work on holidays in addition to the ordinary days of working they shall be paid time-and-a-half rate. It is also to be asked that special rates be paid men working broken shifts, that special overtime provisions be allowed men who are called out at irregular hours to attend breakages, and that shift electricians who are required to attend to steam and electric plant combined shall be paid 11s. a day.—*Sidney Morning Herald.*

Parliamentary.—In the House of Lords on July 17th the Central London Railway Bill passed its third reading.

In the House of Commons on July 14th, the Lords' amendments to the Liverpool Overhead Railway Bill were agreed to.

Institution and Lecture Notes.—Tramways and Light Railways Association.—The delegates to the annual Congress held in Edinburgh last week were entertained to dinner by the chairman and directors of the Edinburgh and District Tramways Co., Ltd. Mr. B. Hall Blyth, who presided, proposed the toast of "The Tramways and Light Railways Association," and said that there were 176 tramway systems owned by the Corporations in the country and 134 private concerns, all of which were represented upon that Association. The Hon. Mr. Stanley and Mr. A. de Turckheim replied.—Mr. George Balfour, London, who gave the toast of "The Edinburgh and District Tramways Co., Ltd.," said that, notwithstanding its tremendous financial burdens and the short route of 25 miles, the company made the system pay.—In reply, Mr. Hall Blyth said it was not the tramway company that had installed the cable system, it was the Corporation, and he was not sure that they were wrong in doing so. It cost an enormous sum of money to install the tramway system, but there was no tramway system in the world that was worked so cheaply as the Edinburgh system.

Association of Consulting Engineers.—Since the draft rules drawn up by the Provisional Committee were circulated in December last, a large number of meetings have been held to deal with points that have been raised by various engineers, and a number of important negotiations have been in progress. It was hoped that these negotiations would have been completed in time to call a general meeting to consider the rules and formally enroll members during the present month. Unfortunately, owing to the large number of interests to be considered, and the complexity of the considerations involved, this has been found impossible, but the Committee hopes to be able to call the meeting after the holidays. In the meantime, Mr. Dykes, the hon. secretary, would be obliged if all letters were sent to his new address, 11, Victoria Street, Westminster, S.W.

Institution of Municipal Engineers.—At the annual meeting of the Southern District, on the 12th inst., Mr. Horace Boot, M.I.E.E., was re-elected district chairman. A paper was read at a Western District meeting, on Saturday last, by Mr. B. Wyand, on "Municipal Engineering as a Profession." He said that municipal engineers must realise their own importance, and recognise the fact that supremacy was their place in local life. Even the chairman of the Council was merely a cipher when contrasted with the municipal engineer, and he should, as far as possible, be made to feel this. The chairman might be the better man in many ways, but when it came to engineering he should be made to recognise the fact that he must play fourth fiddle, and must feel happy that he had not been relegated to the orchestral triangle. A man was estimated in this world much at the value he placed upon himself, and the humble, shrinking individual who was led by his Council was never likely to command either respect or a periodical increase of salary.

Institute of Marine Engineers.—On Saturday, July 17th, the Institute paid a visit to the Bow Generating Station of the Charing Cross, West End and City Electricity Supply Co., Ltd.

The B.A. Meeting at Portsmouth.—The *Times* gave its usual forecast of the B.A. meeting in its issue of Monday last. In connection with Section G (Engineering) the following papers are mentioned:—"The Gyro-Compass," by G. K. B. Elphinstone; "Electrical Steering," by B. P. Haigh; "Electrical Drives for Ships' Propellers," by H. A. Mavor; "Marine Engines Adapted for Burning Crude Oil," by J. H. Rosenthal; "Corrugation of Tramway Rails," by W. Worby Beaumont: "The Vibragraph," by W. Pollard Digby. In a discussion on the merits of superheated steam engines, suction gas plants, and Diesel engines, papers are promised by Captain H. R. Sankey and Messrs. Tookey and Day. Wireless telegraph matters will be brought forward by Prof. T. W. Howe and Captain Sankey. Prof. G. H. Biles is this year's president of "G." In the agricultural section, Messrs. J. H. Priestley and R. C. Knight will deal with "The Effect of High-Tension Electric Discharges and Current Electricity on Plant Respiration."

Copper.—Messrs. Merton's circular of statistics to mid-month shows withdrawals from stock of 2,273 tons, European visible supplies being now 67,899 tons. Of this, 202 tons has gone from French stocks, and quantities afloat from Chile and Anstralia are 1,150 tons less. Supplies from North America for the fortnight are somewhat low; from Spain and Portugal to this country only 157 tons are registered (average monthly, 8,968 tons), but Chilian and Australian shipments are well up to average. Total deliveries appear low at 16,989 tons, but the significance of statistics for the first fortnight may, of course, be considerably altered by those appearing at the end of the month. Rotterdam stocks are reported higher by 200 tons, and Hamburg by 100, than they were at the end of June.

American visible snpplies, at 70,283 tons, dropped 3,822 tons during June. The world's supplies for June 30th, 1911, are thus 6,263 tons less than for the end of May, having dropped 4,700 tons a month since the end of March.

Electrical Fatalities.—A correspondent states that Mr. Reginald E. Brindley, assistant district electrical engineer of the Victoria Falls Power Co., by some means came into contact with a high-pressure electric wire (20,000 volts) in the transformer house. He was quite alone at the time, and was found dead on the floor, having, without doubt, been instantaneously killed.

The *Daily Chronicle* correspondent at Geneva states that a terrible accident happened at the village of Cossonay, near Lausanne, while preparations were being made for the annual festival. Eight men belonging to the Circus Gruss were placing the tent in position when the central pole came into contact with an overhead live wire at 13,000 volts, and five of the workmen fell dead on the spot. Three others received severe shocks. The victims were two Italians and three Frenchmen.

On July 13th a lineman, named Richard Archer, 30, employed in the Telegraph Department of the L.B. and S.C. Railway, met his death by receiving a shock at 6,600 volts from an overhead wire of the railway at the Crystal Palace Low Level Station. According to the evidence given at the inquest on Monday, deceased and another (Staplehurst by name) were making up the signals for an estimate for electric signalling. He mounted the iron ladder of a signal near Anerley Road bridge with a steel measuring tape in his hand, when his fellow-worker who held the other end of the tape received a severe shock and fell to the ground. When the latter recovered consciousness he found Archer lying near him face downwards. Staplehurst said that he could not say how Archer managed to touch one of the wires. According to the *Standard* report, Dr. Scott Turner attributed death to a fracture of the base of the skull. He said that deceased's left hand was burned as though by an electric current, and the measuring tape showed plainly at one end that it had made contact with the wire. Other evidence showed that the contact was very slight, but was sufficient to throw Archer to the ground. Verdict: "Accidental Death."

Appointments Vacant.—Teacher of technical mathematics with special reference to electrical engineering, for evening classes at the Tottenham Polytechnic (12s. 6d. per lesson). Assistant engineer at the Poplar Workhouse (£120). Chief assistant engineer for the Burgh Electricity Department, Falkirk (£100). See our advertisement pages to-day.

Mr. A. Hugh Seabrooke, general manager of the Marylebone Electric Supply, writes, as we go to press, to say that if any supply engineer is looking round for a first class boiler-house and steam-plant superintendent, he can recommend a man whose capabilities, he believes, cannot be excelled throughout the country.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. C. B. Lewis has resigned his position of assistant engineer at the Taunton Borough Electric Light Works, and Mr. Appleby, of Smethwick, was on Tuesday appointed by the Council to fill the vacancy.

The Bedford T.C. has increased the salary of Mr. Jenkins, deputy electrical engineer, from £170 to £190 per annum, with a further increase to £200 next year.

Tramway Officials.—Mr. Chas. W. Hill, general manager of the Bournemouth Corporation Tramways since 1908, has resigned, and will leave the town in October next. Mr. Hill has secured an appointment with a private firm in London.

Mr. A. G. Balfour, manager of the electric tramways at Dartford, has been appointed to a similar position at Carlisle, and leaves the former town in August.

The Exeter City Council has again been recommended to increase the salary of the tramways manager from £160 to £170 per annum as from March 31st last. The Council had asked the Committee to recommend an instant increase to £170, and annual increments of £10 to a maximum of £200.

General.—Dr. Rudolf Diesel, the inventor of the Diesel engine, has been re-elected a director of the Diesel Engine Co., Ltd.

Mr. A. E. Saville has been appointed manager and secretary of the Farnham (Surrey) Gas and Electricity Co., Ltd.

The marriage took place at Castlemere, Rochdale, last week, of Mr. Frank Whipp, son of the late Mr. T. Lancaster Whipp, of Yorkshire Street, Rochdale, and a member of the firm of Whipp and Bourne, electrical engineers and contractors, of Molesworth Street, Rochdale, and Miss Ethel Coulthard, only daughter of Mr. Thos. Coulthard, of Shawlands, Manchester Road, Rochdale.

We are asked to state that Mr. Harry Guest is not now connected with the Reason Manufacturing Co.

Mr. Sydney H. Bill, at present chief electrician at the Houghton Main Collieries, has accepted the position of electrical engineer with the Ebbw Vale Steel, Iron and Coal Co., where he takes up his duties on September 1st.

Obituary.—We regret to report the death, which occurred on the 15th inst., from heart failure, of Mr. R. B. Goodyer, at his house, in Newport Road, Cardiff, at the age of 73 years. The late Mr. Goodyer had a long connection with tramway systems, having held managerial appointments with the Edinburgh Street Tramways Co., the Rothesay Tramways Co., the London Road Car Co., Ltd., and the Continental Metropolitan (Paris) Tramways, Ltd., while for over 20 years he was manager of the Cardiff Branch of the Provincial Tramways Co., Ltd. Mr. Goodyer's son is the tramways manager to the Croydon Corporation, with whom we express our sympathy in his bereavement.

NEW COMPANIES REGISTERED.

Anglo-Brazilian Power and Shipping Corporation, Ltd. (116,742).—This company was registered on July 11th, with a capital of £300,000 in £1 shares, to promote, purchase, apply for or otherwise acquire, contract for and hold, construct, equip, maintain, hire, work, use, grant running or other powers over or in respect of, control, lease, sell, charter or let any works in South America or elsewhere, and in particular factories, roads, tramways, railways, ropeways, telegraphs and telephones (elsewhere than in the United Kingdom), cables, ships, harbours, piers, docks, elevators, sidings, reservoirs, warehouses, bridges, canals, wool, cotton, corn, paper, banana, saw and crushing mills, smelting, ordnance, iron, steel, engineering, hydraulic, gas and electric power and light works, &c., and to adopt an agreement with Horacio P. Vieira, relating to the sale of 6,000 hectares of land in the State of Parana, Brazil, with water rights; purchase consideration, £270,000 in shares and £30,000 in cash. The British South American Financial Corporation, Ltd., of London Wall Buildings, E.C., are to receive £100,000 shares for services rendered in connection with the promotion of the company and the acquisition of the property; J. P. Nelson is to receive £5,000 shares from the vendor for services rendered in connection with the promotion and formation of the company. The subscribers (with one share each) are:—A. W. West, 124, Strathyre Avenue, Norbury, S.W., clerk; G. Rawley, 23, Cumberland Market, N.W., clerk; A. Evans, 424, Mile End Road, E., clerk; J. Oxley, 9, Rockbourne Road, Forest Hill, S.E., clerk; W. B. Place, 12, Woronzow Road, St. John's Wood, N.W., solicitor; J. Morris, 4, London Wall Buildings, E.C., chartered accountant; F. L. Adams, 19, Butler Road, Harrow-on-the-Hill, clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than ten; the first are Horacio P. Vieira, Cantyro, Parana, Brazil, merchant; J. P. Nelson, Kenilworth, Winchmore Hill, N., Brazilian merchant; and J. Wolstenholme, 4, London Wall Buildings, E.C., merchant; qualification (except subscribers acting as directors and directors appointed by them), £5,000; remuneration, £500 each per annum (chairman, £1,000) and a percentage of the profits. Registered office, 4, London Wall Buildings, E.C.

Launceston and District Electric Supply Co., Ltd. (116,654). This company was registered on July 5th, with a capital of £10,000 in £1 shares, to carry on at Launceston and elsewhere in Cornwall the business of an electric light company in all its branches. The subscribers are:—C. H. Gillbard, Trehearne, Launceston, merchant, 50 shares; T. B. Hender, J.P., Landrends, Launceston, tanner and leather merchant, 50 shares; J. Kittow, West Holm, Launceston, auctioneer and land surveyor, 50 shares; W. Prockter, J.P., Pennygillam, Launceston, ironmonger, 50 shares; R. B. Rogers, Hexworthy, Launceston, A.M.I.C.E., 100 shares; W. H. Symons, Church Street, Launceston, jeweller, 50 shares; T. P. Trood, J.P., Broomhill, Launceston, merchant, 50 shares. Minimum cash subscription £4,000. The number of directors is not to be less than four or more than nine. The first are C. H. Gillbard, T. B. Hender, J.P., J. Kittow, W. Prockter, J.P., R. B. Rogers, W. H. Symons and T. P. Trood, J.P.; qualification, £50; remuneration as fixed by the company. Office, Westgate, Launceston.

Halls, Builders, Ltd. (116,633).—This company was registered on July 4th, with a capital of £1,000 in £1 shares, to take over the business of builders and decorators carried on as "Hall & Co.," at 5, Blackstock Road, Finsbury Park, N., and the business of electrical engineer carried on by C. Wainwright, at 47, Foxham Road, Tufnell Park, N. The subscribers (with one share each) are:—W. Hall, 5, Blackstock Road, Finsbury Park, N., builder; H. H. Trendler, 5, Blackstock Road, Finsbury Park, N., electrician. Private company. The number of directors is not to be more than four; the first are A. C. Edwards and H. H. Trendler; qualification, £1; remuneration as fixed by the company. Registered office, 5, Blackstock Road, Finsbury Park, N.

Wilson Apparatus Co., Ltd. (116,761).—This company was registered on July 11th, with a capital of £900 in £1 shares (300 "A" and 600 "B") to carry on the business of electricians, engineers, manufacturers of and dealers in instruments and apparatus used in connection with the generation, supply, accumulation and employment of electricity, &c., and to adopt an agreement with F. W. Wright, E. Wilson and W. H. Wilson. The subscribers (with one share each) are:—E. Wilson, King's College, London, professor of electrical engineering; W. H. Wilson, 14, Cobham Road, Norbiton, electrical engineer; F. W. Wright, York Villa, Stanmore, Carlisle, electrical instrument maker. Private company. Table "A" mainly applies. Registered by Bircham & Co., 46, Parliament Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Union Electric Co., Ltd. (71,115).—Return dated May 18th, and filed June 2nd, 1911. Capital, £25,000 in £1 shares; 24,250 shares taken up; £1 per share called up on 4,250, and 1s. per share on 19,500; £5,225 paid; £500 considered as paid on 500 shares. Mortgages and charges: Nil.

Gilbert Arc Lamp Co., Ltd. (52,679).—Mortgage dated June 30th, 1911, to secure £500 and further advances, charged on the company's book debts. Holders: Engineering and Arc Lamp, Ltd., 3-4, Fenchurch Street, E.C.

Imeson, Finch & Co., Ltd. (97,639).—Debenture dated June 28th, 1911, to secure £800, charged on the company's undertaking and property, including uncalled capital. Holders: Hanson, Brown & Co., Ltd., Middlesbrough.

Staniar, Clegg & Co., Ltd. (114,935).—Debenture dated June 13th, 1911, to secure £170, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. D. Staniar, 112, Portland Street, Manchester.

Barnsley and District Electric Traction Co., Ltd. (72,962). Return dated June 6th, filed June 21st, 1911. Capital £50,000 in £5 shares (5,000 pref.); 4,400 pref. and 4,007 ordinary shares taken up; £5 per share called up; £42,035 paid. Mortgages and charges: £21,000.

Birkdale District Electric Supply Co., Ltd. (70,259).—Return dated May 29th, filed June 21st, 1911. Capital £30,000 in £5 shares. All shares taken up and paid for in full. Mortgages and charges: £3,000.

Reason Manufacturing Co., Ltd. (64,701).—Mortgage dated July 4th, 1911, to secure £1,000 and certain costs, &c., charged on the present and future indebtedness to the company of Motor Meters, Ltd., and of the Municipal Corporation of Stepney. Holders: Barclay & Co., Ltd., London and Brighton.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Floating charge on stock of manufactured lamps for time being at factory at Southfields, dated June 27th, 1911, to secure any moneys to the extent of £9,500, which the mortgagees, as guarantors, may become liable. Holders: Kilburn Brown & Co., Orient House, New Broad Street, E.C.

Woking Electric Supply Co., Ltd. (46,115).—Issue on June 17th, 1911, of £12,000 debentures, part of a series of which particulars have already been filed, secured by trust deed of March 1st, 1906. Present issue makes total now issued £60,250. The £12,000 debentures are issued as collateral security.

Simms Magneto Co., Ltd. (95,109).—Issue on May 31st of £2,500 debentures, part of a series of which particulars have already been filed.

O. Ruhl, Ltd.—A memorandum of satisfaction in full on July 4th, 1911, of debentures dated November 5th, 1909, securing £800, has been filed.

Cutting Brothers, Ltd.—A memorandum of satisfaction in full on November 10th, 1910, of debentures dated June 20th, 1901, securing £4,000, has been filed.

CITY NOTES.

Chatham and District Light Railways Co.

The report shows that the result of the working for the half-year ended June 30th, 1911, is as follows:—Revenue, £21,445; expenses, £12,514—leaving £8,930. Less rent of Rochester Corporation lines, £1,872; interest on debentures, £1,234; interest account, £226—leaving £5,598. Plus balance brought forward, £638—leaving a balance of £6,236, which is to be disposed of as follows:—£2,940 to dividend at the rate of 5 per cent. per annum on the preference shares, £1,590 to dividend at the rate of 3 per cent. per aunum on the ordinary shares, £1,706 to revenue new account. The traffic receipts show a small increase of £71 and the expenses a decrease of £190, as compared with the receipts and expenses for the corresponding half-year of 1910. Rochester Bridge is in course of reconstruction, and the work, which necessitates lifting and relaying the company's track and overhead line, is considerably interfering with the traffic. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year. The dividends are to be paid on August 4th.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
December, 1909..	14·98	4,712,205	£23,045	1·17d.	582,637	45
June, 1910 ..	14·98	4,347,656	21,029	1·16	556,218	45
December, 1910..	14·98	4,869,431	23,699	1·17	586,902	45
June, 1911 ..	14·98	4,372,850	21,101	1·16	551,834	45

American Westinghouse Electric Co.

In our issue of June 16th we gave a summary of the figures appearing in the last report of the above company. From the *Electrical World* of June 15th, we now give some lengthy, but very interesting, extracts showing the general position of affairs and the experience of the American company in connection with its various ventures in Europe:—

"The report points out that the year's business, both in gross earnings and net income, is the largest in the history of the company; and, as the past year was a period of somewhat less than normal activity in other lines of industry, the showing affords a sound basis for continued hope in the future of the electrical manufacturing industry, and in the maintenance by the company of its position in that field. On the other hand, the volume of business now offering is on a dimishing scale, the volume of unfilled orders as of March 31st, 1910, being $11,256,196, as compared with $7,616,058 as of March 31st, 1911. The results of last year are thus no certain indication of a continuance for the future of gross earnings and profits such as the past 12 months have produced.

"The statement is made that the patent agreement entered into with the General Electric Co., March 31st, 1896, expired by limitation on April 30th, 1911, and that no renewal is contemplated. Patent licence agreements with other manufacturers under which the company has been working for some years have recently been cancelled, on the suggestion that they might be questioned as being in violation of the federal anti-trust laws, notwithstanding that they were originally made and have been maintained under the advice of counsel that assured the company of their validity.

"In order to strengthen the company's position the directors have authorised a considerable increase in the expenditures of the selling organisation in order to increase the number of salesmen in the field, for remuneration to representatives adequate to secure the best efforts on their part, for the extension of advertising, and to provide for proper warehouse facilities for carrying stocks at distributing points. While this has added considerably to the aggregate selling expenses, the action has been justified in increased volume of business. The report states that it is a matter of simple computation, on the basis of the operations for the past two years, to ascertain the point at which the volume of gross business fails to provide a surplus over operating expenses and fixed charges, and it is vital that the business shall not drop to that point.

"With the same purpose in view fairly large expenditures have been authorised for the work of new development and for improvements in types of apparatus, such as the re-designing of direct-current motors, alternating-current and direct-current mill and crane motors, small power motors, high-speed turbo-generators, circuit-breakers, railway equipment and heating and cooking apparatus. The cost of new development and re-designing is charged monthly as a part of the current cost.

"After a thorough discussion in detail of the assets and liabilities of the company, and taking into account the elements of uncertainty as to the immediate future of the company's business, the need for cash for new foundry facilities, for the extension of the Newark plant and other factory improvements, and the necessity of making wide provision for shortly maturing obligations, it is stated that the directors have felt that it is not wise at the present time to weaken the company's position by diverting its surplus earnings, even in part, to the payment of dividends on the assenting stock. Whenever changed conditions shall allow the directors to feel that a change of attitude can safely be

assumed, the question will be reconsidered and determined in the light of such a change.

"The report discusses in detail the various items of the balance-sheet, and in particular gives full details concerning the investments in affiliated and subsidiary companies.

"The first foreign Westinghouse company, organised July 11th, 1889, was the Westinghouse Electric Co., Ltd., a corporation of Great Britain. The entire issue of capital stock of this company was carried as an investment on the books of the American company at an aggregate value of $1,773,084, this representing the expenses incurred from 1889 to 1906 in the efforts to establish the manufacture and sale of the company's products in foreign countries. On March 31st, 1910, the assets of the company consisted of practically the patents owned by it in various European countries and of certain licences granted by it under some of its patents. The income had long been insufficient to pay the expenses of the operation of the company and the up-keep of its patents. During the year ended March 31st, 1910, the directors wrote off from the book value of this item $773,084, and during the fiscal year just ended an additional $500,000, leaving the present book value $500,000. It is added that further depreciation of this item must be contemplated.

"The next foreign company, organised July 10th, 1899, was the Westinghouse Electric and Manufacturing Co., Ltd., a corporation of Great Britain, which constructed and equipped immense works for the manufacture of electrical apparatus, steam turbines and gas engines at Trafford Park, near Manchester, England. The preference shares and mortgage debenture stock were sold for cash at substantially par, and the aggregate of the face value, or $18,145,572, represents approximately the amount of money spent in producing the facilities of the British company and in paying the losses incurred in its operation prior to 1907. Its operations, it is stated, have been quite uniformly unprofitable. Several reductions have been made in the capital of the company, and a further reduction seems to be forecast by the necessity for providing for the payment of an award against it, aggregating with costs about $485,000, in an arbitration proceeding recently decided between the British company and the London Underground Railway. The American company own preference shares of the British company to the face value of $2,600,143; ordinary shares, $922,615; and mortgage debenture stock, $3,273,750. Of these, the ordinary shares do not appear on the books of the company as an investment of any value. The preference shares, having a par value of $2,600,143, were carried as an investment until 1910 at a book value representing the original cost of acquisition, or $4,458,083. On March 31st, 1910, there was written off as depreciation of this item the sum of $3,564,563, leaving the present book value $893,520. This corresponds to the present market value of the shares on the London Stock Exchange. The debenture stock, having a par value of $3,273,750, is carried on the books as an investment at the cost of acquisition, $3,137,104. This yields a return of 4 per cent. on par. Recent sales on the London Stock Exchange have been at the price of 62 per cent. of par.

"On November 28th, 1901, the Société Anonyme Westinghouse, of Paris, was organised, which company operates a factory at Havre, where it manufactures a general line of electrical apparatus and certain condensing apparatus for steam engines and turbines. It also has a factory at Freinville, near Paris, for the manufacture of Westinghouse air brakes. Its territory includes France, Belgium, Holland, Switzerland, Spain and Portugal. The operations of the company are stated to have been steadily unprofitable, and, while it earns and pays interest on its debentures, it was only in the year 1908 that it paid dividends on its preference shares. Of the out standing capital of the French company the American company owns preference shares to the par value of $893,348; ordinary shares, $556,563, and 5 per cent. debentures, $1,447,500. During the receivership of the American company the Court authorised the receivers to advance money to the French company, and in 1909 preference shares to the value of $671,398 were purchased at par. The debentures of the French company are now carried on the books as an investment at cost, aggregating $1,430,730. The preference shares are likewise carried at cost, aggregating $896,536. Prior to March 31st, 1910, the ordinary shares were carried as an investment at cost, $494,032; during the year ended March 31st, 1910, there was written off for depreciation of this item $275,057, and during the last fiscal year a further sum of $218,974, leaving the book value of the ordinary shares at $1. It is believed that with careful management the debenture and preference shares of the French company may be made worth their face value.

"On March 11th, 1907, the Societa Italiana Westinghouse was organised. It constructed a factory at Vado, Italy, for the primary purpose of executing important contracts for the electrification of certain of the Italian street railways. Delay by the Italian Government in carrying out its programme for the improvement of its railway lines has temporarily disappointed the expectations with which this company was organised and its plant created, so that it is now looking to the general market for orders for electrical apparatus to keep its works in operation. The amounts advanced by the American company appear in the balance-sheet under the items notes and accounts receivable at $289,746. For the purpose of capitalising certain advances recently made to it by the French company and the American company, the Italian company is about to create an issue of $772,000 of 5 per cent. debentures, of which approximately $289,500 will be received by the French company and $18 ,500 by the American company. In 1908 the net surplus of the Italian company was $32,953; in 1909, $45,782, and in 1910 there was a loss of $32,940.

"In July, 1906, the Société Electrique Westinghouse de Russie was organised, primarily to execute a contract amounting to over $5,150,000 for the electrification of St. Petersburg tramways. Upon the organisation of the Russian company, the American company advanced to it sums aggregating $895,888, of which there remains due $290,000. The American company purchased from the Russian company 5 per cent. debentures at a cost aggregating $2,243,243, and subscribed for its shares an aggregate of $696,322. Of the 'apport' shares the American company owns $198,962. The Russian company owes the American company on open account for material, $32,355, and unpaid interest on debentures aggregating $324,324. The total investment in and accounts due by the Russian company at the close of the last fiscal year, therefore, amount in the aggregate to $3,785,207.

"As of March 31st, 1910, the investment in the cash and 'apport' shares was written off to $1 for each class of shares, leaving the book value of this investment $2,243,245, a further depreciation of which may be required. Other items carried against the Russian company are, accounts receivable, $32,355, and notes receivable, $290,000. The execution of the St. Petersburg contract resulted in a loss of approximately $1,030,000, and in its other operations the losses to the Russian company have aggregated $815,978, the aggregate to date being, therefore, in excess of $1,800,000. There are other losses not yet definitely ascertained, due to the difference between the actual value of the Moscow plant and the price paid for it, and to depreciations occurring since the property was acquired, not entered on the books. The city of St. Petersburg is withholding from the amount due by it to the Russian company an aggregate of over $360,500, by way of fines imposed for alleged delays in the performance of the contract, and the company is urging a large claim for extras. It is said that there is reason to hope that the fines may be substantially remitted, but until these disputes are adjusted and payment is made it is impossible to predict how much of the investment in the Russian company can be realised. To maintain the company as a going concern advances approximating $110,322 to March 31st were made, being secured by mortgage. During the past year improvement in the operation and increase of the business of the Moscow plant have encouraged the hope that it may at least earn its operating expenses.

"On September 6th, 1906, an Austrian company, the Westinghouse Metallfaden-Gluhlampen-Fabrik Gesellschaft, was organised, which operates a factory for the manufacture of tungsten lamps near Vienna. Of the outstanding capital stock of the company, $324,800, the American company owns $249,690, which is carried among investments at the cost of acquisition, aggregating $250,626. The shares of this company are stated to be safely considered worth their par value.

"At the same time the Austrian lamp company was organised the Westinghouse Metal-Filament Lamp Co., Ltd., was organised in Great Britain with a capitalisation of $48,500, 80 per cent. of which is owned by the Westinghouse Lamp Co. and carried on the books at $38,800. This company was organised to control the patents covering the tungsten-lamp manufacturing processes for the territory outside of that of the Austrian lamp company, and it is believed that the book value of the investment will be realised.

"The Canadian Wessinghouse Co., Ltd., has issued $4,376,600 of capital shares, of which the American company owns $1,710,000; of this $500,000 was acquired in consideration of the transfer of patent rights and manufacturing information for Canada, and $1,210,000 for cash. The shares are carried on the books as an investment at par, $1,710,000. The Canadian company has been uniformly and increasingly successful, and has paid dividends regularly since 1903 at the rate of 6 per cent. per annum, with an extra 1 per cent. for 1910. The shares may therefore be considered worth in excess of their book value.

"Of the capital stock of the Westinghouse Machine Co. the electric company acquired $250,000 par value as part consideration of adjustment of relations. These shares were taken on the books at the time of the acquisition at a value of $218,538, and they are now carried on the books at a value of $125,000.

"The company holds $500,000 of 5 per cent. mortgage bonds of the Nernst Lamp Co., which comprises in part money advanced and materials furnished to that company, and in part an unpaid balance on the sale to it of a factory building. These bonds are carried on the books at par. All of the capital stock of the Nernst Lamp Co. is owned by the Westinghouse Machine Co.

"In 1901 the Traction and Power Securities Co., Ltd., was organised in Great Britain as a securities-holding company, and has an outstanding capital of $4,142,385 in ordinary shares. Its assets consist of $3,007,000 par value 4 per cent. prior lien debentures of the Mersey electric railway, which earns a small surplus over and above the interest on its debentures, the market value of which is 81, and $1,670,679 par value ordinary shares of the Clyde Valley Electrical Power Co., which owns and operates two power plants on the Clyde River, near Glasgow, Scotland. Work under way will involve a further expenditure by the latter of $970,000, secured by mortgage to the Traction and Power Securities Co. The receivers of the American company acquired at par $820,377 of the capital stock of the Traction and Power Securities Co., the value of which depends upon the receipts of the Mersey Railway and the Clyde Valley Electrical Power Co. It is believed that eventually the stock may be worth substantially par, and it is carried on the books at a value of $820,135."

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have (according to a financial daily) declared an interim dividend of 2½ per cent. on the preference shares and 2 per cent. on the ordinary shares.

City and South London Railway Co.

THE directors report that the receipts from all sources for the past half-year have amounted to £93,873, and the cost of working has been £42,738, leaving a profit of £51,135. Including the balance brought forward the net revenue account shows an aggregate total of £52,923. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500 and £800 for general purposes, a balance remains available for dividend of £36,049. Out of this the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of 1¾ per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £2,798 to be carried forward.

Half-year.	Number of passengers (exclusive of season ticket holders until 1910).	Receipts (including season tickets).	Dividend per cent. per annum on ordinary stock.
Ended December 31st, 1909	11,234,074	£81,469	1¾
Ended June 30th, 1910 (inclusive of estimated number of season ticket journeys)	12,357,324	83,412	1¾
Ended December 31st, 1910 (inclusive of estimated number of season ticket journeys)	12,800,719	86,103	1¾
Ended June 30th, 1911 (inclusive of estimated number of season ticket journeys)	13,318,622	87,590	1¾

Prior to the Coronation period the traffic has shown a marked increase, which was further augmented during the processions and illuminations associated with this great event. The result of the half-year's working is that the directors are in a position to recommend a dividend on the ordinary stock at the rate of 1¾ per cent. per annum, carrying forward the balance of £2,798, as against 1¾ per cent. per annum and £1,634 for the corresponding half-year in 1910. The enormous number of passengers using the railway during the Coronation celebrations were carried without a single mishap or delay of any kind. The High Level subway connecting the public subways of the Central London Railway and the booking hall of the Bank Station was opened by the Lord Mayor in May last, and its utility and convenience have been since amply demonstrated by the free use of the subway made by large numbers of the public. The directors deemed it prudent to avail themselves of an opportunity to dispose of the small unissued balance of preference stock, 1903, on favourable terms, enabling them to pay off the temporary loan. The death is announced of one of the directors, Mr. Harvey Ranking, who, during his association with the company, displayed warm interest in its affairs and devoted much time and attention to its welfare and advancement. As mentioned last week, the vacancy has been filled by the election of Mr. J. F. S. Gooday. Warrants for the dividends will be posted on August 4th.

National Telephone Co., Ltd.

THE report of the directors for the half-year ended June 30th, 1911, to be submitted at the meeting on Thursday, July 27th, states that the income accrued in respect of the business of the half-year amounts to £1,807,872, as compared with £1,678,312 for the corresponding period of 1910, being an increase of £129,560. The working expenses for the half-year amount to £1,058,169, as compared with £971,914 for the corresponding period of 1910, being an increase of £86,255. The net result for the half-year (after deducting the Post Office royalties amounting to £173,424) is a profit balance of £576,278, as compared with £544,516 for the corresponding period of 1910, being an increase of £31,762. The rentals carried forward for unexpired terms of running contracts amount to £1,577,419, as compared with £1,482,179 at the corresponding period of 1910, being an increase of £95,240. Out of the available balance of £436,887 shown by the net revenue account the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £200,000 to the reserve fund account, and to carry forward the balance of £18,137. On March 20th, 1911, the directors invited tenders for the repayment of part of the 3½ per cent. debenture stock, and up to May 31st last the amount of stock which had been thereby extinguished was £336,972. The sum of £211,122 has been expended on capital account during the half-year in the erection of 15,675 additional exchange and private stations, and in the construction of underground works.

Cordoba Light, Power and Traction Co., Ltd.—At an extraordinary general meeting, held in London last week, Sir J. Irving Courtenay presiding, a resolution was passed increasing the capital by 200,000 new shares of £1 each, making it £1,000,000. The new shares are not to be issued at present, but borrowing powers, which the increase of capital will give, will be exercised in the course of six months or so, the money being required for extensions of the business. The money will be raised by short-dated notes in preference to long-dated debentures, as they are looking for good results from their hydro-electric plant and tramways when they are fully at work.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Mississippi River Power Co.—Scrip, fully and partly paid, for $3,500,000 first mortgage 5 per cent. 40-year gold bonds.

And to allow the following securities to be quoted in the Official List :—

Bombay Electric Supply and Tramways Co., Ltd.—Further issue of £30,000 5 per cent. second mortgage debentures of £100 each, Nos. 1,701 to 2,000.

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

Cascade Water, Power and Light Co., Ltd.—$285,500 first mortgage 33-year sinking fund gold bonds of $500 each.

Cuban Telephone Co.—£441,620 5 per cent. first mortgage convertible bonds.

Mexico Tramways Co.—$5,664,200 additional common stock in shares of $100 each.

Underground Electric Railways Co, of London, Ltd.—467,000 shares of £10 each, fully paid, Nos. 1 to 7,200, 8,201 to 26,792, 46,793 to 47,692, 50,693 to 469,200, 474,201 to 480,200, and 484,201 to 500,000.

British Columbia Electric Railway Co.—The *Times* states that a circular has been issued by the directors inviting applications from existing stockholders for £600,000 of new capital divided into the following classes and issued as follows :—200,000 5 per cent. cumulative perpetual preference shares of £1 each, at 1s. premium ; 200,000 preferred ordinary shares of £1 each, at 2s. premium ; and 200,000 deferred ordinary shares of £1 each, at 4s. premium.

The directors announce that a dividend of 5 per cent. per annum will be paid on the 5 per cent. non-cumulative preferred ordinary for the half-year ended June 30th, together with an additional dividend of 1 per cent. per annum for the same period, payable July 31st.

American Telephone and Telegraph Co.—The *Times* states that the gross earnings for the six months ended June 30th last amounted to $18,204,000, as against $17,596,000 for the corresponding period of 1910. The net earnings, after payment of interest, were $13,555,000, against $13,315,000, and after payment of dividends $2,786,000, against $2,963,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended May 26th, 1911, were 881,872, compared with 786,249 units in the corresponding four weeks of 1910.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary chares at the rate of 10 per cent. per annum, for the half-year ending June 30th. The share transfer books will be closed from July 22nd to August 4th.

Japan.—The half-yearly general meeting of the Yokohama Electric Co. was lately held in that city, when a dividend at the rate of 12 per cent. was declared, and the sum of £970 carried forward. A scheme for the amalgamation of the company with the Yokohama Electric Light and Gas Co. and with the Enoshima Electric Tramway Co. was also submitted and approved, the capital of the company being increased for the purpose. By a later mail we learn that the shareholders of the tramway company have not approved the amalgamation scheme, and that, for the moment, the matter is in abeyance.

Presiding at the half-yearly general meeting of the Tokio Electric Light Co., when a dividend at the rate of 11 per cent. was declared, the president, Mr. Satake, stated that, in view of the creation of a new electric lighting company in Tokio and the extension of the electric lighting department of the Tokio Railway Co., some competition was inevitable, although it was impossible for any of the companies to continue reckless competition for any length of time at the sacrifice of the interests of their shareholders. Notwithstanding the competition, he did not hesitate to declare that the dividend of the company would not in the future fall below 10 per cent.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the quarter.

Metropolitan Railway Co.—The directors announce that, subject to final audit, they will recommend the proprietors to declare a dividend on the ordinary stock for the past half-year at the rate of 2 per cent. per annum, carrying forward about £4,000 to the next half-year's account. The dividend on the Surplus Lands stock will be at the rate of 3 per cent. per annum, carrying forward £230. Last year the dividend on the ordinary stock was at the rate of 1¼ per cent. per annum, while the Surplus Lands dividend was at the rate of 2¾ per cent. per annum.

Prospectus.—*Water Softeners (France), Ltd.* — The company, which has this week been offering an issue of 55,000 shares of £1 each at par, has been formed to acquire the patent rights for France and its Colonies of the Permutit process for the softening and purification of water.

Edmundson's Electricity Corporation, Ltd.

The fourteenth annual meeting of this company was held on Thursday last week, at Salisbury House, Old Broad Street, E.C. Mr. P. Debell Tuckett presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, July 7th), said that the gross trading profits had increased by £2,335: dividends and interest had increased by £4,068, there was a profit of £208 on realisation of investments, and there was a new credit item of £500 under the head of Urban Co. management fee, whilst the Urban Co. guarantee was reduced by £854. On the other hand, the expenses were increased by £517, the loss on working the local authorities' undertakings was increased by £1,871, and the prior lien debenture stock interest by £208, leaving them with an increased net profit of £5,369, a result which they considered satisfactory in a year which had proved by no means favourable to electric supply undertakings generally. The item of Urban Co. management fee arose in this way. Their contract with the Urban Co., whereby they guaranteed its dividends and under which they had hitherto been working, expired on December 31st last. In January of this year they accordingly entered into a fresh seven years' agreement with that company, providing that they should continue the management of its undertakings for an inclusive annual sum of £2,000, of which that £500 was the first quarter's payment. The agreement also provided that they should carry out all new construction work at cost price, plus 10 per cent., and that they should finance the company to the extent of a further £100,000, accepting in satisfaction of such further advance either first debenture stock at market price at the date when the advance was made, or 5 per cent. second mortgage income debenture stock at five points below such price. The expenses had increased by £517, partly owing to a belated item of legal expenses incurred in connection with the creation of the prior lien debenture stock, and partly owing to the natural growth of the business. He might remind them that the expenses were reduced by £730 in 1908, and by over £1,000 in 1909, and he then warned them that the reduction has gone as far as it was safe to carry it, and that some increase was consequently to be looked for. With the extension of the business some increase in expenses must be expected if the efficiency of its conduct was to be maintained and increased. The increased loss on working the local authority undertakings was the one unsatisfactory feature of the accounts, but it was not as unsatisfactory as would appear at first sight, since £980 of the increase was due to additional interest and sinking fund charges on sums paid in respect of work carried out during the past three or four years. In order that they might clearly understand the position, it might be well for him to explain that the local authorities provided the capital for their respective undertakings, the company paying interest and sinking fund charges thereon, but it often, and indeed almost invariably, happened that a very considerable period of time elapsed between the date at which the expenditure was incurred by them and that at which payment was made to them by the local authority. During that interval the money was temporarily advanced by them, and, of course, bore no interest, since they alone were interested in the operating results. It thus came about that they might for several years have some £10,000 or £20,000 invested in these undertakings without any corresponding capital charges appearing in this particular item, until, as was the case this year, the time came for the outstanding amount to be repaid them; and then this particular item was adversely affected. Of course it made no difference to the accounts as a whole. Whilst the money was outstanding, their cash resources were depleted to that extent, and so in some form the money was bearing interest. On the other hand, when it was repaid, the capital charge appeared directly in this particular local authority item, but their cash resources were correspondingly increased. After making allowance, however, for these additional capital charges, the fact remained that the local authority towns had not done well during the past year, showing, as they did, a decreased profit of £890; but of this amount about £300 was due to entirely special losses, quite independent of the year's working, such as losses on free wiring dismantled, which would ordinarily be charged against a depreciation fund. They might have charged them against their general reserve fund, but in the absence of any special fund for the purpose, and in view of the fact that the profit balance was not distributable, and of the probability of their dealing with the whole capital position before another year, they thought it simpler to make no change in the form of the accounts this year. He had previously explained how difficult it was to avoid fluctuations in the profits derived from any individual undertaking owing to the smallness of the business, and it was a mere coincidence that this year the principal decreases had occurred in the case of the local authority towns, and so made themselves more marked. Without questioning the unsatisfactory character of any decrease in profits, he would like to point out that over all the undertakings, the total decreases aggregated £1,312 only, as against total increases of £7,642. By furnishing the full details of the results realised by each individual undertaking, there was an inevitable tendency for the shareholders to attach undue weight to one or more individual returns, whereas, if they were to form a true estimate of the general progress of the company, it was essential for them to take a comprehensive view of the position as a whole, and that, he was glad to say, was by no means unsatisfactory having regard to the fact that last year undoubtedly proved very generally unfavourable to electric supply undertakings. The gross profits on the total capital of the subsidiary companies showed a progressive increase from 4·49 per cent. for 1909, to 4·66 per cent. for 1910, in spite of the fact that a large part of the capital expenditure was incurred towards the end of the year, and brought in no return, whilst the return on capital shown in their profit and loss account had very nearly doubled in the last two years, having increased from 1·68 per cent. in 1908, to 3·0 per cent. this last year. The output had increased by nearly 2,000,000 units, the private lighting output having increased 6 per cent., as compared with 4 per cent. a year ago, whilst the power output had increased 16 per cent., as compared with 19 per cent. The lamp connections had increased by the equivalent of 107,299 33-watt lamps, as compared with an increase of 88,935 the previous year, and they would be pleased to know that this rate of increase had been more than maintained in the current year. This steady growth was a most satisfactory feature, and clearly indicated the progressive character of the business. The metal lamp was undoubtedly tending to stimulate new connections, whilst he thought they might now consider that they had felt the worst of its adverse influence on their revenue. Returning to the accounts they recommended that the year's net profit of £16,138, should with the previous balance of £25,578, be carried to reserve. They had hitherto carried the balance of net profit forward each year, but as the arrangement come to at the time of the creation of the prior lien debenture stock precluded their distributing it, and as the four years during which they had been so precluded, expired on March 31st last, the better course on this occasion appeared to them to be to appropriate this balance to reserve. He did not know whether they realised how substantially the position of the company had been strengthened during the past four years; in the first place, by this addition of £41,716 to the value of its assets, and, secondly, by the reserve against investments in the balance-sheet, which this year had been increased by £1,720, and during the past four years by £4,720. Moreover, during the past four years the reserves of the subsidiary companies had been increased by just on £100,000, the amount so set aside for 1910 being over £19,000 in excess of the provision for 1906, if they excluded Winchester, which was no longer theirs. This increase in the subsidiary companies' reserves, he need hardly tell them, represented extra profits earned over and above those brought into their profit and loss accounts, so that the progress made during a period in which they had been seriously handicapped by the introduction of the metal lamp could not be considered otherwise than gratifying. The actual growth of profits during the past four years exceeded £35,000 on an increased capital expenditure of approximately £200,000; the return on the new capital was, therefore, nearly 18 per cent. In view of the fact that they would be in a position to resume the distribution of profits next year, he thought it might be well for him to warn them against jumping to the conclusion that the whole of the net profits realised for the year would be available for distribution. In the first place, a 1 per cent. sinking fund commenced next year on both their debenture and prior lien debenture stocks. Then there was an extra ½ per cent. rate of interest payable on the debenture stock next July and subsequently as long as any prior lien debenture stock remained outstanding. Moreover, the item of gross trading profits was so subject to fluctuation from year to year, owing to the large extent to which it was dependent on the expenditure of the subsidiary companies, that it might be unwise to rely on it to the full extent, if stable dividends were to be maintained. Before, however, they had to consider the question of a dividend they would no doubt be calling them together to approve a scheme of capital reduction, on which to some extent, at any rate, the question of a dividend was likely to depend. It was, therefore, altogether premature to consider the question of a dividend now, and his only object in mentioning the subject was to prevent their being misled by false assumptions. The prospects were very much better than appeared probable a few years ago, and, so far as they could foresee, were likely steadily to improve from year to year, but it would serve no good purpose, and only create disappointment, to assume that they were better than in fact they were. On the balance-sheet there was nothing to which he desired specially to call attention, beyond pointing out that their financial position was satisfactorily strong, disclosing as it did, liquid assets of over £50,000. The item of investments and advances had increased by £38,754, as compared with an increase of £36,168 the previous year. The reserve against investments was increased by £1,720 Turning to the subsidiary companies, the deficit on the working of the Scarborough tramways had been reduced by £638. This was largely owing to their having discontinued running during the past winter. Last year he told them that the company was in negotiation with the Scarborough Town Council with a view to obtaining some relief either in connection with the upkeep of the roads or in some other direction. He regretted to say that they failed to secure any modification of the conditions under which they were working, and owing to the intervention of the Board of Trade as a result of the discontinued running last winter, they had had to give an undertaking to continue running throughout the coming winter in order to avoid the risk of having the concession cancelled. Since running was resumed in April, the undertaking had shown some improvement compared with the corresponding period of last year, no doubt largely owing to the very much finer weather, but substantially the position remained what it was. At the moment it was difficult to see what more could be done, short of abandoning the undertaking, which they were not prepared to do, but the fact remained that the undertaking could not continue indefinitely to be run under existing conditions. He could only say that the matter would receive their anxious attention, and that sooner or later some way out of the difficulty would have to be found, if the town was to continue to enjoy the advantages of a tramway service. The Lancashire Power Co. continued to make most satisfactory progress. Last year it realised a profit of £6,000, as against a loss of £3,809 two years previously, whilst this year it was expected to earn a profit of £10,000 to £12,000, enough to provide a substantial margin over the £7,500 debenture interest on

its £150,000 5 per cent. debentures. During the year terms had been arranged with the Winchester Corporation as to the price payable by them for the purchase of the undertaking, which would result in their receiving about £6 10s. per share on their 3,363 £5 shares, in addition to a premium of 5 per cent. on their £9,000 debentures, or a total profit of £5,854. Their £9,000 debentures had already been paid off, and the money had been applied in redeeming an equivalent amount of prior lien debenture stock in accordance with the provisions of the prior lien debenture trust deed. The balance of the purchase money would be paid them as soon as the Bill embodying the terms completed its passage through Parliament, which it was likely to do within the next few weeks. He had finally to refer to an important modification which they had secured in their agreements with two of the local authorities whose undertakings they worked. The agreements provided for their working the undertakings for a period of 25 years, with an option to the local authorities in each case to terminate the agreement and take over the undertaking after the fourteenth year. In other words, as long as they were working at a loss after the fourteenth year, the company were to continue to work them and bear that loss. As soon as they became profitable, the local authorities could take them over. This arrangement, he was glad to say, they had been able to modify in the case of Dorking and Hamilton ; in the case of Hamilton, by entirely cancelliug the option ; in the case of Dorking, by stipulating that the option should not be exercised until after the twentieth year. In both cases they hoped that this would enable them to make good, or more than make good, in the later years, the losses incurred during the earlier years. It was only right and proper that they should be afforded this opportunity of making good their losses, and it was no less in the interests of the local authorities and their consumers that they should enjoy this increased security of tenure, for it would have been impossible for them to develop the business with any assurance or energy if they were liable at any moment to be deprived of the fruits of their labours.

Mr. Stanley Beeton seconded the motion.

Mr. Kitchin congratulated the chairman on the clear way in which he had put the exact state of the company before the shareholders, and said that the position was, he thought, a far more satisfactory one than any of them could have anticipated at the time when Mr. Tuckett and his colleagues took over the direction of the company's affairs. Incidentally, he had been struck by one thing in the balance-sheet, and that was that the directors only received the paltry sum of £600 a year for managing that huge undertaking. He ventured to say there was no other company in the City to-day involving such an immense amount of work and thought and such a considerable responsibility, where the directors were so badly paid. He knew it was a very bad time to talk about increasing directors' fees when the shareholders were receiving no dividends, but he did think that at all times it was desirable to pay directors in proportion to the nature of their work, and he hoped that before the next meeting they would have some suggestion either from the board or from the shareholders which would enable them to feel that they were remunerating the directors more in accordance with their deserts.

Mr. H. Mitchell said it was not remarkable that the shares which they held in many subsidiary companies were not yet giving them an adequate return on the capital—that was often the case in the early years of gas and water or electrical undertakings. He thought, however, the shareholders would desire to receive an assurance as to the policy the board would adopt in the future in reference to investing in similar undertakings. They now had a large amount of capital which was practically unremunerative. It was obvious that if the companies in which they had sunk their capital gradually became profit earning, the additional profit would be absorbed if they were undertaking new works in other districts that would have to go through a similar period of difficulty in their inception. He hoped, therefore, that except under very favourable circumstances the board would not embark on any fresh enterprises in the future. He would also like to know whether the board was in a position to foreshadow any proposals for dealing with the arrears of dividend on the preference shares. Unless some arrangement was come to with the holders of the preference shares nothing could be done. As to the remuneration of the directors, he quite realised that the board were working very strenuously for very small fees indeed, and he felt sure that when the company was put on a dividend-payiug basis the shareholders would not be found ungenerous or unjust.

Mr. Paxton, as an original shareholder, endorsed the remarks of Mr. Kitchin with regard to the inadequate remuneration of the directors, and said he thought the time was approaching when the question should be reconsidered. He was delighted with the progress the company had made, and believed that with a little patience they would pull round.

Mr. Hedges remarked that while he heartily agreed with the previous speakers that the directors were not getting a very large remuneration, he thought it was their own fault. When they assumed office they took the work on at the present rate, and he was afraid they would not get any more until some settlement was made in regard to the preference dividend arrears.

Mr. Page called attention to the fact that the additional capital expenditure put into the Urban Co. last year was £71,300, which, he said, had only produced an extra profit of £2,187, which, he thought, was exceedingly poor.

The Chairman, in reply, said that as he had said, they were making steady and satisfactory progress, and their profits this year would be increased both by the growth of the general business, which had been very satisfactory so far, and from the fact that the guarantee of the Urban Co. having expired they would derive a much larger sum by way of interest on their advances than they had hitherto derived as dividend on their ordinary shares in that company. Their arrangement with the Urban Co. was a very fair one. It was to their advantage to see the company prosper, and they were giving them the benefit of their organisation for £2,000 a year, which was less than they would have to pay if they did the work separately. It was perfectly true that the company had shown a disproportionate increase in profits last year, but that was partly due to the fact that 1910 was an unfavourable year for electric lighting companies generally. Then, again, a large part of the capital expenditure of the Urban Co. was expended right at the end of the year and brought in no return. It would bring in a return this year, and a still bigger return in the succeeding year. With regard to the remarks which had been made as to the directors' fees, it was quite true they were not well paid, and if when they undertook the job they had realised the enormous amount of work it involved he thought they would have been somewhat slow to take it on at the present figure, However, the company was in a very bad way, and he and his colleagues were greatly interested in it, and they had put their backs into the thing and had brought the company round to an extraordinary extent, and he hoped the shareholders appreciated the work. The position of the company to-day, compared with four years ago, was as black to white. With regard to the question of Mr. Mitchell, the policy of the board was to conserve their resources for the development of their existing undertakings, and not to go outside and put them into new ventures. As to the arrears of the preference dividend, as he told them last year before they commenced to pay dividends, they would have to call the preference shareholders together to see if some rearrangement of the capital could not be agreed upon. They had no definite proposals yet to lay before them, but he had no doubt that before the next ordinary meeting they would have submitted some scheme to the preference shareholders.

The report was adopted.

General Electric Co., Ltd.

The annual meeting was held on Tuesday at 67, Queen Victoria Street, E.C., Mr. H. Hirst presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, July 7th), referred first to the great loss that their company had sustained by the death of their late chairman and managing director, Mr. G. Byng. The G.E.C. evolved out of a small business which Mr. Byng started in the early eighties. Mr. Byng at all times was a brilliant business man, a deep thinker, a thorough organiser and a hard worker. These qualities were bound to lead to success. His close attention to detail, his watchfulness of the development of the industry in general, his great carefulness, gave an imprint to the character of the G.E.C., which would not fade as long as they existed.. Until 1899 he was the leader of their firm in every sense of the word. In that year a serious illness struck him, with which he successfully battled for 11 years with indomitable pluck. During that period he had to relinquish actual work, but his love for the concern he created, made him follow their steps forward closely and intelligently. He kept himself well informed of all that was going on inside and out of the G.E.C. His mature advice was sought by them and given by him on every question. His own private resources were at their disposal in time of stress, and he left a blank which it would be almost impossible to fill. It was by his request that he (Mr. Hirst) was privileged to stand in his place that day. He was satisfied that with a trained, loyal and hardworking staff such as they possessed, and with the assistance of his old and new colleagues, the G.E.C. might look confidently into the future. Several alterations and additions had been made to the board—another son of the late chairman, Mr. L. G. Byng, who had been for a number of years actively engaged in the firm, had joined the board. Mr. Ernest Byng filled the position vacated by him (Mr. Hirst), viz., the vice-chairmanship. Mr. M. J. Railing, a director since 1900, who had been nearly 20 years with the company in different departments, and who during recent years managed the Witton works so successfully, joined them at the head office as general manager. Dr. A. H. Railing, who enjoyed a brilliant engineering experience outside the firm, and who had been for the last four years his chief assistant in London, in order to add to his commercial and financial experience, went to Witton to take over the works management. Turning to the balance-sheet, the chairman said that the trading profits, £107,858, showed a healthy increase of £16,728. The depreciation was about £5,000 more than last year, not because they had discovered any particular item that needed larger depreciation, but they thought it a wise policy to depreciate even more fully in order to make them fitter in times of stress that might come, not necessarily through faults of their own. The property account now stood at £297,032. During the present company's 10 years' existence £186,000 had been written off, not taking into account the £92,000 which they appropriated this year for writing off goodwill. He thought he was not making a sanguine estimate if he valued the assets at a considerably higher figure than appeared in the balance-sheet. From the fact that they only declared 5 per cent. on the ordinary shares and put £43,615 to reserve, they would gather that the company were anxious to continue their conservative policy of strengthening the business and giving security to the preference and debentureholders. The directors and their friends who held the greater portion of the ordinary shares were perfectly satisfied and willing to wait for a larger distribution of profits. The reserve account now stood at £202,103. This year they had been able to satisfy a long cherished wish by writing down goodwill and patents accounts to £1 which still left the reserve account at the respectable

total of £110,000. Sundry debtors amounted to £402,226, and he was pleased to say that there were no dangerous outstandings, and their reserves against all debts were so generous that that item could be taken as absolutely safe. He would say of this, as well as of the stock amounting to £340,138, that they were both very reasonable figures in proportion to the annual turnover. He now wished to say a few words about the investment account. It might seem strange that the same amount of investment should yield £7,000 more than last year, but the difference was accounted for by the successful working of the British General Electric Co. in South Africa, which was their property, and the satisfactory results of the Peel-Conner Telephone Works, in which they had invested nearly £70,000 18 months ago, and whose first financial report had recently been presented to the shareholders. The investment account consisted principally of two classes of investments:—(1) Investments in manufacturing concerns owned or controlled by them. They were all doing well. (2) Investments in separate trading companies which acted as feeders to their business, some of which had not been developed. The latter included the G.E. de France, the G.E. de Espana and the British General Electric Co. of South Africa. They had recently formed the British General Electric Co. of Australia, and the British General Electric Co. of China, and similar arrangements for India and the Argentine form at present the subject of the directors' serious study, and, he might add, even negotiations. They had found it impossible to do justice to their works through agents in foreign countries, and they thought it a safeguard to the business to so organise it that they could count on each of the companies abroad taking an output from each of the works proportionate to the territory which they covered. Those subsidiary concerns were therefore practically departments in the shape of limited companies so as to limit their responsibilities, and they were managed principally by selected members of their staff trained at the head office and works. During the last few years they had sent over 30 such men to different parts of the world, and had every reason to hope and believe that they would do well for themselves and for the company. As these companies had the absolute backing of the parent concern at home, their capitalisation was on a modest scale. Nevertheless the pursuance of the policy in the future would considerably increase the investments account. Needless to say the formation of these companies and the creation of shares had in no way benefited the profit and loss account. In these days of keen competition a firm like theirs could only prosper if it left nothing undone to increase its sales in every country and in every branch of its manufactures. They must bear in mind the variety of operations the G.E.C. carried on. The engineering works at Witton turned out every description of motor and dynamo from small motors for fans to turbo-generators of 5,000 KW. They installed lighting and power plants for tramway companies, electric light stations, mines and country houses. They equipped factories and steamships and carried on every kind of electrical engineering work for Government departments, municipalities, and all manner of trading concerns at home and abroad. In separate factories they manufactured conduits, electric light fittings of every style and period, electric light supplies, electric heating apparatus, bells, telephones, lampholders, arc lamps, switches and electric measuring instruments. The Robertson lamp still sold in very large quantities, and the Osram lamp continued its great career. At the present moment they were engaged in serious litigation for the purpose of establishing the patents of the latter which they considered were being infringed, and he was sanguine of success. The carbon works, which had been repeatedly mentioned at their meetings—the only works of their kind in this country—had, for reasons familiar to every shareholder, been a source of great loss to them in the past, but had this year arrived at the zero point. They were very grateful to the Admiralty and Government departments, who did their best whenever they could, to insist on the supply of British-made carbons, and thus had enabled them to keep these important works going. In the production of their goods were now employed between 7,000 and 8,000 workpeople and staff, and nothing but a strong footing in the prosperous and coming countries abroad would enable them and the board to weather depression at home. At present their works were fully occupied, and extensions were being carried out.

The CHAIRMAN then moved the adoption of the report, which was seconded by Mr. Ernest G. Byng.

The retiring directors were re-elected, and the proceedings closed with a vote of thanks to the chairman.

Madras Electric Supply Corporation.

MR. A. M. H. WALROND presided at the offices, Salisbury House, E.C., on Wednesday, July 12th, over the annual general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, July 7th), the CHAIRMAN said this was the first time that the accounts showed the working of a complete year since the main generating station was opened. The total expenditure on capital account amounted to £317,876. During the year they had expended £17,415, out of which £6,174 was for completing the main station, the Mylapore sub-station, the erection of workshops, &c., and £9,151 for extensions of mains rendered necessary by the growth of the business. The total under the heading of capital expenditure during the year was a little misleading, as the amount of £4,834 credited to electric fans was what they had received during the year by the sale of these fans, and had to be deducted from the total expenditure. They had sold or had hired out during the year 912 fans, reducing their stock by that number. They regretted they were not going off faster, but since the close of the year they had further reduced the stock by 381, and hoped that sales would increase more rapidly as the extension of their mains came into operation. Their receipts for the sale of current had increased from £3,862 in 1909 to £16,109 last year, and the total receipts came to £17,454. Their expenditure had also naturally increased, principally in the coal bill. The balance of the revenue account was a small profit of £28, which was carried to the net revenue account, in which account were shown the interest on loans, debentures, &c., and the dividends they had received from the Madras Tramways investment. The result was a loss of £1,041 for the year, which they had carried into the general balance-sheet. Comparing 1910 with 1909, it would be seen that the loss on working had been reduced from £7,840 to £1,041. The total amount now standing in the general balance-sheet against them in the suspense account was £11,387, which they would have to deal with out of future profits. During the year they had placed £70,800 debentures amongst the shareholders. The consumers had increased at the rate of practically one a day from 355 to 719, and the equivalent number of eight candle-power lamps connected increased from 29,296 to 75,329. The units sold had also increased from 267,568 to 1,882,787. At the last meeting, Col. Filgate said he anticipated that they would be on a 2,000,000-unit basis by the end of 1910, and he was pretty nearly accurate. The latest return they had received was for the week ended June 17th, when 48,245 units were delivered to consumers. This was at the rate of over 2,500,000 units per annum. Out of the receipts for current £11,205 was for private lighting and £4,903 for power. The number of units delivered to consumers during the current year up to June 17th amounted to 1,073,093, which indicated that their rate of progress was well maintained. The demand for current continued, and, amongst others, they were in negotiation with a firm who were proposing to take a minimum of 500,000 units of current per annum, which minimum they hoped would be considerably increased. Various Government offices and public buildings had been connected to the mains during the past year, and an agreement had been entered into with the municipality for a certain amount of electric street lighting. The board were quite satisfied with the progress the company was making, and it was really that which interested them as shareholders, as it indicated that they were supplying the population of Madras with an article they required. Without steady progress in the earning capacity of the plant they could not look forward to the future as confidently as they did. Another encouraging feature in their business was that they were attracting the native population, and they really still had the bulk of the European residents yet to secure as customers. The average cost of generating and distributing per unit, during the past year was 1·08d. Taking into consideration the way the staff had been hampered by making continual tests of machinery and boilers, experimenting with various coals in an endeavour to obtain the required efficiency out of the boilers, and bearing in mind that during the greater part of the year the contractors' men were working on the plant, and therefore the staff had not complete control, he did not think the shareholders would consider the balance-sheet or the cost of generating and distributing electricity as other than satisfactory. They were doubtless surprised at the paragraph in the report stating that certain questions between themselves and the contractors had been submitted to arbitration. They had every reason to believe last year that everything had been practically settled, with the exception of certain important items on which it was anticipated that an agreement satisfactory to both parties would be arrived at. He was very glad now that he was questioned last year as to the terms of settlement, as he then clearly indicated what constituted the principal matters still in dispute, which were as to the efficiency of the boilers and the capacity of the feeders. He regretted to say they had found it impossible to agree on these and other matters, and he would like the shareholders to understand that the board did everything in their power consistent with their interests to avoid litigation, as they always considered if a reasonable compromise was possible it would be preferable to settle rather than to have a lengthy arbitration. But matters were brought to a head when the contractors issued a writ against them, and so they reluctantly came to the conclusion that the only way to settle matters satisfactorily was by arbitration under the clause of the contract which provided for it. In conclusion, the chairman referred to the fact that the board had appointed Messrs. Merz and McLellan as the consulting engineers of the company, and said a representative of the firm had visited the property in Madras, and they would have the benefit of their advice in connection with the arbitration. They also advised the board that they were preparing a scheme which they hoped would materially reduce the generating costs.

MR. T. E. IVENS seconded the motion, and the report was adopted without discussion.

The retiring directors and auditors having been re-elected, the meeting terminated.

Continental Notes.—A correspondent of the *Financial News* at Vienna, states that the firm Deckert & Homolka Telephon Installations is to be transformed into a joint-stock company by co-operation of the Hungarian Bank and the Handelsgesellschaft, with a capital of 2,000,000 crowns.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ending June 30th, 1911, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 1st.

MARKET QUOTATIONS.

Wednesday, July 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (orystal) ..	per ton	£29	..
a ,, ,, ...	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon ..	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %) ..	,,	£12 10	..
a Copper Sulphate	,,	£20	£3 dec.
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %) ..	,,	£11	..
a ,, Chlorate	per lb.	8¾d.	..
a ,, Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
a ,, Cyanide (basis 100 %) ..	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b ,, Wire, in ton lots ..	,,	£102	..
b ,, Sheet, in ton lots ..	,,	£120	..
p Babbitt's metal ingots	,,	£88 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6¾d.	..
c ,, Tube (brazed)	,,	8¾d.	..
c ,, ,, (solid drawn) ..	,,	7d.	..
c ,, Wire, basis	,,	6¾d.	..
c Copper Tubes (brazed)	,,	9¾d.	..
c ,, ,, (solid drawn ..	,,	8¾d.	..
g ,, Bars (best selected) ..	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electroiytic) Bars ..	,,	£59	..
e ,, ,, Sheets ..	,,	£74 15	15/- inc.
e ,, ,, Rod ..	,,	£62 5	5/- dec.
e ,, ,, H.C. Wire	per lb.	7¾d.	..
e ,, ,,	,,	5/3	..
f Ebonite Rod	,,	4/9	..
f ,, Sheet	,,	1/11	..
n German Silver Wire	,,	8/6	..
h Gutta-percha, fine	,,	4/4	2d. inc.
h India-rubber, Para fine	,,	46/11½	8½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	£14	..
j ,, Wire, galv. No. 8, P.O. qual.	,,	£13 10 to £13 15	..
g Lead, English Ingot	,,	6/6	..
m Manganin Wire No. 28	per lb.	£9	inc.
g Mercury	per bot.	6d. to 2s.	..
d Mica (in original cases) small ..	per lb.	2/6 to 4/-	..
d ,, ,, medium	,,	4/6 to 8/6	..
d ,, ,, large ..	,,	11d.	..
p Phosphor Bronze, plain castings	,,	1/0½	..
p ,, ,, rolled bars & rods	,,	1/1	..
p ,, ,, rolled strip & sheet	,,	172/6	..
o Platinum	per oz.	8¾d.	..
e Silicium Bronze Wire	per lb.	£55	..
r Steel Magnet, in bars	per ton	£180 to £190	£3 dec.
g Tin, Block (English)	,,	2/3	2d. dec.
n ,, Wire, Nos. 1 to 16	per lb.	£15 to £150	..
p White Anti-friotion Metals ..	per ton	£30	10/- inc.
k Zinc, Sh't (Vieille Montagne bnd.)	,,		

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Boiling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Mattbey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE better feeling which has prevailed in regard to Consols and other gilt-edged stocks spread a more cheerful tone throughout the Stock Exchange as a whole. It cannot be said that business has improved to any extent, and. of course, in these dog-days nobody expects to be doing much. Still, there is a fair amount going on in several departments, and the declaration of dividends by the Home Railway Companies helps to keep alive the interest in that market.

New issues are not being received with any particular favour, and underwriters on all hands are complaining of the way in which they get left with stock. There will, however, be no complaint on the score of the new British Columbia Electric Railways issues not finding a ready home. In spite of the premiums at which the Preference, Preferred and Deferred have been offered, there are additional premiums established on the shares of 6d., 1s. 9d. and 4s. respectively. To take up the new stock, a few proprietors have been selling part of their other holdings, with the result that the company's Preference stock shows a fall of 2 points on the week.

The Metropolitan Railway Company has announced a dividend at the rate of 2 per cent. per annum, carrying forward the sum of £4,000 to the new account. This goes against a distribution of 1¼ per cent. a year ago, with £6,000 forward, and the result comes up to the anticipations of the more moderate prophets. Some people had talked of 2¼, or even 2½, per cent., and perhaps it was the disappointing of their expectations which caused the price to fall from 49¾ just before the figures were declared, to 48¾ just afterwards. Even so, however, the price retains a rise of 1 on balance, and the Surplus Land stock which receives 3 per cent., against 2¾ per cent. a year ago, has gained a similar amount. Districts have done better still, and at 28¾, after being 29½, are 1¼ higher on the week, attention having been drawn to the substantial progress which the company is making towards a dividend in years to come on the Ordinary stock. There is considerable talk of fresh labour trouble on the North-Eastern system, which had the effect of depressing Home Railway prices below the best touched during the past few days; but, for all that, there is plenty of confidence felt in the market, and provided there are no open strikes, prices ought to improve.

The half-yearly report of the City and South London Railway makes a satisfactory showing, and to this is due the rise of 1½ in the price of the Ordinary stock. Perhaps the pleasantest part about the report is that which remarks that the increase of traffics is not due simply to the adventitious aid rendered by the Coronation, but that apart from this, the revenue shows a steadily expanding tendency. Central London Ordinary also hardened, and if the dividend announcement should be a good one, it is quite likely that the Deferred will improve.

Electricity Supply shares are almost stagnant again, and the slight interest which was re-aroused in the market earlier this month appears to have evaporated. Changes since we last wrote have been confined to small falls in the price of Edmundson's Preference and Westminster Ordinary. The quiet absorption of 5 per cent. securities is responsible for a rise of 4 in the North Metropolitan Power Supply 5 per cent. mortgages, while the 4½ First Mortgage Debenture stock of the Midland Electric Corporation is ½ higher. County of London Second Debenture put on 1, but the First Debenture stock fell 2, and it is said that the movements were caused by a holder of the latter exchanging into the former on the ground that the security of both is excellent, and that, as there is so little to choose between the first and second Debenture stocks, it is worth while to sell the higher-priced issue in order to put the money into the lower-priced at a margin of about 6 per cent. in favour of the transaction.

Mexican affairs are supposed to be settling down once more, and, as a result, the Canadian-Latin group is quietly steady. The chief feature is the demand for Mexican Light and Power 5 per cent. first mortgage bonds, which are still in the ascendant and by no means easy to buy. The company's Preferred stock has advanced a little. Canadian General Electric Common is 2 better, but Northern 5 per cent. first mortgage bonds continue flat, and are now no higher than 44, the shrinkage during the last few months having been very severe.

Mexico Tramway shares recovered a part of their dividend, and the Company's bonds are both better. British Columbia Preferred and Deferred Ordinary are both quoted *ex* rights, and the falls which the quotations exhibit are the result of this deduction. Sao Paulo Trams continue to improve, and there is a steady demand for the best-known bonds in this department. United Electric Trams of Monte Video Preference have risen over par.

The Telegraph market is still greatly excited over the fluctuations in Marconi shares. Since we wrote last the price has been down to 40s. again, from which it recovered to 45s. 6d., and retained most of the rise. The meeting takes place on the Thursday in this week, and even if the anticipations of a 10 per cent. dividend on the Ordinary should not be realised, it is thought probable that such an account will be given of the company's progress and prospects as will encourage present holders to keep their shares, and possibly stimulate further purchases. Were it not for the Marconi excitement the Telegraph market would be exceedingly quiet, for other changes are so few as to be almost negligible. The only changes worth quoting are improvements in Anglo-American Preferred and Deferred, others being very small.

The Telephone market is good. The rise of 5 points in National Telephone Deferred has restored the price to 120, the latest development in the Arbitration being regarded as in the company's favour. The Preferred stock and the Third Preference shares are both better. Rises have also been secured by United River Plate Telephone shares and New York Telephone bonds, while Chili Telephones are ⅛th easier.

The Manufacturing division remains very placid. Electric Constructions fell back a trifle to 4⅜. Telegraph Constructions are ex their dividend, and show a nominal fall of £1, while Babcock and Wilcox Preference are ⅛ down.

Rubber shares are rather more active. The price of the raw stuff keeps firm at about 4s. 5d. per lb., and the market in the Stock Exchange, although quiet as regards business, is steadier for the time being.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 18th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5¾	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½— 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞— 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝— 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	11⅞— 12⅝	..	5 13 2
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅝— 8⅜	..	6 3 1
Do. 6 % Pref.	10	6	6	11¼— 11¾	+ ⅛	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	+1	4 7 5
Edmundson's, Ord.	5	Nil	Nil	9/16— 13/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	— ¼	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87 xd	..	5 3 6
Folkestone	5	5½	6	4⅜— 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾— 7¼	..	6 11 0
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	91 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82 xd	..	5 9 9
London Electric, Ord.	3	2	2	1⅜— 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾— 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅜— 3⅞	..	6 9 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛— 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	+ ½	4 11 5
Newcastle-on-Tyne	5	4	4	3½— 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	+1½	4 16 2
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7¼	6⅜— 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9⅓	..	5 5 3
Do. 7 % Pref.	5	7	7	6⅜— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84⅓— 86⅔	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜— 1⅞	..	Nil
South London, Ord.	4	5	5	2 1/16— 3 3/16	..	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜— 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3⅜	½— 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3⅜	2⅞— 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord,	5	10	10	7⅞— 8⅛	— ⅛	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼— 5¾	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅛— 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	+1	5 2 0
Canadian Gen. El. Com.	$100	7	7	110 —113	+2	6 3 11
Do. 7 % Pref.	$100	7	7	120 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	2	3	¾— 7/8	— 1/16	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86½— 88½	+3½	5 13 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16— 5/16	..	..
Do. 6 % Pref.	1	6	6	3/32— 5/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	— ½	4 17 1
Madras, Ord.	5	Nil	..	2⅝— 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87½— 88½	+1	5 13 0
Mexican Lt. & Power, Common	$100	4	4	82⅜— 84⅛	+ ½	4 14 10
Do. 7 % Cum. Pref.	$100	7	7	106½—108½	+1	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½— 97½	+1¼	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	—1	5 9 11
Montreal, Lt., H. and Power	$100	6	7	173 —177	..	3 19 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	43 — 45	—3	11 2 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	119 —121	— ½	3 6 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½— 93½	..	5 6 11
Victoria Falls Power, Pref.	1	Nil	Nil	15/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108½—110½	+ ½	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜— 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	142 —144	+1	5 11 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3½	3½	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113¾—114⅝	+ ¾	5 4 7
Do. Det.	Do.	25/-	30/-	26½— 26¾	+ ½	5 12 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	6⅞— 7⅛	— ⅛	5 12 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87½— 89½	..	4 9 5
Cuba Telegraph	10	6	6	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17¼— 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜— 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4¼	4½	7⅜— 8	..	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	— ½	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	— ½	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13¼— 13⅜	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½—101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅛— 11⅛	— ⅛	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13⅜	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½— 58½	..	5 11 1
Mackay Companies Common	$100	4	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 3/16— 2 5/16	+ ⅛	Nil.
Monte Video Telephone, Ord.	1	6	6	7/8— 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/8— 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	105½—106½	+1	5 12 8
Do. Def.	Do.	6	6	119 —122	+4½	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜— 5⅝	+ ⅛	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½% Gen. Bnds.	100	4½	4½	102½—103½	+ ¾	4 7 0
Oriental Telep. and Elec.	1	8	8	1 1/16— 1 1/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛— 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	+ ½	4 9 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅝— 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	..	4 10 0
United River Plate Telephone	5	8	8	7 11/16— 7 15/16	+ ⅛	5 0 10
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅛— 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½— 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	¾	2¼— 2½	..	3 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜— 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9½— 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜— 14⅛	+ ⅛	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½—102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 18th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅝	.	Nil
Do. 5 % Pref.	1	5	5	⅜ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/16 — 1⅜	..	Nil
Do. 6 % Pref.	10	3	3	3¾ — 4¼	..	7 1 2
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	71 — 73	+1	4 2 2
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	55 — 57	..	3 10 2
Do. 4 % Deb.	100	4	4	102 —104 xd	..	3 16 11
City & South London, Ord.	100	1¾	1½	33 — 34	+1½	4 8 3
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	105 —108	..	4 12 7
Do. Do. 1901	100	5	5	104 —107	..	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12⅛ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	¾ — 1	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼ — 2¾	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3/16 — 4/16	..	Nil
Do. 4 % Deb.	100	4	4	74 — 77	..	5 3 11
Metropolitan Railway Consol.	100	1	1⅜	48½ — 49	+1	2 16 1
Do. Surplus Lands	100	2¾	2¾	69 — 71	+1	3 17 6
Do. 3½ % Deb.	100	3½	3½	92 — 4 xd	+ ¾	3 14 6
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 14 6
Do. 3½ % Con. Prcf.	100	3⅜	3⅜	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	28½ — 29	+1½	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	101 —103	..	3 17 8
Do. 4½ % First Pref.	100	..	3¼	89 — 91	+1	3 11 5
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5⅛	3/32 — 1/32	..	5 6 8
Do. Def.	1	Nil	Nil	1/32 — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	3/32 — 1/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99⅛ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	102½ —104½	..	4 15 8
Potteries, Ord.	1	2	..	1/16 — 3/32	..	..
Do. 5 % Pref.	1	5	5	1/32 — 1/32	..	5 18 1
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	10 3
South Metro. Trams, 6 % Pref.	1	3	6	1/32 — 1/32	..	5 15
Do. 4 % Deb.	100	4	4	73 — 78	..	4 18
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 9
Do. 4½ % Bonds	100	4½	4½	99 —101	..	0 14 1
Do. 6 % Income	100	Nil	10/-	65 — 67	..	3 17
Do. Power House Debs.	100	..	4	101 —103	..	Nil
Yorksbire (West Riding), Ord.	5	Nil	Nil	1/16 — 3/32	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛ — 2⅝	..	5 5 1
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 2nd Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	+ ½	4 3 4
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅜	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½ — 98½	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	6 5/16 — 6 7/16	+ 1/16	5 16 5
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	140 —144 xr	..	5 11 1
Do. Pref. Ord.	100	6	6	120 —124 xr	..	4 16 9
Do. 5 % Pref.	100	5	5	107 —110 xd	..	4 10 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	5	5 3/4 — 6 1/4	..	4 0 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	+1	4 5 9
Cape Electric Trams	1	Nil	Nil	1/32 — 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 5/8 — 5 7/8	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102 xd	+1	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	+ ½	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	13/16 — 15/16	..	6 8
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1¼	..	4 16
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	90½ — 93½	..	5 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99⅞ —101⅛	..	4 18
Mexico Trams Com.	$100	6	7	121 —123 xd	+ ¾	5 13
Do. Gen. Con. 5 % Bonds	..	5	5	96⅜ — 97⅜	+1¼	5 2
Do. 6 % Bonds	100	6	6	99 —101	— ½	5 18
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅛	..	6 15
Do. 6 % Pref.	5	6	6	5 1/16 — 5 3/16	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½ —101½	+ ½	4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	5/8 — 5/8	— 1/16	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10
Rio de Janeiro Trams	$100	2	5	115½—116½ xd	+ 2½	4 8
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	+ ½	4 18
Do. 5 % Mort. Bonds	100	5	5	97 — 98	+ ¾	5 2
Sao Paulo Tram, Lt. and P.	$100	10	10	183 —186	+1	5 7
Do. 5 % 1st Deb.	$500	5	5	102½—104½	+ ½	4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 —100	..	5 0
Un. Elec. Trams Monte Video	5	7	7	5⅞ — 6⅜	..	5 5
Do. 6 % Pref.	5	6	6	5 — 5½	+ ⅛	5 5
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 17
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	+ ½	4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	5/8 — 3/4	..	8 0 0
Do. 6 % Pref.	1	12	12	1 3/16 — 1 5/16	..	7 7 8
Babcock & Wilcox	1	24	26	5 1/16 — 5 1/8	— 1/16	4 13 6
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 7/8 — 7 3/8	..	6 15 7
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	101 —103	+1	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1 1/32 — 1 5/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/16 — 3/32	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	8 3/4 — 9 1/4	..	8 2 2
Do. Pref.	5	5	5	4 5/8 — 5 1/8	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3 7/16 — 3 5/16	..	4 18 3
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2
Dick, Kerr	1	5	6	13/16 — 15/16	..	6
Do. Pref.	1	6	6	31/32 — 1 1/32	..	5
Do. Deb.	100	4½	4½	95 — 98	..	4 1
Edison & Swan, A, £3 paid	5	Nil	Nil	2/16 — 3/16	..	
Do. fully paid	5	Nil	Nil	1/16 — 2/16	..	
Do. 4 % Deb.	100	4	4	67 — 71	..	5
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6
Electric Construction	2	Nil	Nil	3/32 — 5/32	— 1/16	
Do. Pref.	2	7	7	1 1/32 — 2 1/16	..	6
Greenwood & Batley, Pref.	10	7	7	7 1/2 — 8 1/4	..	8
Do. Deb.	100	5	5	94 — 96	..	5
General Elcctric, Pref.	10	5	5	8 1/2 — 9	..	5
Do. Deb.	100	4	4	88 — 93	..	4
Henley's, Ord.	5	15	15	12 1/4 — 12 7/8	..	5
Do. Pref.	5	4½	4½	4 1/2 — 5 1/8	..	4
Do. Deb.	100	4½	4½	106 —108	..	4
India-Rubber, G. & T.	10	10	10	11 1/2 — 13 1/2	..	7
Do. Pref.	10	5	5	10 1/4 — 10 1/2	..	4
Telegraph Construction	12	17½	20	35 1/2 — 37 1/2 xd	— 3/8	6
Do. Deb.	100	4	4	99 —101	..	3
Willans & Robinson	1	Nil	Nil	1/4 — 3/8	..	
Do. Pref.	5	3	Nil	3/4 — 1	..	
Do. Deb.	100	4	4	55 — 65	..	6

* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Bank rate of Discount 3 per cent., March 9th. 1911.

MISCELLANEOUS LAMP CHARACTERISTICS.

By M. TAPPLEY.

THE present notes are in no sense or degree intended as a complete survey of lamp characteristics, but merely comprise a collection of miscellaneous data and facts collected from many sources, during a number of years. The lamps dealt with are mainly electric, though other types are referred to from time to time.

Types of Luminous Sources Available.—It is hardly necessary to explain at length the desirability, from the efficiency standpoint, of a "cold" source of light: all heat generated by a luminous source, and stored or radiated at a lower temperature than that at which incandescence commences (700-800° F.), must be regarded as energy wholly wasted so far as the primary object of the source is concerned. What is theoretically desirable is a source emitting light without heat, and in such a case alone is 100 per cent. luminous efficiency even theoretically possible.

The vast majority of commercially successful lamps depend upon incandescence for their luminosity, and it then becomes necessary to operate at as *high* a temperature as possible, in order to increase the ratio of the luminous to the invisible heat radiations.

Thus, while ideal conditions require a low temperature, it is usually necessary in practice to go as far as possible in the opposite direction, owing to the impossibility of realising the theoretical desideratum—in other words, instead of *reducing the heat* emissions we must strain every endeavour to *increase the luminous* radiations.

The "cold" light of fluorescence and phosphorescence cannot be utilised commercially, owing to its weakness and inconstant nature. Some attempt has, it is true, been made to utilise such a "cold" light in the "transforming" reflectors used to correct the illumination of mercury arcs and similar monochromatic or strongly coloured sources. Such reflectors, when for use with mercury arcs, are coated with a varnish in which rhodamine is the essential constituent; collodion is used to "carry" an alcoholic solution of rhodamine, a little castor oil being added to promote subsequent fluorescence of the coating.

A somewhat similar luminous "source" (again of a secondary character) may be obtained by using a solution of pyrogallol and formaldehyde with 30 per cent. hydrogen-peroxide. This solution emits a comparatively strong red light, while remaining cool enough to be easily handled.

Cold sources such as the above are, at present, of little more than academic or laboratory interest, and the most hopeful means of approaching ideal conditions in a *commercial* lamp seems to be by utilising the luminescence of gases traversed by an electric current. Thus the Moore vapour lamp, employing the principle of the Geissler tube by passing a high-tension electric discharge through nitrogen or carbon-dioxide at a pressure of about 1/10 mm., is a comparatively cool source, though its temperature is still too high to enable it to attain very high efficiencies by reason of this characteristic. Similarly, the Cooper-Hewitt lamp, employing the luminescence of mercury vapour, runs at 300°-400° C., a temperature which, though comparatively low, is high enough to preclude any abnormal efficiency due to coolness of the source.

In short, no commercial source of illumination is really *cool*, and it almost invariably pays, therefore, to *increase* the working temperature of the source as far as possible in order that the increased incandescence, outweighing its own heat radiation increment, may contribute something to the reduction of the *relative* importance of the remaining thermal radiations. Thus the quartz mercury vapour lamp owes its great advance in efficiency over the ordinary mercury lamp (see Table I) to the much higher working temperature which is possible in the quartz tubes employed.

Whereas the vapour temperature in the Cooper-Hewitt lamp is probably well under 500° C., that in the quartz type is said to approach 6,000° C. in the central core of the vapour column (probably the actual temperature, though still very high, is considerably lower than this abnormal figure).

Most flame (combustion) lamps derive their luminosity from incandescent carbon particles, formed and consumed in the flame, while later and more efficient sources (other than electric) depend chiefly upon the introduction of refractory solid bodies (*e.g.*, lime or rare earth "mantles") into an intensely hot non-luminous flame. In electric lamps, besides the luminescent vapour types, we have the incandescent filament (of carbon, rare earths or rare metals), and the arc struck between solid electrodes—whether of pure carbon, impregnated carbon or magnetite or similar novel composition.

Failing the commercial feasibility, or pending the realisation, of a "cold" source, what is required is a refractory substance which will *radiate as light a maximum percentage of the energy supplied to it.* The development of rare earth

TABLE I.—Luminous Efficiencies.

Source.	Watts per c.p.*	Relative efficiency.†
Mechanical equivalent ...	0·08	100 per cent.
Black body at 12,000° F. ...	0·16	50
Oil lamp	70‡	0·11 per cent.
Gas burner	70‡	0·11
Incandescent gas	7—10‡	1·1—0·8
Acetylene	15‡	0·53
Carbon filament	3—4	$2\frac{2}{3}$—2
Metallised filament	2—3	4—$2\frac{2}{3}$
Nernst	1	8
Metallic filament	1—$1\frac{1}{4}$	8—6·4
Mercury lamp (L.T.)	0·4—0·65	20—12
Quartz ditto	0·2—0·3	40—27
Moore tube (N_2)	1·6—1·8	5—$4\frac{1}{2}$
Moore tube (CO_2)	about 3	$2\frac{2}{3}$
Geissler tube	0·25	32

Arcs.§	D.C.	A.C.	D.C.	A.C.
Carbon arc: open ...	0·5 —1·0	0·75—1·5	16—18	10—5
,, in globe ...	1·3	2·2	6·25	3·6
,, enclosed, no outer globe	1·5 —2·0	1·7 —2·5	5·3 —4·0	4·7 —3·2
,, with globe	3 —3·5	3 —4·0	2·65—2·3	2·65—2·0
"Carbone" arc ...	0·84	—	9·5	—
Flame arc: vertical carbons ...	0·4	0·4	20	20
,, inclined carbons ...	0·2	0·2	40	40
Bremer arc: no globe	·12— ·20	0·23	66—40	35
,, with globe	·25—0·3	—	32—27	—
Blondel arc: no globe	0·10—0·13	0·17	80—62	47
Magnetite arc ...	0·8	—	10	—
Titanium arc ...	0·24	—	33·3	—

* Watts per M.S.C.P. is intended except in the case of tube lamps, when M.H.-S.C.P. is intended; in the arc lamp data the higher efficiencies refer in general to M.H.-S.C.P. and the lower figures to M.S.C.P. (see also note below).

† *i.e.*, ratio of actual efficiency to 0·08 watt / C.P.

‡ Approximately, and taking full electrical equivalent (100 per cent. conversion) of the calorific value of oil, gas, &c. Approximate consumptions per C.P.-hour are:—

Candle, 110—140 grains. Oil lamp, 55— 65 ,, Fish-tail gas burner, 0·85 cb. ft. Argand burner, 0·80 ,, Regenerative burner, 0·10 cb. ft. Welsbach ,, 0·07 ,, Ditto, after 300 hours' life, 0·1—0·13.

§ Certain of the exceptional figures in this section neglect the power absorbed by the necessary controlling coils, &c., in the lamps and are, even so, too high to be relied upon for general estimates. The following figures, for instance, were obtained by deducting the watts absorbed in the regulating coils from the gross consumption:—

Open arc (10 a., D.C.), 0·4 watt / M.S.C.P.
Enclosed ,, (5 a., D.C.), 0·9 ,,
Flame ,, (10 a., D.C.), 0·15 ,,

TABLE II.—Colour of Light from Various Lamps (Daylight taken as White).

Candle.—Very yellow, even orange.
Oil lamp.—Pale orange or decided yellow.
Acetylene.—Good approach to daylight.
Flat gas flame.—Pale orange or yellow.
Incandescent mantle.—Good approach to daylight; greenish tinge evident.
Carbon-filament glow lamp.—Decidedly yellow.
Nernst lamp.—Much less yellow than carbon-filament light.
Metallic-filament glow lamp.—Good approach to daylight; yellow tinge evident.
Open carbon arc.—Closest available approach to daylight.
Enclosed carbon arc.—Excess of blue and violet rays.
Flame arc.—White, yellow or rose, according to impregnation; yellow is most efficient.
Moore tube, CO_2.—White, nearly equivalent to skylight at 30°-40° elevation.
Ditto, N_2.—Rosy yellow or pink.
Mercury arc, low voltage.—Intense greenish blue; no red rays.
Ditto, high voltage (quartz).—Violet blue when first struck; intense yellow green when running.

and metallic filament glow lamps is typical of the utilisation of substances of very high working temperature,* also fortunately possessed of the property of radiating selectively to a certain limited extent. By "selective" radiation is meant energy radiation in quantities of various wave lengths other than would be radiated by a "black" body under similar circumstances: what is required in incandescent lamps is a selective radiator which will, at a certain temperature, radiate a greater percentage of luminous energy than is accounted for solely by its temperature (taking a "black-body" as standard). Though "cold" radiation is, at present, inapplicable to commercial high-C.P. lamps, we may yet, by aid of selective radiation, approach efficiencies otherwise unattainable.

When it is remembered that a black body at about 12,000° F. (6,700° C.) would radiate only 50 per cent. of its total energy as light, and that the theoretical mechanical equivalent of luminous radiations is about 0·08 watt per C.P. (3·34 ft.-lb. per min. per C.P.), it will be seen how limited is the efficiency which can be attained by any incandescent source of light and how far even the best of modern lamps falls short of the efficiency theoretically obtainable (see Table I).

Rating of Lamps.—The "rating" of lamps—the denomination by which their capacity, and hence their illuminating and commercial value shall be judged—is not a particularly difficult problem in the case of electric lamps other than arcs. "Old-fashioned" lamps (flame lamps, &c.) were, and are, seldom given any particular rating, but their performance is tolerably uniform† whatever the make of lamp, and is so familiar, in a rough way, that no precise rating is necessary. When electric glow lamps and improved gas burners began to be placed upon the market, however, the necessity was felt for devising a definite rating system, if only to enable a graphic description of the merits of the new forms of lamp.

Gas burners and mantles are usually rated by the candle-power they yield when new and consuming so many cb. ft. of gas per hour: such a rating is of fairly permanent value in the case of gas burners, but (as shown later) gas mantles undergo a rapid deterioration which necessitates a liberal reduction from the nominal rating in order to determine the mean useful C.P. during the life of the mantle. Similarly, the rating applied to glow lamps of various types is based upon their C.P. when new and operated upon the supply voltage for which they were designed. In the case of carbon-filament lamps, the deterioration in candle-power, which occurs before the "smashing" point is reached (see later), may be 20 per cent., hence the nominal rating again requires correction in order to yield the mean effective candle-power. In the case of metallic-filament lamps the deterioration is much less rapid and less in total amount: hence correction therefor is proportionately less important.

The question at once arises as to how the "rating" C.P. should be determined. In the early days of electric lighting, when simple filaments were common, it was usual to follow out a gas engineering convention by photometring the lamps with the plane of the filament at 45° to the length of the photometer bench. The candle-power thus estimated was a reasonable and sufficient rating basis for those days, but the complex filament shapes now employed, and the greater accuracy of working needed to discriminate between various lamps, call for a more satisfactory and widely applicable rating. Though mean spherical candle-power would be the fairest basis of comparison (as being proportional to the total luminous flux from the lamp), mean horizontal candle-power is usually accepted for glow lamps, mainly because this quantity is readily determined, and with considerable accuracy, by taking readings in a few radial directions in a horizontal central plane through the lamp. Mean hemispherical candle-power is hardly a suitable rating for glow lamps, since these are generally employed in rooms and similar spaces where upward-going light is of very distinc value. If a glow lamp is to be used with an opaque to reflector, or applied to street lighting, M.H.-S.C.P. (as deter mined when completely fitted for service) is, of course, very suitable rating.

The rating of tube lamps presents difficulty only in th great and distributed extent of the luminous area: a mea hemispherical candle-power rating is most convenient fo these lamps as at present utilised, and the candle-power pe foot (taking the average value for a full-sized lamp) is useful basis for estimating purposes.

(To be continued.)

* Carbon melts at a far higher temperature than the metals used in glow lamp manufacture (tantalum, tungsten, &c.), but the latter can be worked at a temperature 200°-400° C. higher than that at which carbon filaments commence to disintegrate.

† At least there is nothing comparable to the vast difference in efficiency which may exist between outwardly identical electric lamps; and differences in the grade of oil used in paraffin lamps, say, are less important than changes in the brand of carbons used in arc lamps.

ELECTRICAL TRADE WITH CANADA.

It is now over three years since this journal dealt at son length with the question of the cultivation of electrical tra with Canada, with special reference to the report made l Mr. Richard Grigg, then Commissioner of the Adviso Committee to the Board of Trade on Commercial Intel gence. Mr. Grigg, who was shortly afterwards appoint British Trade Commissioner to the Dominion of Cana with headquarters at Montreal, has prepared a further repo which dates down to the end of March, 1910, and which also worthy of the careful attention of British exporters. appears from an introductory letter accompanying the rep that the work of the Montreal office is steadily increasi as is indicated by the number of inquiries received a letters dispatched during last year; whilst, at the same tin a growing number of British visitors call at the Co missioner's office, which now has seven correspondents different parts of the Dominion. Many conferences ha occurred with the Governor-General, and numerous intervie with Ministers of the Crown in Ottawa and elsewhere ha also taken place. Experience has confirmed the opini that there exists throughout Canada a keen desire, both patriotic and business grounds, to better understand differ points of view, and to draw closer the bonds of commerc union. Although a marked improvement has occurred the attention given to the Canadian market by British ma facturers, the impression still remains, the Commissio submits, that British knowledge of the Canadian market a appreciation of its great future is much less extensive th in the case of rivals in the United States.

The report, in first proceeding to deal with the econo conditions, considers it desirable to draw prominent att tion to those factors of industrial and trade developme which have assumed importance since the issue of former report, and in this connection emphasis is on the fact that Canada is destined to undergo a gr industrial and financial expansion of a permanent charac owing to the increase in the population, the development transportation facilities, the possession of natural wa courses capable of yielding 25,000,000 H.P., and enormous forest wealth and other resources in the coun These circumstances point to the necessity for the trader broad views and large capacity to look to the future rat than to the present, and the Commissioner has consequen selected those essential facts which are needed for a comprehension of the conditions and prospects of Bri trade in Canada. After referring to the augmentation the population which now exceeds 7,174,000 persons immigration and land settlement and railway transport, report raises the question of the development of power amplification of the information which was given in former report. It is considered that the sources of po supply from the water courses are inexhaustible, amoun to 25,693,000 H.P. of which only 486,887 H.P. is utilise the present time. A statement is given showing the r charged for light and power in various parts of the coun Mr. R. E. Young, secretary of the Canadian Conserva Commission, estimates the consumption of coal for 1 for one year at 21 tons 9 cwt., and on this basis 25,693, H.P. would require 551,134,000 tons of coal for one y The Province of Quebec is specially endowed with w courses, the power and volume of which are unsurpas Ontario, where a greater development of water power

taken place, occupies the second position ; British Columbia ranks third, and the Province of Alberta fourth.

The question of native manufacturers from the standpoint of being competitive with British products is next mentioned, but in the absence of new official statistics it is deemed unnecessary to repeat the information given in the former report. It is, however, considered desirable to draw attention to the progressive consolidation of capital and to the formation of large industrial undertakings by the amalgamation of a number of companies previously on a competitive basis, and it is significant of the present development of manufacturing that capital from the United States is being invested in Canada in a continuously increasing volume, and is recorded at the total of £45,000,000. In connection with the tendency towards combination of manufacturing, reference is made to a Bill passed in 1910 for the investigation of combines and monopolies which may tend to restrict competition. If the results of such an inquiry should indicate that a combine promotes unduly the advantage of the manufacturers or dealers at the expense of the consumer in regard to any article, the import of which is subjected to a Customs duty, the Governor in Council may direct that the article be admitted to Canada free of duty, or at a reduced duty. This new law also provides in similar cases for the revocation of patents issued under the Patents Act, and it likewise stipulates monetary penalties for limiting the facilities for transporting, manufacturing, supplying, storing or dealing in any article which may be the subject of trade. The report proceeds to give tables indicating in some degree the level of wages in certain important classes of labour. Thus, in the case of additions to the Post Office building at Toronto, Ontario, the electricians received 32½ cents per hour, and worked eight hours per day ; and the electrical workers on the Dominion lands building at Lethbridge, Alberta, were paid 37 cents per hour for a nine-hour day. All statistics of current wages are, however, incomplete unless account is taken of the sharp increase which general prices have undergone of late in Canada, and of the enhanced cost of living thereby brought about.

After referring to the commercial convention concluded between Canada and France in February, 1910, the report mentions the termination of the surtax on German goods as a result of the provisional agreement which was entered into on February 15th, 1910. The agreement contemplates at a later date a formal convention for the regulation of commercial relations between Canada and Germany. It is submitted there is little doubt that Germany will recover much of the trade which was lost because of the imposition of the surtax, and trade thus regained will be mainly taken from that at present enjoyed by Great Britain and the United States. It is added that German firms are showing great activity and earnestness in their attempt to re-enter the Canadian market, and that if Germany succeeds in obtaining the benefit of the intermediate tariff, she will prove an extremely formidable competitor, and the utmost efforts would be required on the part of British manufacturers and merchants to maintain their position in the Canadian market. The report also discusses commercial agreements with the United States, but the observations were made before the recent negotiations for a reciprocity agreement took place.

The second part of the report treats of the import trade of Canada, particularly in regard to the keen struggle proceeding between the British and United States competitors for the possession of the trade. At present the honours of the contest are divided, not perhaps evenly, but, at any rate, in such a proportion as to show that the struggle is by no means settled in either direction, and that the balance may be turned to either side by superior efforts and greater efficiency of one competitor or the other. It would appear, in the opinion of the Commissioner, that victory in regard to really competitive goods must ultimately lie with those who best understand the conditions of the country ; who can expand their business to meet the rapidly changing conditions of the Canadian market ; who can foresee the directions in which a forward policy of organisation and advertisement may secure in advance markets of vital importance for the trade of coming years. It is not meant to imply that the promotion of closer trade between Canada and Great Britain must depend solely on the efforts of the British producer, as it is obvious that some responsibility also rests upon the merchants and the general community in the Dominion. At present very strenuous efforts are being made in financial and industrial circles in the United States to control, and, indeed, to dominate not only the trade, but the whole commercial life of Canada. If these efforts are to be combated, the Commissioner states that it cannot be done merely by arousing the British merchant to greater endeavours, but it must depend to some extent on the amount of co-operation afforded him by the importers and consumers in the Dominion.

The report, in proceeding to give an analysis of the existing trade situation, submits that the question of the moment is whether British trade with Canada under existing conditions has increased or declined during the past five years in proportion to that of its great competitor. It is shown in this connection that the augmentation in the total trade of Canada amounted to 93·16 per cent. in the 10 years ended with March, 1910, and an average increase of 32·2 per cent. took place in the five years 1906-10 as compared with the five years preceding. As to the respective positions of the United Kingdom and the United States, a tabular statement indicates that the share of the latter country averaged 58·68 per cent. of the total trade in value in the three years ended with March, 1910, as contrasted with an average of 59·91 per cent. in the years 1905-7, whilst the figures of the share of the United Kingdom in the Canadian import trade were 25·79 per cent. and 24·72 per cent. in the same years respectively. The report, in classifying the Canadian imports, rules British participation out of consideration in regard to (A) natural products and raw materials ; (B) neutral trade, consisting of articles derived from countries other than the United Kingdom and the United States ; (C) special American imports ; and (D) exceptional cases, being articles not manufactured and not on a competitive basis. On the other hand, the only field with which British competitive trade is concerned is said to be class E, consisting of imports, practically all manufactured, and on a more or less competitive basis.

The special American imports included under class C comprise manufactured goods in the case of many of which the United States have an inherent natural advantage, such as carriages and electrical apparatus, or the imports of which depend upon considerations other than those of a purely commercial character ; and by natural advantage are implied the peculiar conditions of manufacture, transport or sale, owing to which British competition is scarcely operative. By way of illustration, the following figures relating to Canadian imports of electrical apparatus are quoted from the report for the years in question, the values being in dollars :—

Canadian Imports of Electrical Apparatus.

	1905-6.	1908-9.	1909-10.
Dutiable	3,513,714	2,073,161	3,528,504
Free	70,540	55,080	162,462
Total	3,584,254	2,128,241	3,690,966
United Kingdom dutiable ...	81,301	91,092	435,312
United Kingdom free ...	111	—	—
United Kingdom total ...	81,412	91,092	435,312
United States dutiable ...	3,391,184	1,937,371	2,998,381
United States free	69,439	54,739	162,460
United States total	3,460,623	1,992,110	3,160,841

Discussing the commodities of competitive trade, it is shown that the United Kingdom participates to the extent of 19·2 per cent. in the Canadian imports of copper in manufactured form, as compared with 77·7 per cent. in the case of the United States. The former with a percentage of 18·5 to 18·7 in iron and steel, holds its own against the United States, with from 77·8 to 78·1 per cent. As proved by a tabular statement of the imports the proportion of the dutiable import trade derived from the United Kingdom, averaged 41·3 per cent. in the five years ended with 1910, whilst that of the United States averaged 44·1 per cent. in the same period. The share of the United States in the free importation of competitive goods is larger, but even in this case the United Kingdom is not only holding its own, but has also increased its percentage from 12·6 per cent. in 1905-6, to 22·1 per cent. in 1909-10, whereas that of the United States declined from 79·5 per cent. in 1905-6, to 68·6 per cent. in 1909-10.

The general conclusions arrived at by the Commissioner from the tabular statement are that the United States

enjoy a preponderant share of the total of the Canadian import trade, and that the share is not appreciably declining, having averaged 59·07 per cent. in the five years 1901-5, and 59 per cent. in the five years ended with 1910. But if from the general field of importation there are eliminated all those different articles which can hardly be said to be on a competitive basis, a different result is found. The British share of the actual competitive trade has stood during the past five years at from 35·8 to 38 per cent., and shows no sign of declining, whilst in the competitive trade liable to import duties the British share in the five years is larger, and runs from 40·7 to 41·4 per cent., and seems to be increasing; the preferential tariff being a contributory factor to this result. Where various lines of British goods are not holding their position against American products, it is due to the failure to adapt them specially for the Canadian market, and to push the sale by those energetic methods of advertisement and personal contact in which certain rivals of Great Britain excel. But with a somewhat closer attention to methods of sale and to the particular requirements of the market, there is no reason why British traders should not share the field at least in equal proportions with the Americans.

The whole position of British trade, the report emphasises in several places, is intimately dependent upon shipping facilities. No amount of preferential duty and no alacrity on the part of British merchants can avail to hold the Canadian market if the conditions and cost of shipment are such as to militate against the supply of the market from overseas. It is, therefore, necessary for all who are interested on both sides of the Atlantic in the maintenance and extension of British trade to see that ocean freight rates are kept at a point which will not imperil the future importation of British goods. As to the difficulty of allocating classes of trade under special headings, the report cites electrical apparatus by way of illustration. The Canadian tariff imposes a duty of 27½ per cent. upon American goods of this class, as compared with 15 per cent. upon British electrical apparatus. Yet the average dutiable imports from the United States in the five years, 1906-10, amounted to $2,730,540, as against $151,297 from Great Britain, or about 5·15 per cent. of the joint trade. With such a preponderance of imports it does not appear possible at present to treat this class of goods as consisting of articles of competitive trade, and electrical apparatus has consequently been placed in Class C, or special American imports.

The question of the investment of capital in Canada next receives consideration. It is assumed that in the present struggle between British and American competitors for the Canadian market, the relative investment of capital from either country must count for much, but a great difference exists in the matter. American capital has been more particularly directed into enterprises such as are connected with the import trade of the country. On the other hand, the purchase of Government securities and municipal bonds, and even the bonds and shares of the Canadian railways—the forms which British investment has hitherto principally taken—operates less directly and immediately to stimulate trade than the investment of capital over a wide range of industrial concerns, together with the establishment of branch factories and agencies, which is the form of American interest in the development of Canada. It is calculated that the industrial investments of the United States in Canada amount to $226,800,000, and the electrical machinery works established by Americans in that country are those of the Canadian Westinghouse Co., the Packard Electric Co. and Conduits, Ltd. On the other hand, British capital investments in Canada during the five years ended with 1909 reached $605,453,000, but only a relatively small part of it had been placed in industrial enterprises. In addition, the Canadian public flotations in London during the past five years have included the British Columbia Electric Railroad Co., with a capital of £1,285,000: the Winnipeg Electric Railway Co., with a capital of £300,000; the Canadian General Electric Co., £620,000; the Electrical Development of Canada, £500,000; the Kamanistiquia Power Co., £265,000; the Montreal Light, Heat and Power Co., £710,000; the Shawinigan Water and Power Co., £700,000; the Toronto Power Co., £500,000; West Kootenay Power and Light Co., £240,000; Montreal Water and Power Co., and the Northern Light, Power and Coal Co., £111,522. The total of all the Canadian flotations in London in the five years is £98,983,000.

The removal of the surtax upon goods entering Canada from Germany, the report states, creates a new situation. It is very difficult to say to what extent it will injure the position now occupied by the United Kingdom in the Canadian market. In a great many lines of goods British manufacturers will undoubtedly be able to make more favourable prices than any German competitors would be able to do; but this is not the case over the whole range of imports, and it is considered probable that a certain loss of trade will be inevitable. At any rate, the abolition of the tax will call for renewed vigilance on the part of British traders, and will make it more than ever necessary for them to adapt their goods as closely as possible to the special requirements of the Canadian customer. The report again refers to the question of freight rates, and quotes figures showing that increases have taken place since 1907. It is thought that the rise in freight rates threatens to reach a point which, in the opinion of many well-informed people in Canadian circles, may affect the benefits accruing to British traders from the preferential tariff.

The third part of the report gives a survey of particular branches of trade. As far as mining machinery is concerned, it is held that the identity of mining conditions in the United States and Canada affords to American makers an advantage over British, especially owing to the relatively short distance over which goods sent in from the Western States have to be transported to western parts of Canada. A large quantity of hauling engines, mill engines, winding engines, boilers, &c., is made in Canada, whilst pumps, wrought-iron pipes and rails are brought in from the United States, where the large home consumption renders it possible for dealers to offer a great variety of choice at very favourable prices. In British Columbia the United States have a specially strong hold on the market for mining supplies in consequence of the facility of transportation and the ease of business communication at such a short distance from the western basis of American supply.

It is not likely that any considerable part of this trade can be diverted into British channels without special efforts in the way of despatching travellers, establishing agencies and maintaining a sufficiently large stock on the spot to be able to deal with all questions of breakdowns and repairs without undue delay. This point was emphasised by Mr. C. Pepper in a United States Consular report, who submits that the chief reason for American firms being so successful, both in the east and west of Canada, lies in the keeping of large stocks in all the principal distributing centres, and in having competent and well-informed travellers constantly on the road. For instance, two large American firms in the machinery trade have agents with large stocks at Vancouver, Winnipeg, Nelson and Montreal, with travellers frequently visiting these points.

The British Trade Commissioner, in conclusion, adds that a large and growing business awaits those English houses which will show sufficient enterprise to adopt the methods suited to the needs of the country, methods which in many instances may be totally different from those to which they have been accustomed.

Coronation Festivities at Shanghai.—Electricity seems to have had a very large part to play in the enthusiastic Coronation rejoicings at Shanghai. On the night of June 22nd, the maximum load on the municipal generating station, including traction, was 4,200 KW., or, say, 5,600 H.P. The normal load during the month of June this year, was about 2,820 KW., so that it will be seen what a very largely increased demand the station had to meet. For temporary illumination the equivalent of 36,654 30-watt lamps were connected. To provide for this extra number of lamps, the bulk of which were connected on the Bund and vicinity, 5·4 miles of cable were used by the electricity department. Additional transformer capacity was provided in temporary sub-stations to the extent of 668 KW. The units generated on June 22nd were 34,728, as against a daily average of 22,000 during the rest of the month. Lighting and power accounted for 24,139 and traction for 10,589. It is impossible to say how many additional units were sold for lighting, as some of the temporary lamps were fed through consumers' house meters. For those temporary installations where special meters were installed, the extra units registered totalled 8,950. All the plant in the station was working with the exception of the two Howden-Siemens turbo-alternators which are not yet in commission, and some of the machines were carrying substantial overloads.

THE PLUMBED JOINT AND BONDING.

By WALTER E. ROGERS, A.M.I.E.E

Considering how the advantage of the plumbed joint for lead-covered street mains is appreciated in many quarters, and that it has recently been very much in evidence in connection with high-tension work, it is a matter of surprise to find that it is not universally adopted for all underground lead-covered cable joints.

Why should the cast-iron box still be found on many of the smaller low-tension networks? I am inclined to think that the real reason why some undertakings continue to use cast-iron is the fact that plumbing does not form part of our usual Technical College course, and beyond knowing how to sweat a thimble on to a copper conductor, the average station or mains man has a very vague notion as to how to wipe a joint in lead. Those wishing to learn the process, should commence wiping practice joints with the aid of a blow lamp, and when proficiency has been gained with the lamp, discard it and try without. The metal, or plumber's metal, as it is called by the man who comes in the winter to repair your burst water pipes, consists of, roughly, two parts lead and one tin, rosin being stirred in as the metal melts.

Each individual plumber prefers some slight variation from his neighbour, and one man will do good work with metal which his neighbour will say is too fine or too coarse, fine meaning too much tin, whilst too coarse means the opposite or too much lead.

When lead sleeves plumbed over the insulated joint were first introduced, the plumber-jointer did not exist. When the jointer had finished the electrical side of the job the man of burst-water pipe fame was sent for to plumb the sleeve. If the sleeve had been slipped on over the cable before the joint was made, the plumber had to draw the sleeve into position, and dress down the ends, *i.e.*, hammer down the ends of the sleeve with a piece of wood, called a dresser, till each end formed a sloping cone to the surface of the cable sheath. He would then apply with a brush the plumber's soil or black, which consists of lamp-black glue, a little size, and sufficient water to make the mixture suitable for application with a brush when warm. This soil or smudge should be applied to all surfaces where it is desired that the plumbing metal should not adhere. With a shavehook, the lead of the sleeve and the lead of the cable sheath to which it is desired to plumb should be clean scraped, each stroke of the shavehook covering or lapping the previous stroke, the sleeve being held in position by a light portable plumber's pipe vice.

Our friend then proceeded exactly as he was in the habit of doing with a water pipe, the finished joint appearing with a large swelling at each end. The sleeve was water-tight, and what a plumber would call a good sound job.

Not so the electrical man who had had experience of this bulky work. The tendency with the plumber, pure and simple, is almost invariably to use more metal than is necessary, and unless the finished joint is handled as gently as you would a gas mantle, the lead of the cable will part or crack just where the plumbing finishes off on to the cable sheath. On contract work, where all is rush and hurry and "do it cheap," one has little time to put a highly-skilled, velvet-fingered man into each joint pit to cleat the cables up. Frequently these same joints are left to take care of themselves once they have passed the specified test, and in later days many joints have had to be remade owing to lead ruptures when attempting to straighten things out a bit. This applies more particularly to small joints, such as pilot cables, &c., but it is present in all purely plumber-made joints. I have known a joint on a ·2 sq. in. single conductor cable break down, owing to its own weight, some 10 years after it was made.

Traffic vibration naturally assists the above action; therefore, dispense with the borrowed man and train your own plumber-jointer on the following lines: Use light lead soil pipe for your sleeves, say about 4 or 5 lb. lead. As the only object in a sleeve is to provide a watertight case over an insulated joint, there is no object in using heavy lead, as the extra mechanical protection secured by thick lead is not appreciable, and so not worth considering. In fact, there is no object in using lead thicker than the normal sheath thickness of the cable.

The plumbing metal as obtained from the ordinary dealers in various parts of this country differs greatly, for which reason I recommend every man to mix his own; he will then speedily come out as an efficient plumber, and be able to rectify such metal as comes into his hands, and will, in a little while, gain such dexterity as to be quite independent of bought metal:—Melt in a metal pot some 2 lb. of ordinary solder, as procured from any ordinary firm of local repute; add to this when molten, say, a $\frac{1}{4}$ lb. or $\frac{1}{2}$ lb. of lead stripped from scrap cable; add rosin freely, and stir with a piece of dry wood as the metal runs. When nicely fluid take a small previously heated ladle full of the metal, and pour some of it on to the dry pavement or floor. As the metal sets, small stars or spots, blurred as to outline, or sometimes fairly clear, appear on the surface; these same stars or specks also appear brighter than the remainder of the surface, and indicate the presence of tin. When holding the cold metal obliquely to the eye, the surface will appear somewhat mottled. Nothing but practice will tell you whether the metal is too fine or too coarse. But very roughly, if the mottling or starring of the surface is as regular as the currants in an ordinary bun, the metal is near enough for practical purposes. Now run your metal into sticks or bars roughly resembling sticks of tinman's solder as usually bought.

Turning now to the cloths for wiping joints, these should be several in number, varying in size from, say, 2 in. × 4 in. to 4 in. × 6 in., according to the dexterity of the operator, and four to six thicknesses of moleskin—not the skin of the mole, but the cloth known as moleskin. Into these moleskin pads or cloths, as they are called, rub tallow whilst the cloth is hot. When not in use, these same cloths should be kept in a more or less dust-proof tin box, and they should always be warmed and suppled before one commences operations. Sewn seams should be avoided on the working surface of the cloth.

When we have gained sufficient experience to know that the metal is about right, but it is found that the metal hangs or shows a tendency to stick to the cloth, probably too much tin is present, and often a little chalk rubbed on the cloth surface will remedy the trouble. When the sleeve and cable have been scraped clean, as already described, with the aid of a blow lamp melt some of the plumbing metal on to one end of the sleeve at the point where it is desired to wipe the joint, then with the blow lamp in one hand, and the cloth in the other, proceed to work the metal round the joint, adding more metal as you go.

A good way of applying the smudge is first to clean the surfaces to be plumbed; then take a clean piece of linen tape about 1 in. broad, and lap it once round the part to which one wishes the metal to take. Holding this tape with one hand, whilst with the other you apply the smudge, a clearly defined line is produced where the soil ends and the bright part to be plumbed commences; this indirectly greatly facilitates the plumbing operation, by ensuring a neat finish. Of course, care must be observed not to touch the clean lead with the fingers when applying the tape.

Generally speaking, if the smudge shows a tendency to blister or flake when heated, too much size is present, though greasy matter will produce a similar result. When experience has been gained, nothing but the wiping cloth should be used to finish a joint neatly; no file, rasp, or emery cloth should be used. Having finished wiping, and whilst the plumb is still hot, rub it over with tallow; this produces a very soft finished appearance to a well-made joint. When plumbing lead, tallow is the only flux used.

Having now presumably finished our plumb, the next thing is to fill the sleeve with some form of insulating compound, the electrical portion having previously been insulated with tape, paper, or mica, or any combination of these materials. Two straight cuts are made longitudinally in the top of the sleeve at each end, just clear of the plumbing, but approximately above the points of least diameter of the insulated electrical joint. Depress one side

and raise the other of each cut so as to form a lip or aperture through which, with the aid of a small enamelled iron funnel, to introduce hot filling composition.

Here it may be well to say a little as to filling compounds. When the above type of joint was first introduced, oil, of the resin oil type, was exclusively used for filling, and very good results were obtained for many years. But it must be remembered that oil will take up moisture: also oil does not tend to prevent a joint being crushed to any appreciable extent.

It is now generally admitted that it is better to fill a joint sleeve with a good quality of bituminous compound which sets hard, but becomes sufficiently fluid under the influence of heat, to ensure its running in the sleeve and so filling the interstices of the insulated electrical joint. When cold, this compound affords considerable resistance to any crushing the sleeve may be subjected to, and should the sleeve be at any time punctured, water will not get in and the compound will not get out as readily as oil would. Also, when a navvy stands on a compound-filled joint, it does not so readily crush up as the oil-filled specimen does.

One disadvantage of the compound-filled joint is the fact that as the compound cools from the outside, shrinking takes place, very much as cast-iron behaves in the foundry, *i.e.*, hollow spaces tend to form which, in an absolutely impregnable substance, would be in a state of perfect vacuum. In practice they are filled more or less with air; this matters little or nothing in low-tension work, but is a serious matter on H.T. or E.H.T. joints.

Many engineers still favour oil for filling purposes. When pouring in the oil or compound, the sleeve should be kept warm with the blow-lamp, and preferably the joint should be slightly inclined during the filling process in order to allow the air inside to be displaced as the filling compound runs in. When no more compound can be got into the joint, and bubbles have ceased to appear, the filling cuts should be dressed into their original pre-cut state, and soldered up. One small point in favour of oil as a filling is that, if the plumbing is defective, oil will in time make its appearance at the outer surface of the joint, and personally, I have more than once averted trouble by detecting oil where it should not be. Again, when the now almost universal paper-insulated cable was introduced, frequently the impregnation was of a very elementary character, and the paper would be crying out for more oil, which it would often take from our newly made joint.

Quite recently I came upon a piece of triple-concentric paper-insulated cable. The inner was ordinary seven-strand conductor, the middle was made up of segmental conductors of a beautiful mechanical fit—so much so, indeed, that the intervening paper might well have been utilised for cigarette manufacture.

Turning now to the question of bonding. Every man, however remotely connected with street mains encased in metal in one form or another, knows that the metal covering should be bonded. How many men really consider that their cable sheaths, armouring and troughing should be as electrically continuous as the revenue-earning copper conductor which it surrounds. Yet the object of bonding is to give your lead or armour a good path for carrying current, however objectionable the said current may be. If you do not provide a good path for the steady current it will take such a path as it finds, and in doing so it will corrode, burn and destroy your lead or armour.

There is absolutely nothing to say about bonding in relation to the plumbed joint, as, if properly carried out, it is as near perfection as we are likely to get in this 20th century. Practically all supply authorities, for service connections, use a cast-iron box, either with or without screwed and plumbed glands.

This sounds very nice, and so far as the plumbing goes it is, but the other end is the invention of a very inferior individual to Archimedes. The thread in the cast-iron, into which the gland screws, is frequently painted, to say nothing of the application of red lead and jute, just to make it watertight, and even if initially all that could be desired in so far as Ohm's law applies, time, moisture and temperature variation, to say nothing of vibration, soon destroy its right to the name conductor.

Many boxes I have seen, even on H.T. work, simply have an annular groove at the end of the gland attached to the box, which groove fits into a reverse groove in the box casting, the compound with which the box is filled actually forming an insulating film between box and gland. The commonest of all types of box, either disconnecting or service, is equipped with wood bushes, either impregnated with some form of creosote, or boiled in paraffin wax. If the bushes are of fairly hard wood, so far as they are concerned, the above treatment appears fairly efficient, but as nothing lasts for ever, and these same bushes are in contact with the lead sheath, and possibly armouring as well, moisture and the atmosphere always being present, shall we not in time find our lead, &c., being acted upon by vegetable acids and salts as decomposition takes place?

Split unglazed porcelain or earthenware bushes, designed as a slack fit, and previously plunged into hot or liquid compound will, I believe, ultimately be universally used. The object of the plunging in molten compound is to thicken up the otherwise too small half bush, with a non-corrosive, yet pliable insulation, roughly analagous to the Stamford joint on the Sykes conduits of the Albion Clay Co.

Some makers of boxes, fix in the box, adjacent to the sealing glands, a piece of copper tape, which is efficiently screwed to the box, but has to be soldered to the cable sheath on the site. As this is the last operation prior to filling up with compound, can one wonder that the necessary soldering is frequently skimped. Compound will cover a multitude of sins.

Some engineers will not use the copper tape as above noted, and prefer to bond externally with copper wire, coupling up each lead sheath and armour with the box. In principle this is right, but as carried out in practice it usually combines all the bad faults of any and all methods of bonding.

To begin with, my brethren, who have not had the fortune or misfortune to burn their fingers with molten solder. To the practiced hand, nothing is easier than to do soldering such as is required for mains work, so that to the eyes of all but the soundest practical men everything appears good and sound, whereas not a single joint has really taken. So with the copper wire bonding, where solder is generally melted either with a copper bit or a blow lamp, and is allowed to do little more than flash on to the part which should be lasting in soundness as regards continuity. I know a whole town bonded on the above lines, and the first time the man who knows a sound job gets into a joint-pit and pulls at the bonding wire it will come away in his hands, showing below it evident signs of corrosion, and sometimes actually melted lead sheath.

Lead strip, cut from sheet lead and doubled where necessary, is the only suitable material for bonding lead cables. Lap it once round each lead sheath external to the cast-iron box, and do not do any amateur soldering, but honestly plumb it or wipe it on to each cable sheath, so that it makes a jumper, or completely bridges the service-box. Join one of the bolts of the cast-iron box to one or two bare copper wires: the opposite ends of the said copper wires being taken to and plumbed or wiped in with one of the bonding joints proper. Of course, care must be taken to ensure the lead bonding tape having sufficient sectional area to enable it to carry any current it may be called upon to deal with, as I have known cases where the fall of a live wire on the local tramways has caused the bonding strip to blow as if it were a fuse.

When L.T. cables are armoured, the armouring generally takes the form of steel tape, and this should be electrically continuous throughout, like the lead sheath. What is widely admitted to be a very efficient method of bonding the above type of armouring, consists of unlapping sufficient of the steel tape each side of a joint or service box, so that opposite lengths of cable armour may be lapped, punched or drilled, and a small bolt used to hold all together; then the surfaces, having been previously rendered scrupulously clean and preferably tinned, the whole should be sweated or soldered up solid.

Painting exposed armouring at jointing or bonding points with hot compound will be found advantageous, as in a great measure preventing the corrosion and destruction of that portion of the armouring which has been unlapped from the cable, in order to secure a sufficient length for bonding. Wire-armoured cable, such as is frequently employed on H.

cables, should be bonded by a special clip, as shown in fig. 1, which is a part section through a joint on an armoured cable of the above description, which has proved very satisfactory in practice.

The flanged cones A, A are of cast-iron, split in a horizontal plane, the two halves of the cones forming a butt joint similar to the butt of the brasses in a high-speed engine cross-head. The provision of, or rather the use of, a butt joint ensures that as the outer flanges B, B are pulled up, the cones A, A do not pinch the lead cable sleeve or sheath.

The upper part of the figure shows opposite bonding clip cones connected by means of a wrought-iron side rod; whereas the lower half of the figure shows the flanges held together by bolts, the whole being electrically connected by a copper bond, either flexible or solid. I have used a piece of trolley wire before now, the ends of which were hammered out flat and drilled prior to use. If wrought-iron side rods

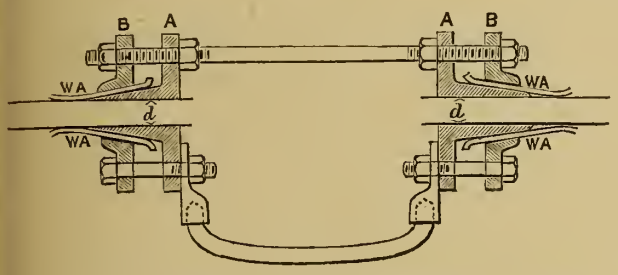


Fig. 1.—Special Bonding for Wire Armoured Cable.

are used, at least two must be employed, and preferably three or more; these rods should have as large a diameter as possible, consistent with bridging the intervening lead sleeve, which is not shown in the figure; ½ in. rods are the smallest that should be used. Flanges A, A should be notched or toothed to receive the side rods, whilst flanges B, B must have drilled holes, and these same flanges should be slipped over the cable before the joint is made. For B B flanges I have frequently employed ordinary gas flanges, the thread having been removed in a lathe and a cone formed where the thread was obliterated. The whole of the bonding fittings should finally be thickly coated with hot compound. The above method of bonding will be found infinitely superior and more lasting than any form of saddle clip arrangement.

INSULATION OF GAS-ENGINE DRIVEN GENERATOR WINDINGS.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

With the increasing application of gas-engine driven generators, insulation troubles peculiar to these machines are receiving more and more attention. That such troubles are still experienced is due mainly to an entire misconception of the root cause of the failures.

The opinion generally held is that the chemically active fumes from the gas engine attack the insulating materials on the windings and destroy their protective value, and this has led to the extended use of special acid-resisting varnishes on all exposed portions of the windings.

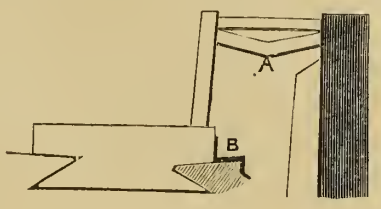
From the fact that practically all the troubles experienced occur on direct-current machines, it is clear that other factors have to be taken into account.

A number of insulation failures on gas-engine driven machines have been investigated by the writers. While in some instances the insulating coverings, particularly the varnished surfaces, have been attacked to a slight extent, no cases of breakdown traceable to this cause were found.

Trouble is first indicated by a gradual reduction of insulation resistance. Finally the windings become grounded, due to surface creepage and burning. This invariably occurs on the commutator end of the windings and can be traced to the formation of a conducting surface from the commutator to "ground." The surface creepage usually takes place from the commutator necks across the under side of the insulated ends of the coils to the armature iron, though occasionally "grounding" may occur over the commutator bushing. The two paths are shown at A and B respectively in the figure below.

If the trouble is taken in hand in time, a thorough cleaning of the surfaces affected is sufficient to restore them to their original condition, as shown by a high insulation-resistance measurement.

In an actual case, the insulation resistance of an armature, taken over a period of three months only, fell from 10 megohms to less than 0·1 megohm. In the latter condition a voltage of 250 applied directly between the windings and the armature iron was sufficient to cause a leakage and burning across the taped ends of the windings for a distance of 8 in., which, under normal conditions, would be



good for thousands of volts. That this deterioration was due solely to the accumulation of conducting deposits, and not to chemical action on the insulation, was shown by the fact that merely cleaning the surfaces was sufficient to restore the insulation to its normal condition. An insulation resistance was then obtained in excess of 10 megohms, and a pressure test of 2,000 volts was applied without causing any creepage.

The conducting deposit is formed by the action of fumes on the wearing surface of the commutator, the sulphide or other salt formed being worn off by the brushes, and, together with carbon dust, carried by windage on to the surfaces already referred to.

Failure may be prevented by frequent cleaning, the insulation resistance of the winding not being allowed to drop below a certain minimum figure. Usually, however, the affected surfaces are very difficult to get at, and the cleaning becomes an expensive and tedious undertaking. The difficulty of cleaning is frequently increased by the presence of an oil film, which causes the deposit to adhere to the insulation, and renders an air-blast practically useless.

Attempts have been made to obviate the trouble due to this deposit by heavily varnishing the commutator necks and also the armature iron, this being done in the case of small armatures by completely immersing them in varnish. In service, however, the expansion and contraction is sufficient to crack the varnish film just where the protective value is most needed, *i.e.*, where the coils leave the slots.

A drastic, but efficient, remedy is to completely house in the generator and provide a pure air supply. This, however, is expensive and cannot always be arranged. It therefore becomes necessary to prevent the deposit having access to the windings. This can be done by entirely enclosing the windings at the commutator end, or by so designing the armature as to create a draught from the rear end of the machine. The first of these alternatives has the great disadvantage of destroying ventilation, and for this reason is comparatively seldom adopted on large units.

Another remedy which has proved eminently satisfactory in practice is to break up the exposed under surfaces of the winding by means of insulating barriers so arranged as to prevent the formation of an unbroken layer of conducting deposit.

In all cases it is desirable thoroughly to fill the insulating tapings and provide a smooth glossy surface so as to afford as little lodgment for dirt as possible. Other than in this respect it is not necessary to use any special kind of insulation on gas-engine driven generators.

While the trouble is mainly confined to armatures, field coils are also sometimes affected where surfaces are depended upon to any large extent for insulation.

Troubles such as the above are by no means confined to gas-engine driven generators, but are likely to occur on machines subject to any chemically active fumes such as those met with in alkali works or in the vicinity of gas-producer plants.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

Purchase of Fuel.

A DISCUSSION on this subject was initiated by MR. C. E. C. SHAWFIELD (Wolverhampton), who pointed out the increasing importance of fuel costs, with the rapid improvement in generating methods. A determining factor in fuel purchase was the relative situation of the plant and coalfield. It did not pay to buy coal of less than 13,000 to 14,000 B.TH.U. calorific value if the plant was far from the coalfield. Another factor was the class of furnace and stoking apparatus; mechanically-fired boilers could use inferior fuel, as the loss of combustible contents in cleaning was of small value. The percentage of incombustible contents in coal was important; the effect of the ash and clinker was much more serious than moisture, as drawing red hot clinker meant an entire waste of heat, while steam gave up some of its heat to the boiler. As regards washed and unwashed fuel, as the result of experiments carried out, he found that 1 lb. of unwashed pit bank sludge had a calorific value of 9,500 B.TH.U.; the moisture content was 5 per cent. and the ash content 28 per cent., while the price including carriage was 4s. 5d. per ton. Allowing for heat lost, ash and clinker, the commercial calorific value was 290,000 B.TH.U. per 1d. The same fuel when washed showed a calorific value of 11,700 B.TH.U. per lb. of fuel, with moisture 13 per cent. and 11 per cent. of ash. The cost was 5s. 6d. per ton, and the commercial calorific value came to 350,000 B.TH.U. per 1d., showing an appreciable gain in the latter case. A South Staffordshire pit used a simple washing apparatus consisting of a wooden trough, 12 in. deep and 12 in. wide, and from 50 to 100 yds. long, set at a gradient of 1 in 30. The fuel was fed in with water and the shale was deposited in the first 30 yds.; afterwards came comparatively clean fuel, the best being at the lower end. The fireclay was carried away in suspension. The trouble was that this fuel often contained 25 per cent. of moisture when delivered. In the Midlands he thought it best to purchase direct from the colliery, and this ensured a fairly regular grade of fuel. The practice of making a contract for a definite quantity, rather than for a fixed time, seemed much the best. It was difficult to purchase fuel on a heat unit basis through agents, but a contract could be entered into based on the net commercial value of fuel as it left the pit; something similar was done by the L.C.C. tramway authorities, who, however, based their contracts on coal as delivered. In Wolverhampton they took regular daily tests of fuel delivered; the apparatus originally cost about £10, and there was a yearly cost of some £25, but it had certainly saved them £500 a year in running costs.

MR. R. A. CHATTOCK (Birmingham) said that those stations near pits had to get their coal from the latter. He didn't entirely agree that ash heat was all lost, and it might be that unwashed coal was better than washed. With washed coal there was a good deal of moisture which tended to corrode economiser tubes. When placing a large contract he found it better to deal through an agent; the price was generally lower, as the agent could purchase on better terms and from a wide range of pits. While he quite agreed as to the value of the calorific basis, it was not the only factor to be considered, as fuels of similar calorific value gave varying results under the boiler. At Birmingham there was a testing department, and both laboratory and boiler tests were carried on continuously. It was a rule to test two ordinary boat loads and one "trial" boat load of coal each week, and they now had complete information of 130 different classes of coal in the Birmingham district, and, as a result, had reduced the average cost of fuel from 8s. to 6s. 10d. per ton, and decreased the ash content as well. The cost per unit for fuel had dropped in three years from ·18d. to ·14d., a decrease of 22 per cent. The average thermal efficiency of the boiler house plant over 24 hours was 65 per cent. The total cost of the coal burnt last year was £23,500, and the cost of the testing department came to 1·7 per cent. of that amount. In conclusion, he pointed out the necessity of obtaining coal suitable for the local conditions, and urged that for this purpose a system of testing was preferable to purchasing on the calorific basis.

MR. FRANK NEWINGTON (Edinburgh) said he found no advantage in cost when purchasing dry fuel, and unless everybody bought on the calorific basis, there would be no gain in that, as the price would be raised to those who did. In Scotland it was usual to deal through agents, and this was an advantage in case of a strike. Calorimeter tests were not reliable, and the boiler house test was better.

BAILIE WILLOCK—speaking both as a coal agent and coal master, "anything to make money," as he put it—urged that it was better to deal through an agent, whose knowledge of the business was of value in case of strikes, &c.

MR. FRANK AYTON (Ipswich) said he found that opinion on the London Coal Exchange was unfavourable to purchase on a calorific basis, as the handling of the fuel and variations in seams were beyond the merchants' control; so the merchant added a margin for contingencies, and the price went up. The colliery owner wouldn't bother about any new system as long as he could sell coal as it was raised. On the subject of coal specifications, an interesting contrast was shown by the L.C.C. Tramways Department and the Underground Railway Co., each of whom purchased about 150,000 tons per annum. The former had a specification covering 11 pages, and the latter one of 159 words on half a sheet of foolscap. At Greenwich they certainly sampled coal, but by the time it was fully tested according to specification, the shipload was half consumed. The Underground Railway engineers at Lot's Road had discarded the calorimeter in favour of the Berthier test, which took only 20 minutes, and could be carried out before the coal was unloaded from the barge. The Berthier test, to which we refer in our leader this week, is as follows: Weigh out 1 gramme of finely powdered dry coal. Mix this with about 60 grammes of lead oxide (litharge (PbO) free from silver). Also mix, say, 15 to 20 grammes of glass powder (coarse). Put this in a Battersea clay crucible, and cover with a layer (tablespoonful) of common salt, and heat in a forge fire or otherwise for about 20 minutes at a bright red. When cold, break crucible and extract the lead button from the bottom, clean off slag, then weigh and multiply its weight in grammes by 483. This will give the calorific value of the coal in British thermal units per lb. The constant 483 is worked out from the atomic weights and calorific values of the various constituents of the coal. The speaker considered that it was necessary to test continuously, and found it best in his case to purchase through London firms.

MR. H. FARADAY PROCTOR (Bristol) said some years ago he was unable to get any South Wales or Bristol coal owner to tender on the basis of calorific value.

MR. E. E. HOADLEY (Maidstone) gave his experience a few years ago, when he sent selected samples from barge loads of coal to three laboratories, and the results from the same kind of coal differed widely; also the same calorific value fuels gave varying results under the boiler. After a year's experience he gave up the idea of purchasing on a heat unit basis, and now bought on the result of boiler house tests, of which records were kept.

The PRESIDENT (Mr. John Christie) said it was the practice to test each shipload of coal received at Brighton, and to watch its performance under the boilers.

MR. SHAWFIELD, who replied briefly, admitted the influence of the tester on individual results, but considered that with the same tester the results would be comparable.

Street and Shop Front Lighting.

MR. A. H. SEABROOK (Marylebone), who opened a discussion on the above, dealt with the latter part of the subject, and particularly with the competition of high-pressure gas lighting. At West Ham an inclusive hiring charge of £2 1s. per quarter per 500-watt arc was charged, and this paid after two years, but the gas company had now introduced a competitive scheme. He found that in the adjoining area of East Ham, where a lower price was charged than in West Ham, numerous high-pressure gas lamps had been introduced, while in the latter area, the gas lamps were, if anything, being displaced. As the same gas company supplied both areas, he came to the conclusion that West Ham's advantage was derived from its business-getting department, and that price was not the all-important factor. In Marylebone, higher charges were necessary, and at 3½d. per unit it was possible to supply four 1,000-C.P. direct-current arcs for £30 per annum (900 hours). The gas company charged 25s. to 30s. per quarter for a 1,000-C.P. gas lamp. A new 4½-ampere flame arc now on the market could be supplied at an inclusive charge for energy, trimming, &c., of £5 per lamp per annum (900 hours), and gave 1,200 C.P. In conclusion, he said he had no sympathy with the idea of co-operation between the electrical and gas interests. The gas industry was much better organised, and the electrical industry could not afford to give them an inch in any way.

MR. HAYDON HARRISON, dealing with the question of street lighting, said he had come to the conclusion that, given an equal start, electric lighting would be less costly than gas lighting, but the conditions were that gas lighting had to be displaced, on which practically all the capital charges had been paid off. The electrical suppliers, on the other hand, had had great obstacles to contend with: in some cases they had not been allowed to borrow for street lighting, and in others a period of only five years was allowed for repayment of loans; but despite the high capital charges, it was possible to compete with gas. If the ordinary loan periods were allowed, it would be possible to give 50 per cent. more illumination for the same price. He pointed out that only 70 arc lamps had been removed in Westminster, and half that borough was still electrically lighted, the other half remaining gas lighted as before. This small turnover to gas (due to special reasons recorded in our pages at the time) provided the gas people with a great advertisement, and the electrical suppliers decided that this should not occur again, and consequently tendered lower than the gas company when the Holborn contract came along. The speaker explained the position at Holborn (full details of which appeared in the ELECTRICAL REVIEW), which led to a joint electric-gas tender being put in, and which, in his opinion, was preferable to a competitive tender at unremunerative rates. The standard specification which was being proposed for street lighting would almost certainly be based on the minimum illumination, and to provide this, the most effective units were between 100 and 500 C.P. The 100-watt tungsten lamp in the old lantern in dark back streets, gave by far the best result. Greater candle-power would be obtained by grouping 100-watt lamps, and an efficiency of 1·5 C.P. per watt was possible. At prices of 1½d. to 1d. per unit, the prices for such lighting were about equal to those for gas, excluding capital charges. He drew attention to the importance of having at least a share of the street lighting, if only for advertisement purposes.

MR. J. R. DICK urged that the use of ordinary gas lanterns for electric lighting was not a good advertisement for electricity; a good distinctive bracket and lantern could be obtained for about 30s. to 35s. He thought the attitude of the Local Government Board to electric street lighting was indefensible, and as regarded short loan periods for such work, he pointed out that some of the Brighton

ittings had been in use 14 or 15 years. He thought the I.M.E.A. should take the matter up with the Local Government Board. The case for automatic switching would be very favourable if a good reliable time-switch, costing 25s. to 30s., were obtainable; at present they were too expensive.

Mr. S. J. Watson (Bury) said he had adopted group lighting, using three 300-c.p. (and some 200-c.p.) metal lamps, spaced 70 yards apart, and he found he was obtaining an illumination equal to that given by modern flame arc lighting. The lamps were on tramway poles and were not affected by vibration; the cost of energy was higher, but the attendance cost less and the burning was more reliable. The fittings were not enclosed in a globe, which appeared unnecessary. He had charged £11 10s. per annum per arc lamp, and was obtaining the same amount for the tungsten groups.

Mr. Alex. Cramb (Croydon) referred to the solid rows of high-pressure gas lamps which had come into use for outside shop lighting in the London suburbs. The installation was all outside the shops, with a gas main under the pavement, and it was all under the control of the Gas Co., which charged about £5 per 1,000 c.p. lamp per annum and took all responsibility. With electric arc lighting the shopkeeper had the trouble of trimming, &c., and he was naturally glad to be free of it. If the electrical people would offer inclusive terms and take over the maintenance, trimming, &c., from the shopkeeper, the latter would prefer electric lighting, and even pay more for it. The gas people were doing high-pressure shop lighting at cut prices, but if the electric supplier could run outside shop lighting with street lighting, and cut out all intermediate costs, it would be quite possible to compete. He thought powers should be obtained for such work.

Mr. A. J. Cridge (Electrical Co.) (communicated) said Mr. Haydn Harrison had mentioned combination between the rival illuminating authorities; he (Mr. Cridge) thought they ought to take all straightforward methods of making money, and if reasonable combination was a means to this end, then let them reasonably combine. He wished to emphasise the usefulness of a business-getting department. The value of its missionary work was enormous. The Gas Publicity Committee was new, and he thought that if they had men in the gas industry who made the serious and well-sustained effort which some of the electric supply undertakings did, the gas people would go forward much more rapidly than they did. He advised electrical men to take in a gas paper and read it carefully week by week, as a means of bringing them to a wholesome state of humility.

CONFIDENCE BETWEEN MASTER AND SERVANT.

[BY A LEGAL CONTRIBUTOR.]

In every business implicit confidence between master and servant is of the first importance. Sometimes the written terms of employment are such that the rights of the master and duties of the servant are set out in express terms, but it is more often the case that there is no written contract, and when trouble arises both parties are at a loss to know what are their exact rights.

It is proposed in the present article to consider the legal principles which are applicable in a case where there is no express contract.

A long series of cases has established that where a relation exists between two parties which involves the performance of certain duties by one of them, and the payment of reward to him by the other, the law will imply, or the jury may infer, a promise by each party to do what is to be done by him. It follows from this that a court of law will look not only to the contract or agreement itself, but to everything which is implied in such a contract.

It is generally understood that if a man undertakes to work for another, he will devote his whole time and energy, not to further his own interests, but for the benefit of his employer. The law will apparently interpret every contract in accordance with this doctrine. But it goes further, and will restrain a servant who has been discharged, or whose term has otherwise come to an end, from taking advantage of information which he may have unlawfully acquired in the time when his whole energies should have been devoted to his employer. It may be of use to refer to one or two cases in which these principles have been recognised. In the case of Robb *v.* Green ((1895) 2 Q.B., I), the defendant, being employed by the plaintiff as manager of his business, secretly copied from his master's order-book a list of the customers, with the intention of using it for the purpose of soliciting orders from them after he had left the plaintiff's service and set up a similar business on his own account. Subsequently, his service with the plaintiff having terminated, he did so use the list. It was decided that it was an implied term of the contract of service that the defendant would not use, to the detriment of the plaintiff, information to which he had access in the course of the service, and therefore that the defendant was liable in damages for any loss caused to the plaintiff by reason of the breach of the term.

It must not be inferred from the decision in this case that a clerk or workman is not allowed to enter into competition with his master after the end of the service. What the law strikes at is the unlawful use of information acquired during the term of service. If there was an implied term in every contract of service that the servant when discharged should not compete with his master, restrictive covenants would be quite unnecessary.

That this is the true state of the law appears from a closer study of the case, for in the course of his judgment Mr. Justice Hawkins said:—"It is good law that a servant having left his master may, unless restrained by contract, lawfully set up in the same line of business as his late master, and in the same locality; and that he may without fear of legal consequences, canvass for the custom of his late master's customers, whose names and addresses he has learned *bona fide* accidentally during the period of his service. . . . But here we are dealing with a flagrant breach of trust during service, with intent to reap the advantage contemplated afterwards. In such a case, too, it seems to me that the fraud in service with intent to use afterwards, and the use afterwards, are both discountenanced by the law. The breach of confidence in service can hardly be said to be a duty of imperfect obligation, for, as I pointed out upon authority, the law will imply a promise to perform it; and the utilisation of the fraud cannot be legalised by the fact that, though that utilisation was contemplated when the fraud was committed, the relation of master and servant had terminated before it was carried out. So to hold would be a great encouragement to fraud. In what I have said I do not intend to convey that while the contract of service exists, a person intending to enter into business for himself may not do anything by way of preparation, provided only that he does not, when serving his master, fraudulently undermine him by breaking the confidence reposed in him. For instance, he may legitimately canvass, issue his circulars, have his place of business in readiness, hire his servants, &c. Each case must depend on its own circumstances."

The principle above laid down seems to apply in every case where the relationship of master and servant has existed, and it was accepted by the Courts long before 1895.

In the case of Lamb *v.* Evans ((1893) I Ch., 218), canvassers who had been employed under agreements which bound them to devote themselves in a particular district, exclusively to obtaining from traders advertisments to be inserted in a directory, and to supply the blocks, and materials necessary for producing such advertisements, proposed at the expiration of their agreements to assist a rival publication in securing similar advertisements. It was decided that they were not entitled to use for the purposes of any other publication, the materials which, while in the plaintiff's employment, they had obtained for the purpose of this particular directory.

There is one other aspect of the question under discussion which is of great interest to manufacturers who find it necessary in the course of business to disclose to mechanics and other persons working for them the nature of, and secrets connected with, inventions for which they may be desirous of obtaining letters patent. The suggestions made by a workman, employed in making a model of an invention for an inventor, cannot be patented by that workman, but, in fact, belong to the employer, and merge in his invention. Hence he is the only person entitled to a patent for them. Therefore, improvements in details suggested by such workman, and embodied in the machine, do not entitle that workman to oppose and stop the master's patent, on the ground that material parts of the invention have been obtained from him. At the same time, inventions devised by a workman while engaged in his master's employment do not necessarily, by virtue of that employment, belong to the master. It is a question of fact in each case. The invention may be so entirely independent of anything suggested to the workman as to be clearly his own invention. In order that employers may secure the benefit of all patents on inventions of those employed by them, it is well to secure the insertion of a definite clause in the agreement.

The following clause is suitable for insertion in an agreement with a tramway manager:—"Any invention or patent either connected with tramways or otherwise invented or acquired by the manager during the continuance of his employment by the company, shall be his sole property; but the company shall have free licence without payment of any royalty to the manager to use the same either during the continuance of the employment of the manager hereunder, or at any time thereafter, provided always that no such patent shall be used by the company until a resolution of the board of directors to that effect has been passed, and a copy of the said resolution sent to the manager, addressed at his last known place of abode or business."

It would seem to follow from what has been said that if a workman, after the termination of his period of service, were to take out a patent for some article which he had virtually invented during the period of employment, his title might be unassailable, but if it were shown that he, in fact, robbed his master of an invention, and forestalled him in taking out a patent for it, the Court would, in all probability, interfere.

Hitherto we have dealt with cases in which the duty not to avail himself of his master's secrets had not been expressly laid down in the contract. Where there is an express term, but little difficulty arises.

In a case which was heard in the High Court in 1904 (Barr *v.* Craven) an action was brought by an insurance company against four discharged agents and another insurance company, alleging that the agents had made use of the knowledge which they had obtained while they were in the employment of the plaintiff society for the purpose of inducing persons, who were policy-holders in the plaintiff society, to transfer their policies to the defendant society. Each of these agents had signed contracts which contained clauses to the following effect: "(7) To deliver up in case of my resigning the agency, or being dismissed therefrom, all nameplates, show-cards, books, papers or other property belonging to the society, or in any way relating to the business of the society, to

my superintendent or any other officer of the society, as directed by the general manager for the time being of the society, or by my said superintendent; (8) to introduce all the members in my agency to my successor or to any officer of the society, and not to interfere directly or indirectly with any of the business, after having resigned this agency, or being dismissed therefrom."

It was urged on behalf of the defendants that this covenant was too wide, and therefore void, as being against public policy. It was limited by neither space nor time, and it applied to the whole business of the plaintiff society, wherever carried on. The Court granted an injunction. Lord Justice Matthew said: "In my view upon the true construction of these contracts, the 'business' meant the 'business of my agency,' and the restriction is confined in each case to the locality in which the particular defendant was agent to the plaintiff society. There can be no objection to such a contract, and it is right to restrain a breach." This was a case of restraining the discharged servant from canvassing customers. A similar injunction would, doubtless, be granted if the servant were under covenant not to disclose the information which he might acquire during his term of employment.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,398. "Brakes for steam and electric travelling cranes." F. H. M. Thomas. July 3rd.

15,431. "Electric railway signalling systems." M. L. Hein and J. Copp. July 3rd. (Complete.)

15,447. "Method of using electric batteries for supplying lamps." Chemische Fabrik Greisheim-Elektron. (Convention date, August 2nd, 1910, Germany.) July 3rd. (Complete.)

15,453. "Secondary storage batteries or electrical accumulators." O. Oldham. July 3rd.

15,469. "Safety device for controllers for electric motors." J. Woodford. July 3rd. (Complete.)

15,474. "Electric arc lights." General Composino Co. Ges. m.b.H., (Convention date, July 4th, 1910, Germany.) July 3rd. (Complete.)

15,502. "Circuits for telephone instruments." British Insulated and Helsby Cables, Ltd., and J. B. Redfern. July 4th.

15,503. "Telephone exchange systems." W. Aitken and British Insulated and Helsby Cables, Lld. July 4th.

15,508. "Switches for controlling the electric lighting systems of automobiles." J. B. Brooks and W. Holt. July 4th.

15,512. "Carriers for electric lamp shades, globes, reflectors, galleries, or the like." G. St. J. Day. July 4th.

15,513. "Electrical signalling device." T. Weiss. July 4th, (Complete.)

15,524. "Electrical headway clock." H. B. Swift and W. D. Baxter. July 4th.

15,531. "Dynamo-electric generators." G. Inrig and L. Inrig. July 4th.

15,544. "Method of manufacturing metallic filaments or bands to be used particularly in connection with thermic telephones." B. Gwozdz. July 4th. (Complete.)

15,550. "Means for fixing electric fans and the like apparatus." A. H. Railing and A. J. D. Krause. July 4th.

15,551. "Measuring the output of Röntgen rays from an X-ray tube and regulating the dosage for skin treatment and the like." R. S. Wright. July 4th.

15,559. "Printing telegraphy." C. Kingsley. July 4th. (Complete.)

15,564. "Portable electric fuse wire-carrier." F. Chase. July 4th.

15,569. "Subscribers' sender mechanism for automatic telephone systems." Telephon Apparat Fabrik E. Zwietusch Co. G.m.b.H. (Convention date, July 5th, 1910, Germany.) July 4th. (Complete.)

15,585. "Electric switches." British Thomson-Houston Co., Ltd., E. B. Wedmore, J. M. Wallace and W. P. Hamlyn. July 4th.

15,597. "Auxiliary apparatus for electric traction." W. D. B. Duddell and G. W. Partridge. July 5th.

15,599. "Electric lampholders." R. Crust. July 5th.

15,607. "Device for starting, controlling and protecting electric motors." Wolseley Sheep Shearing Machine Co., Ltd., and A. E. Brewerton. July 5th.

15,646. "Electric safety fuses." M. Kallmann. (Divided application on No. 16,258/10, July 7th.) July 5th. (Complete.)

15,684. "Clock having electrical winding mechanism." A. F. Gerdes. July 5th. (Complete.)

15,690. "Electrically-actuated sewing machines." A. Rebsamen. (Convention date, July 6th, 1910, Switzerland.) July 5th. (Complete.)

15,695. "Dynamometers." Heenan & Froude, Ltd., and F. Harrison. July 6th.

15,719. "Electric incandescent lampholder cap." F. C. Mayes. July 6th.

15,725. "Telephones." C. F. Killar. July 6th.

15,730. "Electric arc lamps." Ges. fur Machinen und Metal Industrie m.b.H. (Convention date, July 6th, 1910, Germany.) July 6th. (Complete.)

15,751. "Electric conductors." J. Harden. July 6th.

15,794. "Electric arc lamps for cinematograph projection and the like." A. Cole and F. Wilson. July 7th.

15,798. "Current distributors for power looms having electrical stopping and signalling devices." E. C. R. Marks. (Spinnerei & Weberei Steinen Akt. Ges., Germany.) July 7th. (Complete.)

15,804. "Electric alarm." W. H. Boorne. July 7th.

15,841. "Electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 7th.

15,845. "Dynamometers." W. G. Walker. July 8th.

15,859. "Attachments in telephone mouthpieces." A. E. Bradshaw. July 8th.

15,862. "Clutch mechanism for the detachable attachment of an ar lamp or other appliance to a post or high-up support or suspender." F. E Worsley. July 8th. (Complete.)

15,866. "Electrical conduit junction boxes and the like." T. G. Gati (trading as Graiseley Foundry Co.). July 8th.

15,889. "Electric heating and cooking devices." Ferranti, Ltd., an M. B. Field. July 8th.

15,894. "Telegraphy and telegraphic apparatus." J. S. Enright and A. E Plews. July 8th.

15,898. "Means for automatically controlling heat in electric heatin apparatus." V. Nightingale. July 8th. (Complete.)

15,899. "Apparatus for electric cooking and heating." V. Nightingale July 8th. (Complete.)

15,901. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtaine of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and a Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Metallic Filament Electric Lamps. Westinghouse Metallfaden Gluhlamper fabrik. Ges. 22,852. October 3rd. (October 6th, 1909.)

Automatic Telephone Systems. E. Neuhold. 22,959. October 4th. (Sep tember 3rd, 1910.)

Electric Incandescent Lamp Cap. F. C. Mayes. 24,216. October 19th.

Inclinable Electric Lamp Supports. J. Neple. 24,818. October 25th. (Oct ber 26th, 1909.)

Telephone Switch Boards. W. Aitken and British Insulated and Helsb Cables, Ltd. 25,502. November 3rd.

Automatic Telephone Circuits. Siemens & Halske Akt.-Ges. 27,02 November 21st. (November 20th, 1909.)

Fire Alarms. J. H. Bruhn. 28,135. December 3rd.

Mercury Contact Electric Switches. Dr. Paul Meyer Akt.-Ges. & Kohne 28,657. December 9th.

Apparatus for Electrically Controlling Mechanism at a Distance. C. C Lohay. 29,378. December 17th. (Addition to 14,431 of 1908.)

Electric Arc Lamps. R. Schmidt. 29,506. December 19th. (December 20t 1909.)

Incandescent Lamp Regulator. R. Smith and Kaatz. 29,700. December 19t

Electro-Maonetic Apparatus Applicable to Stamps, Crushing Maohiner and the like. Franz Meguin & Co. 6,212. March 12th. (March 12th, 1909.

Electrolysis of Liquids. J. Billiter. 11,693. May 11th. (Convention dat not granted.)

Apparatus for Actuating Bells and for other Purposes. N. K. Harri 12,047. May 14th.

Electric Insulating Material. British Thomson-Houston Co. (Genera Electric Co.) 13,946. June 8th.

Terminals or Connectors for Wires, Cables or the like. C. N. Staniland 14,045. June 10th.

Earthing Devices for Conductors and other Electric Apparatus. R. Loma 14,057. June 10th.

Circuits for Automatic or Semi-Automatic Telephone Exchanges. Siemen Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,196. June 11th.

Electrically-Illuminated Letter Signs and the like Devices. H. Hirst an G. Maurice. 14,349. June 14th.

Electric Alarm Systems. F. Castle, E. J. Riddiford, W. E. Bidwill and L. L McDermott. 14,383. June 14th.

Electrical Machines. W. A. Price. 14,499. June 15th.

Dynamo-Electric Machinery. H. C. P. Parsons and A. H. Law. 14,68 June 17th.

Electric Resistances for Electric Heating and other Apparatus. F. E Wilkinson. 14,912. June 21st.

Controllers for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg Co.) 14,946. June 21st.

Controllers for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg Co.) 14,956. June 21st.

Alternating-Current Electric Meters. G. North. 15,170. June 23rd.

Incandescent Electric Lampholders. H. Specht and O. Beige. 19,033 August 12th. (August 12th, 1909.)

Manufacture of Detachable Electrolytic Iron Deposits. Marks (Langbein Pfanhauser-Werke Akt.-Ges.) 25,092. October 25th.

Enclosed Electric Switches. V. Hope. 25,923. November 8th.

Revolving Electrical Furnaces. O. Serpek. 29,299. December 16th (August 11th, 1910.)

1911.

Arc Lamps. H. E. Moul. (Korting.) 741. January 11th.

Electric Furnace for Treating Gases. H. Pauling. 3,251. February 8th.

Supports for Electric Conductors or Railless-Track Systems. H. Sefton Jones (Oesterreichische Daimler Motoren Ges.). 3,747. November 29th (Divided Application on 27,798/1910. November 29th.)

Process and Apparatus for Electrolytically Measuring Electricity Schott and Gen. 10,792. May 4th. (May 23rd, 1910.)

Means for Mechanically Operating Railway and Tramway Points from the Vehicles. G. Campana. 1,020. January 14th. (January 14th, 1910.)

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THE
ELECTRICAL REVIEW.

VOL. LXIX. JULY 28, 1911. No. 1,757.

ELECTRICAL REVIEW.

Vol. LXIX.] CONTENTS: July 28, 1911. [No. 1,757.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE COAL MINES BILL.

THE Standing Committee of the House of Commons on the Coal Mines Bill met on Tuesday and Wednesday of last week, and on both days the Government were defeated. In the absence of Mr. Masterman, the Bill was in charge of the Solicitor-General for Scotland, and on Tuesday an amendment was carried which instituted an eight hours day for colliery enginemen. As, however, the Government have insisted upon an eight hours day for other colliery workmen, it is a little difficult to see why they should object to an eight hours day for the engineman.

The more serious defeat, however, happened the following day, and one interesting feature about it was that on this occasion the amendment so carried against the Government was also most detrimental to the best interests of the mining industry. The matter under discussion was Clause 60, which contains restrictions as to the use of electricity, and Mr. Walsh, one of the Labour representatives, moved an amendment to prohibit the use of electricity in any mine where safety lamps were used, which, of course, was supported by the Labour party generally. This we may expect, and on more than one occasion we have referred to the almost incomprehensible attitude taken up by these men as being neither more nor less than playing to the gallery. They know nothing of the technics of electricity, and undoubtedly are quite possessed on one point, namely, that whatever the cost of production may be, it will be impossible for the coal owners in this country to close down their collieries. Since they must know that the introduction of electricity in coal mines has lessened the more arduous labour and increased the wages of the miner, and also that all attempts so far to saddle electricity with being the cause of the West Stanley and Hulton disasters have proved futile, no reasonable person can describe their attitude as other than both incomprehensible and foolish in the extreme. This particular amendment was defeated, fortunately for the miners themselves, but, unfortunately, its supporters gave their adhesion to Sir Arthur Markham's amendment, which was very little better than Mr. Walsh's, and it is difficult to understand what the honourable baronet could possibly have been thinking about. The amendment was to the effect "that electricity shall be discontinued in any place or part of a ventilating district of a mine, where the amount of inflammable gas in the air exceeds *one-half per cent.* or upwards until the air current is cleared." (The italics are ours.) "If the Committee carried this amendment" he (Sir A. Markham) continued, "they might say good-bye to *nearly all explosions in mines resulting from electricity.*" Again the italics are ours, and we would ask Sir Arthur, When and where have explosions resulted from the use of electricity? Surely he is not one of those narrow-minded people who believe all the clap-trap that has been uttered about

the dangers of using electricity in a gassy mine? Or does he believe, in spite of all evidence to the contrary, that the West Stanley and Hulton explosions were caused by electricity?

It is reported that all he asked was that the use of electricity should be made subject to the same standard as was imposed in connection with the use of safety lamps in mines, but this is a very different condition to that imposed in the actual amendment. In the former, no mine is to be worked *without* safety lamps when the average percentage of inflammable gas detected in six samples of air taken from the *main return airway* at intervals of not less than a fortnight amounts to ½ per cent. But there can be no comparison between ½ per cent. in the main return airway, and in a working place, and probably this amount could be found in the workings of a mine where naked lights are used with impunity. This limit of ½ per cent. is reasonable in determining whether a mine shall be worked by safety lamps or without, but it is absolutely absurd to apply the same limit at a working face to regulate the use of electrical machinery. Further, it is practically impossible for this amount of gas to be detected by an ordinary safety lamp: the Royal Commission on Mines, after giving great consideration to this question, decided that 2½ per cent. was the least that might reasonably be detected by an experienced workman, and why the majority of the Standing Committee did not realise this it is difficult to imagine. The Solicitor-General for Scotland, in expressing the Government's objection to the amendment, stated that in the opinion of experts one-half per cent. of inflammable gas was not necessarily dangerous, and further, the conditions could not easily be enforced, because there was no means of readily detecting in a practical way such a small amount. With this everyone who has any mining experience will readily agree. The Royal Commission, as mentioned above, fixed 2½ per cent. of firedamp as the condition under which workmen were to be withdrawn from the working place when using *safety lamps*, and 1¼ per cent. when using *naked lights*. Why, then, in the face of this should anyone, and more especially one who is supposed to have some knowledge of, and experience in, mining suggest that electrical machinery should only be allowed to work under conditions more onerous than these? There is not a single argument or a thread of evidence that can be adduced in favour of such an amendment, which is both foolish and mischievous as well as impracticable, and it is sincerely to be hoped that it will be either discarded in its entirety or at least altered to suit practical conditions. If the amendment stands it will have serious and far-reaching consequences in the mining industry, unless it be annulled by the Home Secretary, who has power to make regulations which will vary or amend any of the provisions contained in Part II of the Act.

As we have repeatedly pointed out, there is no danger in the use of electricity in mines if reasonable precautions be taken in its installation and operation. The Departmental Committee on Electricity in Mines, which so thoroughly investigated the whole question, expressed the same opinion, and it was only due to the possibility of inferior plant or workmanship being employed, and to err on the side of safety, that the rule was drafted prohibiting the use of electricity in any place where gas is given off frequently and in sufficient quantity to be detected by the ordinary safety lamp, which, taking the quantity as fixed by the Royal Commission, would be limited to 2½ per cent. It is evident that the consequences of such an amendment as that adopted have never been considered by the members of the Committee, for it would debar electricity from being used for shot firing, miners' hand lamps, and even electric signalling. Where explosives of the permitted class are used, it is one of the regulations that these shall be fired by electricity, and without explosives many mines would undoubtedly have to be closed. Sir Arthur and his supporters may not unnaturally scout this idea, and say there is no comparison between low-tension apparatus used for such purposes and electrical haulages or coal-cutters, but it is only a question of degree, and we repeat that, with well-constructed apparatus, the latter can be rendered as safe as the former. Further, a brief inspection of the reports of H.M. Inspectors of Mines will soon show whether more danger is to be apprehended from the use of explosives than from the worst-constructed electrical apparatus. Accidents due to electricity form a remarkably small percentage of the fatal accidents in mines, and every serious explosion has usually been traced to one of two causes, namely, a faulty safety lamp or a blown-out shot.

We sincerely trust that a more reasonable counsel will prevail, and that the amendment will not find a place on the statute book, and we would recommend Sir Arthur Markham and all others of like opinion to investigate a little more closely the best practice relating to electrical apparatus for use in mines, when we have no hesitation in saying they will at once admit, like worthy Britons, that they are in the wrong.

Bang went Saxpence.

A short paragraph in the agenda for the Hammersmith Borough Council meeting this week appears to be worthy of some notice. The Electricity Committee have been considering the question of popularising the uses of electricity, having plunged last year to the extent of £50 for publicity literature, and in the paragraph in question they say "we are now strongly of opinion, having regard to the active methods pursued by the gas companies, that the Council should authorise the Committee to undertake, on a larger scale than hitherto, the distribution of literature and the general advertising of their electric supply. We also consider that it would be advantageous that actual demonstrations of the advantages of using electricity should be given when considered desirable. For this purpose we consider that a sum of not less than £300, which does not amount to one per cent. of the revenue of the undertaking, should be set aside, this amount to include the annual salary of the canvasser, amounting to £156." The Council agreed to expend £300 in this way.

Reckless enterprise of this sort is irresistible—the "active methods" of the gas companies are to be met by an expenditure of *less than one per cent!* of the revenue of the undertaking. Exactly how the great feat is to be accomplished, we don't know—but, no doubt, the secret of safeguarding the business of a commercial undertaking by an expenditure of less than one per cent. of its revenue will not remain a secret long. Perhaps the gas companies may be able to throw some "light" on it.

LARGE GAS ENGINE PROGRESS.

On the 19th inst. we had the pleasure of inspecting a very fine example of a large Ehrhardt & Sehmer type gas engine, constructed by Messrs. Galloways, Ltd., at their Knott Mill Works, Manchester.

This engine, as no doubt our readers will be aware from previous articles in our columns, especially that in our issue of October 25th, 1907, is of the horizontal tandem type, with double-acting four-cycle cylinders; such an arrangement gives a turning moment at the crankshaft equal to that of the ordinary double-acting steam engine. The engine inspected develops a maximum of 1,350 B.H.P. at 105 R.P.M., and will operate upon producer gas, driving an 800-KW. alternator day and night for months at a time without stopping, at a large English chemical works. Two similar engines by Messrs. Ehrhardt & Sehmer have been running successfully at these works on Mond gas, for about five years and one year respectively. The engine is of massive construction, but is designed on simple lines, and with an entire absence of all unnecessary details, which in Continental designs are usually so prominent, and in practical operation are a frequent source of trouble. In fact, Messrs. Ehrhardt & Sehmer in their designs have kept consistently in view the requirements of the operating engineer.

Messrs. Galloways, it may be remarked, are working strictly to the working drawings, and with the fullest technical assistance of Messrs. Ehrhardt & Sehmer, who have built about 150,000 B.H.P. of these engines within the last seven years, the engines being of an average size of over 1,200 B.H.P.

A special feature of the engine built by Messrs. Galloways is the patent built-up cylinder, which is now exhibited publicly for the first time in England. Until recently Messrs. Ehrhardt & Sehmer followed the practice usual amongst large gas-engine makers of casting each cylinder in one piece. Such a cylinder consists of an inner, or working, barrel and an outer barrel or jacket casing connected by the end flanges, and no fewer than 12 necks for the valves, igniters, &c. A casting of this kind is exceedingly complex, and in practice, owing to unequal cooling in the foundry moulds, is never obtained free from initial casting stresses. Furthermore, when working, the explosions heat up the inner barrel, causing it to expand, whilst the outer barrel, being in contact solely with cold water and cold air, does not expand. Consequently the outer barrel or jacket casing resists the expansion of the inner barrel, and very serious bending stresses are transmitted through the valve ports. These are further exposed to extreme high temperature on one side, and frequently are inadequately cooled on the other side of the metal, so that

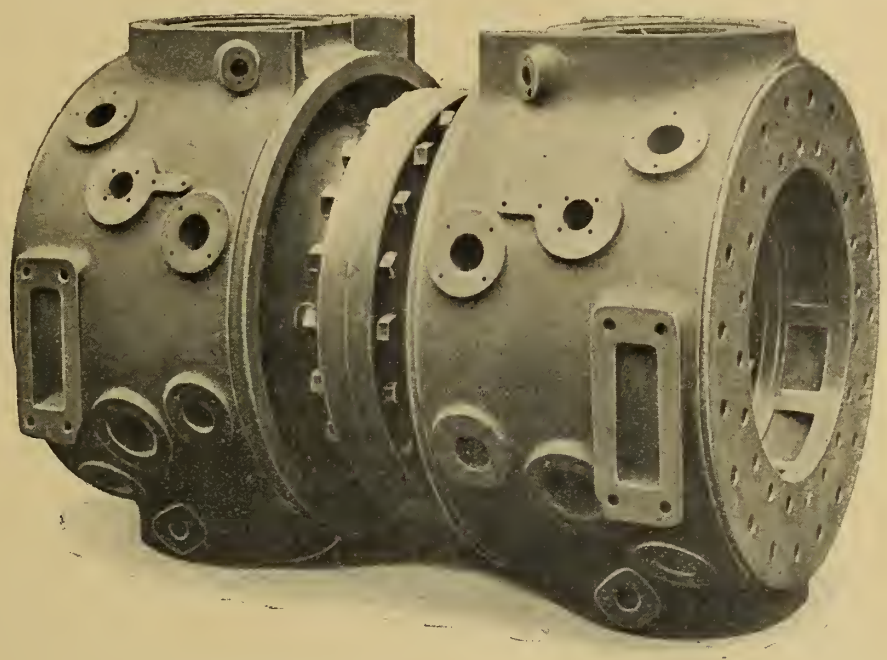


Fig. 1.—Built-up Cylinder, with Jacket Casing Removed, Showing Flange Joint.

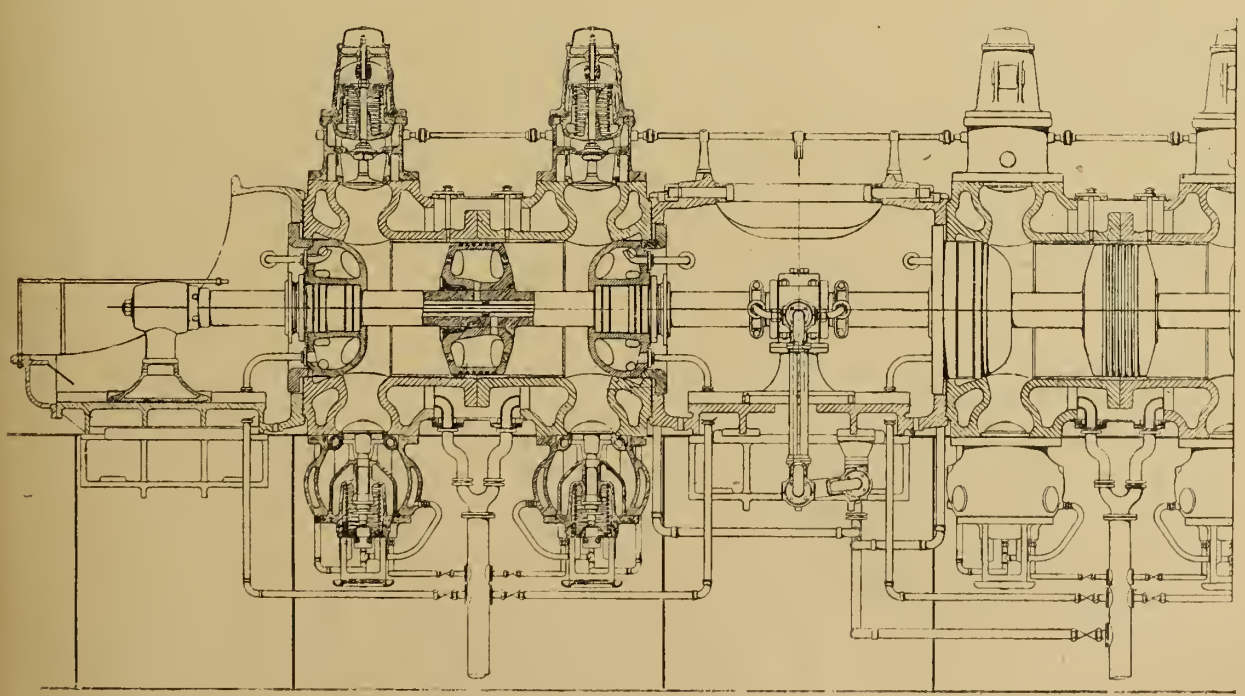


Fig. 2.—Sectional Elevation of Galloway-Ehrhardt and Sehmer Gas Engine Cylinders.

Cylinders, 37·4 in. diameter, 43·3 in. stroke. Weight of engine, 160 tons; fly-wheel, 50 tons; total 210 tons. The bedplate casting weighs 28½ tons.

cracks are started at the junctions between these ports and the inner cylinder barrel. These cracks extend, and ultimately cause the breakdown of the cylinder.

In the new built-up design the main cylinder body is constructed of two separate symmetrical castings, bolted together at a transverse flange joint midway between the two cylinder ends. Each of these castings is comparatively simple, and is readily obtained quite sound and free from initial stresses. In the new design the jacket casing is not now solid with the cylinder, but consists of a detachable rolled steel band, split longitudinally in halves, and clipped on to the cylinder castings through thick rubber jointing rings. This jointing forms an expansion coupling, and the cylinder casing in no way prevents the free expansion of the inner, or working, barrel of the cylinder under the influence of heat and stress. Hence this new construction eliminates both casting stresses and expansion stresses.

The new cylinder has also several other advantages to which attention may be drawn. It will be noted from the cross-sectional drawing that the cylinder is fitted with a liner, which is prevented from working loose by means of a collar on its outer surface, which is held between the two flanges of the cylinder. This liner is made of special wearing metal, as it is not required to carry any stress. On the other hand, the cylinder body proper is not subject to rubbing action, and is made of specially strong and tough metal to withstand explosive pressure. In the old design, the cylinder being in one piece, a compromise between strength and wearing properties had to be adopted. Furthermore, when after a lapse of time it is necessary to renew the cylinder liner, this can readily be done, whereas, with a single-piece cylinder, the entire cylinder had to be replaced.

A further advantage of the built-up cylinder is to be found in the accessibility of the water jackets. The jacket casing can be removed in a few minutes, and the entire water space thoroughly inspected and cleaned, a point of very great importance.

The valve gear of the engine has also been greatly simplified, the old-fashioned mixing valves with trip cut-off arrangements having been abolished, and their place taken by a simple gas valve on the main inlet valve spindle, and a throttle valve on the gas supply pipe, the latter being under the control of the governor.

The Ehrhardt & Sehmer gas engine embodies a number of other patent features in addition to the built-up cylinder, which the makers believe marks a revolution in large gas-engine cylinder design.

The main frame is in one piece, with the pedestals and crank race cast in; the cylinders and frames are connected by bored and turned joints, securing perfect alignment. The cylinders are carried entirely by the frames, but the back and intermediate frames slide in machine-grooved foundation plates, so that expansion stresses are obviated. The pistons and rods are water-cooled, and have proved very satisfactory. The cross-head is of a special patented design, and can be removed from the piston rod even when the nuts are bound fast. Ignition is effected by the "Lodge" high-tension system, in duplicate at each end of the cylinder, sure starting and reliability of running being ensured by this means. The highly successful results obtained in the past with the Ehrhardt and Sehmer engine, which have been greatly added to since, in 1907, we first described the pattern then constructed, give every reason to believe that the new design, which embodies many important improvements upon the former, will prove that a good gas engine is as reliable in running and as cheap to maintain as a good steam engine. Thus the undoubted prejudice which exists in the minds of supply station engineers in this country against the large gas engine, and which has certainly not been without justification in the past, may be dispelled, and the day of gas-power stations will be brought one stage nearer.

Hydro-electric Power in Canada.—Dispatches from Edmonton state that a by-law to provide the sum of $100,000 for an initial section of the municipal plant at Grand Rapids on the Athabasca has been defeated. It was said that the scheme was too big for the city at present, and that it would have cost nearly $4,000,000 to complete.

VIBRATING WIRES AND THE MEASUREMENT OF DISTANCE.

By C. A. SMITH, A.Am.I.E.E., Birmingham.

Under the above heading, the writer wishes to place before those engineers whose business it is to superintend and control the working of aerial wires, the results of a number of successful experiments which he has recently conducted, with a view to determine distance by means of vibrating wires.

Every student of physics will, no doubt, remember the laboratory experiments on the propagation of transverse waves along a stretched wire or cord, and the fundamental law deduced therefrom, viz., that the velocity of propagation is expressed thus:

$$v = \sqrt{\frac{T}{m}}, \quad \ldots \ldots \ldots \ldots \ldots \quad (1)$$

where T is the tension applied, and m is the mass of unit length of the wire, in absolute units.

The writer has found that these experiments can be usefully extended to the measurement of distances, over which aerial lines are strung, with very close results.

The method is both accurate and simple, and should have an important application to the measurement of distances between poles or wire supports, when the bases are inaccessible. Such cases frequently occur where the wires cross over house property, and particularly abroad, where they pass over mountain gorges, and over water or swamps.

The usual method resorted to by telephone and telegraph men in cases of this kind is to cut a wire and attach a cord to it. After the cord has been drawn across the space and tightened up, an indication knot is made in it. Then the cord and wire are pulled back and the wire joined again. Afterwards the cord is measured up on the ground.

Such a procedure, while good enough in many instances, is only an approximate expedient, and requires the services of several men. Then, as often as not, it means the cutting of a working wire—an objectionable feature.

Another method, still more approximate, is to measure the distance on an ordnance map.

The first of these two methods is rendered inaccurate by the stretching of the cord, and sag, while the second one may be considerably out owing to inaccuracies in the plan itself, or shrinkage of the paper.

Trigonometrical determinations and the use of the theodolite for such purposes are, of course, out of the question.

The method about to be described can be readily applied by the engineer himself, either with or without the assistance of one man only.

Referring to the propagation of wave motion in a horizontally suspended wire, supported at both ends, if the wire be struck, or "plucked," near one end, a transverse wave results, which travels at a uniform

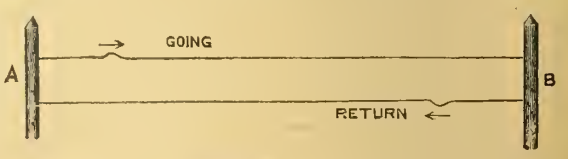


Fig. 1.—Travelling Wave on a Single wire.

velocity to the distant end. On reaching the far end, it is reflected, and continues to traverse the wire to and fro several times, always maintaining the same velocity, but gradually falling in amplitude.

Fig. 1 shows diagrammatically a going and return wave, travelling along a single wire, in exaggerated form.

Since the velocity is uniform, it follows from the above equation (1) that, if we know the exact time in seconds taken for the pulse to reach the distant end, also the tension applied to the wire, and its weight per unit length, it becomes a simple matter to calculate the length or distance traversed. The following description of my experiments will make the matter clear:—

An accurate dynamometer (fig. 2) is attached to one end of the wire, which need not be cut, and with it the wire is

rawn up to several tensions, which are noted. At each ension the wire is struck at a convenient distance from the raw-tongs attached, and the exact time observed for the th return wave to reach the experimenter's hand, held on he wire. This time interval is divided by 10, to give the ime taken for the wave to travel n one direction. A $\frac{1}{5}$th-second watch s best suited for this purpose, ind the mean of several readings hould be taken at each tension and ioted.

If these readings are then plotted as ordnates, T and t, on squared paper, a curve of the shape given in fig. 3 will be obtained, if carefully drawn. Then f, say, three points a, b and c well spaced along the curve be taken, the correct distance between the poles can be calculated from the following empirical formula (2) by applying it to the three pairs of values so found, and then taking the mean of the results—

$$D \text{ (feet)} = t\,(c \times T)^{\cdot 503} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where t is time of outward wave; c is $30{\cdot}5/w$, a constant; w is weight of 1 ft. of the wire in lb. to four significant figures.

This equation having the exponent ·503 instead of ·5 in the equivalent expression to (1), has, for some reason or other, been found necessary to give correct distance, and is independent of sag. It also holds good for any kind of wire used for aerial lines.

Still more accurate results can, however, be had if logarithms of the tension and time are plotted instead of the natural numbers. In this case we get a straight-line curve, which can be more easily drawn through the points, and the three points chosen from it, which would be used in logarithm form in the equation, will be nearer the true values required (see fig. 4).

The curves given herewith were drawn from the data contained in the table, and correspond to an actual experiment made upon a No. 14 iron wire, weighing 89 lb. per mile, strung between two trees 220 ft. apart.

TABLE.

T in lb.	Log T.	t in secs.	Log. t	Constant.
30	—	·90	—	
40	—	·76	—	
51	1·7076	·70	$\bar{1}$·8451	
60	1·7782	·64	$\bar{1}$·8062	
71	1·8513	·59	$\bar{1}$·7709	
82	1·9138	·54	$\bar{1}$·7324	
94	1·9731	·51	$\bar{1}$·7076	
104	2·0170	·48	$\bar{1}$·6812	
113	2·0531	·46	$\bar{1}$·6628	
122	2·0864	·44	$\bar{1}$·6435	
135	2·1303	·42	$\bar{1}$·6232	
142	2·1523	·41	$\bar{1}$·6128	
150	2·1761	·40	$\bar{1}$·6021	
164	2·2148	·39	$\bar{1}$·5911	
172	2·2355	·37	$\bar{1}$·5682	

Weight per foot = ·01689 lb.
Constant c = 1,806.

The following six experiments were also made upon different wires of various lengths :—

No.	Actual distance.	Calculated distance.	Error %
1	499·5 ft.	499·3 ft.	0
2	336·0 ,,	337·0 ,,	+ ·30
3	220·0 ,,	217·5 ,,	— 1·13
4	533·0 ,,	537·0 ,,	+ ·75
5	406·0 ,,	403·0 ,,	— ·74
6	297·0 ,,	300·0 ,,	+ 1·00

The factor of greatest importance, and the one which requires close attention, is the reading of time. One fifth of a second, although easily read with a little practice, is sufficient to throw out the measurement considerably.

As a converse measurement to distance by the same method, if the exact distance be known in feet, the tension of a given wire can be closely calculated, rendering a dynamometer unnecessary, by the following expression :—

$$T \text{ (lb.)} = \frac{w(D/t)^{1\cdot987}}{30\cdot5} \quad \ldots \quad \ldots \quad (3)$$

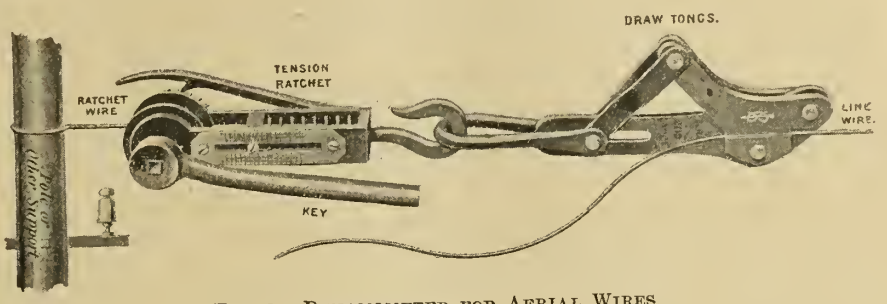


Fig. 2.—Dynamometer for Aerial Wires.

I find from my experiments that the tension so determined agrees within 5 per cent. always, with an

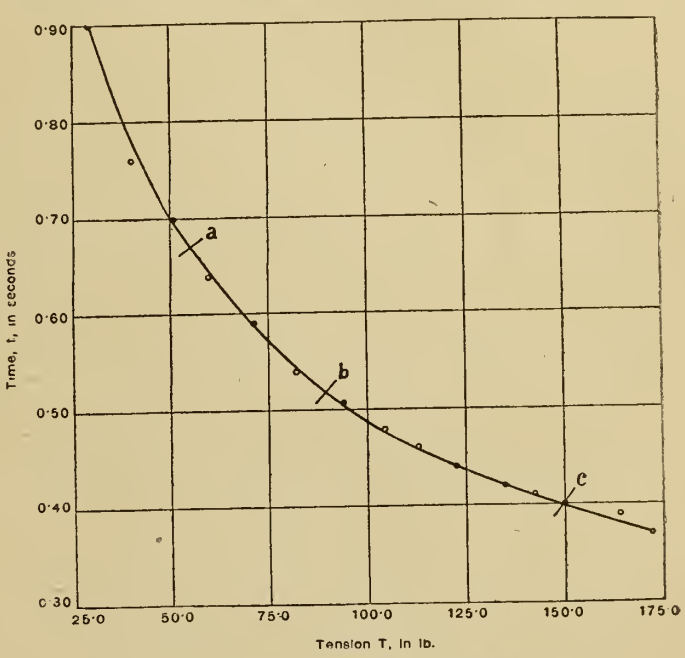


Fig. 3.—Ordinary Curve, No. 14 Iron Wire.

average of 2 per cent., above or below the actual values given by the dynamometer.

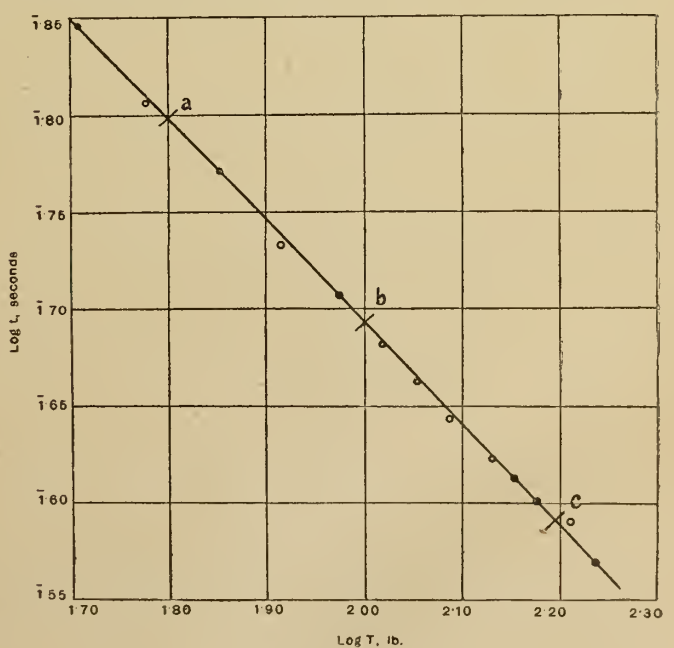


Fig. 4.—Log Curve, No. 14 Iron Wire.

To expedite the brief mathematical operations involved, the engineer would, of course, keep on record the weights

per foot, w, and the constants, c, in his notebook. These weights and constants for the wires employed in the six experiments referred to were :—

Wire.	Weight per foot.	Constant.
No. 14.—Iron	·01689 lb.	1,806
No. 14.—Copper	·01890 lb.	1,614
No. 16.—Steel	·01095 lb.	2,786

But as these values vary with different makers, they should be occasionally checked.

Finally, to assist those not conversant with curves, and the mathematical deductions, I append two examples taken from the above curves, for No. 14 iron, length of span known to be 220 ft. :—

Example 1.—Curve fig. 3.

Taking middle pair of values only, viz. :—Tension = 90 lb. and time = ·52 second.

We have from (2)—

$$\begin{aligned} D &= \cdot 52\ (1{,}806 \times 90)^{\cdot 503} \\ &= \cdot 52\ (162{,}540)^{\cdot 503} \\ &= \cdot 52 \times 417{\cdot}8 \\ &= 216 \text{ ft.} \quad \text{Difference} = -4 \text{ ft.} \end{aligned}$$

Example 2 :—Curve fig. 4.

Taking $\log T = \bar{2}{\cdot}000$

and „ „ $t = \bar{1}{\cdot}692$

We have :—

$$\begin{aligned} \log D &= \log t + \cdot 503\ (\log c + \log T) \\ &= \bar{1}{\cdot}692 + \cdot 503\ (3{\cdot}2567 + \bar{2}{\cdot}0000) \\ &= \bar{1}{\cdot}692 + 2{\cdot}646 \\ &= 2{\cdot}338 = 217{\cdot}8 \text{ ft. (218 ft.),} \end{aligned}$$

or a difference of − 2·0 ft., which shows, as my experience indicates, that the logarithmic method is the more accurate of the two.

As a further test in the converse rule to find the tension on a given wire, suppose the same wire, No. 14 iron, and span of 220 ft. be taken.

If the time t of wave be ·438 second, then the tension on the wire is, from log curve, and (3) :

$$\begin{aligned} \log T &= \log w + (\log D - \log t)\ 1{\cdot}987 - \log 30{\cdot}5 \\ &= \bar{2}{\cdot}2276 + (2{\cdot}3424 - \bar{1}{\cdot}6415)\ 1{\cdot}987 - 1{\cdot}4843 \\ &= 2{\cdot}2276 + 5{\cdot}3680 - 1{\cdot}4843 \\ &= 2{\cdot}1113 = 129{\cdot}2 \text{ lb., instead of 126 lb.} \end{aligned}$$

or a difference of + 2·5 per cent. Nearer results can generally be had, especially with copper wires. Most of these tests were made during windy weather, which might have had a disturbing influence.

Of course, the dynamometer used in the distance measurements must be accurate, and should be set aside specially for the purpose.

The writer found, after trying several different makes, that the improved form of dynamometer and vice, shown in fig. 2, which was made by Messrs. Geo. Salter & Co., of West Bromwich, and kindly lent to him by them, was the best suited to his purpose. It was found to be quite accurate, and was beautifully made. These are supplied with double draw tongs, *i.e.*, they have two distinct jaws, to take two sizes of wire for which the dynamometer is designed. The sets are supplied by this firm in two standard sizes. The smaller indicates from 0 to 150, 160, and 170 lb., and the larger one, up to 400, 600, 650 or 672 lb. All draw tongs have jaws of phosphor bronze.

Electricity Supply at Honiton.—At a meeting of the T.C. last week the Lighting Committee recommended that an agreement be drawn up with Dr. Purves (Exeter) for supplying the town with electric light. A letter had been received from the Honiton Gas Co. asking the Council to sanction its applying for provisional powers for supplying the town with electric light. The Committee, however, much as it would like to help the local company, regretted it was impossible to do so, as matters had gone too far with Dr. Purves. In certain places the mains would be carried underground, and in others overhead. The contract was to be completed within 18 months, otherwise the agreement would lapse. A penalty clause, providing for the payment of £10 per day, had also been added, in case of the conditions of the agreement not being carried out. The Council decided in favour of the agreement.

SOME PROTECTIVE RELAYS FOR ALTERNATING-CURRENT CIRCUITS.

By KENELM EDGCUMBE.

Of the many relays in use, the present article deals only with those which are intended to open a circuit-breaker, as a means of protection from the ill-effects of some abnormal condition, such as a short circuit or an "earth."

It might, at first sight, appear to be a retrograde step, on the score of simplicity and economy, to employ a relay at all for this purpose, instead of operating the circuit-breakers direct. In the case of low-tension systems this is probably correct and, particularly in continuous-current work, the use of such relays is so limited that it is not proposed to deal with them. On a high-tension alternating-current system, however, the case is quite different and, although various attempts have been made to dispense with their use with a view to economy, their installation has now become almost universal.

The use of such relays is based upon three main considerations :—

1. The possibility of insulating the tripping mechanism from the high-tension circuit.
2. The convenience of being able to affect all adjustments to time-lag, tripping current, and so forth at the switchboard instead of at the breaker itself.
3. The power available for the direct operation of circuit-breakers is often insufficient, particularly in the case of those of the reverse pattern.

As regards the first mentioned feature, a relay is by no means essential, seeing that a transformer having its primary in the high-tension circuit and its secondary connected to

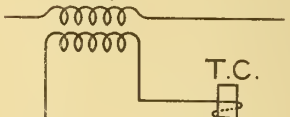


Fig. 1.

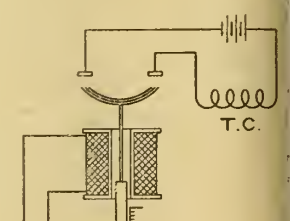


Fig. 2.

the tripping coil of the circuit-breaker would obviously meet the case. This arrangement is shown in fig. 1, where C T represents the current transformer, and T C the trip coil of a circuit-breaker.

The second and third considerations, however, are extremely important, and the second, in particular, is becoming daily more so, owing to the increasing size of power houses, and to the growing tendency to place the circuit-breakers, and the switchboards controlling them, at greater and greater distances from one another.

Protective relays may be divided, broadly, into four classes, according to the nature of the protection to be afforded :—(1) Overload relays ; (2) no-voltage or minimum relays ; (3) reverse or discriminating relays ; (4) differential or balanced relays.

Overload Relays.—Probably the simplest form of relay for this purpose consists in a solenoid having an iron core which is attracted so soon as the current flowing in the coil exceeds a certain pre-determined value. Such a device is shown in fig. 2. Directly the core is raised, the contacts at the top are closed and the trip coil of the circuit-breaker (T C) is energised. By means of the adjusting screw A S, the position of the iron core in the coil can be altered, and the current at which it will act thereby varied over a comparatively wide range, the actual value in amperes being usually marked upon a scale, as shown.

In the majority of cases it is wished to add some form of time-lag device so that, on the occurrence of a momentary overload, the breaker will not trip, although doing so if the overload is maintained. It is often stipulated, further, that

the interval of time which elapses between the occurrence of a fault and the opening of the breaker shall be considerably less with a severe overload than with a moderate one. This is sometimes spoken of as an "inverse time element." A simple device which will occur to every one is to add an air or liquid dashpot to the iron plunger. Such an arrangement fulfils all the requirements of an inverse time element, since the stronger the pull, the shorter will be the time interval. It is, however, rendered almost useless with this particular form of solenoid, at any rate, by the fact that as the core is drawn up it gets into a more and more effective part of the magnetic field, so that, when once started. the plunger may continue to travel upwards, even when, in the meantime, the current has fallen to its normal value, and the breaker is thus tripped quite needlessly.

To overcome this objection, a most ingenious time-lag device was introduced some years ago by Mr. J. G. Statter. It consists in a smooth metal disk attached to the lower end of the iron plunger of the relay and resting upon a fixed plate covered with a film of some viscous liquid. It is found that an extremely small force applied continuously is sufficient to separate the two surfaces, whereas, to do this suddenly entails the application of a very much larger one, thereby giving the inverse time feature required. Moreover, the core is held stationary until it is completely freed, so that



Fig. 3.

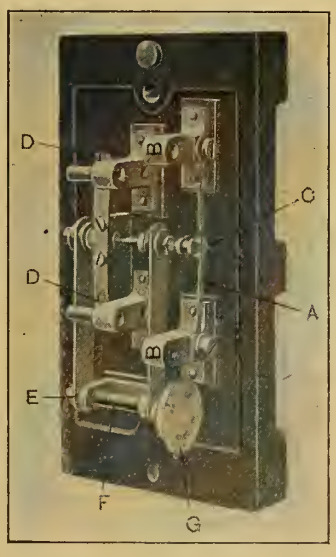


Fig. 4.

no "creeping" can take place with a reduced load. Besides this, the contact is made with considerable force, owing to the momentum of the plunger. The only drawback to this device lies in a slight indefiniteness of time-lag owing to variations in the viscosity of the oil due to time or to changes of temperature.

Referring again to fig. 1, if the trip coil T C has a fuse connected across its terminals, of such a capacity that it will blow when the required secondary current is flowing, an inverse time feature will be given to the combination. Under normal conditions, most of the secondary current flows through the fuse, whereas, as soon as this blows, the current is diverted through the trip coil, and the circuit-breaker is operated. A certain interval of time will necessarily elapse before the blowing of the fuse, depending, other things being equal, upon the magnitnde of the overload.

The thermal relay (shown in fig. 3 and, with cover removed, in fig. 4) has many advantages over the simple fuse, as an inexpensive relay for general work. Its construction is as follows: The curved strip A of resistance material is fixed at each end to the blocks B B, and is connected to the secondary of a current transformer in the circuit to be protected. Under normal conditions, the small spring catch C is held down under the strip A, so that the contacts D D, carried by the same arm as the catch C, are held open. This arm is pivoted at the farther end E, and is pressed upwards by the spiral spring F, so that, directly the strip A expands sufficiently to release the catch C, the latter flies up, and the contacts D D are closed. A simple attachment is provided whereby the current setting may be adjusted to any value between full-load and, say, 200 per cent. overload by means of a screw carrying an index, which moves over a graduated scale G.

This relay possesses, as has been said, several advantages over the fuse previously alluded to. For example, it is possible to set the tripping current to a nicety by means of

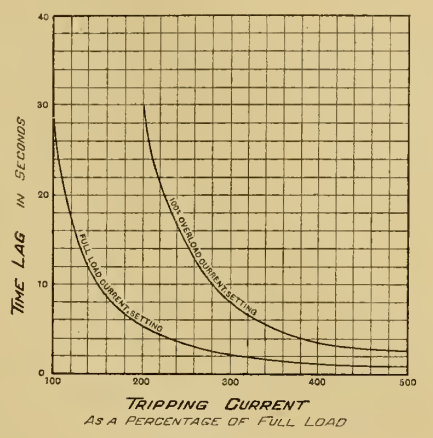


Fig. 5.

the attachment just mentioned, and, again, to reset the relay, it is merely necessary to depress an ebonite knob (see fig. 3), instead of having to replace a fuse. Moreover, the time-lag and current setting can be determined once for all, instead of involving the unavoidable uncertainties of a fuse. Fuses have, of course, low cost to recommend them, but the thermal relay just described is so simple in construction that there is but little difference even in this respect.

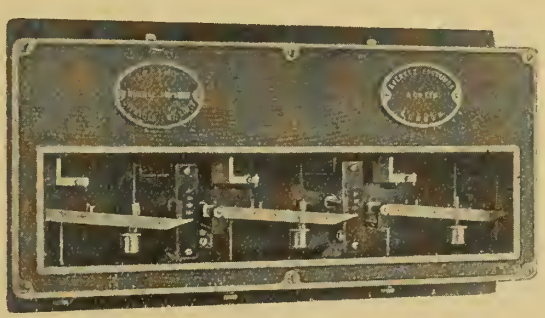


Fig. 6.

Fig. 5 shows typical time curves of this thermal relay, and it will be noticed that the curves have no tendency to meet, which, as will be seen later, is a most important consideration.

Undoubtedly the best overload relays are those working on the induction system. Fig. 6 shows one form of such an instrument, the working principle being indicated

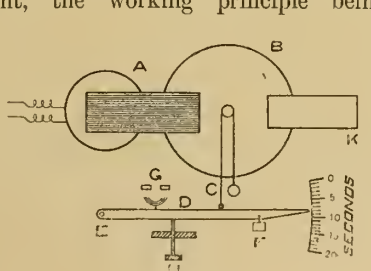


Fig. 7.

diagrammatically in fig. 7. The exciting coil (A) is usually connected to the secondary of a current transformer, and is provided with a copper ring which screens some two-thirds of the pole face, thus producing a phase displacement between the two magnetic fields, and exercising a torque on the copper disk B. This disk, which runs in centres, carries a small pulley, round which passes a silk cord C. One end of this cord is attached to the lever D, pivoted at E, while the other end terminates in a small weight serving to keep the cord taut. An adjustable weight F attached to this lever, keeps the latter pressed down against the screw H

until the torque exerted by the electromagnet on the disk is sufficient to lift it. So soon as this occurs, the lever commences to travel upwards and finally, after a certain interval of time, closes the relay contacts G. The time which elapses between the occurrence of a sufficient overload to cause the lever to travel upwards and the closing of the contacts, naturally varies with the magnitude of the current flowing in A. In order to increase this interval, a horse-shoe magnet K is provided which induces eddy currents in the disk.

The adjustment of the current setting is made by means of the weight F, the position of which is variable along the lever D, the usual range allowed for being from full load to

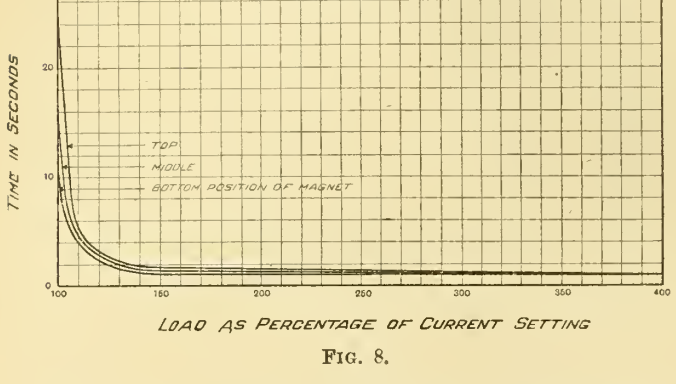


Fig. 8.

200 per cent. or 300 per cent. overload. Both the current and time-lag scales, which are entirely independent of one another, are seen in fig. 6.

In several forms of induction relay on the market, the adjustment of time-lag is carried out by altering the magnetic damping by moving the magnet nearer to, or further from, the centre of the disk. Such an arrangement is, however, far from satisfactory. Fig. 8 shows a typical set of curves representing the time-lag corresponding to three positions of the magnet in such a relay. It will be noticed that with an overload corresponding to three times the full load, the time-lags of all three curves are identical, viz., about one second. Hence it follows that if two relays are connected in series, the one being set for a greater time-lag than the other, with a view to ensuring that it will trip first, they may both trip at the same moment if subjected to an overload exceeding

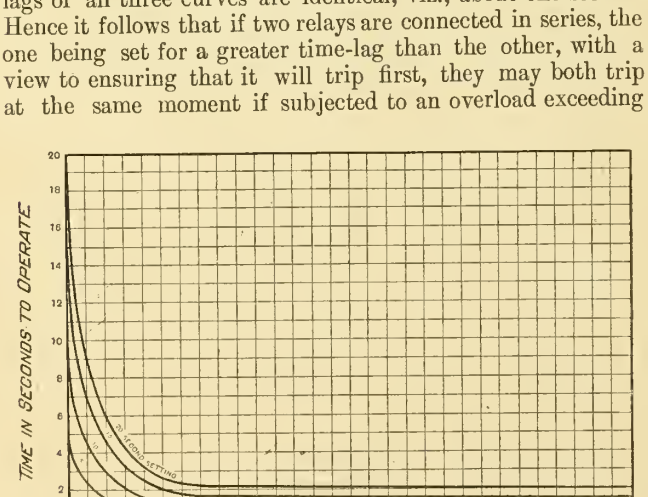


Fig. 9.

three times the normal full load, so that all discriminating action is lost.

By "discriminating action" is meant that if two or more breakers are connected in series at different points on the system (for example, one on a feeder connecting the generating station with a sub-station, and another on a feeder leaving the sub-station) it must be possible so to set the time-lags that, no matter what may be the overload, the relays, and with them their respective circuit breakers, will always act in the same order. This is a question of fundamental importance in relay design, which has not by any means received the attention it deserves. Many relays are excellent as regards their discriminating action over a certain range, but are far from being so on a heavy over load, which is precisely the occasion on which this is o particular importance.

The reason for the meeting of the time curves in fig. 8 i that the distance travelled through is always constant, an that the disk will not run above synchronous speed, howeve great may be the excitation of the electromagnet. In thi particular instance, synchronous speed evidently correspond to one second, and this time cannot, therefore, under an circumstances, be reduced. In the case of some other relay on the market, particularly those of the solenoid pattern wit dash-pot time-lags, the time interval, above a certain over load, becomes practically zero, so that in this case also a discriminating action is lost.

In the relay illustrated in fig. 6, on the other hand the time setting is adjusted, not by varying the dampin but by altering the number of revolutions made by the dis before contact is made. This is effected by means of th screw H. Fig. 9 shows typical curves obtained with thi instrument, and it is clear from these that, no matter ho great may be the overload, it is impossible for any numbe of relays connected in series to trip in the wrong order. I specifying time-lag relays this question should be given du consideration, as a failure to do so almost invariably leads t trouble afterwards.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear unt the following week. Correspondents should forward their commun cations at the earliest possible moment. No letter can be publishe unless we have the writer's name and address in our possession.*

Cheap "Stannos" Wiring.

With reference to my letter kindly inserted in this week issue of your paper, I would point out that the figure 83 ft. should read 33 ft. This is evidently a printer's erro

Engineer.

I must thank "Engineer" for pointing out my mistal in the cost of Stannos wire, the cause of this error bei a misprint in the catalogue. I have since referred to t invoice, and I find that the correct figure per 110 yd. £1 14s. 9d., this bringing the cost per point to 9s. 4 Seeing that this includes service cable and sealed fuse-bo I think you will admit the cost is low. I do not consider main switch necessary on these small jobs.

No circuit consists of more than five points, and ea point is controlled by a separate switch. I do not qui follow "Engineer's" arithmetic with regard to length wire per point; personally, I make it 33 ft.

Your correspondent's remarks *re* obstacles encounter are unfortunate, as on this particular job it was necessa to pierce a wall in excess of 29 in. thick, and also anoth 15 in. wall. This being one of the first jobs, I was th woefully short of plant.

I hold no brief for Stannos wire or its makers, n original letter being intended more as a criticism of M Beauchamp's figures. I am certainly of the opinion th the speakers at the recent Brighton Conference would well to devote more attention to existing wiring systen rather than strive after the unattainable system, which c be sent out ready made and fixed by the local handy man.

S. A. Hughes.

Cloughjordan, *July 24th*, 1911.

Private Electricity Supply.

I am seeking advice on the subject of the powers o public lighting station and local authority, to prevent private firm crossing streets with overhead wires (of cou to comply with the Board of Trade requirements) for t supply of our other factories for driving and lighting.

We will call our factories A, B and C. A is the factory which we propose to use as a generating station, supplying B and C with current at 1,000 volts and transforming to our working voltage in each factory to suit conditions. There is enclosed a print with the factories A, B, C and all our own land and buildings lined round with red ink and red filled in. There is another point. We have to supply the machine owners or tenants in our factories with power for a fixed rental per week per machine. Can the public supply company prevent us from using electric drives instead of the existing steam drives, and, if we care, can we put meters in the shops of the tenants and charge them according to what they use, both for power and light?

A few particulars as to how we stand in this matter will be greatly appreciated.

Extension.

[This case appears to be covered by the Electric Lighting Act of 1909; in Clause 23 it is clearly stated that the Act does not prevent any company or person from supplying electricity to any other company or person, provided that the business of the former is not primarily that of supplying electrical energy. This condition is fulfilled, and therefore neither the supply company nor the local authority can interfere with our correspondent's arrangements.—Eds. E.R.]

Early Electric Lighting.

I note in your comments on my presidential address on page 82, the date of the original installation of six arcs in Madeira Road, Brighton, is given as 1891. This was a misprint, which I corrected in the first proof, but which the printers omitted to note. It should have been 1881, which was really three years before the South-Eastern (Brush) Electric Light and Power Co.'s experiment at Colchester, and it was even prior to the installation in St. Enoch's station, Glasgow; in fact, I have been given to understand on fairly good authority that the machines and lamps used in Brighton were transferred to Glasgow.

John Christie,
Engineer and Manager.

Electricity Works, Brighton,
July 21st, 1911.

Meters on Cars.

The tabulated summary of systems using car meters, prepared by Mr. Goodyer, does not mention the following:—Lanarkshire Tramways using 30, Manchester Corporation Tramways using 180, and Swansea Tramways using 16 time meters; and as this may lead to wrong conclusions as regards the use of time meters in this country, we shall feel obliged if you will kindly publish this information.

The "Acme" Meter Co.,
N. Gunn, *Manager.*

London, *July 20th*, 1911.

Battery Maintenance.

In a recent battery specification issued by a Corporation, alternative tenders were asked for maintenance in the ordinary way, and for a graduated scheme of payments. No particulars were given as to how the payments were to be graduated, but there is no doubt that the purchasers had in mind to pay a gradually increasing sum per annum; that is, to pay, perhaps, 2½ per cent. of the total ten years' payments in the first year, and increase the payments till they paid, perhaps, 25 per cent. or 30 per cent. in the last year. I remember two other public bodies having obtained tenders in this way. One of them was a very large municipality, and the battery was very small, the total maintenance for ten years being only about £40! In the other case the battery was a fairly large one. It seems to me a most reprehensible practice to maintain under such a scheme as this, as it necessarily means penalising the future ratepayers for the sake of the present ones.

J. S.

LEGAL.

The Factory and Workshops Act.

The Newcastle and District Electric Lighting Co., Ltd., were summoned at the Newcastle-on-Tyne Police Court on July 21st, on five charges of alleged neglect to observe certain regulations under the Factory and Workshops Act. The first information alleged that the defendant firm neglected to observe Regulation No. 14, in that at a switchboard in the said factory the bare conductors were not so placed as to prevent danger from accidental short circuit, and that, in consequence of such neglect, one William Middleton died. The second information was of a similar character, with the exception that it was alleged that the bare conductors were not so protected as to prevent danger, &c. The third information alleged neglect to observe Regulation No. 1, in that at a certain switchboard at the said factory the conductors were not so protected as to prevent danger so far as was reasonably practicable, and that in consequence of such neglect Thomas Cox suffered bodily injury. The fourth information was the same as the preceding, except that the man injured in this case was William Greenwood. The fifth, and last, information charged the company generally with failure to comply with Regulation No. 1, without alleging that such failure was the cause of death or injury to any individual. The counsel engaged were Mr. H. S. Mundahl for the prosecution (instructed by Mr. R. Sheriton Holmes, for the Director of Public Prosecutions); and Mr. E. Meynell, for the defence (instructed by Messrs. Leadbitter and Harvey).

Mr. Meynell said he would plead guilty to one charge, and it was decided to go into the second charge, that which alleged neglect to protect the conductors, which resulted in the death of Mr. Middleton, the assistant superintendent of the power station in The Close, Newcastle-on-Tyne.

Mr. Mundahl, in opening, said the case was taken under Sec. 136 of the Factory and Workshops Act, and they were there to consider the death of a man which arose from neglect to protect bare conductors so as to prevent danger from an accidental short circuit. On April 6th Mr. Middleton was killed in the performance of his duties at The Close Power Station, and it was necessary for the purpose of explaining the accident that the switchboard should be described. It was placed in a passage-way between two walls or partitions. Two bus-bars stood out from the switchboard about 10 in., and some distance from two copper brackets on the fifth panel of the switchboard was a screw. This screw was found to have got out of order on April 6th, and two men named Cox and Greenwood went to it to do some repairing. Apparently the spanner was not held straight, and in some way a contact was established between the positive bus-bar and the nut which was on the negative side; a slight flash occurred which resulted in the two men being injured. This must have led to a wave of current along the bus-bars to the two brackets, which were only 1 in. apart. Of course it was impossible to say exactly how the whole thing occurred, but it was surmised that the flash caused a great heat and fusion of the metal, which must have set up a deposit or film of metal between the copper faces of the two brackets, which allowed the current to flow over the short circuit. About an hour and a half later Mr. Middleton, the assistant superintendent, went to examine the sparking established at the point of the two brackets by this short circuit, and sent the man Cox to fetch a piece of wood, presumably to scrape away the film of metal. Before Cox returned he heard a loud report, and saw a flash, and running to the switchboard he found Mr. Middleton with his clothes on fire in front. There had apparently been a complete and extensive flash between the two faces of the metallic brackets, with the result that the edges were fused. As it required 2,000° F. to melt the copper, the heat must have been something in excess of that. It was not therefore surprising that Middleton was badly burned, or that the injuries combined with the shock had proved fatal.

Mr. Meynell: He had a weak heart and died of shock.

Mr. Mundahl: I do not think it matters, or has much bearing upon it. The man was undoubtedly killed. Proceeding, he said that was the position with regard to the accident, and the Home Office said that the regulations which were framed in the interests of the public ought to be carried out and every precaution taken. In this case, it was very obvious that precautions were not taken, because if the inch between the two brackets had been insulated, as it easily could have been with a piece of marble or slate, the accident could not have occurred.

Mr. Meynell said that the switchboard had been entirely redesigned.

Mr. Mundahl said the fact remained that after the accident the chief engineer at the works admitted that the switchboard was not safe for men to work at.

The chairman (Mr. J. W. Robson) asked if the switchboard had to be examined or passed by anyone?

Mr. Meynell said the local inspector had found no fault prior to this.

Mr. Mundahl said it was not the duty of the factory inspector to be a superintendent engineer to every company he visited. It was the company's duty to take every precaution. He asked the Bench not to treat the offence as a technical affair, but to impose a substantial penalty so that it might be a warning to other companies to place their houses in order.

Mr. Meynell submitted that the offence was a very trivial one, although the result had been very serious. The accident was one which no human being could have foreseen, and was of so extraordinary a character, that although Prof. Thornton had

examined the switchboard with a pressure of 14,000 volts—or 25 times the pressure it usually carried—he failed to obtain any of the results which had occurred on the day in question. The switchboard, which was made in 1907, was designed by one of the best firms of electrical engineers, and no one had ever suggested, either factory inspectors or the defendant company's own employés, that it was not safe. Until the accident happened, such an idea never entered the mind of anyone. He pointed out that whereas the company could have had the defects remedied for half a sovereign, they had spent £200 on a new switchboard, so that it was not a case of economy or a wilful breach of the regulations.

The Chairman of the Bench, after consideration, said if the precautions had been taken, as shown in the evidence at the inquest, the accident would not have occurred. The full penalty was £100, but having regard to the fact that the company's attention had not been specifically directed to the switchboard by the Board of Trade, and that the neglect was not wilful, they had decided that the penalty should be £50 and costs.

Mr. Mundahl said that the charges based on informations Nos. 1 and 5 would be withdrawn, and he only asked for a nominal penalty in regard to the other cases.

Mr. Meynell contended there was really only one offence, but left the matter to the justices.

Eventually a fine of 20s. and costs was imposed.

Islington Electric Lighting Undertaking.

On Friday last the Lord Chief Justice and Justices Lawrence and Avory, sitting in the King's Bench Divisional Court, heard an application by Mr. Cecil Walsh, on behalf of the London County Council, for a rule *nisi* for a mandamus directed to the Islington Borough Council calling upon them to show cause why they should not have five testing stations to their electric lighting undertaking in accordance with the County Council's electric lighting order. That order stipulated that an electric light undertaking should include five testing stations within such reasonable distance as the County Council should deem sufficient.

The Lord Chief Justice: When did you apply to the Islington Council to carry out the order?

Mr. Walsh: Notice was given in July, 1907. Since then they have been temporising.

His Lordship: What was the result?

Mr. Walsh: They have done nothing. Later, Mr. Walsh said the Islington Council said they had given careful consideration to the matter and come to the conclusion that they did not like the County Council's Act of Parliament.

The Lord Chief Justice: You can have your rule.

Electricity in Silica Working.

(*Continued from page* 89.)

Mr. Bousfield, opening the defence, said the articles which the defendants sold to Messrs. J. and G. Cox, and of which the plaintiffs complained, were obtained from Beuel. That place had, however, ceased to manufacture such articles, and nothing the defendants now sold came from Beuel. As to the patent, the process claimed by plaintiffs had been gradually worked up by the efforts of a number of people helped by public money, who had co-operated to bring it up to the point at which it had arrived quite independently of any contributions which the plaintiffs had made. The view that defendants took was that the gas pressure in connection with the working of the silica had nothing whatever to do with it, except perhaps to some slight extent to modify the shape of the cavity. It was not a good specification of things material, and things immaterial were so mixed up that the vital conditions could not be elucidated. As regarded elucidation of conditions under which one was able to get the result which plaintiffs called initial separation—where was the information? Assuming that it was the gas which gave the result, he submitted that the specification of plaintiffs wholly failed, because it did not set out any of the necessary conditions to enable one to produce the result which plaintiffs said was vital. As a matter of fact, gas pressure played a very secondary part in the matter.

Evidence was then called. Mr. Otto Dollmann, secretary to the defendant company, said he had filled that position since January 10th. He remembered his firm selling silica goods to Messrs. J. and G. Cox, Ltd. Witness received the order for the goods about April 5th or 6th, which he passed on to Beuel on April 6th for execution. The goods were delivered on April 25th with the exception of a crucible.

Cross-examined: There was no explanation as to why the crucible was not sent in the first place. The defendant company was incorporated on November 18th, 1909. Witness denied that the company was formed with the object of selling goods acquired from Beuel. He could not say when they first commenced selling silica goods; it might have been the early part of last year. They were still selling such goods now.

And unless you are stopped, you intend to continue the sale?—Yes.

Is it a fact that, since you commenced the sale of these goods, you have continued to import silica goods, advertise them, and offer them for sale, and are doing so at the present time?—Yes.

How long did you continue to obtain a supply from Beuel?—We ceased all connection with them shortly after July, last year. I think about £2 6s. 11d. worth of goods has been purchased since the issue of the writ.

Mr. Schuen, formerly technical director of the melting department of the works at Beuel, gave evidence as to the supply of silica goods from Beuel to the defendant company.

Cross-examined: The stock of silica tubes of plaintiffs' manufacture had been entirely used up before April, 1900. He could not say what price was paid for the tubes to the plaintiff company. He knew that an attack was made in Germany by the Beuel Co. on the Thermal Syndicate on the ground that the gas layer was a natural phenomenon and that the patent for blowing out could not be supported, because it was a natural phenomenon.

Mr. Fdk. Wilhelm Kuehue said he was technical director to some large electrical works in Zurich. He had been requested to make some experiments in connection with this action, which had been carried out after the English specification. The hollow in the centre of the silica tubes was produced by natnral causes, and was not in any way due to gas pressure.

Mr. James Swinburne gave evidence as to the interpretation of plaintiffs' specification. He was of opinion that the sausage shape of the fused silica was determined by capillary attraction, and though the gas pressure might help, he thought it would take up the same shape without the pressure. There was no suggestion in the specification of inflating the tube by generating gas. Witness was cross-examined at great length on technical points, and also as to certain experiments with silica made by the plaintiffs.

Re-examined by Mr. Bousfield: The presence of gas under pressure in the actual condition of working did not affect the size of the hole inside the sausage of fused silica. He considered that gas pressure had nothing whatever to do with the size of the hole.

Evidence having been concluded, Mr. Colefax addressed the Court on behalf of the defence. He pointed out that the plaintiffs had not attempted to offer any evidence at all as to whether they had endeavoured to make silica ware in a furnace, such as they now knew the articles in question were manufactured in. The whole of their experiments were made with their own furnace. They admitted that they had got particular conditions, but did not even attempt to put forward any evidence of their own as to what, in fact, happened if one were to work under different conditions in a furnace such as the furnace in which the infringing articles were made. The two furnaces were absolutely and entirely different. He would ask his Lordship to accept the evidence of fact as put forward by the defendants' witnesses. He submitted that not only did defendants not infringe, but the patent was bad on account of insufficiency, and also, in some respects, from want of utility. There was nothing before the Court on which his Lordship could find that defendants had in any way manufactured articles in accordance with the plaintiffs' specification. In fact, he failed altogether to see what case the plaintiffs really had against the defendants. Their case was based on a fallacy from start to finish. In order to establish that the defendants had infringed, plaintiffs must show that in the manufacture of the alleged infringing articles, the defendants enclosed the gas that was produced so as to facilitate the separation of the carbon core from the fused mass of silica. The evidence, as a matter of fact, clearly showed that, instead of retaining the gas, the defendants deliberately allowed it to escape.

Mr. Walter, K.C., replied at considerable length, and at the conclusion of the arguments his Lordship reserved judgment.

West Hartlepool Tramways.

An interesting question under the Tramways Act, 1870, was raised in the case of the Hartlepool Electric Tramways Co., Ltd., and Others, *v.* the West Hartlepool Corporation, which came before the Court of Appeal on Friday last, composed of Lords Justices Vaughan Williams, Fletcher Moulton and Buckley. The plaintiff company and Messrs. Sellon and Ashby, the promoters of a tramway undertaking in West Hartlepool, brought the action claiming specific performance by the West Hartlepool Corporation of an agreement to purchase the tramways. In other words, they claimed £12,963, the sum fixed by an arbitrator as the value of the undertaking.

It appeared that in 1905 a provisional order was obtained by Messrs. Sellon and Ashby, as promoters, for the construction of the tramways, which are known as the Park route and the Foggy Furze route. The order was confirmed by an Act passed in 1895, by which it was provided, *inter alia*, that the Corporation might purchase the undertaking after the lapse of 14 years. In August, 1896, before the tramways were constructed, the promoters entered into an agreement with the British Electric Traction (Pioneer) Co., Ltd., to sell the undertaking to them; and by a further agreement made in October, 1896, the undertaking was purported to be sold to the plaintiff company. Neither of the agreements was sanctioned by the Board of Trade, as provided by a section to that effect in the Confirmation Act. The construction of tramways, which was commenced in March, 1897, was duly completed. In January, 1910, the Corporation gave notice to the promoters, requiring them to sell their undertaking, knowing, as it was said, that the sale to the plaintiff company had not been approved by the Board of Trade. The matter was referred to an arbitrator, who assessed the value at £12,963. The Corporation, however, contended that they could make no valid payment to the original promoters who now had no legal title to the tramways; and that they could not pay anything to the plaintiff company, inasmuch as the assignment had not been approved by the Board of Trade. The plaintiffs accordingly brought the present action.

Mr. Justice Bray gave judgment for the plaintiffs, holding that the original promoters were the owners of the undertaking, and that inasmuch as the Corporation had exercised their option to purchase, with notice that the transfer to the company had not been approved by the Board of Trade, they could not now be heard to say that the promoters were not the legal owners. The Corporation now appealed.

Mr. Balfour Browne, K.C., in support of the appeal, said that his submission was that, inasmuch as the tramways were not constructed by the promoters, but by a company which had no

authority either to construct or to work them, the provisions of Sec. 43 of the Tramways Act of 1870 had not been complied with, and, therefore, neither the promoters nor the company had any legal ownership in or title to the undertaking. In those circumstances, it would be *ultra vires* of the Corporation to purchase the tramways.

Lord Justice Moulton: Is it your case that the Corporation ought to get these tramways for nothing?

Mr. Balfour Browne: No, my Lord; my point is that we cannot acquire a title, and are, therefore, not entitled to purchase.

Lord Justice Buckley: You want to get out of your bargain?

Mr. Balfour Browne: We want the company to get out of the streets, because, as we say, they are trespassers.

Lord Justice Moulton: Then the tramways fall to you, as the highways authority.

Mr. Balfour Browne: No, my Lord; the company can take their tramways—remove both lines and cars at once if they choose.

Lord Justice Vaughan-Williams reminded counsel that he was appearing for a public body, whose duty it was to act reasonably in the public interest. Was it right, asked his Lordship, for the Corporation to rely upon mere legal technicalities?

Mr. Balfour Browne replied that it was entirely because he was appearing for a public body, that he felt it necessary to press the point. The Corporation could only act according to statute, and if they purchased this undertaking when they had no right to do so, individual members of the Corporation would be liable to be surcharged, and in the end would have to pay the £12,900 out of their own pockets. If the company would apply for a provisional order, and thus clothe themselves with the right which they at present did not posssess, the Corporation were quite willing to pay for the undertaking.

Lord Justice Moulton: The Board of Trade, apparently, have not objected to the assignment to the tramway company.

Mr. Balfour Browne: The Board of Trade have not given their sanction, and therefore the undertaking is not transferred to the company.

Lord Justice Moulton: Then it belongs to the promoters.

Following Mr. Balfour Browne, K.C., for the appellants, Mr. McCardie argued that the Corporation were not bound to perform the agreement and purchase under the Act of 1870.

Replying to Lord Justice Moulton, Counsel said the Corporation did not want to take the tramway materials or rolling stock. They wanted the undertaking conveyed to them, but they did not want to have to take over the materials, rails, &c.

Lord Justice Moulton said that it was really scandalous to suggest that because the company had made some irregularity in the formal transfer to themselves, the Corporation should have power to take the undertaking and not pay anything for it.

Mr. McCardie replied that he was not there to argue points of municipal etiquette, and contended that the Corporation were not bound to take anything more than the statute compelled them to. The consent of the Board of Trade was never obtained to the transfer to the company, and the Corporation were entitled to insist on their right to have transferred to them only the powers to run tramcars.

Mr. Danckwerts, K.C., for the plaintiffs, submitted that the consent of the Board of Trade was not necessary, but if it were, then in fact it had been obtained.

The Court intimating that they did not wish to hear Mr. Danckwerts further,

Lord Justice Vaughan Williams, in giving judgment, said the case for the Corporation failed for two reasons. In the first place certain correspondence which passed between the Assistant Secretary of the Board of Trade and the company was only consistent with a recognition by the Board of Trade of the company being the transferees of this undertaking. Such letters could not have been written unless the Board of Trade intended to give their permission. Moreover, no written consent of any sort was necessary in respect of the powers given by the tramways order, and in as much as there was an assignment from the promoters to the tramways company, and that assignment required no written consent, the company became themselves the promoters by succession. This diplomatic action by which the Corporation desired only to purchase a portion and not the whole of the undertaking of the company therefore failed. He did not think that any great harm was done by the failure of the action, but rather that it would be in the public interest.

Lords Justices Buckley and Moulton concurred, and the appeal was accordingly dismissed, with costs.

Claim on a Guarantee.

In the Lord Mayor's Court on Monday, before the Recorder (Sir Forrest Fulton, K.C.), and a jury, a claim was made by E.M.F., Ltd., electrical manufacturers, of Ironmonger Lane, E.C., against Mr. Fred Spink, butcher, of Kenway Road, Earl's Court, to recover the sum of £21 8s. 9d., the price of goods sold and delivered to Mr. W. Barnes, electrical engineer, of 12, Kenway Road, Earl's Court. Mr. McCaskie appeared for the plaintiffs, while the defendant was represented by Mr. Liversedge.

For the plaintiffs, it was stated that, in the early part of last year, Mr. W. Barnes was anxious to open an electrical establishment at Kenway Road, and the defendant Spink was desirous of assisting him. A shop was opened, and the business carried on under the style of W. Barnes & Co. On January 24th of last year, the defendant and Barnes called upon the plaintiffs and the two selected goods to the value of £62 12s., and subseqnently a further order amounting to £7 was received. Certain goods were sent to Kenway Road, and a cheque was received from Barnes for £25. The plaintiffs then informed Barnes they would not send him any more goods unless they received cash against delivery. On February 7th, 1910, it was alleged that the defendant, who was behind Barnes in the venture, wrote to the plaintiffs saying: 'Mr. Barnes has been to me with reference to goods ordered from you. Your representative most certainly told him in my presence that he might have the goods and pay within three months; also he would let him have plenty of material to show, and as he is anxious to open, if you will send him on the goods to-morrow, I will see your account is settled during the week. He has some money due, and is daily expecting it."

Counsel said that the defendant undertook to be responsible for goods delivered, if Mr. Barnes did not pay for them. In due course the plaintiffs delivered the whole of the goods comprised in the two orders, of the value of £69. Subsequently cheques were received in part payment of the goods from the defendant. There was still a balance due to the plaintiffs of £21 8s. 9d., which was now sued for. An action had been brought against Mr. Barnes for the amount, and judgment was obtained against him on November 4th last. When the plaintiffs went to levy execution they found that the goods they had delivered were included in a bill of sale which had been registered in favour of the defendant. In addition to being behind Mr. Barnes, the defendant also had the plaintiffs' goods.

The Recorder held that the plaintiffs could not succeed against the defendant, and at his direction the jury returned a verdict for the defendant, for whom judgment was entered, with costs.

British Westinghouse Electric & Manufacturing Co.

On Monday, July 24th, the case of The British Westinghouse Electric & Manufacturing Co. *v.* The Electrical Co., Ltd., came before Mr. Justice Swinfen Eady, in the Chancery Division. This was a patent action in which the plaintiffs had succeeded, and the defendants now applied that the judgment, as given out, should be varied. The judgment ordered the delivery up to the plaintiffs of the arc lamps or parts of lamps in their possession, and the defendants asked that they should have the option of, instead of delivering up, destroying the lamps in the presence of plaintiffs or their agents. It was urged on behalf of the defendants that where articles were made in infringement of a patent, the property in the article did not vest in the patentee, but remained in the person who had unlawfully infringed the patent.

His Lordship said the Court had jurisdiction either to order the delivery up of infringing articles, or to order their destruction in the presence of the plaintiffs, so as to prevent them being used. He had, however, to consider what the order was that was made at the hearing. The plaintiffs asked for delivery up, and the whole order proceeded on the footing of delivery up, and the defendants did not then ask for the alternative that there should be a destruction of the lamps or parts of lamps. It was, in his opinion, too late to ask for relief of that sort, and the motion to vary the order failed accordingly.

Central London Railway *v.* Land Tax Commissioners.

On Monday, before the Master of the Rolls, Lord Justice Farwell and Lord Justice Kennedy, an appeal by the Central London Railway against a decision of Mr. Justice Swinfen Eady was heard, regarding the company's liability to pay land tax where the line lay under highways, and the tax had been redeemed on lands abutting on those highways, and where it lay under any lands the surface of which had been exonerated from the tax by redemption. According to the *Times* report, Mr. Justice Swinfen Eady held that land exonerated from land tax when in its normal condition was entirely exonerated, but not when at the date of its redemption it was not in its normal condition and special circumstances existed to modify the price of redemption. He also held that redemption of the tax on lands or houses abutting on a public street did not confer exoneration up to the middle line of such street. The plaintiffs appealed upon the last point, and the Court allowed the appeal by a majority.

Defective Electric Clocks.

At Westminster County Court on Monday last, a case was heard in which Miss M. Blackwood sued Messrs. John Walker, Ltd., for £41 2s. 6d. as damages for breach of contract in respect of a series of electric clocks which plaintiff presented to St. Columbia Church, Chelsea, last year. The defendants installed a master clock with three dials on the church tower, and several other dials inside the church, at a price of £118 13s. The clocks were guaranteed for 20 years, but soon began to behave in a very erratic manner, the dials registering different times, and eventually plaintiff called in Mr. Hope Jones to rectify matters. Since then the clocks had kept satisfactory time. Mr. Hope Jones charged £41 2s. 6d. for the work, and the plaintiff claimed this sum from the defendants. Judgment was given for the plaintiff for £25, with costs.

Electric Fittings Dispute.

In the West London County Court, on Monday, before his Honour Sir W. Lucius Selfe, Messrs. Childs & Co., electricians, Westbourne Grove, Bayswater, sued W. Strongitharm, builder, 183, New King's Road, Fulham, for £3 9s. 6d.

Mr. H. Watts Dollen, for the plaintiffs, said the claim was for £2 balance of a contract price for fitting up the electric installa-

tion at Peterborough Mansions, 5s. balance of an account rendered for goods sold, and 11s. 3d. the price of goods delivered to the defendant for sale and subject to 10 per cent. discount; the total amount of the claim was £3 9s. 3d. Defendant counterclaimed £2 15s. for work done to repair defects in the plaintiffs' work.

His Honour gave judgment for the amount claimed, with costs, the amount to be reduced by the value of the articles scheduled if returned to the plaintiffs in 14 days; and on the counterclaim for the defendant for 30s., with costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Bennis Stokers at Leeds.

The Leeds tramway system is one of the most important in the United Kingdom, and, contrary to the usual practice in this country, it operates its own power station, generating 16,342,280 units during the past year.

A feature of the boiler house is the range of 15 Lancashire boilers, all fitted with Bennis machine stokers and self-cleaning compressed-air furnaces. The stokers used are of the sprinkling type. These machines, by means of an ingenious device, feed the fuel at regular

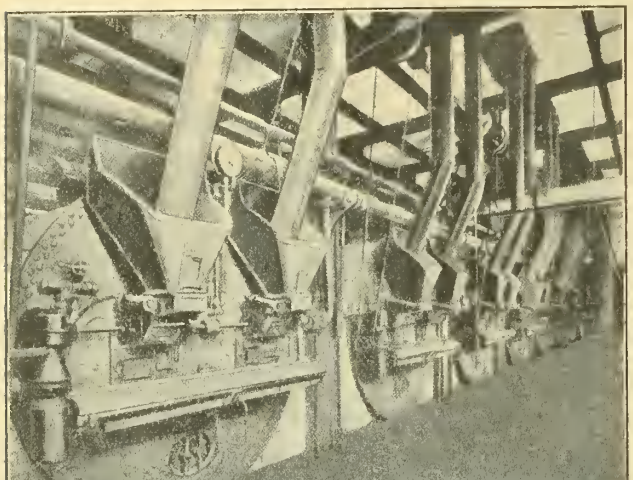


Fig. 1.—Bennis Stokers in Leeds Tramway Power Station.

intervals on to the parts of the fire where it is immediately required. The result of this distribution is a clear, strong fire, burning steadily and without smoke. The quality of coal used is practically immaterial, as the machine will burn smudge, duff and other pit rubbish effectually and without smoke. The fuel burnt at Leeds is "washed nuts," and the fuel cost per unit is ·23d. Our view shows the installation in the boiler house.

High Candle-Power Metal Lamp Fittings.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, N.E., have recently issued a list (No. 84A) dealing with their 200-

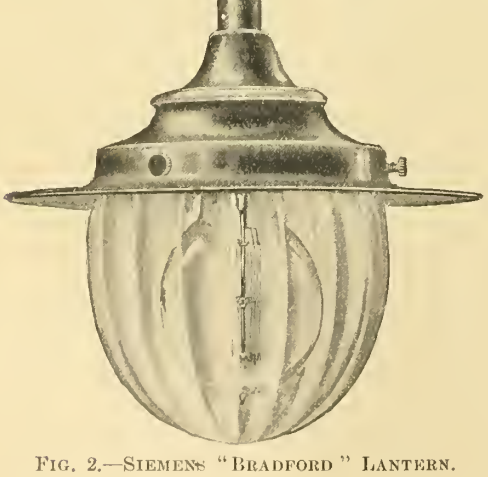


Fig. 2.—Siemens "Bradford" Lantern.

watt "Onewatt" drawn tungsten lamps, and drawing attention to the Bradford lantern a new type of lantern, suitable for the above lamp, and, in smaller and larger sizes, for the 100-watt bell or spherical lamps, and 1,000-watt lamps respectively.

This lantern is in zinc, with a special fluted clear globe and white enamel reflector, as shown in fig. 2. The same list covers the Sheffield lantern, with pear-shaped globe, half opal obscured diagonally, and suitable for one 200 or four 55-watt lamp Messrs. Siemens are, of course, specialising in drawn-wire lamp and their "Onewatt" series has recently been added to, by a 30(watt lamp, for voltages between 100 and 250. Full particulars c these drawn-wire lamps are given in list 4a 13.

Denny's Refillable Cartridge Fuse.

A novel form of refillable cartridge fuse has recently bec devised by Mr. C. W. Denny, of 39, Oakley Crescent, Chelse

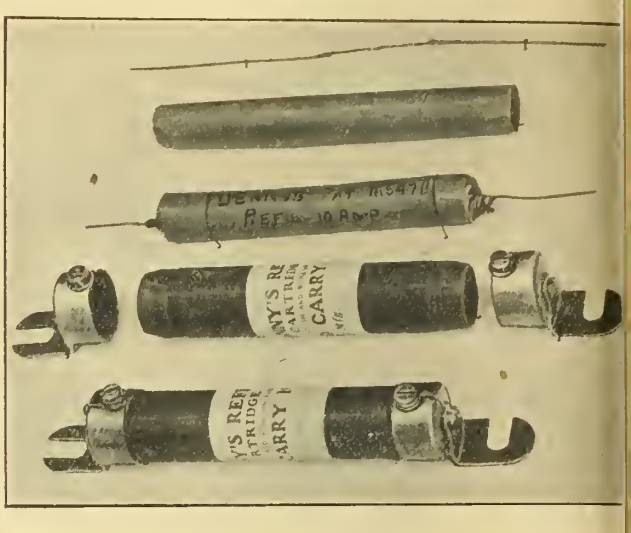


Fig. 3.—Denny's Refillable Cartridge Fuse.

illustrations of which we reproduce above. The unique featu of this fuse is that the refills, which are made up in paper asbestos tube, are accurately calibrated and packed, making th operation of refilling as simple as possible, and also maintainin the maximum degree of accuracy. Refills for various capaciti and voltages can be supplied neatly packed in cardboard boxes a very small cost. The refills, which are practically paper cartridg fuses, are an easy fit into the outer fuse-case proper, and can al be made to fit porcelain handle type fuses.

E.A.C. Starting Panel.

The Electrical Apparatus Co., Ltd., of Vauxhall Work South Lambeth Road, S.E., have sent us an illustration of the standard E.A.C. multiple solenoid panel, consisting of a number

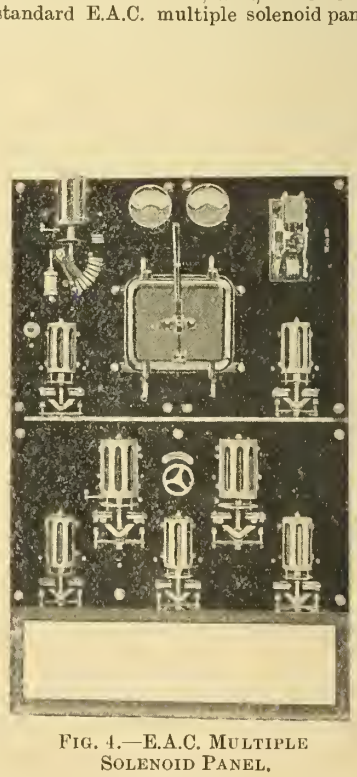


Fig. 4.—E.A.C. Multiple Solenoid Panel.

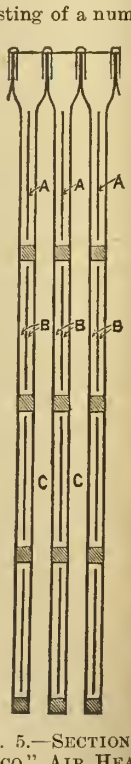


Fig. 5.—Section of "Usco" Air Heater.

solenoid contactors, controlled by one master solenoid. An overlo circuit-breaker is provided, besides a double-pole main switch an fuses, and an interlocked shunt regulator, all of which can readil be identified on the view, fig. 4.

The "Usco" Air Heater.

The "Usco" air heater, for recovering heat from the was gases from boiler furnaces by heating the air supplied to the latte has been described in our pages, and we need only mention he

that it consists of a nest of heating elements, each of which takes the form of a flat, semi-circular steel cell; these are fixed in the flues, so that the hot gases pass between the flat cells, while the fresh air passes through the interior of the latter and is thus heated. The Underfeed Stoker Co., Ltd., of Coventry House, South Place, Finsbury, E.C., have increased the efficiency of the heating elements by fixing inside them flat plates, as shown in section in the accompanying figure. Radiant heat passes through transparent gases without raising their temperature, so that they can only be effectively heated by contact with hot surfaces. It will readily be seen that the "radiation plates" AA, receiving radiant heat from the outer walls of the cells CC, will become almost as hot as they, and being in contact with the air in the spaces BB, give up heat to the air and greatly increase the effectiveness of the heater. We understand that the use of these plates has been protected by letters patent in this country and abroad. A number of methods of utilising the heaters are illustrated in a pamphlet recently issued by the company.

BUSINESS NOTES.

Book Notices.—*Low-Voltage Electric Lighting with the Storage Battery;* and *Wiring Houses for the Electric Light.* By N. H. Schneider. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.—The first of these books is intended to give practical information about the installation of electric light in isolated premises, on yachts, &c. The author explains in simple language the elementary facts about the electrical units and apparatus required for his purpose, and proceeds to describe various accumulators, fittings, &c., in somewhat haphazard fashion, giving specifications for installations of 6 and 10 lamps at 10 volts, and 10 and 14 lamps at 27½ volts. Some typical installations are described, with half-tone illustrations, and instructions for running the plant are given.

The second book gives a detailed account of house-wiring for a pressure of 110 volts, though the author is more particularly concerned with low-voltage installations. The system adopted is mainly that of wiring through joists and on "knobs," and full directions are given, as well as for surface wiring with cleats and in casing. Unfortunately both books deal solely with American practice, which differs so much from British practice that they are not likely to be of much service to readers in this country.

Universal Directory of Railway Officials. 1911. London: The Directory Publishing Co., Ltd. Price 10s.—This directory is now in its 17th year, and will, no doubt, prove as useful a book of reference as it has certainly been in previous years. It is especially interesting to electrical men, because it includes practically all the electric tramways in the United Kingdom, as well as the electric railways. The "Personal Index" is a particularly useful feature of the work.

"The Physical Review." Vol. XXXII, No. 6. June, 1911. Lancaster, Pa.: Price 65c.

"Applied Electrochemistry." By M. de Kay Thompson. London: Macmillan & Co., Ltd. 1911. Price 9s. net.

"Building in London." By H. Cubitt. London: Constable and Co., Ltd. 1911. Price 31s. 6d. net.

Dissolution and Liquidation. — Aluminium Corporation, Ltd. (incorporated 1907, went into voluntary liquidation December 9th, 1908).—Creditors are required to forward particulars of claims before September 1st to R. Lawson, 60, London Wall, E.C., one of the liquidators. This notice does not apply to the Aluminium Corporation, Ltd., incorporated December 17th, 1909.

Stanley & Simpson, Margate, electricians.—The partnership between C. W. Stanley and J. W. Simpson has been dissolved by mutual consent, as from March 31st, 1911. The business will be carried on by J. W. Simpson.

Bankruptcy Proceedings. — Cuthbert Fenton Lindop, electrician, 62, Dale Street, Liverpool.—The first meeting of creditors herein was held last week at the Official Receiver's offices, 35, Victoria Street, Liverpool, Mr. Britten, the Assistant Official Receiver, presiding. The statement of affairs showed unsecured liabilities amounting to £900 11s., and no assets. The debtor attributed his failure to loss on contracts, insufficient trade, and losses on working a patent electrical sign. The receiving order was made on a creditor's petition, the act of bankruptcy being the execution by the debtor of an assignment of his property in June last to a trustee for the benefit of his creditors generally. It was stated that the debtor in October, 1909, commenced business as an electrical engineer under the style of C. F. Lindop & Co., at 62, Dale Street, Liverpool, with a capital of £200, which he had borrowed for the purpose of exploiting an electrical patent advertising sign of his own, which seems to have proved a failure. A company called C. F. Lindop & Co., Ltd., was registered on March 18th, 1910, and on April 26th a debenture was issued by the company for £100, of which the debtor received £73, the balance being applied in payment of costs of registering the company. The debtor stated that he signed two agreements for the sale of his assets to the company. A debenture-holders' action was commenced against the company shortly before the receiving order, and on the 3rd inst., the Vice-Chancellor of the Lancashire Palatine Chancery Court appointed a Receiver of the assets on behalf of the debenture-holders. The only book of account kept was a rough day-book. The whole circumstances attendant upon the creation and formation of the company and the issue of the debenture were unsatisfactory, and called for the closest investigation. No resolutions were passed, and the matter remains in the hands of the Official Receiver.

Charles Hellyer Pearson (Pearson & Co., and the B.O.A. Engineering Co.) Manchester.—Notice of dividend is given in the *London Gazette*; last day for receiving proofs, August 4th, 1911. Trustee, A. Yearsley, 27, Brazennose Street, Manchester.

Alphonse C. A. Wampach, Hythe.—Notice is given in the *Gazette* of first and final dividend of 8¼d. in the £; Official Receiver's office, Canterbury.

W. H. Ridpath (Ridpath & Wells), Ilkeston.—The first meeting will be held on July 31st, and the public examination on August 2nd, at Derby.

E. Ristori, Westminster.—Adjudication in the High Court of Justice in Bankruptcy, July 19th, 1911.

J. G. Childs & Co., Ltd., Hawthorne Road, Willesden Green, N.W.—First meeting of creditors, August 1st, at Carey Street. Proofs to Official Receiver by noon, July 31st.

George Montague Sellick, manufacturer of electrical accessories, Forest Gate, Essex.—An order was made on June 27th for discharge as from June 27th, 1913.

Annual Holidays.—The British Prometheus Co., Ltd.—Offices and works will close on Wednesday, August 2nd, and re-open on Monday, August 14th. A small staff will be in attendance to deal with urgent matters.

British Insulated and Helsby Cables, Ltd.—The Prescot Works will be closed from noon, Saturday, August 5th, to 8 a.m., Monday, August 14th, for the purpose of the annual overhaul. The offices at Prescot will be closed only from Saturday noon, August 5th, to Wednesday morning, August 9th.

A. Seage & Co., London, W.—The works and offices will be closed from noon, Saturday, August 5th, until Monday, August 14th.

Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden, N.W.—The works will be closed from August 7th to 12th.

Messrs. Mawdsley's, Ltd., Zone Works, Dursley.—The works will be closed from Friday night, the 4th prox., until Wednesday morning, the 9th.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—The works will be closed from Friday, August 4th, until Monday, August 14th.

The Electric & Ordnance Accessories Co., Ltd., Aston.—The works and offices will be closed from Friday evening, August 4th, until Monday morning, August 14th.

Trade Announcements.—The Benjamin Electric, Ltd., inform us that the telephone number at their new offices and showrooms at 117, Victoria Street, Westminster, is No. 1297 Victoria.

Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall, have appointed as their London agent Mr. S. H. Fielden, of 90, Charing Cross Road, London, to whom they wish readers to send all inquiries.

Mr. Stanley Harvey Douglas has taken over the business of Messrs. Price & Co., electrical engineers, of 16, High Street, Newport (I. of W.).

Messrs. Tetley & Co., of Falcon Electrical Works, Bedford Street, Greengate, Salford, inform us that they have given up their London agents, and, pending further arrangements, wish all orders and inquiries to be addressed direct to the works, so that they may receive prompt attention.

Lea Recorders.—Orders have recently been received for these recorders from the Dublin United Tramways Co., Stretford, Dublin, Aberdeen, East Ham, Sheffield, Torquay, Cape Town, Walthamstow, Walsall, Eastbourne, Burnley and Blackburn Electricity Works, City and South London Railway, Midland Electric Corporation, County of London Electricity Supply Co., and Melbourne Electric Supply Co., Ltd.

For Sale.—Messrs. P. Huddleston & Co. will, on Tuesday, August 1st, sell by auction a large quantity of electrical apparatus at 16, Long Millgate, Manchester. See our advertisement pages to-day.

Fire at Taunton.—Messrs. Newtons, Ltd., electrical engineers, Taunton, inform us that the fire which occurred in their main foundry on the 19th inst. has done no serious damage, and they are able to give their usual quick deliveries, the damage having been promptly repaired.

Catalogues and Lists.—Messrs. Croft & Perkins, Ltd., Thornbury, Bradford.—Catalogue of power-transmitting machinery and appliances, which, it is claimed, is the most complete compilation of up-to-date mill-gearing practice ever issued. It is a substantial volume, divided into 15 sections, with thumb indexes. The respective sections deal with shafting and couplings, plummer blocks and brackets of several types, belt driving (pulleys, guides, tighteners, &c.), rope driving, gear wheels, clutches, speed changes, belts and ropes, and a variety of accessory and special devices incidental to the use of the foregoing apparatus. The book, however, is by no means only a catalogue; it is a technical work of high order, containing a great store of information on every department of mechanical power transmission, numerous tables of technical data, and, in Section XV, rules, tables and formulæ covering a wide range of applications. Some electrical

data are given, and flexible insulating couplings are included. Altogether, the "catalogue" is quite an encyclopædia of knowledge on the subject of power-transmitting machinery.

The Piggott Electrical Co., 24, New Bridge Street, E.C.—Price list of cables and wires, and china cable connectors.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—Price list of "Crane-rated" motors for driving cranes, lifts, winches, hoists, &c., including both D.C. and A.C. (three-phase) machines, open protected, enclosed ventilated, and totally enclosed, of which very complete data are given. The sizes range from ¼ to 40 B.H.P., D.C., and from 1¾ to 65 B.H.P., A.C.

The Corona Lamp Works Co., Ascham Street (St. Pancras), London, N.W.—Price list of the "Corona" new patent tungsten lamps with double frame cross filaments, as devised by Mr. S. Horvath, whose business is incorporated with this company. All the usual sizes and voltages are listed—up to 1,080 C.P., as well as "Metaflect" and other special types, and they are all British made.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, S.W.—Leaflet recording long motor-cycling runs which have taken place recently, in which a Siemens-Obach ignition dry battery, without reserve, was used by Mr. H. Karslake over distances aggregating more than 764 miles, without failure. A similar battery was used for a run of 762 miles, from London to Edinburgh and back.

National Electric Lamp Association (Engineering Department), 4,411, Hough Avenue, Cleveland, Ohio, U.S.A.—Bulletins Nos. 16 and 17, relating to "Mazda" incandescent street lighting, and the economical operation of incandescent lamps.

The Weston Electrical Instrument Co., Audrey House, Ely Place, Holborn, E.C.—Folder giving illustrations of eight different types of switchboard A.C. indicating instruments, with some brief particulars regarding them.

F. Hodgson & Co., 24, Queen Victoria Street, E.C.—Leaflet relating to the "A P" electric fan.

Messrs. Wilson Hartnell & Co., Ltd., Volt Works, Leeds.—Catalogue (Section IV) of governors and governor gear. The Hartnell governor, first patented in 1876, has ever since been a household word in steam practice, and is still the firm's standard type of vertical governor, lending itself to the control of trip-gear and link-gear expansion valves; in addition, various modifications of the governor are listed with full particulars, and some useful technical notes, based upon the unique experience of the firm, are embodied in an introductory section, which greatly add to the usefulness of the catalogue.

Scottish Tube Combine.—It is reported that practically all the Scottish firms making wrought-iron and steel tube have joined in the formation of a company, to be known as the Scottish Tube Co., Ltd., with a capital of £600,000. Messrs. Stewarts and Lloyds, the largest producers, are not included, but will work in harmony with the company, in which they will hold shares. The object of the combination is to put an end to the ruinous price-cutting which has prevailed since the disruption of the International Tube Trade Association four years ago.

LIGHTING and POWER NOTES.

Argentina.—The Sociedad Empresea de Luz y Fuerza, of Buenos Ayres, which owns the central electricity station in the town of Mendoza, is about to considerably extend the same; it is also in negotiation with reference to the construction and working of an electric tramway in the town.

Baildon (Yorks.).—The District Council of Baildon, a very popular and growing residential area near Bradford, had reported to it on Tuesday last week, the fact that the Wharfedale Electric Light and Power Syndicate is about to apply for an order to enable it to supply electricity in the Baildon district. The syndicate asked the council to consider the purchase of electricity in bulk from the company. The Council, however, which appears to have a rooted dislike to outside companies gaining a monopoly in any branch of public supply in the district, decided very emphatically to maintain its position in that direction and to withhold its support and oppose the granting of the order.

Barking.—The price of energy for cooking purposes is to be reduced to 1½d. per unit. The Council has decided to retain the services of Messrs. Hammond & Son, consulting engineers, at an inclusive fee of 50 guineas, to report upon a scheme of extensions to the electricity works.

Barnstaple.—At the instance of the T.C., the B. of T. has deleted from the Barnstaple Gas Order the words, "or a supply of electricity."

Belfast.—At the fortnightly meeting of the Tramways and Electrical Committee on Monday, the electrical engineer reported on the tenders for a circulating pump and motor-driven air pump, and those of the Rees Roturbo Manufacturing Co., Wolverhampton, and the Worthington Pump Co., respectively, were accepted. It was decided to make application to the L.G.B. for sanction for a loan of £40,000 for the purpose of carrying out the proposed extensions to the cables, &c. The necessity for extending the generating station was also discussed, and a Sub-Committee was appointed to consider the matter and report.

Bingley.—The U.D.C. has adjourned the question of consenting to an application for a prov. order for electric supply by the Electrical Distribution of Yorkshire, Ltd., pending inquiries as to whether it is possible to get a supply of current from Bradford, Shipley or Keighley.

Bootle.—The annual report of Mr. T. D. Clothier (Borough electrical engineer) on the electrical undertaking shows that a record surplus was obtained in the year ended March 31st, 1911. There is every indication, he points out, that the setback to the output due to the introduction of the metal-filament lamps has now disappeared, and with the increased output during the year there has been an increase in the maximum demand upon the works, which last winter reached the limit for which the plant should be relied upon. The number of customers was 755. There were users of electricity having motors equal to 2,533 H.P., receiving a supply from the undertaking, but there were users of over 9,000 H.P. being served by steam and gas engines, and most of those users might wish to change as their present arrangements got older. Little progress had been made in the use of electricity for heating and domestic purposes, and it was unlikely that any considerable development would take place until the price for these purposes had been reduced. In regard to the Corporation trading in the supply of fittings, wiring, motors, and the installing of apparatus, for which it possesses powers, the Electricity Committee has been trying as an experiment a scheme whereby metal-filament lamps of suitable candle-power are supplied and maintained for a payment of 20 per cent. on the amount due for current consumption, except as against mechanical breakages.

Reporting upon the plant, the engineer states that the units sold work out at an average of 1,480 for each electrical H.P. of plant; 1,000 units is a good average figure, being the exact output, for instance, in the case of the Liverpool supply. With regard to the financial position of the undertaking, the percentage of gross profit was 8·83 per cent. of the total expenditure; it was, however, 13·6 per cent. when compared with the capital at present represented. The capital outstanding reached a maximum figure in 1905 of £99,192, since which time it had steadily declined to £74,254. The entire revenue only amounted to 17·8 per cent. of the capital expenditure, so that careful management was required to leave any surplus.

Brazil.—A decision, which will become law when passed by the Brazilian Parliament after the third reading (the second reading having been passed), grants permission to the Compagnie Brésilienne d'Energie Electrique or any other company or private individual who may apply for it, to lay down, work, and use a system of transmission of electric power for private lighting in Rio de Janeiro and its suburbs. This concession will have a duration of 60 years. The holders of the concession undertake to:—(*a*) Accept such clauses as the Government may impose for the public safety and the regularity of the service; (*b*) Not to charge more than 100 reis-paper per KW.-hour consumed for lighting; (*c*) To inaugurate the service on September 16th, 1915. The present concession grants no monopoly, the Government reserving the right to grant same in open competition. All decisions contrary to this are abrogated. The Rio de Janeiro Municipality has signed a contract with the above company.

Bridlington.—On the 21st inst., the Mayoress switched on the new electrical illuminations introduced on the Royal Princes Parade at Bridlington, the property of the T.C., and she was presented with a mounted and inscribed silver switch by the Property Committee.

Bristol.—The annual report of the engineer and general manager of the electricity undertaking (Mr. H. Faraday Proctor) states that the number of additional consumers connected during the 12 months exceeded that of any of the past six years, and the increase in the power connections was again highly satisfactory, being nearly twice as great as the increase in the previous year. The use of metallic-filament lamps is still operating to the advantage of the consumer, as evidence of which the following particulars of revenue from lighting supply during the past four years are given: 1908, £47,447; 1909, £43,416; 1910, £40,779; 1911, £41,543. Thus, although the amount of actual light supplied to consumers for the past year has been enormously greater than that supplied in 1908, the consumption required to produce this increased amount of light has diminished to the extent that consumers have paid in the aggregate £6,000 less. There has again been a substantial decrease in the total costs of production for the year which work out at ·887d. per unit sold, as compared with 1·002d. in 1910, a net reduction of over 11 per cent. The gross profit has increased over that of last year to the extent of £5,612. The accounts show that the gross receipts amounted to £84,434 and the gross expenditure to £36,001, leaving a gross profit of £48,433. After deducting interest on loans, &c., and also putting aside £3,042 for renewals there is a deficiency of £768 in the revenue account which is to be met from the unappropriated balance in hand which stands at £4,041.

Bury.—At the forthcoming Lancashire Agricultural Show to be held at Bury, there will be a representative exhibition of electrical apparatus by the Corporation Electricity Department.

Cardigan.—The T.C. has informed a resident who desires a supply of electricity, that it is not the intention of the Corporation as such to embark upon an E.L. scheme, but that it was open for anyone to do so.

Clitheroe.—At a meeting of the T.C. on July 20th, a letter was read enclosing notice under the Electric Lighting Act, 1882, by Mr. James Speight, that he intended, on behalf of a pro-

posed company, to apply for a provisional order for the supply of electricity within the borough.

Continental Notes.—Austria.—A syndicate of Swiss capitalists in conjunction with the municipal authorities of Pettau, contemplates erecting a large power station on the River Drau between Pettau and Friedau. Power to the extent of 34,000 h.p., to be eventually increased to 54,000, will be generated. The Siemens-Schuckert Werke and the Elektricitäts Gesellschaft Ganz, of Budapesth, are associated in the project.

Although Innsbruck, the capital of the Tyrol, already possesses two large electrical works (one in the Mühlan Valley and the other in the Sill Valleys), with a total output of 21,000 kw., it has become needful as a result of the constant increase in the consumption of power for industries and tramways to erect a third station. According to statements made at a municipal meeting several schemes have been considered, that for the utilisation of the Achen Lake being the most favourably regarded. Its realisation, it is estimated, will cost upwards of 4½ million gulden. Pending the raising of the necessary capital and the completion of the technical details, the Council has decided to set up a temporary steam installation of a maximum capacity of 3,000 h.p. The funds for the purpose have already been voted. The permanent scheme is expected to be actively taken in hand at the beginning of next year.

France.—A company has just been formed at Beauemont, with a capital of £11,200 and the title La Société d'Energie Electrique de Chauffailles, La Clayette et Extensions, to acquire and carry on a small electricity generating station near Beauemont (Saone-et-Loire) and the concessions for the electric lighting of the little towns of La Clayette, Chapelle-sur-Dur, and Chauffailles.

Derby.—The T.C. has reduced the price of energy for the tramways from 1·5d. to 1·45d. per unit.

Edinburgh.—The Corporation Electric Lighting Committee recommends the T.C. to give from the surplus (which amounted, for the the year ending May last, to about £8,000) on the electric lighting account such sum as may be required to meet the deficit on the building fund account of the College of Art. Under the Electric Light Order Confirmation Act, 1891, the Corporation has power to apply such surplus to the improvement of the district, and it is in virtue of this clause that the Committee has made the recommendation. If the whole surplus were handed over, together with the other contributions expected, the total cost of the building would be met.

Thanks to the co-operation of the Citizens' Committee and the Corporation Electric Lighting Department, the latter supplying the current free of charge, the illuminations on the occasion of the Royal Visit were on a brilliant scale. At the west end of Princes Street the triumphal arch and the circle of Roman Columns were decked out with thousands of electric lamps and the spectacle was a magnificent one. The triumphal arch at the east end of Princes Street was also illuminated, but perhaps the most charming in its artistic effect was the Nelson monument on the Calton Hill on which a searchlight was placed.

Egham.—Mr. A. P. Trotter, of the B. of T., attended last week for the purpose of hearing objections to the proposal of the Egham District Electric Light Co. to erect a generating station upon land adjoining the gasworks at the Causeway. The Inspector said at the outset that it was not a question of finding a site free from all objection, but one where objections were at a minimum.—On behalf of the company, Mr. Dykes said it was proposed to put up a station containing two Diesel oil engines of about 110 to 120 h.p. each. His firm had installed them in other residential districts, and there had been no complaints. The proposed building would be an ornament to the district. To meet the wishes of the Thames Conservancy, the company had agreed to plant trees on the riverside boundary, and the Conservancy were not objecting to the proposals.—Mr. Hutchins, for the objectors, urged that the proposal was prejudicing intending tenants of adjoining property, and if it were sanctioned the company's engineers would be the judges as to the engines. The adjoining owners would have very little opportunity of protesting after the present inquiry.—Mr. Dykes said two years ago similar engines were installed in Messrs. Peter Robinson's premises in Oxford Street, just under their showrooms, and that they could not be heard in the rooms above.—The Inspector stated he could confirm this, having visited the premises mentioned. In conclusion, Mr. Trotter said the objections which had been made were very reasonable and very well expressed, and he hoped that when the works were erected it would be found that the objections were not well founded. He would report in due course to the B. of T.

Fleetwood.—The electricity undertaking has made a profit for the past year of £1,207. Of this amount, £807 is being placed to reserve; the remaining £400 is to defray the expenses in connection with the Coronation festivities. Owing to the successful year's working the Council has been enabled to make a substantial reduction in the scale of charges. It is anticipated that with careful management the undertaking will prove a profitable asset to the town and one which will thoroughly justify the Council's action in purchasing the business.

Haslingden.—The Education Committee has forwarded to the Director of Education for the County, the scheme and estimate in connection with the proposals for the electric lighting of the old and new portions of the secondary schools.

The L.G.B. has sanctioned the borrowing of £8,188 for purposes of electric lighting as follows:—£6,238 for mains, including £1,000 for future extensions (25 years); £850 for sub-station equipment (15 years); £350 for services (15 years); £250 for meters (5 years); £500 for the purchase of motors for hire (10 years).

Japan.—The Tamagawa Electric Railway Co. is now supplying electrical energy for lighting purposes to Adyama, Shibuya, and other suburban districts of Tokio.

Killeshandra (County Cavan).—The L.G.B. has authorised Dr. B. Macarthy, one of its inspectors, to hold an inquiry into the application of the Cavan R.D.C. for powers to act as an urban authority for the purpose of carrying out an electric lighting scheme for the town.

Llandudno.—Following a reduction a month ago in the price of gas, a proposal was submitted to the U.D.C. on July 21st, by the Electricity Committee, that the price of electricity to householders and other consumers who pay on the flat rate, should be reduced from 5d. to 4½d. per unit. It was shown that the profit from the concern last year was £838 less than that of the previous year, but this was mainly explained by extraordinary expenditure on renewals, new installations, &c. The proposed reduction created much discussion, some members contending that the concession would lead to financial difficulty. Eventually the reduction of ½d. per unit was approved on the chairman's casting vote.

London.—St. Pancras.—The borough treasurer reports that the gross income of the electricity undertaking for the year ending March 31st last amounted to £81,368, an increase of £4,396 over the previous year, and £6,010 over the income for the year ending March, 1909. The net profit was £13,203, which showed an increase of £3,696 over the preceding year and £6,076 over the year before. The net balance to the credit of the reserve fund is £40,547. In regard to the disposal of this year's profit of £13,203, £3,161 is to be written off the capital account of the electricity undertaking in respect of the small engines at the Regent's Park generating station, and £4,000 is to be added to the balance of the net revenue account to avoid the necessity of an overdraft of the current account at the bank. Mains are to be extended and rearranged by the chief electrical engineer at an estimated cost of £3,000. Application is to be made to the L.C.C. for sanction to borrow £10,314. This amount includes the following sums for the estimated expenditure to March 31st, 1912: Mains, £3,324; services and switches, £1,040; meters, £500.

Stepney.—The Works Committee has received a letter from the Electricity Committee upon the subject of the charge for steam supplied from the dust destructor. The letter states that in the opinion of the Electricity Committee the present charge of ·4d. paid to the Works Department for each unit distributed on destructor steam should be reconsidered, and suggesting that the charge as from, and including, the financial year should be not more than ·23d. per unit, which represented the Committee's works costs, and in this connection to guarantee to take 1½ million units per annum, subject to the Works Committee agreeing to maintain a steam pressure of 180 lb. and supplying sufficient steam to enable two engines to be run on such steam.

Marylebone.—At present the rate for contractors' showrooms is 2d. per unit, and providing a reasonable amount of heating, cooking and apparatus other than lighting is displayed, it is to be reduced to 1d. per unit. In the event of any difficulty being experienced in contractors obtaining the necessary apparatus to exhibit, this will be surmounted by the department supplying apparatus on loan. The Electricity Committee has approved the following suggestions of the general manager which affect wiring contractors, viz., hire of wiring and inclusive charges per quarter for rent of installation, maintenance and current. As regards this an agreement for three years is required, by which time the cost of wiring is repaid by the consumer, and it becomes his property. It is proposed to sublet this kind of wiring entirely to contractors, and to arrange for one in each district representative's area to do the work. If this arrangement works satisfactorily it will no doubt be extended. The second suggestion is with regard to the loan of apparatus on trial, and in this respect the Council is in a better position than contractors, owing to the fact that it possesses special facilities. It is proposed to offer contractors any apparatus which their customers desire to try, on the same conditions as the Council's representatives loan such apparatus to consumers, and if the contractors' customer purchases the apparatus the department will sell it to him at trade price. According to a certificate from Messrs. Price, Waterhouse & Co., chartered accountants, the bonus payable to the general manager and chief officers of the department, pursuant to the resolution of the Council of July 14th, 1910, amounts to £788, in respect of the audited accounts for the year ended March 31st last. This amount is subject to a deduction of 2 per cent. under the Superannuation Act, leaving a net payment of £772. The payment of this bonus was subject to two conditions, viz.: (1) The sales of the electrical energy were to exceed those of the previous year by 500,000 units (the actual increase, as will be seen from the annual report, was 1,560,497 units); and (2) the average price charged for both private and public supplies was to be diminished by not less than 5 per cent. on the previous year's average (the actual decrease was ·387d. per unit or 10·73 per cent.). The present alternative methods and rates of charge for the supply to consumers are to be continued until June, 1912.

Hammersmith.—The Electricity Committee recommends that a sum of £300 be set aside for the current year from the revenue of the electricity undertaking for the purposes of general advertising, this amount to include the salary (£156) of the present canvasser, and to be spent from time to time as the Committee may consider most desirable. The Committee is apparently waking up, but as the amount voted is not 1 per cent. of the revenue of the undertaking, there is evidently considerable further scope for activity.

Maidstone.—The T.C. has applied to the B. of T. for permission to supply current to the pumping station of Messrs. Balston, which is outside the borough.

Meltham.—The old dining hall at the mills of Messrs. J. Brook & Bros., sewing thread manufacturers, is being converted into a power station for the installation of power plant.

Milnrow.—The Rochdale T.C. has asked the U.D.C. to consent to the Corporation supplying current to a cotton-spinning shed proposed to be erected at Newhey. The Council has referred the matter to a committee for consideration.

Norwich.—The Electricity Committee of the T.C. reports that during the year ending March 31st there was an increase of 704,000 units in the output, or 17 per cent., as compared with 1909-10. The increase in the lighting was 9 per cent., and in power 26 per cent. The production, given in precise figures, was 4,817,412 units, as compared with 4,113,197 units. The income showed an increase of £4,097, while the expenditure increased £4,340. After provision for interest and sinking fund (£15,122), a balance of £5,744 remained for transfer to the appropriation account. It was not proposed to apply any part of this balance in reduction of rates, but £8,841 was now available for further expenditure on public lighting, &c. It was proposed out of this sum to provide a new battery of accumulators, which, with additions to buildings and special machinery, would absorb £5,100. The cost of production per unit last year was 0·913d., as compared with 0·943d. The total length of distributing mains was now 49 miles; it had been found necessary to lay some trunk mains at a cost of £2,338, which had been paid out of revenue.

The Electricity Committee is engaged in converting about one-third of the city street lamps for electric lighting, at a cost of £5,000. The other two-thirds will be similarly dealt with in the next two years, the expenditure being met out of revenue, and it is expected that at least £1,000 a year will be saved by the change.

Oldham.—The Electricity Committee of the T.C. on July 19th decided to discontinue the practice of supplying motors on hire to consumers, if the traders of the town will take up the business. This is the outcome of representations by the electrical section of the Chamber of Trade, who contended that in hiring out motors the Committee is infringing not only moral rights, but statute laws. On the other hand, the Committee has pointed out that the local traders have refused to let motors on hire, and compelled the electricity department to meet the demand.

Oswaldtwistle.—A conference between the Gasworks and Lighting Committees is to be held to consider the best system of lighting the highways.

Pwllheli.—A scheme for the laying down of plant to provide the town with electric light is contemplated.

Rawtenstall.—The T.C. has received a letter from the L.G.B., sanctioning the borrowing by the Corporation of a further sum of £15,650 for the purpose of the electricity undertaking.

Runcorn.—The Mersey Electric Power Co. proposes to apply to the B. of T. for sanction to the running of overhead wires in certain parts of the R.D.C.'s district. The Council has given its consent to the application.

Selby.—The U.D.C. has decided to inform the firm which has given notice of its intention to apply to Parliament for a provisional electric lighting order for Selby, that it will oppose the same.

South Africa.—Some discussion has taken place in the financial papers on a report that several Johannesburg mines where electric power has been introduced, had decided to recommission their steam engines. The natural explanation given is that the Power Co. has been unable to keep pace with the demands made upon it; in any case, the mines have contracted to use electricity for a long period of years only after careful investigation. That they have not been misled can be gathered from the chairman's statement at the New Gooch meeting, that the saving effected by the use of purchased electrical power was equal to 7·28d. per ton milled. The Roodepoort United plant, excepting hauling engines and compressors, is entirely driven by purchased electrical power, and the total cost of power for the whole reduction process, from the headgear bin to the residue dumps is given as 8·8d. per ton, including the cost of mine pumping. The compressed air plant of the Rand Mines Power Supply Co. is not yet completed sufficiently to supply the demands of the Rand Mines, Ltd., but the 4,000 H.P. compressors already installed are reported to be quite satisfactory.

Stockton-on-Tees.—The T.C. has adopted the following revised scale for current for power: Below 150 units per quarter, 2d. per unit; 150 units to 500, 1½d.; 500 to 5,000, 1¼d.; 5,000 to 20,000, 1⅛d.; beyond, 1d.

Stourbridge.—The Stourbridge and Halesowen Hospital Committee has decided to procure an estimate for lighting the hospital by electricity.

Swansea.—The Chairman and Vice-Chairman of the Tramways and Electric Lighting Committee and the electrical engineer have been instructed to prepare and submit an actual working scheme for a restricted-hour system of charging for current for power purposes, and in the meantime they have been authorised to adopt a rato of chargo on a restricted-hour system to about six consumers, with a view to obtaining further information before submitting the above-mentioned scheme.

The B.C. has adopted recommendations of the Electric Lighting and Tramways Committee accepting a tender for extending the power station, amounting to £3,827, and giving instructions to the electrical engineer to obtain tenders for new boiler plant, &c. The total extensions are expected to cost about £30,000. Considerable discussion ensued over a recommendation that the sum of £8,062, being the profit on the electricity undertaking up to March 31st, be placed to the reserve fund. Alderman Sinclair supported the recommendation on the ground that a reserve fund was absolutely necessary, having regard to the big extensions contemplated. Mr. David Davies raised the point as to whether the £8,000 was actual or merely paper profit. In reply, Ald. Sinclair said that but for the balance there would have to be an overdraft at the bank, so that in reality it was working capital. Mr. Davies considered it was not profit at all. The Committee's recommendation was adopted.

Watford.—The report of the district auditor states that the sale of current by meter produced during the year £9,336, as compared with £8,041 in 1909-10, or an increase of £1,321. The gross profit on the year's working shows an increase of £914 over the previous year, and after deducting instalments of loans and interest, the net profit to be transferred to the relief of the district fund is £790, which compares favourably with that transferred at the end of 1909-10, viz., £274, being an increase of £516. The total capital expenditure on the works now amounts to the sum of £99,229, as compared with £95,423 in 1909-10, the increase during the year being chiefly due to the cost of new machinery and the laying of new mains and services.

West Ham.—Sanction has been received from the B. of T. to the borrowing of £2,925 for the extension of the cables in connection with the tramway system.

Willesden.—The Council has had under consideration reports as to the expediency of supplying electrical contractors with electricity at special rates when their window show is of such a character as to advertise the Council's undertaking. The Committee states that during last winter two showrooms were opened in Kilburn, and it was desirable, in lieu of opening others during the ensuing winter, that the electrical engineer should, as an experiment for a period of six months, be empowered to make arrangements with any of the electrical contractors in the district who are prepared to make a satisfactory show of the apparatus belonging to the Council, or otherwise advertise the Council's undertaking, for the supply of the necessary current at a substantial rebate. This is to be done.

TRAMWAY and RAILWAY NOTES.

Bacup—Rochdale.—On Saturday the Bacup Corporation's new electric tramway to Shawforth was completed at a cost of £24,038, and trial cars were run preparatory to the B. of T. inspection by Major Druitt on the 25th inst., when through running between Bacup and Rochdale, a distance of seven miles, was arranged for. This important section of tramway links up a large radius of tramways throughout the County Palatine measuring about 100 miles. The new line to Shawforth, which completes the Bacup-Rochdale through system, is leased to the Rochdale Corporation for 30 years, at the end of which period it will be worked by the Bacup Corporation, whose property it will become. The new route is an intensely interesting one, and embraces the famous resort known as Healey Dell, between Bacup and Rochdale, which abounds in enchanting scenery.

Blackpool.—At a meeting of the Tramway Committee on July 20th, announcement was made that so far in the present financial year there has been an increase of £3,600 in revenue over the amount for the corresponding period of last year. The excellent Easter traffic was responsible for about £2,000 of this sum; and the continuance of the fine weather has made up the remaining £1,600. During the Aviation Carnival, when many thousands of people were carried, special through tramcars were run to the extreme end of the boundary at a charge of 6d. The Committee has decided on a through service from Talbot Square to the new racecourse during the coming steeplechase meetings at the ordinary fare of 4d.

Bradford.—The satisfaction given by the recently-instituted system of railless trolley cars in Bradford and Leeds is stirring up activity amongst the smaller authorities of the West Riding of Yorkshire. The Corporation has had a considerable number of invitations from outlying districts, at present unserved, to install the system on the respective routes desired. The District Council of Bingley, at a meeting last week, decided to approach the Corporation with a view to Bradford's running electric cars, railless or otherwise, *via* Nab Wood to Bingley. It was announced at the same meeting that a letter had been received from the Keighley Corporation asking for the Council's consent to the running of railless cars through Bingley to Nab Wood, to connect with the electric cars on the permanent way of the Bradford Corporation. The minute was unanimously adopted.

Bury.—The B. of T. has written to the Bury Corporation Tramways Committee suggesting that indicators be fixed on a certain number of cars in order that motormen may be trained in judging speed. Consideration of the matter has been deferred until the manager has reported to a future meeting.

Continental Notes.—Germany.—A scheme for the establishment of a railless service of electrical vehicles between Carlsruhe and Daxlanden is at present under consideration.

Spain.—Plans for a projected light electric railway for the transport of both passengers and goods between Vitoria and Santa Cruz de Camperol are being prepared by the Sociedad Electrica-Hidraulica Alavesa.

Dewsbury.—The T.C. has received a communication from the Yorkshire (heavy woollen district) Electric Traction Co., which owns the cars and has a lease of the track, &c., between Dewsbury and Cleckheaton, through Heckmondwike and Liversedge, and connecting with Thornhill and Ravensthorpe, asking that increased accommodation be provided for the cars in the semi-terminus at the west end of the Dewbsury Market Place. The application is under the consideration of the General Purposes Committee of the Dewsbury T.C.

Edinburgh.—Mr. Campbell, burgh engineer, in a report to the T.C. in regard to railless tramways, points out how much more cheaply the new system can be worked compared with the ordinary overhead electric tramways or cable tramways. In his opinion the railless system would be applicable for use in Fountain Bridge and other narrow thoroughfares in the city as well as for extensions into the country, where there would not be sufficient traffic to justify the cost of laying down a complete railed track. The Corporation Tramways Committee has recommended the Council to appoint Councillors Rusk, Rawson and Stewart and Mr. Campbell to visit Leeds and Bradford during the holiday season to inspect the new system.

Handsworth.—A petition, asking for a tramway to be constructed along Grove Lane and Oxhill Road is to be forwarded to the City of Birmingham Tramways Co.

Huddersfield.—Several tramway extensions are in progress at Huddersfield. The Newsome Road section which has been extended to Newsome Church, is the most recently completed, and it has been formally inspected by Major Druitt, of the Board of Trade. Cars were run over the extended route on Wednesday last week.

Leeds.—The Hon. John Murray, Premier of Victoria, Australia, paid a special visit to Leeds last week for the purpose of inspecting the newly inaugurated system of railless trolley cars. It is stated that since the commencement of the service in Leeds there has been an average of one deputation a day from tramway and other authorities in all parts of the country.

Liverpool.—The Tramways Committee at its meeting on July 21st, unanimously passed the following resolution:—"That each driver and conductor who has been in the service of the Corporation for a period of five years be granted 1s. per week merit pay, with an additional 1s. per week for each subsequent period of five years' satisfactory service from the date of the resolution." There are about 1,600 tram drivers and conductors in the service of the Corporation, and this new regulation immediately applies to 1,400 of them, involving an increased annual charge upon the tramways department of £3,500 a year.

Superintendent Cross, of the Lancashire County Police, has written to the Liverpool Corporation tramways manager, conveying this thanks for the efficient help rendered by Mr. Gallagher (foreman at the Litherland depôt) and other tramway employés, at the recent fire in Linacre Road, Litherland, Liverpool, when six persons lost their lives. The Tramways Committee has awarded 10s. each to the employés who rendered assistance on that occasion, together with an expression of the Committee's appreciation of their promptness and courage.

Llanelly.—The official inauguration of the local tramway system took place last week. Mr. Balfour, of Balfour, Beatty and Co., Ltd., the contractors for the work, presided over a preliminary luncheon, which was followed by an inspection of the power station and tramway.

London.—L.C.C.—The Council is recommended to seek Parliamentary powers in the session of 1912 for seven tramways, the estimated cost of which, including equipment, &c., is £274,820, while road widenings will cost over £88,000.

East London Railway Electrification.—At the half-yearly meeting held on the 25th inst., Lord Claude Hamilton announced that the six leasing companies had passed a resolution which practically ensured the immediate electrification of the line. The engineers estimated the cost at £65,000; and the extra working expenses incidental to the electrification were put at £3,000 a year. The District Railway Co. would supply power from its Lot's Road station, and the Metropolitan Railway could probably supply the necessary rolling stock. It was proposed to run four through Metropolitan trains per hour to New Cross and eight locals between Shoreditch and New Cross (S.E. and Brighton stations alternatively).

Manchester.—On Tuesday the Tramway Committee received a report from Mr. McElroy, the general manager, to the effect that no difficulty had been experienced in granting free passes on the cars to blind people during the past year, and the Committee decided to recommend a continuance of the privilege provided that the passes are renewed annually. Last year 291 applications for free passes were made, and 261 granted. The refusals were on the ground that the applicants did not live in the Manchester area.

Oldbury.—The U.D.C. has requested the Electricity and Tramways Committee to consider the possibility of arranging for a service of railless trolley cars between Oldbury and Blackheath and Langley.

Perth.—The Tramway Committee of the T.C. had a good time last week. It was recently resolved to acquire two motor-char-a-bancs as feeders for the electric cars, and the members of the Committee, comfortably seated in motor-cars, were on a tour inspecting different makes of cars.

Portsmouth.—The T.C. has been recommended to extend the electric tramways in three parts of the town, at an estimated cost of £31,500.

Rawtenstall.—The draft agreement for the supply of current from the Rawtenstall Corporation for the working of the Bacup Light Railway, is now under consideration by the Rochdale Corporation.

Swansea.—At last week's meeting of the B.C. the report of a special committee was presented containing the heads of agreement between the Corporation and the Swansea Improvements and Tramways Co. for the acquisition of the tramways by the Corporation. This provides for the working of the entire tramway system by the company for a period of 31 years from December 31st last, 7 per cent. per annum being paid in respect of the capital laid out upon the Corporation sections during the 15 years extending beyond the period covered by the existing leases, and an additional £920 in the event of the net profits in any year admitting of the payment of 6 per cent. to the shareholders of the company. At the end of the 31 years the Corporation has the option of purchasing all the company's lines at their constructed value. An important concession obtained from the company is the privilege for working men of travelling at all times at a reduced rate of ½d. per mile with a minimum fare of 1d. Mr. David Davies said that if the Corporation failed to accept the agreement substantially, it would be committing an irreparable blunder. It was resolved to hold a special meeting of the Council to discuss the clauses of the proposed agreement.

U.S.A.—According to the *Financial Times*, the City of New York has awarded the whole of the work of subway extension to the Brooklyn Rapid Transit Co. The extension will cost $225,000,000.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Rates.—In the course of a discussion in the Ottawa House of Commons recently, the Postmaster-General, Mr. Lemieux, stated that he had been informed by Mr. H. Samuel that the English and German cable companies had agreed to a reduction of the rates to 6d. a word for "semi-urgent" messages not in code, but that the French companies were holding out against the reduction. It was hoped that the difficulty would soon be overcome.

Automatic Telephone Exchanges.—The automatic exchange to be installed at Epsom by the Post Office will be of the Strowger type; for the purpose of comparison, it has been decided to install one on the Lorimer system at Caterham, the capacity being 500 lines in each case.

Belgian Telephone Case.—In the action for £8,000 damages brought against the Bell Telephone Co. by the electrical engineers who were recently prosecuted by the company for betraying trade secrets and were acquitted, the Civil Tribunal has declared that the claim is admissible, and has ordered the case to proceed.

Loaded Telephone Circuits in the U.S.A.—In a paper read before the American Institute of Electrical Engineers, Mr. B. Gherardi stated recently that in the United States there were 85,000 miles of loaded open-wire circuits, and over 170,000 miles of loaded underground circuits, requiring the use of 125,000 loading coils. The coils used were about 10 in. in diameter, and the resistance of the two windings was 2½ ohms, with an impedance of 6½ ohms at 800 cycles per second. By loading, the distance of telephonic transmission over No. 8 B.W.G. wire had been increased from 1,000 to 2,000 miles.

New Pacific Cable.—A Bill providing for the construction and working of a new Pacific cable was read a first time in the House of Commons on Tuesday last.

Telegraph Construction Bill.—This week a Committee of the H. of C. has been considering a Bill to enable the P.M.G. to carry telegraph wires over railways without payment to the railway companies. Three Scotch companies opposed the Bill, claiming compensation for the loss of existing rights.

Wireless Telegraphy.—Three inspectors of wireless telegraph apparatus on vessels have been appointed by the Department of Commerce and Labour of the United States Government. The law requiring all passenger vessels plying from United States ports to have "wireless" equipment sufficient to call for help in

cases of emergency is now in force, and all vessels will be inspected to see that they comply with the law. It will be the duty of the inspectors to go aboard all outgoing vessels carrying more than 50 passengers, not only to inspect the apparatus itself, but to pass judgment upon the qualifications of operators. No vessel will be permitted to leave a United States port without a certificate of inspection. If an inspector is not at hand the master of the vessel is required to deposit a certificate with the Customs officials. Wireless operators holding certificates by the Governments which ratified the Berlin Wireless Telegraph Conference will be acceptable to the United States authorities. To secure a certificate from the United States Government it will be necessary for operators to pass an examination.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Tenders for four double-deck cars. Drawings and specifications from R. Stuart Pilcher, general manager.

Australia.—Victoria.—August 15th. 80,000 insulators, and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" July 7th.

August 9th.—530 A.C. meters, 496 D.C. meters and 133 maximum-demand indicators, for the Melbourne City Council. See "Official Notices" to-day.

September 5th.—(*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia. — August 9th. (*a*) Letter-box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 23rd.—Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—August 9th. P.M.G. Letter-box fronts. See "Official Notices" July 7th.

August 8th.—According to an Australian exchange tenders are invited for electrical generators, storage batteries, and voltmeter, for the Stores Supply Department, 15, Young Street, Sydney. A. Berckelman, executive member.

Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" to-day.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 16th. — Cable, conduits, cast-iron pipes, iron poles, insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" July 7th.

Western Australia.—August 2nd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

Austria.—August 1st. The Austrian State Railway authorities at Stanislau are inviting tenders for the supply of five continuous-current electric motors for the railway works at that place.

Belgium.—The municipal authorities of Tongres are inviting tenders until August 5th, for the extension of the electric lighting undertaking in the town.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local repesentation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

September 25th.—All electric lighting fittings, fans, lamps, insulated conduetors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. Directoria Geral do Expediente, Ministerio da Viacão e Obras Publicas, Rio de Janeiro.—*Board of Trade Journal.*

Bulgaria.—The T.C. of Philippoli is prepared to receive up to August 4th, tenders for a gas lighting and electric tramways concession for a period of 50 years. Guarantees, 80,000 and 90,000 fr. respectively.

Canada.—August 10th. According to the *Canadian Engineer* tenders are invited in connection with the municipal installation at Penticton, B.C., for two 100-K.V.A. three-phase, 4,600-volt, 900 R.P.M., A.C. generators direct connected to impulse wheels operating at 2,045 ft. effective head, pressure pipe line of about one mile of 10-in. and one mile of 12-in. pipe, switchboards, transformers, meters, distribution and street lighting system. For further particulars see this column last week.

Erdington (near Birmingham).—Construction of 1¼ miles of double-track tramway. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switchboard, for the Farnham Gas & Electricity Co. See "Official Notices" July 21st.

Frodingham.—August 11th. Poles, lamps, wires and switches for street lighting, for the Brumby and Frodingham U.D.C. See "Official Notices" July 21st.

Hungary.—August 2nd. Electric lighting plant (public and private) for the authorities of the Grossgemeinde Pászto, Komitat-Heves, Hungary.—*Board of Trade Journal.*

London.—L.C.C.—August 1st. Electrical installation (250 lamps) at the Gt. College Street Elementary School, N.W. See "Official Notices" July 21st.

Pembroke (Co. Dublin).—July 31st. Installation of electric light in new artisans' dwellings and in new streets, for the U.D.C. Deposit 20s. Specifications, &c., J. C. Manly, clerk, Town Hall, Ballsbridge, Pembroke. Irish materials and labour and Dublin standard rate of wages.

Pontypridd.—August 1st. 1,700 ampere-hour storage battery, with motor-driven booster and switchgear, for the U.D.C. See "Official Notices" July 21st.

Rochdale.—August 2nd. Twelve months' supply of paper-insulated cables. Specification and form of tender obtainable from C. C. Atchison, engineer and manager, Dane Street, Rochdale. Deposit of £2 2s. (returnable).

Russia.—The T.C. of Stavropol (Caucasus) is open to receive tenders for the installation and working of an electric tramway service. The last day of submission is August 14th.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" to-day.

Spain.—The municipal authorities of Matilla de los Canos (province of Salamanca) have recently invited tenders for the concession for the electric lighting of the town.

Sweden.—Tenders are invited by the Swedish Postal Authorities for the supply of 4,000 to 6,000 metal-filament lamps, 16-50 normal C.P., and for 110-250 volts. Tenders, marked "Anbud a Metalltradslampor." will be received up to August 1st at the Generalpoststyrelsens Registratorskontor, Vasagatan, Stockholm.—*B. of T. Journal.*

Tonyrefail.—August 1st. Mains, switchgear, and street lighting fittings at the Ely Valley Extensions, for the Tonyrefail and Gilfach Goch Electric Light Co., Ltd. See "Official Notices" July 21st.

Turkey.—Tenders are invited for concessions (1) to establish a public water service: and (2) an electric installation for lighting and traction purposes in the city of Jerusalem and its suburbs. Guarantees, 1,000 and 2,000 £T respectively.

Warrington. — August 9th. Motor-driven induced-draught fan, for the Corporation. See "Official Notices" to-day.

Whalley.—Electrical plant, &c., for the new asylum. The Lancs. Asylums Board will shortly invite tenders for the above from a selected number of firms. See "Official Notices" to-day.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

CLOSED.

Belfast.—The Tramways and Electricity Committee has accepted the tenders of the Rees Roturbo Manufacturing Co. and the Worthington Pump Co., for circulating and air pumps respectively.

Bolton.—We are informed that the name of the Electrical Apparatus Co., Ltd., should have been included in the list of tenders accepted for electricity meters published in our last issue.

Derby.—The E.L. Committee of the T.C. has accepted the following tenders:—

Messrs. W. Rickard, Ltd.—Cable, £913 13s. 6d.
The British Electric Transformer Co.—Transformers, £696 10s.
Messrs. A. Reyrolle, Ltd.—Sub-station switchgear, £342.

France.—The French Post and Telegraph authorities in Paris last week gave out contracts as follows:—La Société de Commentry-Fourchambault et Decazeville, 15 tons of iron wire 1 mm. dia., and 100 tons ditto, 3 mm. dia.; La Société des Forges Trefileries et Pointerie de Creil, 100 tons ditto, 4 mm. dia.; and La Société des Forges de Chatillon-Commentry, 100 tons ditto, 4 mm. dia.

Huddersfield.—The following tenders for 10 new cars have been accepted, viz.:—Car bodies, United Electric Car Co.; electrical equipment, Dick, Kerr & Co., Ltd.

Irish Town Lighting Contracts. — The Swinford (County Mayo) R.D.C. has accepted the tender of the National Gas Engine Co. for the electrical plant for the lighting of the town. The plant will include two 28-KW. sets, comprising National gas engines, with suction gas plant, coupled direct to two continuous-current generators, and one motor booster, storage batteries, &c., by the Electric Construction Co.

The tender of the General Electric Co., Ltd., for the lighting of Charleville, has been accepted. The plant will comprise a 30-KW. National gas engine, with suction gas plant, coupled direct to a G.E.C. continuous-current generator.

Loddon and Clavering.—The B. of G. has accepted the tender of Messrs. A. Pank & Co., of Norwich, for an installation of electric bells at the workhouse, at £23.

London.—Hammersmith.—The following tenders were received for lanterns for side street lighting :—

	Bracket, switch, and hood.	Fitting for converting gas lamps to electric.
Reason Manufacturing Co.	£0 16 0	£0 17 0
	1 1 0	0 16 0
	0 13 6	
	1 6 6	
Haydn Harrison & Co.	0 17 0	0 13 6
	0 17 0	0 12 0
	0 17 0	
	0 16 6	
Lucy & Co.	0 15 5	0 11 8
	0 16 2	
	0 15 8	
	0 18 6	
	0 18 5	
Wardle Engineering Co.	1 8 0	0 15 6
	1 4 6	0 15 6
	1 3 6	
	1 7 5	
	1 2 9	
General Electric Co.	1 2 6	0 16 6
	1 4 6	
	1 15 0	
Wm. Edgar	1 19 6	1 16 6
Pontifex & Co.	1 5 6	0 15 0
Falk, Stadelmann & Co.	1 0 6	0 16 6
	0 17 6	
	0 19 0	

The Electricity Committee recommends that the tender of Messrs. Lucy & Co. for the supply of bracket and switch for the sum of 8s. 10d. each be accepted, and that hoods be purchased from the General Electric Co. at 8s. 3d., of the same type as that approved by the Council in connection with the scheme for the hiring out of fittings for the external lighting of business premises.

The following tenders were received for the supply of time switches for public electric lamps, viz. :—

Venner & Co.	£1 11 0	£1 12 8	£1 17 0
Laing, Wharton & Co.	1 14 0		
Reid & Co.	1 14 0	1 13 0	1 12 9
Engineering & Arc Lamps, Ltd. ..	1 19 0		
General Electric Co.	2 0 0	3 10 0	4 0 0
Ferranti, Ltd.	2 10 0		

The engineer has reported as follows upon the proposals received :—

"The lowest price received is 31s. per switch, and as some 700 instruments will be required, the total cost will be £1,085. Taking this sum borrowed at 3¾ per cent. interest and repayable in five years the annual sum required for repayment of principal and interest will be £266, whilst taken on the basis of repayments spread over 10 years, the annual amount required will be £153.

"At present 11 men are employed attending to trimming, cleaning, maintaining, repairing and switching the public lamps, the average weekly cost being £16 15s. Under the proposed arrangement of conversion from arc lamps to incandescents, and with the extra lamps now being changed over from gas to electricity and not using automatic switches, I estimate three men less will be required, meaning a saving of about £236 per annum. With time switches installed the extra work of attending to the instruments would enable the services of only one more man to be dispensed with, amounting to £73 per annum.

"Accordingly, the estimated saving in wages if time switches are installed will be £73 per annum, as against a cost of £266 per annum, for repaying loan for the purchase of the instruments, taken on the basis of a five-year loan.

"There will also be a small saving in bicycle hire, which now amounts to 5s. per week."

The Electricity Committee recommends that in view of the cost involved in carrying out the proposed installation of time switches, no further action should be taken in the matter at the present time.

The Electricity Committee recommends the acceptance of the tender of Messrs. Nichols Bros., of Gateshead, for a 24-in. stroke feed pump. at £190 15s. Eleven tenders were received ; the first seven did not comply with the specification. Also that the tenders of Messrs. Wm. Cory & Son. Ltd., for the supply of "Seven Sisters" hard dry coal. at 11s. 3d. per ton. and for 2,000 tons of "Nixon's Navigation" free-burning coal. at 13s. 6d. per ton, be accepted ; and that that of the Main Colliery Co. for the supply of "Graigola and Victoria" free-burning coal. at 13s. 11d. per ton, be accepted.

L.C.C.—The following (fresh) tenders were received by the Fire Brigade Committee for the electric lighting (wiring and fittings) of Kennington fire station :—

Alex. Hawkins & Sons	(accepted)	£229 0 0
W. J. Fryer & Co.		242 18 0
G. E. Taylor & Co.		269 15 0
Tilley Bros.		269 15 0
Pinching & Walton		287 1 2
John Bryden & Sons		314 0 0
Chief Engineer's estimate		260 0 0

Tenders were also received for the wiring and supply of fittings for electric lighting at Shadwell and Stoke Newington fire stations :—

(1) Shadwell Fire Station.

Malcolm & Allan, Ltd.	(accepted)	£202 15 9
Tilley Bros.		206 9 0
E. Newbald & Co.		236 0 0
G. Harland Bowden & Co.		280 0 0
Tredegar & Co.		280 4 0
Chief Engineer's estimate		212 0 0

(2) Stoke Newington Fire Station.

W. J Fryer & Co.	(accepted)	£168 15 6
Foote & Milne, Ltd.		176 17 2
E. Lawrance & Sons, Ltd.		185 0 0
G. Weston & Sons, Ltd.		185 0 0
Waring & Withers		214 10 9
Lund Bros. & Co.		230 0 0
Chief Engineer's estimate		180 0 0

The Committee is asking sanction for an estimated capital expenditure of £1,255 for an electrically-driven motor turntable long ladder.

The Highways Committee recommends the sealing of a contract with Messrs. Hadfield's Steel Foundry Co., Ltd., for points, junctions, crossovers, &c., required for tramway renewals during 1911-1912, at £13,245 15s.

The Fire Brigade Committee recommends an expenditure of £90 on electric radiators for various fire stations.

Stepney.—With regard to the supply of energy by the Council to the Port of London Authority, special meters, each consisting of a combination of meter and restricted-hour demand indicator, were required, and the offer of the Aron Electricity Meters, Ltd., to supply the meters at £164 5s. has been acccpted.

London and North-Western Railway.—Messrs. W. Geipel and Co., of Vulcan Works, St. Thomas Street, S.E., have for the third time secured a contract for the annual supply of Henrion arc lamp carbons, open, enclosed and flame types, amounting to nearly 1,150,000 carbons.

Chelsea.—The Chelsea Electricity Supply Co., Ltd., has accepted the tender of Messrs. Ed. Bennis & Co., Ltd., Bolton, for a bucket coal elevator to feed four chain grate stokers.

Fulham.—The Electricity Committee recommends that a tender of the British Westinghouse Co., at £210, be accepted for extensions to the main switchboard at the generating station.

St. Pancras.—The B.C. received the following tenders for cables :—

Western Electric Co., Ltd.	(accepted)	£1,352
Henley's Telegraph Works Co., Ltd.		1,383
Siemens Bros., Ltd.		1,396
B.I. and H. Cables, Ltd.		1,415
Callender's Cable Co., Ltd.		1,444

The tender of E. C. and J. Keay, Ltd., at £261, to provide a boiler-house roof at the King's Road generating station, and to carry out the lengthening of girders at the station, has been accepted.

Marylebone.—The B.C. has accepted the tender of the Electrical Co., Ltd., for the supply of lamps for street lighting.

Manchester.—The Co-operative Wholesale Society, Ltd., of Manchester, have placed the contract for wiring, erecting and setting to work three A.C. motors and control gear, for their central premises in Deardengate, Haslingden, with Mr. A. M. Cramp, of Regent Street, Haslingden.

Morecambe.—The T.C. has ordered two "Bennis" stokers and self-cleaning compressed-air furnaces for the electricity works.

Redditch.—For the extension scheme of the U.D.C., Mr. W. J. Ferguson, the electrical engineer, informs us that 26 tenders were received, and the Council has accepted the following :—

Mixed pressure turbine and single-phase alternator.—Messrs. Willans and Robinson, Ltd., Rugby, for Willans turbine and Parsons alternator, £2,111.

Condensing plant.—Messrs. Willans & Robinson, Ltd., Rugby, for Willans augmentor condenser and Balcke cooling tower, at £838.

Pipework.—Mr. Ed. White, Redditch, at £549.

Southend.—The T.C. has accepted the tender of the Worcester Foundry Co. for 47 brackets for the electric lighting of the pier, at 16s. 9d. each.

Stoke-on-Trent.—The Electricity Committee of the Stoke-on-Trent Town Council has accepted the tender of the Sterling Boiler Co., at £5,044, for three boilers and all accessories for the new works ; also the tender of the Davenport Co. (Bradford), at £1,035, for a new cooling tower.

Street Lighting Contracts.—The progress of electrical street lighting is well exemplified by a number of important contracts recently placed with Mr. Haydn Harrison for the supply of his special grouped H.C.P. tungsten lanterns for street lighting. He is converting from gas to electric lighting 7 miles of streets at Beckenham, and 7 miles at Caversham ; at West Hartlepool, Lancaster, Walker and the Curragh Camp, he is supplying large tungsten lamp fittings ; and at Maidstone, Tunbridge Wells and Battersea (436 arcs), he is replacing arc lamps with tungsten lanterns. He is also supplying them to the Imperial Paper Mills, Gravesend, and the new car sheds and repair shops connected with the electrification of the L.B. & S.C. Railway.

Swansea.—The E.L. and Tramways Committee of the T.C. has accepted the tender of the Electric and Ordnance Co., Birmingham, for a two years' supply of motors.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following Orders are issued for next week :—

Saturday, July 29th.—Falmouth Detachment will parade at headquarters at 8.30 a.m. Weymouth Detachment will parade at headquarters at 11 a.m. Dress for the above detachments will be :—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

Headquarters will open from 10 a.m. to 4 p.m. from Monday, July 31st, to Friday, August 4th.

Saturday, August 5th.—Falmouth Detachment (2nd party) will parade at headquarters at 8.30 a.m. Weymouth Detachment (2nd party) will parade at headquarters at 11 a.m. Dress for the above detachments will be :—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before each parade.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, July 29th, to Saturday, August 5th. Summer meeting. Visits to works, &c., at Felixstowe, Ipswich, Norwich and Cambridge.

Friday, August 4th. At the University Arms Hotel, Cambridge. Summer dinner.

NOTES.

Electrical and other Fatalities.—Deputy-Coroner Shepherd conducted an inquiry on 11th inst. into the circumstances attending the death of Robert Anderson, of Hebburn, an electrical jointer, who was killed on 10th inst. at the Jarrow sub-station of the Durham County Electric Power Distribution Co. Robert Anderson, the father of the deceased, who was a labourer at the power station, said that at the time of the accident he was assisting deceased to uncover an oil switch. They had completed their work and his son got upon an angle bar. There was a sudden flash, after which he saw him lying on the floor of the chamber dead. Henry Alfred Myles, senior assistant engineer, said that after the oil tank was removed, he examined the switch and told the deceased to file the contacts. Witness stated, in answer to Mr. W. Lauder, Factory Inspector, that he did not put in the trays to protect the terminals. He did not think it necessary. Having drawn Myles's attention to the regulations, Mr. Lauder asked: Were all the conductors in the cell made dead while the work was being conducted there?—Witness: No. Mr. John McLaren, the company's district engineer, agreed that the regulations had not been observed, but said that the places where Anderson had to work had been made dead. Witness, in reply to Mr. Burton, representing the company, said that if the deceased had done nothing but his work an accident would have been impossible. It was stated that deceased received a shock at about 12,500 volts. The jury returned a verdict of "Accidental death," and expressed the opinion that the accident would not have occurred if the regulations had been complied with.

Deputy-Coroner Shepherd also held an inquiry on the 11th inst. into the circumstances of the death of Robert Cragg, an electrician, who was killed at Swalwell Colliery on 8th inst.—William Olman, a joiner, stated that Cragg and he were preparing to start a motor which worked a pump in the Brockwell seam, and when Cragg touched the switch casing he found it was "alive"; almost immediately afterwards he received another shock, which proved fatal. Cragg had india-rubber gloves, and was wearing one.—Arthur Gibson Booker, an electrician, who said the current was 440 volts alternating, stated that he noticed that the back of the switchboard was off, there was no earth wire connected to the pillar, and one of the contacts was askew.—The Deputy-Coroner said the Government Electrical Inspector might desire to attend the inquiry, and he adjourned the inquest for that purpose. The inquiry was closed on the 18th. The evidence was gone over, and the jury returned a verdict that death was due to the effects of an electric shock accidentally received while examining a switch pillar at Swalwell Colliery, for the purpose of discovering a leakage of electricity.

On the 18th inst. an inquest was held at Barnsley regarding the bursting of a steam valve at the Grimethorpe Colliery on the 10th inst., by which three persons were killed—Frank Green, colliery engineer, John Allen, enginewright, and Herbert Duckworth, foreman fitter in the employ of Messrs. Vickers, Sons & Maxim, Ltd., Sheffield. Mr. Gill, manager of the colliery, explained that a new turbine had been fitted up by Messrs. Vickers to generate electricity for the colliery, and this was coupled up with the boilers by pipes supplied by another firm. The pipes had been tested and proved satisfactory, and after adjustment had been made, a further test was being conducted when the accident occurred. The bursting of the valve was due to the presence of water in the pipes, which caused "water hammer." In reply to Sir William Clegg, witness said there was no fault to be found with Messrs. Vickers's work. Mr. Wilson, Inspector of Mines, gave evidence as to the result of his inspection, and said there could be no doubt that the pipes were full of water before the test was made, and the real cause of the accident was the absence of a drain pipe. The jury returned a verdict of "Accidental death," and expressed the opinion that the accident was caused by the want of an outlet for the condensed steam from the pipes.

An inquest was held on Tuesday last at Pendlebury touching the death of Sydney J. Douglas, 31, electrician, who had been employed as assistant mains engineer by the Lancs. Electric Power Co. Evidence of identification having been given, Roger F. Hutchinson, an electrical engineer in the employ of the company, was afterwards called, and stated that he accompanied the deceased on Saturday to the Pendlebury sub-station for the purpose of locating a fault in the H.T. feeder. While the deceased was in the H.T. chamber there was a sudden flash, and when witness and the sub-station attendant ran in they found Douglas lying near a live switch carrying 10,000 volts, which deceased had apparently touched. He was promptly released and carried outside, but lived only a few minutes. Witness said that he and the attendant were in the low-tension chamber at the time and did not see exactly how the accident occurred. He thought, however, that Douglas was examining the blank oil switch. There were two sides to the switch, one alive and one dead, and he thought the deceased mistook which was which and touched the live one. It was stated that the deceased was an experienced electrician, and was known as a cautious man.—Mr. Leslie, mains superintendent to the company, said that the deceased had been instructed to locate a fault. The most probable cause of the accident was that the deceased touched the live switch in a moment of forgetfulness. If the switch was faulty, there was a method known to witness and the deceased whereby it could be examined without touching it. There were stringent regulations against touching switches which were alive. The use of the rubber mat would have been no protection against such a high voltage. A verdict of "Accidental Death" was returned. Mr. Taite, manager of the Electric Power Co., expressed profound regret at the fatality and sympathy with the deceased gentleman's family.

On Monday morning last, Mr. Arthur Street, assistant electrical engineer to the Batley Corporation, received fatal injuries as the result of a motor-bicycle collision at Allwoodley. He succumbed to his injuries on the way to the infirmary. He leaves a widow and five children.

Institution and Lecture Notes.—Associated Municipal Electrical Engineers (Greater London).—The A.M.E.E. held their annual general meeting at the Institution of Electrical Engineers on July 5th, and the following executive officers were appointed for the session 1911-1912: President, W. C. P. Tapper, Stepney. Vice-Presidents, F. A. Bond, Battersea; L. L. Robinson, Hackney; A. H. Shaw, Ilford. Hon. Treasurer, G. G. Bell, Hammersmith. Hon. Auditors, J. G. Bruce, Willesden; E. Calvert, Finchley. Hon. Secretary, Norman Staniland, Hornsey. Council, S. W. Baynes, St. Pancras; J. H. Bowden, Poplar; H. H. Couzens, West Ham; C. S. Davidson, Barnes; A. J. Fuller, Fulham; F. Hill, Hammersmith; W. Innes, Poplar; C. Newton Russell, Shoreditch; P. E. Rycroft, Heston; E. Sayer, Hampstead; A. H. Seabrook, St. Marylebone; W. C. Ullmann, East Ham.

Royal Society of Victoria.—In a paper on "The Magnetic Properties of Stalloy," by H. R. Hamley, M.A., and A. L. Rossiter, B.Sc., read in November last, and recently published, the authors give an account of a research on the above subject, and state the following conclusions:—"Stalloy" cannot be used to advantage in the unannealed condition. In the annealed state the results obtained fully bear out the claims made by the makers, the permeability being very high and the losses small, particularly the eddy-current loss. "Stalloy" behaves very much like ordinary iron under varying frequencies, and the constancy of the value of the hysteresis loss for different frequencies is remarkable.

The research was carried out at the University of Melbourne, where the authors were Government Research Scholars with Prof. Lyle.

Chinese Trade.—Referring to a number of reports from diplomatic and consular representatives in the chief trade centres in China, the *Financial Times* remarks that one pleasant feature noticeable in running through the reports is the strain of compliment toward the enterprise of British merchants, which has replaced the old attitude of tired expostulation against the continuance of obsolete methods. Mr. R. S. Pratt, at Canton, states that signs are not wanting that British merchants and manufacturers have succeeded to a considerable extent in revising their ideas of the exploitation of the China market. Showrooms for machinery, &c., have been opened in important centres, the use of advertisements in native newspapers and by the exhibition of posters is extending, and some firms have sent out travellers, accompanied by good interpreters, to various inland marts, and have found their enterprise well rewarded. One prominent firm in Canton is making the interesting experiment of employing University-trained men to act as agents and travellers. The reason given is that the Oriental is a keen admirer of education, and is quick to discern whether a man is well educated or not, and it is therefore important that those who come into contact with him should be men that he can respect. Altogether the commercial outlook seems promising, and with the development of the railways the demand for foreign goods should rapidly increase.

"Electrical Review" Rifle Club.—On Thursday last week, the prizes and the Bell, S.M.R.C., and *Express* medals, awarded in connection with the annual and other shooting competitions held during the season 1910-11, were distributed by Mr. H. Alabaster, the president of the club, who congratulated the members on the progress made in shooting during the three years the club has been in existence.

M.E.T. Sports.—The fourth annual athletic sports meeting of the Metropolitan Electric Tramways, Ltd., took place on July 20th, at the Tufnell Park Athletic Ground. There were 357 competitors down to take part in the lengthy programme of events, and the military band of the M.E.T. beguiled the proceedings with music. The attendance was all that could be desired, and the organisers are to be congratulated on the success of their efforts.

Insurance at Fleetwood.—The insurance of workmen has become a burdensome matter for employers. Messrs. Walmsley and Oldham sent in to the Council a tender for £3 7s. for tarring the cooling tower at the electricity works. The Council required the workmen to be insured, and the premium for this was £2 10s., nearly as much as the cost of the work. The tender is now £5 17s.

Holborn Street Lighting.—The B.C. on Wednesday accepted the joint tender of the Metropolitan E. S. Co. and Gas Light & Coke Co., for street lighting for 10 years, at £7,645 per annum subject to the L.C.C. consenting to the form of contract.

Educational Notes.—City and Guilds (Engineering) College.—The Council of the City and Guilds of London Institute have awarded the diploma of "Associate of the City and Guilds of London Institute" to 96 matriculated third-year students of the City and Guilds College who have completed a full course of instruction as prescribed by the Council—56 in Civil and Mechanical Engineering, 30 in Electrical Engineering, and 10 in Chemistry. Mr. C. O. C. Reilly has been awarded the Bramwell Medal, and Mr. A. H. Barrett the Siemens Memorial Medal.

University of Bristol.—Particulars of the new sessions, &c., are given in our advertisement pages to-day.

Northampton Polytechnic Institute, London, E.C.—Full day courses in mechanical and electrical engineering and electrochemistry will be commenced on Monday, October 3rd, 1911. For further particulars, see our advertisement pages in this issue.

University of London: King's College.—Some particulars regarding the Faculty of Engineering are given in our advertisement pages to-day.

Appointment Vacant.—Assistant clerk for the Shanghai Municipal Council Electricity Department (£24 per month). See our advertisement pages in this issue.

The Australian Tariff.—It has been decided in connection with the British preferential tariff of the Commonwealth, that goods in which all manufacturing processes are performed in the United Kingdom from unmanufactured raw material of foreign origin, are entitled to preference irrespective of the proportion of the value produced by British labour. The wording of Paragraph 2 of the certificate required in connection with shipments of British goods for which preference is claimed, is to be so interpreted.—*Financial Times.*

Inquiry.—The name of makers of electrical apparatus for cutting large type in heavy box-side branding machines is asked for.

The Whitehall Club.—On July 20th, the ceremony of laying a commemorative stone at the new premises of the Whitehall Club, in Princes Street, took place in the presence of a large gathering of representative engineers. The stone, which is situate in the wall of what will form the hall of the new buildings, was laid by Mr. Alexander Siemens, president of the Institution of Civil Engineers. The chairman of the club, Mr. G. Midgley Taylor, in opening the proceedings, pointed out that, as the club buildings were now well advanced in construction, this could not be considered as a foundation stone, but that it would bear a tablet which would serve to remind the members that their club did not date merely from the opening of the new building. Associated with Mr. Siemens in the laying of the stone were Mr. Edward B. Ellington, president of the Institution of Mechanical Engineers, and Major W. A. J. O'Meara, C.M.G., vice-president of the Institution of Electrical Engineers. The usual mementoes (a copy of the *Times*, coins, &c.) were inserted in a cavity in the stone. A vote of thanks to the presidents concluded the ceremony, and the meeting then adjourned to the Westminster Palace Hotel, where upwards of 100 members and guests took luncheon. The toasts afterwards proposed included the health of the presidents of the three institutions, proposed by the vice-chairman of the club, Mr. G. N. Abernethy, that of the guests, proposed by the chairman of the club, and that of the Whitehall Club, proposed by Sir Robert W. Perks, Bart. Mr. Siemens, in responding as president of the Institution of the Civil Engineers, alluded to the fact that that institution was erecting a building at the other end of Princes Street, adjacent to the club premises. Mr. Ellington and Major O'Meara also spoke of the convenience the club was likely to be to engineers. Sir Henry Tanner, president of the Concrete Institute, who replied to the toast of the guests, in the absence of Sir Wm. Hall-Jones, alluded to the want of a non-political club in Westminster. Sir Robert Perks, in proposing the toast of the Whitehall Club, noted that the club was founded in 1869 by many of the then leading engineers in Westminster. The chairman responded, and the proceedings then terminated.

A Manchester Printing Works.—Practically the whole of the Irkdale Printing Co.'s works are now driven electrically, power being purchased from the Manchester Corporation in the form of three-phase current at 2,600 volts and 50 cycles. Approximately 255 H.P. of A.C. motors have been installed, varying in size from 5 to 50-H.P., and about 240-H.P. of D.C. motors, varying in size from 5 to 40 H.P. For the A.C. motors the pressure of supply is transformed down to 400 volts between phases, and to deal with the D.C. motors, a motor-transformer has been installed. The A.C. motors are squirrel-cage throughout, provided with star-delta starters. The D.C. motors are provided with regulating gear for varying the speed in accordance with the requirements of the driven machines. The motors have been supplied by the General Electric Co., Siemens Bros., and the British Westinghouse Co., and the work has been carried out in accordance with the specifications of Messrs. Lacey & Sillar.

Production of Mica.—The total value of the mica produced in the United States in 1910 amounted to $337,097. The production of sheet mica amounted to 2,476,190 lb., valued at $283,832, and that of scrap mica amounted to 4,065 tons, valued at $53,265. The electrical industry consumes by far the greatest part of the sheet mica produced.—*Electrical World.*

Annual Outings.—The sixth annual outing of the Ormorduct Co. took place on Saturday last, when the head office staff, accompanied by some of the branch managers and agents—a party over 50 strong—assembled at Kingston, boarded the launch *King*, and proceeded up river to Staines, luncheon being served *en route*. On arrival the party separated to find amusements in punting and other pastimes. The return was made soon after 4 o'clock, tea being provided on board. At night the company assembled for an excellent dinner at Nuthall's Hotel, and music and singing concluded a most enjoyable day. Mr. Schmahl, in expressing his congratulations on the success of the outing, said it was gratifying to note the good feeling which existed between the executive and staff, he hoped they would continue in their determination to do whatever they had to do with success.

The annual outing of the employés of Messrs. Stegmann & Co., of Clapham Junction, took place on 15th inst., the party going to Margate. Good weather prevailed, and an excellent dinner and tea at the Royal Albion Hotel contributed greatly to the enjoyment of the trip, which concluded about 12 o'clock, midnight.

The staff of the Guildford Electricity Supply Co., Ltd., held their annual outing on Monday, July 3rd, when a very enjoyable trip was made to Margate. The staff accompanied by Mr. H. L. Alderton (engineer and manager) and Mr. R. H. Piper (secretary) left Guildford at 7 a.m. and arrived at Margate soon after 10 a.m. A first-rate dinner was served at the Imperial Hotel, the staff being joined by several guests. The outing was voted to be one of the most enjoyable the staff had ever had.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Robert E. Armstrong (of the Newcastle Electric Supply Co.) has been appointed charge shift engineer at the L.C.C. Greenwich generating station, at a salary of £250 per annum, rising to £300, subject to the usual medical examination.

Mr. H. E. Munday, shift engineer at the Canterbury Electricity Works, has been appointed junior assistant engineer at the Borough of Shrewsbury Electricity Works.

The Huddersfield T.C. has decided to increase the salary of Mr. J. W. Turner, the chief electrical assistant, from £185 to £200 per annum.

The Electricity Committee of the Keighley T.C. has recommended the Council to increase the salary of the borough electrical engineer from £250 to £300 per annum.

Tramway Officials.—The Exeter T.C. has again rejected the proposal to increase the salary of the tramway manager from £160 to £170 per annum. A similar decision some time ago was on the ground that the increase was too small.

General.—Mr. J. H. West, works manager of the British Aluminium Co.'s factory at Stangfjord, Norway, is leaving the company to take over the management of the Havre works of la Société Anonyme Westinghouse. On the occasion of his leaving Stangfjord, Mr. West was presented by the workmen and staff with a handsome set of fittings for a writing table in Norwegian silver.

Mr. J. W. Speight, electrical engineer, of St. Annes-on-the-Sea, was cycling from Bispham the other day when he had the misfortune to be run down by a vehicle. His knee was rather badly wrenched.

Mr. J. Aked, manager of the Keighley district of the National Telephone Co., has been appointed manager of the Blackpool district, vice Mr. J. Tranter, who retires after 26 years' service, and will be succeeded by Mr. C. Gate, of Gateshead.

Mr. H. B. Tilley, well known in the Manchester district as the manager of Messrs. Bruce Peebles's office in that city, has just left this country for an extended business tour in Canada on behalf of his firm. Mr. Tilley will visit all places of importance in the Dominion, and expects to be away for fully a year. His many friends will, we know, wish him every success, and in due course a safe return home.

Mr. Gerald Hooghwinkel, of Messrs. Hooghwinkel, Anthony Brown & Partners, and director of the San Luis (Mexico) Tramways, Ltd., is leaving for Mexico and Cuba on the 29th inst. on professional business, and also to prepare for the electrification of the above company's lines.

NEW COMPANIES REGISTERED.

C. S. Wilson & Co., Ltd. (116,870).—This company was registered on July 18th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturing, supplying and laying "Litosilo" and other compositions, engineers, electricians, &c., to acquire the business carried on by G. Harding, at Liverpool, as "C. S. Wilson & Co." The subscribers (with one share each) are:—G. Harding, 80-84, Regent Road, Liverpool, manufacturer; R. J. Graham, 84, Regent Road, Liverpool, secretary; J. McIntyre, 84, Regent Road, Liverpool, clerk; E. Griffiths, 84, Regent Road, Liverpool, clerk. Private company. G. Harding is managing director while holding 50 shares. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

London and Mexico Concessions Syndicate, Ltd. (116,939)—Registered July 21st, by G. Reiche, 3, Lombard Street, E.C. Capital £20,000, in 18,000 ordinary shares of £1 each, and 40,000 deferred shares of 1s. each. Objects: To apply for, or acquire and turn to account, powers for the construction and operation of railways, tramways, telegraphs, telephones, harbours, quays, docks and sanitary, irrigation, gas, electric light and power, and other public works, &c., and to carry on the business of miners, traders, explorers, financiers, &c., in relation to Mexico, Great Britain, Africa, Australia, Canada, any British Colony or Dependency, North and South America, Japan, China and Europe. The subscribers (with one share each) are:—J. Colyton, Stanley Villas, Peidley Manor, Tring, gentleman; J. Yarwood, 21, Wolverton Gardens, Hammersmith, W., manager of motor company. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Registered office, 3, Lombard Street, E.C.

San Luis (Mexico) Tramways, Ltd. (116,808).—This company was registered on July 13th, with a capital of £150,000 in £1 shares (25,000 preference), to construct, purchase, lease or otherwise acquire, sell, grant leases of or otherwise dispose of, use or work any tramways, railways or any running powers, licences, rights or easements over or interests in the same, to generate, purchase and supply electricity, &c. The subscribers (with one share each) are:—R. C. Howley, 11, St. Ann's Road, Leytonstone, clerk; W. H. Morgan, 70, Park Lane, Clissold Park, N., clerk; P. M. Cullen, Revidge, Blandford Road, St. Albans, clerk; P. H. Wiggins, 141, Station Road, Church End, Finchley, clerk; S. H. Penwarden, 36, Peterborough Road, Leyton, clerk; A. A. Amos, 285, Lea Bridge Road, Leyton, clerk; W. H. Walford, 239, Mortlake Road, Ilford, Essex, clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £200; remuneration, £150 each per annum (£50 extra for the chairman) and a percentage of the profits. Registered by Ashurst Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Aldeburgh Electric Supply Co., Ltd. (116,867).—This company was registered on July 18th, with a capital of £7,000 in £1 shares, to manufacture and supply electricity in Aldeburgh, Suffolk and neighbourhood, and to adopt an agreement with Christy Bros. & Co., Ltd. The subscribers are W. H. Hall, Albert House, Aldeburgh, J.P., 100 shares; G. O. Knowles, Kenilworth, Aldeburgh, builder, 100 shares; W. Hill, Crabbes House, Aldeburgh, draper, 100 shares; L. F. Christy, 51, Broomfield Road, Chelmsford, electrical engineer, 100 shares; Sir Fredk. E. S. Adair, Bt., J.P., Flixton Hall, Bungay and Aldeburgh, 300 shares; F. C. U. V. Wentworth, Black Heath, Saxmundham, Com. R.N., 200 shares; F. Christy, 53, Bloomfield Road, Chelmsford, electrical engineer, 100 shares. Minimum cash subscription 2,000 shares; the number of directors is not to be less than three or more than seven; the first are W. H. Hall, G. O. Knowles, W. Hill, L. F. Christy and F. Christy; qualification, 100 shares; remuneration as fixed by the company. Office, 177, High Street, Aldeburgh.

Thomas Thorp & Co., Ltd. (116,961).—This company was registered on July 22nd, with a capital of £10,000 in £1 shares (3,000 preference), to take over the business carried on at Victoria Works, Besses-o'-th'-Barn, Whitefield, Lancs., as "Thomas Thorp & Co.," and to carry on the business of manufacturers of and dealers in gas, electric and water meters and scientific instruments, electricians, electrical, mechanical and civil engineers, &c. The subscribers (with one share each) are:—T. Thorp, Moss Bank, Whitefield, mechanical engineer; F. Thorp, Gasmere, Whitefield, mechanical engineer; H. T. Thorp, Moss Bank, Whitefield, mechanical engineer. Private company. The number of directors is not to be less than two or more than four; the first are T. Thorp, F. Thorp and H. T. Thorp; qualification, £100; remuneration as fixed by the company. Registered by Woodcock, Ryland & Parker, 15, Bloomsbury Square, W.C.

Alexander Harvey Exploitations, Ltd. (116,852).—This company was registered on July 17th, with a capital of £6,000 in £1 shares (1,000 ordinary and 5,000 "B"), to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c., and to adopt an agreement with H. A. Harvey, G. P. M. Lee and C. A. Owen. The subscribers (with one share each) are:—C. Bowen, 25, Ely Place, Holborn Circus, E.C., solicitor; H. J. Turner, 25, Ely Place, Holborn Circus, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the first are H. A. Harvey, G. P. M. Lee, Q. Marino and C. A. Owen. Remuneration, £100 each per annum. Registered office, Norfolk House, Laurence Pountney Hill, E.C.

CITY NOTES.

United River Plate Telephone Co., Ltd.

THE annual meeting of this company was held on July 18th at Winchester House, E.C., Sir Irving Courtenay, Kt., M.A., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, July 14th), said that the result of the year's operations was highly gratifying, especially when they remembered the droughts, locusts and other adverse influences which affected the prosperity of the Argentine generally. The business went on increasing, and the service was steadily improving. In August last they inaugurated a new common-battery board in the Avenida Exchange, their most important exchange in Buenos Ayres. The influence of that board on the service had been most marked, and warm congratulations on the improvement had been received. Two other exchanges transformed to the common-battery system were just on the point of being opened, while important extensions to three of the already existing common-battery exchanges had been carried out during the year, as well as extensions to several of the magneto exchanges. They had completed and opened a common-battery exchange in the Sunchales district of Rosario, and as soon as they could come to terms with the municipality of Rosario they hoped to install a full common-battery board in the central exchange in that city. In Bahia Blanca they had a common-battery board undergoing its final test before being put into operation, and there was very little doubt that one of their duties in the near future would be the joining up of that city to Buenos Ayres by means of trunk lines. The distance was not much short of 500 miles, and the operation would be a somewhat costly one, but as traffic between the two places was ever growing it could not be long delayed. Indeed, there appeared to be some probability that the Government would build large docks for warships in Bahia Blan and in that case communication with the Federal capital would an absolute necessity. In the city of La Plata, the provinc capital of Buenos Ayres, they had been granted a concession put their plant underground. That concession was only gran after several years of constant and strenuous effort. They h been much hampered in La Plata by the fact that the lines w aerial and liable to damage by every severe storm, and the pl was somewhat old-fashioned, but until they got the concession t were helpless to improve matters. Now, however, the necessa plans for a new board and building would be taken in hand; t had already got the underground conduits on the spot, and w collecting gangs to start work on that part of the undertaki They were engaged in building a new line between La Plata a Buenos Ayres with creosoted pine poles carrying 20 circuits different gauges to take both long and short-distance traffic, extensions having been rendered necessary by the continual grow in the number of messages between La Plata and other parts their system. The city of Cordoba was also claiming their att tion; already they had plans prepared for a new building, a as Cordoba was making splendid progress, a new and mod switchboard would before long be necessary. In some of smaller towns they had had to enlarge their boards during the y as the number of subscribers increased, while they had opened u several towns where they had not hitherto been established. most cases these smaller towns were connected up to the near large town, while in other cases through and direct communicat with Buenos Ayres had been necessary. They had been exceedin busy during the year, in spite of the fact that their operati were considerably hindered at the end of last year and beginning of the present year by a series of storms and flo quite unpreecedented in their experience. In Buenos Ayres t had already installed 73 private branch exchanges, controll 2,114 instruments through 265 exchange lines in banks, pu offices and large business establishments; the convenie of them had appealed to the commercial community, month by month they kept adding to the number with sa factory results to all concerned. These private branch exchan too, afforded an opportunity of gradually introducing the mess rate, which system of payment they hoped by and by to m universal, in the large cities at any rate. The extensions in h and in contemplation necessitated fresh capital, and they propo to make an immediate issue of 40,000 new ordinary shares, wh as before would be offered to the ordinary shareholders at The reserve fund was increased by the amount of the approp tion of last year, and reserve for renewal of plant, &c., had been increased, for they had this year charged direct to revenue provision for renewal of plant, which hitherto they had only d with by means of an appropriation from profit. The expenditure plant of all kinds was year by year expanding rapidly, and now total expenditure in that account was £1,376,539. With reg to the profit and loss account, the figures showed increases receipts and expenses in the Argentine of £64,885 and £60, respectively. At first sight it would look as if the expendit had gone up out of proportion to the increased revenue, but t was explained by the fact that they had this year inclu their provision for the renewal of plant under the heading "maintenance." In other respects the expenditure had been fectly normal. The profit for the year was £129,854, as aga £123,557 in the previous year. The chairman proceeded finally refer to the proposal to vote £2,000 to the staff provident fund.

The CHAIRMAN then moved the adoption of the report, w was seconded by MR. F. GREEN. The retiring directors re-elected, and the proceedings terminated with a vote of thank the chairman for presiding.

Metropolitan Railway Co.

THE report of the directors shows that the total receipts for half-year ending June 30th, 1911, amount to £400,735 and expenses to £195,666, leaving a profit of £205,069. Compared w the corresponding half-year of 1910 the receipts show an increas £9,247 and the expenses an increase of £1,646. The net reve account, after providing for the interest upon the debenture st and other fixed charges and placing £5,000 to the electrical rene and depreciation fund, shows a balance of £166,728, which permit of the payment of the dividends upon the preference sto and leave a balance of £61,424 available for dividend upon ordinary stock. The directors recommend the proprietors to dec a dividend upon the ordinary stock for the past half-year at the rat £2 per cent. per annum, and to carry forward the balance of £4,10 the next half-year's accounts. This compares with £1 5s. per c for the corresponding period of 1910, when the carry forward £6,044. The passenger traffic of the railway maintains a ste development, notwithstanding keen competition. During the h year further improvements have been made in the train service the various sections of the line, and more "non-stop" trains h been introduced during the busy hours of the morning and even The result has been a considerable increase in the issue of se tickets. The parcels and goods traffic continues to show a s factory expansion. The Bill promoted by the company in the sent session of Parliament is expected to receive the Royal As at an early date. The directors propose to avail themselves with delay of the provisions of this Bill empowering the issue of st certificates to bearer where such certificates are desired by st holders. Clauses for the protection of this company have inserted in Bills promoted by the London Electric and Cen London Railway Companies. The London County Council incl in their Bill of this session a scheme for constructing a tramway f

'ricklewood to the Marble Arch, which was opposed by this company, and ultimately struck out of the Bill. The installation of utomatic signalling between Willesden Green and Neasden has ow been completed. The replacement of the existing electrical lant at Neasden by machines of larger capacity and improved conomy is proceeding satisfactorily. The work of widening he tunnel and approach to Baker Street (East) Station from he north is being rapidly pushed forward. Additional contracts for carrying out further portions of the scheme for he improvement of Baker Street Station have been let, nd the works are proceeding. Arrangements for the electrification of the East London Railway are engaging the special ttention of the lessee companies, and the work is expected to be ut in hand shortly. Its completion will permit of this company's rain service over that railway to New Cross being resumed. The irectors regret to report the death of Sir William Birt, and desire place on record their high appreciation of his valuable services the company since his election to the board in 1902. The acancy has been filled by the election of the Hon. Francis McLaren, .P. The progress of the traffic carried on the railway since 1905 as been as follows :—

Year.	Number of passengers.	Gross receipts for passengers, goods, minerals and tolls.
1906	98,384,766	£681,268
1907	96,859,108	640,838
1908	99,846,735	680,357
1909	99,961,997	696,881
1910	102,849,458	718,089
1911 to June 30th	51,430,913	362,427

Report of Surplus Lands Committee for Half-year ending June 30th, 1911.

The rental accrued during the half-year amounts to £40,976 and e outgoings and expenses to £3,178, leaving, with the balance ought from last half-year, £39,845 available for dividend. This ill admit of a dividend at the rate of £3 per cent. per annum on the surplus lands stock, carrying forward a balance of £232. wenty properties—nine private houses and 11 business premises—e vacant, representing £1,438 per annum in rental. This time st year the unlet properties were of the value of £1,392 per num. The vacancy in the stockholders' representatives created the death of Sir W. Birt has been filled by the appointment of r. Robert Hope Selbie, subject to confirmation at the ensuing lf-yearly meeting.

Electric Construction Co., Ltd.

HE annual meeting of the shareholders of the above company was ld on Thursday of last week at Winchester House, Old Broad reet, Mr. W. S. B. McLaren, M.P., presiding.

The Chairman, in proposing the adoption of the report (see LECTRICAL REVIEW, page 68), said he was pleased that the forest of an increased demand for electrical machinery and of creased profit, which he ventured to make last year, had been lfilled. They had not been engaged on contracts of any magnide, but the number of machines supplied for industrial purposes home had been greater than in any previous year. The result the year's working was that they were able to recommend a dest dividend of 2½ per cent. on the ordinary shares—the st since 1904. It was a poor return for all the capital ployed and all the skill and energy exercised in the conduct of e business, but it was something to find themselves once re in a position to recommend a dividend, however all. They had commenced the new financial year with a ger amount of work on hand than last year, and, as stated in e directors' report, they viewed the future with confidence, if the sent demand were maintained. He wished to emphasise this dition, however, because the capacity for production at home d not diminished, nor had the keen competition among British d foreign manufacturers in all parts of the world relaxed. As dicated in the report, they had disposed of their holding ordinary shares in the Madras tramways. Their lding in the tramway was now represented exclusively by er cent. cumulative preference shares, and, as the traffic receipts re still developing, and the extensions (to which he referred t year) had now been sanctioned, their investment would yield teady and satisfactory return. With part of the proceeds from e sale of these shares they had redeemed the remaining £10,000 ond mortgage debenture stock and also £17,300 of first mortgage enture stock. During the past two years, therefore, they had eemed £67,300 of debenture stock, and the amount now outnding was £182,700 only. The reduction had strengthened the ancial position of the company, reduced the charge for interest, d established a more equitable relation between the amount of e mortgages and the amount of share capital issued. As he ormed them last year, the whole of the stock redeemed would kept alive for the purpose of re-issue, if required, but they did expect this would be necessary. A net deficit of £18,827 arising of the sale of the Madras tramway shares less the surplus on redemption of debenture stock had been debited to general rve fund ; but he would remind them that the sum of £10,000 s credited to this fund last year out of the surplus arising from redemption of the first portion of the second mortgage enture stock, and, therefore, the net debit to general rve fund for the whole series of transactions had been 827 only. They had always recognised that fund as a rve against realisations of shares in other companies, and the of £25,000 which would remain at the credit of the fund, if they adopted their recommendations, was a very substantial reserve against reduced holdings, which now amounted to £73,331. He was pleased to be able to inform them that the judgment in their favour in the action brought against them by a German concern, for alleged infringement of a patent, was unanimously confirmed by the Court of Appeal. They had not heard whether the plaintiffs intended to prosecute the matter further. Turning to the profit and loss account, there was an increase in gross profits on manufacturing and contracting of £8,075. Interest and dividends received showed an apparent reduction of £434, due entirely to an alteration in the period for which one of the dividends had been calculated. On the other side of the account there was a reduction in debenture interest of £1,813, and an increase in general charges of £1,203, due chiefly to the increased volume of business transacted. In common with others, their investments showed some depreciation. They were entered this year at the market value, the sum of £277 having been written off.

In reply to a shareholder, he said they had preference shares of £1 each at par in the Madras Co. and also shares in the Electric Power Storage Co., which were valued at £55,000. Against that, in case they were sold at less than par, they had a general reserve fund of £25,000. Replying to another shareholder, the chairman said the Electric Power Storage Co. had passed their first dividend.

Anglo-American Telegraph Co., Ltd.

The report of the directors states that the total receipts from January 1st to June 30th, 1911, including the balance of £2,609 brought forward from the last account, amounted to £191,455. The traffic receipts showed a decrease of £37,794, as compared with the half-year ended June 30th, 1910. The working expenses of the half-year, as shown by the revenue account, amounted to £76,980, being an increase of £1,328 as compared with the corresponding period of 1910. In addition, there were the expenses of negotiations with the Western Union Telegraph Co., for which a sum of £3,500 had been set aside. The agreement with the Western Union Telegraph Co. is settled in principle and in detail, but is not yet exchanged. It provides for a guarantee of £262,500 a year, payable quarterly, equal to 3¾ per cent. on the ordinary, 6 per cent. on the preferred and 1½ per cent. on the deferred stock. In these circumstances the board has decided to place £5,000 only to the renewal account for the half-year and to credit the interest on sundry securities to the revenue account, thus leaving a balance of £105,974. Quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on May 1st, 1911, absorbing £52,500, and second quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, amounting to £52,500, will be paid on August 1st, 1911. The balance of £974 will be carried forward to the next account.

Crompton & Co., Ltd.

In their report to be presented at the annual general meeting on July 31st, the directors regret that the result of the year's trading, after the usual provision for depreciation, shows a loss of £14,195, as compared with £20,493 for the year ending March 31st, 1910. After providing for debenture interest and other charges shown in the net revenue account, the balance to the debit of this account is increased to £48,271. The margin of profit obtainable during the financial year on the sale of goods of the company's manufacture has been small, but the demand is steadily improving, and an increase in the turnover is all that is required to enable the company to earn satisfactory profits. Pending the realisation of certain retention moneys and other items which tended to lock up the working capital of the company, and which might otherwise have been used to develop the output at the company's works, the directors did not feel that they were warranted in permitting the works to hold so large a stock as in past years, and this reduction had adversely affected the output and the company's profits. The amount of capital so tied up is being gradually reduced, and it is anticipated that further sums will shortly be realised which will be employed for the benefit of the company's business, and this should materially improve the position. The necessary structural alterations at the company's works, to accommodate the headquarters of the sales department, were completed in December last, and the past year's accounts, which had to bear the cost of removal, benefit but little by the saving in expense now being effected. Mr. Lionel H. Hanbury retires from the board by rotation, but offers himself for re-election. Lieut.-Col. John Clibborn, C.I.E., has been appointed to a seat on the board, which appointment requires the confirmation of the shareholders.

Liverpool Overhead Railway Co.—The directors recommend payment of dividends at the rate of 5 per cent. per annum (the same as last year) on the preference shares, and 1 per cent. per annum on the ordinary shares (on which no dividend was paid in 1910), leaving a balance of £4,665 to be carried forward.

Chelsea Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum (2s. per share) on the ordinary shares for the half-year to June 30th, being the same as last year.

Vickers, Ltd.—The directors have declared an interim dividend for the half-year ended June 30th last of 1s. each on the ordinary shares, free of income-tax ; the same dividend was paid last year.

Lanarkshire Tramways Co.

The directors report that the result of the half-year's working was as follows :—Revenue £36,532, expenses £19,359, leaving £17,172, from which are deducted contributions payable to local authorities £878, interest on debentures £673, interest account £614, leaving £15,006. The balance brought forward from December 31st, 1910, was £1,499, and the directors recommend a dividend at the rate of 5½ per cent. per annum for the half-year on the issued share capital £9,432, and the carrying forward of £7,073 to revenue new account. The traffic receipts for the half-year show an increase of £320 and the expenses a decrease of £1,240, as compared with the receipts and expenses for the corresponding half-year of 1910, the saving in expenses being mainly on permanent way and overhead line repairs and third party accident claims. The application to Parliament for an extension of time order, referred to in the last report, was withdrawn owing to the action of the Lanark County Council regarding the non-completion of the authorised lines. The expenses of the Bill, amounting to about £450, will be written off. It was decided to proceed with the extension to New Stevenston, as this can be completed before the powers lapse in August next, but the extensions to Bellshill and Mossend cannot be proceeded with. The New Stevenston extension will be completed and opened for public traffic early in August. Towards the cost of this extension 4 per cent. debentures of £50 each were offered to the shareholders in June at £47 10s. per debenture. Four additional cars have been ordered and will be put into service shortly. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year. The following details relate to the last two years' working :—

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Car-mileage.
December 31st, 1909	21·28	6,896,172	£35,887	936,238
June 30th, 1910	21·28	6,926,878	35,681	890,689
December 31st, 1910	21·28	7,206,852	37,226	907,632
June 30th, 1911..	21·28	7,074,121	36,001	885,322

Marconi's Wireless Telegraph Co., Ltd.

The annual meeting of the shareholders of this company was held on Thursday last week at the Hotel Metropole, Commendatore G. Marconi, LL.D., D.Sc., in the chair.

In proposing the adoption of the report (see Electrical Review, page 69), the Chairman said that at the last meeting he told them that in view of the general development of their business there was good reason to expect that not only would the preference shareholders be able to look in the future for regular payment of their dividend, but that the ordinary shareholders might also expect to receive very shortly some return upon their investments. Examination of the balance sheet justified what he said on that occasion. It was a matter of considerable satisfaction to the board to have been able to place before them accounts which showed so marked an improvement in the profit and loss account as compared with the preceding year. Looking to the figures, they would find on the credit side of the profit and loss account the sum of £127,452 under the heading "by balance of contract and trading account," which figure in itself showed the magnificent progress of the business. They had informed them in the report that it had not been considered prudent to continue to set out in the future the figures of the profit and loss account in the same form as they were submitted last year. There was no hidden mystery in their decision in this matter ; their object was merely to avoid giving to those who were not interested in the company information which it were better they were without. At the same time they did not think they were keeping from the shareholders anything which they had any interest in knowing, other than, perhaps, the amount of the gross sales, and it was exactly this which they did not propose to make public. The accounts were treated in the books in exactly the same way as they were last year, and no profits were taken into consideration on account of contracts which were in course of completion. In order to avoid any possible misunderstanding, he wished to say there was no truth in the suggestions which had been made that the balance of contracts and trading account embraced any sums received by way of compensation resulting from the patent action, nor did the figure include the dividends declared by the associated companies, to which they had made reference in the report. In the first instance, it was scarcely necessary perhaps to remind them that the judgment in the action was only given towards the end of February last, and the dividends of the associated companies were declared and paid during this year, whereas their accounts for 1910 were closed on December 31st of that year. The trans-Atlantic service, which was opened in April last year, continued to work very satisfactorily, particularly in so far as the wireless operation of the service was concerned. They had had, and continued to have, some trouble owing to the mutilation of code words by the landlines, which, they regretted to say, applied more to this country than it did to the other side. They had arrangements in view which would eliminate this trouble ; their programme, however, in this direction must be subject to circumstances. A satisfactory solution would be the continuance of their wireless service into London, provided the necessary licence could be obtained from the Post Office. In view, however, of the Government programme in connection with wireless telegraphy, they felt that this question must stand in abeyance for the present. The difficulty to which they had referred did not arise with plain English messages ; these the Post Office operators seemed able to handle very efficiently. It was, therefore, probable, subject to negotiations pending, that at an early date they would carry into effect their intention of accepting plain English messages at a rate of 4d. per word. By adopting this course, they thought a great many messages now sent by code at the higher rate would be s in plain English, and at 4d. per word they would be just as pr able to them, and certainly more satisfactorily handled than c messages at 7½d. He was engaged at the present time in mak the necessary arrangements at the Clifden Station for the in duction of their new duplex system, and so soon as these arra ments were completed, and in the very early future, he was posing to proceed to Canada to similarly install their Glacé Station. When this was done, their service would be materi improved, and its capacity at least doubled a with very small incr of running expenses. Amongst the large amount of work w had been completed during the past year was the constructio two stations in Brazil for the Madeira Mamore Railway Co., thus ting Porto Velho into radio-telegraphic communication with Ma He made particular mention of these stations as an indication of probable adoption of wireless telegraphy in undeveloped coun for the commercial telegraph service of the future in place of l lines. During the year under review a number of important tracts were entered into, which included the erection of station Italy, Turkey, Greece, Spain and the Canary Islands. The sta of the Italian Government at Coltano would be inaugurated autumn, and would enable communication to be carried out bet Italy and North America, and probably also with Great Bri Spain, Turkey and Greece. A first agreement was made with Eastern Extension Telegraph Co. for the erection of a coast sta at Cocos Island for the purpose of maritime communication, w station would be worked on the joint account of the Cable Co. themselves. This was the first of a series of coast stations exten to Hong Kong, Singapore, Malta and Gibraltar, to be erected u similar conditions. These should materially assist their i national maritime business. Important negotiations had carried on with the French Government, which had since res in the completion of a working arrangement between the Fr Government and the affiliated Marconi Companies. They designed several types of portable apparatus for military purp and business of a substantial nature was resulting therefrom Press agency had been organised upon the high seas, enabling t to receive and distribute any news of importance occurrin board ship or coming within the knowledge of ships upon the o During the early part of the year under review they submitte His Majesty's Government a scheme to put all the Br Possessions into wireless communication with each other, applied for a concession for the erection and working o necessary stations. From this would appear to have deve the Imperial wireless scheme introduced by Sir Joseph Ward a recent Imperial Conference. They would have preferred to carried out the scheme they had proposed ; there were, how reasons which they were quite able to appreciate why the Go ment should prefer to take this scheme in hand themselves un working arrangement with the company. They would, howev equally satisfied if their negotiations eventually resulted in erecting the stations on behalf of the Government upon which would compensate the company for the large sums of m and the immense amount of work which it had devoted t development of long-distance commercial wireless telegr They were satisfied that the Government recognised it was solely due to the company's patents, and to experience and knowledge which it had obtained thr its work in connection with its commercial operatio the trans-Atlantic service, that the Imperial scheme come within practical politics. It was well to point out th company other than theirs had been able to erect stations fo purpose of long-distance commercial radio-telegraphy ; all had been done by others in this direction had been of an eleme experimental nature. They were aware that during last ye travelled to Buenos Ayres, experimenting on the way with Clifden and Glacé Bay stations ; they were successful at diff distances, and right up to his arrival at Buenos Ayres, in rece messages from both stations at a distance of over 6,000 Their Argentine company would now proceed with the erecti its long-distance station, which should put South America commercial wireless communication with Europe. They engaged in active negotiations with foreign Governments fo erection of other long-distance wireless telegraph statio countries outside the British Empire, which stations would e be worked by them, or they would remain interested in the wo of them. The policy of the board was to erect long-distance mercial wireless telegraph stations throughout the world, a remain interested in the working of them. The judg obtained against the British Radio-Telegraph and Telephon had materially strengthened the position of their company. were, no doubt, all aware that it was an action brought by for infringement of the patent which was known as the " sevens " patent, and which embraced syntonisation. The important commercial development of wireless telegra especially in regard to long distance—dated from this paten he did not know of any commercially useful system of wi telegraphy to-day which did not infringe it. They had inf them in the report that it was their intention to protect rights throughout the world. Their financial position t enabled them to set aside a substantial sum of money fo purpose, and it was a policy which they intended vigorous pursue wherever it might be desirable and necessary. He reg that after the report was drafted, they found it incumbent them to issue a writ for infringement of patent against the L Muirhead Wireless and General Telegraphy Syndicate, who had in turn retaliated by issuing a writ a them. It had been suggested to them that an arr ment might be made which would have obviated necessity of their taking legal proceedings, and

ordingly for a time deferred taking any action. It uld be his pleasure to submit for their approval the payment of cumulative 7 per cent. dividend upon the preference shares to the l of December, 1910, and to declare an interim dividend upon the ference shares for the half-year ending June 30th at the rate of er cent. per annum. He would then have the pleasure of laring for the first time in the history of the company a dividend on the ordinary shares. The board was unanimous in contenting lf for the present with the declaration of an interim dividend on the ordinary shares for the six months ending June 30th, l, at the rate of 10 per cent. per annum. In conclusion, the airman referred to the loyal and untiring support which they l received from the whole of the staff, and remarked that there l been periods in the history of the company when they were ggling with very great difficulties, when the staff not only stood ally by them, but generously agreed to accept reductions in their aries. Having now emerged from these difficult and unprofitable ies, they desired, and he was sure they would have the approval the whole of the shareholders, to mark more particularly their preciation of their work and consideration by allocating to them m the profit and loss account a reasonable bonus, which should left to the discretion of the board, for distribution amongst m.

Mr. Godfrey C. Isaacs, in seconding the motion, referred to remarks of the chairman regarding their patent action and to ir four-sevens patent. He said he had been frequently asked of e what would be their position when this patent matured. In first instance, before that time arrived they would have built a big and staple business, but in any case he was advised and ieved that for so important an invention they would have no ficulty in obtaining a substantial extension of their patent; but ir four-sevens patent was only a part—true, an important part, nevertheless only a part—of their system of wireless telegraphy. e whole consisted of this and a number of other patents of portance, and to these Mr. Marconi added improvements year by ar. They had an excellent example of this in the new duplex tem. Who would be satisfied to-morrow with their four-sevens l other patents, or with any other system of wireless telegraphy, he duplex, which doubled capacity, were not included?

The report was adopted.

Consolidated Electrical Co., Ltd.

E report of the directors for the year ending March 31st, 1911, tes that the ordinary income for the period under review ounted to £5,477, in comparison with £5,760 for the previous ancial year. The figures for the preceding year included a sum £287 for interest receivable from the Consolidated Supply Co., d. The general charges for the year amounted to £1,279, in nparison with £1,331 for the preceding 12 months. Of the lance of £6,261 standing to the credit of revenue account, the erim dividend of 3 per cent. paid on the preference shares on nuary 1st, 1911, absorbed £450, leaving a disposable balance of ,811. The final dividend of 3 per cent. paid on the preference ares on July 1st absorbed a further £450, and the directors now ommended the payment of a dividend on the ordinary shares 3½ per cent., free of income-tax, for the year ending March 31st, 11. This will absorb £3,850, and leave a balance of £1,511 to be ried forward. The directors are satisfied that the valuation ced upon the company's investments in the balance-sheet is well thin their intrinsic and realisable worth; the position of the glo-Portuguese Telephone Co. continues entirely satisfactory. e director retiring is Mr. Charles Woolley, who offers himself for election.

Mr. Herbert Allen (chairman) presided on Thursday last week River Plate House, E.C., over the ninth ordinary general meeting the company.

In moving the adoption of the above report, the Chairman d it was on the usual humdrum form, and practically the only eration from last year was in the paragraph relating to dividend, ich they were now paying for the first time free of income-x; on several occasions shareholders had suggested that this ould be done, and in a rash moment last year he promised that should. He supposed that in these days of heavy income-tax it ade the 3½ per cent. dividend equivalent to 3¾ per cent., or some-ing like that. In the balance-sheet their liabilities were un-anged. Sundry creditors showed a slight increase, which was e to a temporary loan, repaid since the report was printed. On e other side, the three tangible assets of the company were the in-stments, the revenue suspense account and the cash at the bank, and ese represented more than the figure given in the accounts. To all in-nts and purposes they were now a single investment trust company. e investment they held was in the Anglo-Portuguese Telephone ., and beyond that they had practically nothing. Last year they out the securities of the Consolidated Supply Co., but as they were rth practically nothing, they had eliminated that item from the counts, as it might mislead shareholders. The item of investments, ich comprised 72,000 shares in the Anglo-Portuguese Telephone ., was pnt down at £81,000, which was about 22s. 6d. a share, d, as a matter of fact, that was well within not only their intrinsic lue, but their realisable value, so that the investment was under ther than over-estimated. The Private Wiring and Installation . had been got rid of altogether, and the Consolidated Supply Co. as, to all intents and purposes, done with. It had not yet actually en wound up, but they hoped it would be before long, and in the antime they were incurring no further responsibility in connection th it. They had not let it have any money for several years, and what they were aiming at was that, in the process of winding up, they were not saddled with any obligation or responsibilities. When those companies were finally out of the way, they might then be able to bring up a scheme for dealing with the remaining asset of the company. The item of dividends, received, &c., was smaller by about £300, owing to the fact that they had not included certain interest from the Consolidated Supply Co. which they knew they would not get.

Mr. C. Woolley seconded the motion.

Mr. Weddrell urged that the board should wind up the Consolidated Supply Co. as quickly as possible, and then they might divide the shares of the Anglo-Portuguese Telephone Co. amongst the shareholders of the Consolidated Electrical Co. and wind that up. He estimated that if this was done and he received one share in the Anglo-Portuguese Co. for two shares in the Consolidated he would get 4 per cent. instead of 3½ per cent.

Mr. Riverton hoped they would have the assurance that the company would not lend any more money. He also thought that if they divided up the Anglo-Portuguese Co.'s shares and wound that company up they would get 5 per cent. on their money.

The Chairman, in reply, said that it was the intention of the board at the first favourable opportunity to realise the Anglo-Portuguese shares and distribute the assets, but the present was not an opportune time.

A Shareholder pointed out that the shares could be divided.

The Chairman said he thought it would be far more advantageous for the shareholders to realise the holding *en bloc* and then distribute the cash. It was not a case of giving one Portuguese share for two Consolidated shares, and there were the preference shareholders and the creditors to deal with first. The delay which occurred in winding up the Consolidated Supply Co. was due to the fact that they had the factory at Canonbury on a long lease, which they were trying to dispose of. The factory was let, and threw no cost on the company.

The report was then adopted, and the retiring director re-elected.

Mersey Railway Co.

The report of the directors for the half-year ended June 30th, 1911, states that the train-mileage run during the half-year was 326,063 miles, as compared with 330,307 during the corresponding six months of 1910. The number of passengers conveyed during the half-year ended June 30th, 1911, has been 6,027,753, as against 5,948,152 for the corresponding period of 1910, exclusive of season-ticket holders. The total receipts from all sources for the half-year have been £55,796, as compared with £54,653 for the corresponding period of 1910. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £26,426, equal to 47·36 per cent., as against £28,916, equal to 52·91 per cent. for the corresponding six months. These charges for pumping, ventilation, and hydraulic lifts for the past half-year amounted to £2,798, equal to 5·01 per cent., as compared with £3,279, or at the rate of 6·0 per cent. for the corresponding period of 1910. In accordance with the provisions of the Mersey Railway Act, 1910, the sum of £5,005 standing at the debit of the net revenue account at the close of the half-year ending December 31st, 1910, has during the half-year been transferred and charged to the capital account of the company. After providing for rent charges, renewal fund and interest on the new first perpetual debenture stock, there is a balance at the credit of the net revenue account of £8,061, which has been carried forward to the next half-yearly account to be applied so far as available therefor, after December 31st, towards payment of interest on the debenture stocks, which are contingent on the revenue available therefor in each separate year ending December 31st.

Stock Exchange Notices.—The Stock Exchange Committee has appointed a special settling day as under :—

August 3rd.—Metropolitan District and London Electric Railways.—Speyer Bros.' scrip certificates, fully and partly paid, for £1,538,700 joint power house rent charge stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Bell Telephone Co. of Canada.—$4,899,000 5 per cent. bonds, 1925, Nos. 301 to 900, 1,201 to 1,800, 3,801 to 4,800, and 7,151 to 7,650 of $500, and Nos. 1 to 300, 901 to 1,200, 1,801 to 3,749, 4,901 to 5,500, and 6,001 to 6,400 of $1,000 each.

British Columbia Electric Railway Co.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

Metropolitan District and London Electric Railways.—Speyer Bros.' scrip certificates, partly paid, for £1,538,700 joint power house rent charge stock.

Mexico Tramways Co.—$5,664,200 additional common stock in shares of $100 each.

South American Light and Power Co., Ltd.—According to the *Financial Times*, the net profit for the year ended March last is £9,478, which, added to £558 brought forward, makes a total sum available of £10,036. The directors recommend a dividend of 5 per cent. and also the payment of interest at the rate of 5 per cent. per annum on the £71,380 capital expenditure incurred during the year by the railway company, leaving a balance of £1,079, out of which it is proposed to place £500 to reserve, and to carry forward £579.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th, 1911, on the ordinary shares at the rate of 4 per cent. per annum, less income-tax, being the same as last year.

Bombay Electric Supply and Tramways Co., Ltd.

THE directors' report for the year ended December 31st, 1910, shows a total revenue for the year amounting to £219,317, being an increase of £21,489 over the previous year. The total expenditure amounted to £122,139, being an increase of £7,007 compared with the previous year; the net receipts were £97,177, an increase of £14,482. After deducting £32,383, the proportion of debenture interest chargeable to revenue, and £629, appropriated to sinking fund in lieu of interest on debenture stock cancelled in 1909 and 1910, there remained £64,164, to which is added the amount brought forward from last year, £4,567, making an available total of £68,731. From this has to be deducted the dividend on the 6 per cent. cumulative preference shares paid to August 15th, 1910, £22,489, also the dividend on the 6 per cent. cumulative preference shares accrued to December 31st, 1910, £13,493, leaving a balance of £32,748. The directors recommend that this sum should be applied as follows: Depreciation account, £15,000; sinking fund for capital redemption, £6,000, and carried forward to next account, £11,748. In accordance with the method adopted last year, the directors propose, in regard to the above-mentioned £15,000 to be placed to depreciation account, to invest the sum of £10,000 outside the business.

The tramway traffic receipts amounted to £144,182, compared with £134,153 for the previous year. The working expenses in Bombay amounted to £73,488, compared with £70,596 for the previous year. The balance of receipts over expenses in respect of the year's working is £73,222, compared with £65,918 for the previous year. The following statistics relate to the tramways:—

	Year ended Dec. 31st, 1909.	1910.
Miles opened—Route miles..	20·38	20·38
Number of passengers carried	32,210,468	34,163,079
Proportion of expenses to receipts ..	51·7 %	50 %
Number of cars in stock—electric.. ..	172	178

The gross receipts from electric supply for the year, including the amount represented by the sale of current to the tramways, amount to £66,921, compared with £57,552 for the preceding year. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amount to £37,043, compared with £31,493 for 1909. The working expenses were £43,897, against £40,934 for the previous year. The balance of £23,024, as the result of the year's operations, compares with a balance of £16,618 for 1909. The following figures show the comparative results for the past five years:—

Year ended Dec.	No. of consumers.	Units sold.	Revenue.	Expenses.
1906	330	531,731	£8,435	£10,075
1907	588	2,056,907	21,566	19,545
1908	803	5,263,630	47,714	39,737
1909	1,084	6,253,112	57,552	40,934
1910	1,494	7,296,856	66,921	43,897

The Bombay Municipal Corporation has agreed to a tariff of flat rate charges for the supply of electrical energy to all consumers, except for industrial motive power purposes, in substitution for the maximum demand system heretofore in force.

The capital expenditure during the year in connection with the construction of the new Kussara power station, on new mains and the development otherwise of the supply of electricity for lighting and power, and the further equipment and improvement of the tramways, has amounted to £129,882. Debenture stock to the amount of £5,300 was bought and cancelled last year under the operation of the sinking fund, reducing the amount outstanding on December 31st to £588,323. Since the close of the financial year arrangements have been made for the sale of a further £50,000 5 per cent. second mortgage debentures, to provide for the expenditure in connection with the new power station, the extension of the supply mains, and additional rolling stock. Sir Edward Sassoon and Mr. F. W. Chanter are the directors retiring by rotation, and, being eligible, offer themselves for re-election.

The sixth ordinary general meeting of the above company was held on Wednesday at the Electrical Federation Offices, Kingsway, Sir Charles Ollivant, K.C.I.E., presiding.

The CHAIRMAN, in moving the adoption of the report, said that the net receipts resulting from the past year's operations, amounted to £97,178, compared with £82,696 for the previous year, being an increase of £14,462. After deducting debenture interest amounting to £33,013, there remained the sum of £64,164, to which had to be added £4,567 brought forward from the previous year, making an available total of £68,731. Of this amount, £35,983 was required for the dividend paid on the preference shares to August 15th last, and for the proportion of dividend accrued to December 31st last, leaving a balance of £32,748, which the directors recommended should be dealt with by placing £15,000 to depreciation, £6,000 to sinking fund, and carrying forward £11,748. The total revenue from all sources, including the amount represented by sale of current to the tramways, amounted during the year to £219,317, an increase of £21,489 over the revenue of the previous year, which additional revenue was earned by the further expenditure of only £7,007. The increased revenue derived from the working of the tramways, provided them with £10,197 of the gross increase, and £9,369 was attributable to increased receipts in the electricity supply branch. At the last general meeting allusion was made to the depression then existing in the mill industry, and to its retarding effect upon the progress of their traffic receipts. He was unable to say as yet that this depression had passed away. The past year was described by the president of the Bombay Millowners' Association, at their recent annual meeting, as having been one of the most unfortunate ones in the history of the Bombay cotton industry. A large number the mills had suspended work, and several others have been worki half time, with the result, as estimated, that about 30,000 peo have been thrown out of employment. There could be no dou that the closing of so many mills had adversely affected th traffic receipts both last year and this. The board, neverth less, felt that they were justified in regarding as decidedly sat factory the further improved results in the working of the tra ways, which, notwithstanding these adverse circumstances, h been achieved—viz, an increased net return of £7,364, and w continued to be maintained. In order to meet the demand increasing travelling facilities the directors have found it necess to further augment the company's rolling stock by the additi of 12 more cars. Turning to the balance-sheet, the capi expenditure during the year amounted to £129,882. this amount, £115,817 represented expenditure in the electric supply branch, called for chiefly in connection with the constr tion of the new power house at Kussara and on new mains for t development of the electricity supply business. During t current year, further heavy expenditure had been nec sary for these purposes, which had been met fr funds already in hand and temporarily invested, and the issue of a further £50,000 of second mortgage debentu In connection with the approaching Royal visit to India, t directors had made a contribution of 5,000 rupees to the Celebrat Fund. They would be pleased to hear that the arrangements illuminating the principal public buildings in Bombay had b entrusted to the company. With regard to the Bombay Hyd Electric Power Co., whose works were now in active progress, so from there being risk of injurious competition between the t companies in their respective spheres of activity, they were m more likely to derive benefit from mutual assistance and frien co-operation. He thought that the report gave them fa which encouraged the hope that their position by the t they next met might be such as to justify the payment a dividend on the ordinary shares, if only on a modest sc He might for their convenience summarise the revenue outlook follows:—The net receipts after providing for working and adm stration expenses were £94,000, and this sum just sufficed interest on the first and second debentures, including in the la £50,000 still to be taken up, for the sinking fund and depreciat assignment, and for the dividend on the preference shares. Bu they had seen, they carried forward nearly £12,000, and the pr on this year's working over that of the previous year, £14,000, roughly speaking, equally divided between the older and youn branches of the undertaking. This showed that the older, tramways, had a healthy capacity for further development, that the younger (supply for lighting and power) was mak speedy and vigorous progress. The sums carried to profit and account for the last four years successively had been as foll (in round figures) £2,000, £8,000, £15,000, £23,000.

The resolution was seconded and carried unanimously.

MR. CURRY, a shareholder, asked why they borrowed money 5 per cent. on second debentures, and then bought 3½ per c securities with the money.

The ASSISTANT SECRETARY said that the money was borro at 5 per cent., but they took the best care they could, and inve it where there was greatest security.

MR. CURRY said that it was always possible to get 4 per cent.

The CHAIRMAN said it was invested in Government securi and they had been fortunate enough to secure a profit of abo per cent. in all. There being 3 per cent. in the first instance, another 1 per cent. on the deal.

After the retiring directors had been re-appointed, and auditors had been re-elected, a vote of thanks to the chair concluded the meeting.

City and South London Railway Co.

THE fifty-fourth half-yearly meeting of the shareholders of above company was held on Tuesday at the offices, 71, Finsb Pavement, the Right Hon. C. B. Stuart Wortley, K.C., M presiding.

The CHAIRMAN, in moving the adoption of the report (see E TRICAL REVIEW, page 104), said they met after a record half-y in which they had carried more passengers than ever, and n passengers per train (126·6). As against the first half of 1910 t showed increased receipts per train (17s. 11·84d., against 17s. 4· also increased receipts per train-mile (2s. 5·41d., against 2s. 4·3 and a decreased percentage of working expenses to receipts (4 against 47·52). The chief fact that emerged from the acco was that taking the great increase in gross receipts, less the s increase in expenses, and bringing into account the increased brought in on December 31st, 1910, as against 1909, and diminished sum required for general interest, they had for di bution in dividends a sum increased by no less than £5,663. would have enabled them had they chosen to divide up to the to pay a dividend at the rate not merely of 1¾ per cent., but at the rate of 2 per cent., and still carry forward more by £ than they did this time last year. The sum that he mentione £5,663, included an increase in gross receipts within the half- of £5,040. And of this large increase of £5,040 a large proportion attributable to a genuine increase of their ordinary passe traffic, of the kind that railway managers and shareholders alw regarded as a sound indication of prosperity. He was leadin to a mention of the abnormal and extraordinary traffic and o receipts that were brought to them by the Coronation; bu might point out first, and as evidence of the growth of ordi traffic, that at the end of the last week before the Coronation t

ad recorded an increased passenger traffic of no less than £2,363 he two weeks which comprised the Coronation and all the sights nd ceremonies that went before and after it, brought them ncreases in traffics amounting to £1,400. They made, moreover, bout £600 by letting spaces for the erection of stands for pectators of the royal procession. They would, therefore, see that ese two non-recurring items of profit just about corresponded in mount with the £1,850 that it would have cost to give them a ividend for the half-year at the rate of 2 per cent. instead of 1¾, lus a small increase of only £113 in the carry over, which in that se would have been all that they could have added to the carry er of June, 1910. The net substance of their recommendations as that in the form partly of a large increase on the large carry er of June, 1910, and partly in the form of the £800 which they ut aside for what they had called "general purposes," they pro-osed to keep in hand for such purposes as the directors might ereafter determine so much of their increased receipts as were to e attributed to special and exceptional causes. The new high-vel subway at the Bank station had now been open for nearly ree months. It afforded safe and convenient access between their n Bank station and those of the Central London and the Waterloo d City. Last year he intimated that the speed of their trains was a atter which the pressure of competition was forcing upon their tention. They were advised that without incurring such expense would involve an application to Parliament, it might be possible to improve their existing locomotives as to reduce by or 6 minutes the time taken in each journey from one end of the stem to the other; that was from Clapham Common to Euston. hey had sanctioned the expenditure needful for a practical periment in this direction; and before many weeks were passed e hoped they would have some useful knowledge as to what nprovements to their locomotives were practicable, safe, and kely to improve their means of contending with their muni-pal competitors of the disregarded speed limit and the long rse.

The report was adopted.

Central London Railway Co.

HE directors' report for the half-year ending June 30th gives e financial results as follows:—

	1911.	1910.	
Traffic receipts	£137,846	£146,586	— £8,740
Miscellaneous receipts	12,263	11,753	+ 510
Gross receipts	150,109	158,339	— 8,230
Less working expenses	84,208	87,628	— 3,420
Balance to net revenue account	£65,901	£70,711	— 4,810

After providing for interest on the debenture stock, and other yments, the net revenue account shows that, including the nount brought forward from last half-year, there is an available lance of £76,877, as compared with £85,078 in the corresponding riod. After deducting £1,222 for interest on the 4½ per cent. eference stock, there remains a balance of £75,655, out of which e directors recommend the declaration of dividends on the un-vided ordinary stock at the rate of 3 per cent. per annum, and on the referred ordinary stock at the rate of 4 per cent. per annum. ese payments will require £39,117, leaving a balance of £36,538. e number of passengers carried since 1906, including those using rough tickets and the cheap return tickets issued before 7.30 a.m., as follows:—

	Half-year ending June.	Half-year ending December.
1907	20,260,871	16,646,620
1908	19,901,750	21,996,623
1909	18,989,109	19,394,285
1910	20,664,896	19,995,960
1911	20,006,287	—

The decrease of 658,609 in the number of passengers carried during e half-year is attributable to the very large increase in motor-nibus competition along the entire line of route, and to the ather conditions, which have been extremely favourable to nibus traffic, and also to the fact that the attendance at the hibition at Wood Lane—up to this time—has not been as great as former years. Against this decrease in passenger traffic, it is tisfactory to record that a material saving has been effected in rking expenses. The high level subway at the Bank, connecting is railway with the City and South London line, was opened by e Lord Mayor on May 3rd last, and has proved a great convenience the public. The construction of the Liverpool Street extension progressing as rapidly as possible, and arrangements have been ade with the contractors whereby the work will be expedited six onths. The company's Bill, referred to in the last report, under nich through running to the Ealing Broadway Station of the eat Western Railway will be secured, has passed through both ouses of Parliament, and now awaits the Royal Assent. The onair system of ventilation is being installed over the whole line, d will be completed during the course of the next few weeks. By is system some 80 million cb. ft. of ozonised air will be pumped ily into the tunnels, which will thus render the atmosphere ceptionally pure. Season tickets were introduced on July 1st, 11. and are proving popular, and the carriage of parcels has also come a marked feature in the daily work of the company. Sir nry Oakley, feeling the burden of increasing years, has resigned e chairmanship, but the company will still have the advantage of his vice and assistance as a member of the board. Mr. H. F. Parshall s been elected a director, and appointed chairman of the board. e has been associated with the railway—as consulting engineer—om the beginning, and is acquainted with all the details, both from an engineering and commercial point of view, and, on account of the large number of engineering matters which have to be attended to in the operation of the railway, the directors consider his appointment to be of great importance. Changes have been made in the organisation, which not only render the working arrangements more effective, but at the same time result in great economies in the working of the railway.

The Chili Telephone Co., Ltd.

THE annual general meeting was held at the offices, 42, Old Broad Street, E.C., on Thursday last week, Mr. George Keith presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 28), said that ever since the earthquake disaster in 1906, the company's business year by year had been making steady progress. Last year the Chilian Centenary was celebrated, with great enthusiasm, and it had also been a year of great activity and progress in Chile, in which their business had duly participated. The comparative statement of accounts in their report showed that the revenue in Chile had increased by about 10 per cent. during the year. The improvement was due to the general expansion of all classes of the company's service throughout the country. Whereas by far the greater part of the revenue was collected by annual subscriptions, payable quarterly or half-yearly, the measured rate or toll system had for some considerable time been introduced for inter-town communication, which had resulted during the past year in a very satisfactory increase in the revenue derived from that service. Exchange had also been favourable, the average rate for the previous year being 10·90d. Income in Chile, when converted into sterling, showed an increase for the year of £7,946, and altogether, the result of the year's business was a credit balance of £46,144, which, after providing £22,805 for reserve and £9,900 for interim dividend, paid in January, enabled the board to recommend the payment of a final dividend of £13,200, making, with the interim payment, a total distribution for the year of 7 per cent., free of income-tax, and to increase the balance carried forward to next year's account by £238, to £3,225. The reserve account now stood at £52,300 and investments at cost at £34,784. As regarded the service revenue of the year, the £2,840 expended on replacements of plant had been charged to reserve, and £17,470 on increasing and expanding the property had been carried to the capital expenditure account. Altogether, he thought he could congratulate the shareholders upon the result of the year's operations, and he looked forward to the continued prosperity of the company.

The motion was seconded by the HON. HERBERT T. ALLSOPP and was carried unanimously.

After Mr. Eric B. Butler Henderson, the retiring director, had been re-elected, a vote of thanks to the chairman terminated the meeting.

Montreal Water and Power Co.—For the year ended April 30th, 1911, the gross earnings amounted to $132,150; and the net surplus to $141,155, as against $86,500 12 months ago. $23,549 has been placed to reserve, and $25,283 has been paid in interest on the cost of new works during construction; $40,000 has also been added to reserve for general depreciation, &c. Out of the surplus of $32,822 it is proposed to pay a dividend on the income securities of the company.

Monterey Railway, Light and Power Co.—We gather from the *Financier* that the operations of the company during the past year have been satisfactory. The results of the operations may be summarised as follows:—Gross earnings from railway service, $144,181; expenses, $93,296; net earnings, $50,884; income from Waterworks Co., Light and Power Co. and other sources, $401,873; total net, $452,758; deduct interest on debenture stock, $253,472; dividend on preference stock, $25,000; surplus, $174,286.

Electric and General Investment Co., Ltd.—The directors recommend a dividend at the rate of 6 per cent. per annum on the ordinary shares for the year ended March 31st, being the same as in the previous year.

Notice re Companies.—Notice is given in the *London Gazette* that after three months, unless cause is shown to the contrary, the following companies will be struck off the register and dissolved:—

Formby and Freshfield Electric Light Co., Ltd.
Macclesfield Electric Lighting and Power Co., Ltd.
Penarth Tramway Syndicate, Ltd.
Phœnix Electric Heating Co., Ltd.

STOCKS AND SHARES.

Tuesday Evening.

POLITICAL complications of all kinds, and arising from various quarters of the world, have upset the Stock Exchange markets badly. By the time this issue of the paper is out there may be a

general settling down, but for the time being the prevailing feeling is one of great unrest, and prices in every department of the Stock Exchange have reflected the general nervousness. No doubt people are crying "War, War!" when there is no war, but the very raising of the shout serves to depress prices and investors' courage, with the natural consequence that until calmer waters are reached buyers prefer to keep out of the Stock Exchange altogether.

Home Railway stocks have suffered severely in the depression. Although dividend declarations on the whole are satisfactory, they have been powerless to make any favourable impression against the concatenation of adverse circumstances which have pressed upon them from other directions. Perhaps the firmest market has been that for City and South London Ordinary, which retained its full rise of last week. Central London Ordinary lost 2 points upon the dividend declaration—giving the Ordinary stock 3 per cent., as usual, and providing for the Deferred to receive at the rate of 2 per cent. at the end of the year. The carry-forward, however, is reduced to the extent of £15,000, and this, in the Coronation year, cannot be considered brilliant. Districts have gone back 1¼, while Metropolitans fell ½. There has been a sharp drop in Brighton Deferred stock, and the East London issues fell back a little. Underground Electric income bonds are slightly easier, but Great Northern and City Preferred have regained their loss and are up to £1 middle again.

The home traction companies have been somewhat neglected. British Electric Tractions Preference lost ⅛, and Potteries gave way to a slight extent. Amongst the foreign descriptions the feature is the demand for 5 per cent. bonds, and this has raised the prices in Mexico Trams, Rio Trams and Sao Paulo first Debenture stock. Rio Tramways Ordinary have been a strong market, touching 118½, but the price slipped back to 117. Bombay Preference rose ⅛, United Electric Tramways of Monte Video lost a similar fraction. The demand for first-class Debenture stocks may be further illustrated by the rises in Anglo-Argentine Tramways 4½ per cent. Debenture and Bombay 4½ per cent. Debenture.

Amongst the English Electricity Supply shares, Metropolitan Ordinary are a good feature, with a rise of ⅜ to £4 middle, the block of shares which has been hanging over the market being practically all absorbed. City Ordinary rose ⅛, and Charing Cross Preference are a shade better. On the other hand, London Electric Ordinary and Preference have eased off. The Colonial and Foreign catalogue is chiefly remarkable from the fact that the long-continued fall in Northern Light and Power Bonds has been arrested, and the price shows a rise of a point. The Canadian-Mexican group is steady, and the flatness in other parts of the House has not prevented substantial rises in the prices of Mexican Light and Power varieties. The Common shares have risen no less than 3½, while the Preference are 2½ better, and the 5 per cent. first mortgage bonds gained 1. Canadian General Common stock and Shawinigan Water Capital have both improved. In fact, this market is about the only one where hardly any falls have occurred during the past week.

In the Telegraph market the issue of a report which was regarded as distinctly unsatisfactory has led to sharp falls in the Anglo-American trio. The 6 per cent. Preferred stock lost its rise of last week, and the Deferred fell ⅞. Certainly the showing which is made by the figures cannot be considered at all good, but it is suggested in the market that these figures must not be read as too bad. It is asked with a good deal of curiosity whether part of the Anglo-American profits may not have been possibly included in the takings of the Western Union Company, but this, of course, is sheer guesswork, and the question may have been raised merely by a disappointed bull who wanted to see the prices go better. At the same time the fall, we consider, should frighten nobody who holds the 6 per cent. Preferred stock, and it is conceivable that the unsatisfactory character of the report may help to hasten the desired consummation of complete agreement between the English company and the American.

Direct United States Cable shares, rather singularly, have put on ⅜, and this, perhaps, is not altogether without significance to those who are mystified by the drop in the Anglo-American figures. West India and Panama shares have come into renewed favour, the Ordinary being put up ⅜ upon a steady demand. Marconi shares have fallen back into quietude now that the dividend on the Ordinary shares is actually announced, and on balance the price shows a small fall. This is due to the speculative buyers taking their profits upon their best anticipations being realised, but the holders of the shares who have bought them for investment profess that the price will go much better in the future, provided that no effective competition comes into being—and of that there seems small possibility at present.

National Telephone Deferred rose 2, but lost its gain later on. The stock came into favour upon the consideration that the company will do well in its arbitration, now that the Railway and Canal Commissioners have shown that they do not intend to let the Post Office have everything its own way. That the quotation should have kept steady in days so dull as these is taken as a good augury for the future, and there are still people content to buy the stock in the expectation of being paid off at a much higher rate next year. United River Plate Telephones have fallen 5s., but Chilis are ⅛ better.

In the manufacturing group, Babcock & Wilcox receded ½ upon a small amount of selling, and Telegraph Constructions are 10s. lower. Castner-Kellner shares picked up a little. The Rubber market has been a good deal excited by a rise in the raw material to 4s. 9½d. a pound, with the result that a certain amount of bear covering ensued. To-day's sales at Mincing Lane, however, rather disappointed the optimists, and led to a reaction from the best prices reached for rubber shares last week.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.
Aberdeen	July 19	3,618	+ 183	7	11,367	+ 798	..
Ayr	,, 22	1,560	+ 112	10	3,962	— 53	8
Bath	,, 19	2,052	+ 226	29	28,434	+ 886	..
Belfast	,, 21	9,681	+ 967	16	71,045	+ 9,348	40
Birkenhead	,, 23	2,433	+ 174	16	19,044	+ 902	13·7
Birmingham Corp.	,, 15	18,438	+4,940	15	115,179	+12,052	56·8
Blackburn	..	..	..	..	..	..	..
†Blackpool Corp.	,, 20	2,077	+ 220	..	20,420	+ 3,582	..
Blackpool-Fleetw'd	,, 22	2,598	+ 118	3	4,174	+ 405	..
Bolton	,, 23	5,149	+ 193	17	42,579	+ 3,348	26
Bournemouth	,, 19	3,878	—3,268	16	28,266	— 2,107	22
Bradford	,, 15	11,481	+ 675	15	86,398	+ 7,579	56
Brighton	,, 23	2,394	+ 299	16⅔	17,150	+ 1,655	9·5
Bristol	,, 21	14,296	+1,864	..	..	..	..
Brit. Elec. Trac. Co.							
Airdrie	,, 14	481	+ 16	23	6,091	— 4	3·65
Barnsley	,, 14	357	+ 31	,,	5,028	+ 307	..
Barrow	,, 14	743	+ 89	,,	7,638	+ 523	5·37
Devonport	,, 14	1,119	+ 298	,,	13,035	+ 1,585	8·85
Gateshead	,, 14	2,152	+ 146	,,	28,612	+ 1,555	11·25
Gravesend	,, 14	491	+ 40	,,	5,691	+ 147	6·5
Greenock	,, 14	1,637	+ 138	,,	19,417	+ 2,483	7·25
Hartlepool	,, 14	662	+ 91	,,	7,021	+ 588	6·72
Kidderminster	,, 14	292	+ 13	,,	3,001	+ 200	..
‡Leamington	,, 14	446	+ 76	,,	4,460	+ 70	..
Merthyr	,, 14	470	..	,,	5,719	+ 84	2·9
Metropolitan	,, 14	20,203	+4,535	,,	240,160	+37,317	22
Middleton	,, 14	770	+ 49	,,	9,211	+ 611	8·5
Mid. Joint Com'tee	,, 14	8,559	—3,289	,,	158,363	+ 5,151	..
Oldham—Ashton	,, 14	1,195	+ 33	,,	15,663	+ 441	9·13
Peterborough	,, 14	492	+ 164	,,	3,455	+ 370	5·31
Potteries	,, 14	4,061	+ 523	,,	53,750	+ 5,353	29
Rotbesay	,, 14	975	— 60	,,	4,046	— 204	2·75
Southport	,, 14	811	+ 84	,,	8,091	+ 285	8·17
S. Metropolitan	,, 14	2,129	+ 368	,,	23,320	+ 1,038	..
Swansea	,, 14	2,507	+ 192	,,	31,015	+ 2,184	12·5
Tynemouth	,, 14	781	+ 71	,,	6,246	+ 155	3·75
Weston-s-Mare	,, 14	710	+ 44	,,	3,025	+ 153	3
‡Worcester	,, 14	706	+ 66	,,	7,869	+ 406	5·75
Wrexham	,, 14	222	+ 24	,,	2,735	+ 87	..
Yorks. Wool. Dist.	,, 14	2,177	+ 168	,,	28,897	+ 2,059	17
Miscellaneous	,, 14	501	+ 58	,,	6,056	+ 331	..
Burnley	,, 22	2,672	+ 115	..	..	..	11·7
Burton-on-Trent	,, 23	600	+ 49	16	4,781	+ 437	6·6
Bury	,, 23	2,603	— 167	16⅔	21,186	+ 1,576	22·5
Cardiff	,, 15	2,966	+ 483	15	38,632	+ 4,020	..
Chatham and Dist.	,, 20	1,932	+ 232	29	23,844	+ 293	14·98
Cork	,, 20	1,195	+ 61	29	14,187	+ 2,2	9·9
†Croydon	..	..	..	..	..	..	..
Darlington	,, 22	472	+ 56	17	3,729	+ 403	..
Darwen	,, 21	534	+ 26	16	4,422	+ 397	4·36
Dover	,, 15	591	+ 112	15	3,874	+ 686	4·75
Dublin	,, 21	18,533	+6,256	..	26,170	+ 8,132	54·25
Dundee	,, 19	2,447	+ 2	9⅔	11,323	— 83	15
East Ham	,, 22	2,252	+ 152	16⅔	18,077	+ 1,265	7·87
†Exeter	,, 15	404	+ 30	..	5,296	+ 409	5·5
Glasgow	,, 22	35,072	+3,142	..	144,183	+ 9,997	98
Hastings	,, 20	2,462	+ 169	..	..	..	..
Huddersfield	..	..	..	..	..	..	..
Hull	,, 22	5,779	+ 349	16	46,269	+ 2,434	14·5
Ilkeston	,, 19	269	+ 8	16	2,148	+ 104	..
Ipswich	,, 22	1,040	+ 86	16	7,375	+ 734	10·5
†Kilmarnock	,, 15	202	+ 39	9	1,452	+ 93	4·4
Lancashire United	,, 19	2,929	+ 132	29	38,266	+ 1,014	89
Leeds	,, 22	16,022	+1,516	16	124,038	+10,132	108
Leicester	..	..	..	..	..	..	..
Leith	,, 22	1,756	+ 356	9⅔	7,007	+ 581	8·72
Liverpool	,, 15	25,154	+1,827	29	320,614	+12,227	116
‡L.C.C.	,, 12	93,806	+7,410	15	671,067	+48,114	141
London United	,, 22	15,817	+1,912	..	188,220	+ 8,347	..
Lowestoft	..	..	..	..	..	..	3·5
Manchester	,, 22	33,147	+1,616	17	266,035	+15,495	133
Newcastle	,, 22	8,476	+ 380	..	70,210	+ 4,841	14·5
Newport	,, 15	1,519	+ 120	15	11,285	+ 854	14·5
Oldham	,, 23	4,138	+ 331	17	34,340	+ 2,023	23·5
Portsmouth	..	..	..	..	..	..	15·25
†Preston	,, 12	818	+ 55	..	..	..	..
Salford	,, 17	10,360	+ 584	16⅔	76,998	+ 4,440	..
Sheffield	,, 23	12,927	+1,031	17	101,583	+ 7,621	40
Southampton	,, 19	2,750	+ 456	16	19,727	+ 2,477	..
Southend-on-Sea	,, 19	1,654	+ 217	16	10,569	+ 1,606	..
South Shields	,, 22	1,854	+ 155	16	10,421	+ 1,403	..
Swindon	,, 19	318	+ 57	16	2,519	+ 345	..
Tyneside	,, 19	1,088	+ 56	3	1,433	+ 21	..
Wallasey	,, 22	2,431	+ 251	16	18,533	+ 3,079	..
Walthamstow	,, 22	1,690	+ 178	16	13,111	+ 1,341	9
West Ham	,, 13	5,788	+ 699	15	41,897	+ 4,611	15·25
Wolverhampton	,, 19	2,204	+ 141	16	16,163	+ 1,241	25
Cen. London Rly.	,, 22	9,526	—1,789	3	14,624	— 2,717	6·82
City & S. Lon. Rly.	,, 23	6,199	+ 54	3	9,376	+ 98	7·26
Dublin-Lucan Rly.	,, 21	258	— 2	3	509	— 14	7
G.N. and City Rly.	,, 22	2,784	+ 88	3	4,222	+ 128	3·5
L'pool Overh'd Rly.	,, 23	3,217	+ 338	3	4,844	+ 508	6·8
Llandudno-Col. Bay	,, 21	1,110	+ 139	83⅓	7,347	+ 890	..
London Elec. Ry. Co.	,, 22	25,530	+1,140	3	88,620	+ 1,370	21·25
Mersey Railway	,, 22	3,904	— 57	3	5,775	— 69	4·5
Metropolitan Rly.	,, 23	24,506	+ 399	3	52,342	+ 707	24·5
Met. District Rly.	,, 22	22,8?2	+1,575	3	34,910	+ 2,479	24
Anglo-Argentine	,, 22	94,761	+8,022	..	1,423,135	+142 257	..
§Auckland	June 30	17,327	+2,469	52	210,167	+22,754	23·8
Bombay (B,E,T,)	,, 23	5,621	+ 894	25	71,437	+ 8,994	..
Brisbane	May	21,099	+2,609	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..
Calcutta	July 22	7,755	+ 751	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	June	3,649	..	..	20,454	..	20·5
§Lisbon	..	..	..	..	..	..	..
Madras	July 15	1,537	+ 245	..	18,956	+ 1,526	..
§Montevideo	June	21,752	+1,376	24	204,245	+11,495	..
Perth (W.A.)	July 21	3,185	..	..	46,959	+ 2,634	29

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 25th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bonrnemouth & Poole, Ord.	*					
Do. 4½ % Pref.	10	5½	5½	8 — 9	..	6 2 3
Do. Second 6 % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. 4½ % Deb. Stock	Stock	6	6	10¼ — 10⅜	..	5 11 7
Brompton & Kensington, Ord.	5	4½	4½	101 —103	+1	4 7 5
Do. 7 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Central Electric Supply, 4 % Guar. Deb.	100	7	7	7½ — 8	..	4 7 6
Charing Cross, West End & City	5	4	4	98 —101	..	3 19 3
Do. 4½ % Cum. Pref.	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Do. 4 % Deb.	100	4½	4½	3⅞ — 4¼	..	5 5 11
Chelsea, Ord.	5	4	4	94 — 98	..	4 1 8
Do. 4½ % Deb.	Stock	4½	5	4 — 4½	..	5 11 1
City of London, Ord.	10	4½	4½	98 —100	..	4 10 0
Do. 6 % Cum. Pref.	10	7	7	12 — 12½	+ ⅛	5 12 0
Do. 5 % Deb.	Stock	6	6	12 — 13	..	4 10 0
Do. 4½ % Second Deb.	100	5	5	119 —123	..	4 1 4
County of Durham, 5 % First Mort. Deb.	Stock	4½	4½	100 —103	..	4 7 5
County of London, Ord.	10	5	5	89½ — 91½	..	5 9 3
Do. 6 % Pref.	10.	6	6	7⅝ — 8⅜	..	6 3 1
Do. 4½ % Deb.	Stock	4½	4½	11¼ — 11¾	..	5 2 2
Do. 4½ % Second Deb.	Stock	4½	4½	108 —110	..	4 1 10
Edmundson's, Ord.	5	Nil	Nil	100 —103	..	4 7 5
Do. 6 % Cum. Pref.	5	Nil	Nil	3/16 — 13/16	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	2 — 2⅜	..	Nil
Folkestone	5	5½	6	84 — 87 xd	..	5 3 6
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 4⅝	..	6 9 9
Do. 4½ % First Deb.	100	4½	4½	4⅜ — 5¼	..	4 15 3
Hove	5	8½	9	97 —100	..	4 10 0
				6¾ — 7¼	..	6 4 2

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 25th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	*					
Do. 4 % Deb.	5	8	9	7 — 7¾	..	6 2 0
Kent Elec. Power, 4½ % Deb.	Stock	4	4	91 — 93 xd	..	4 6 0
London Electric, Ord.	Stock	4½	4½	78 — 82 xd	..	5 9 9
Do. 6 % Pref.	3	2	2	1⅝ — 2	— ⅛	3 0 0
Do. 4 % First Mort. Deb.	5	6	6	4⅜ — 5	— ⅛	6 0 0
Metropolitan	Stock	4	4	89 — 92	..	4 7 0
Do. 4½ % Cum. Pref.	5	5	5	3¾ — 4¼	+ ⅜	5 17 8
Do. 4½ % First Mort. Deb.	5	4½	4½	4½ — 4¾	..	4 14 9
Do. 3½ % Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Midland Electric Corporation 4½ % First Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Newcastle-on-Tyne	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Pref., Non. Cum.	5	4	4	3½ — 4	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	5	5	5	4 — 4⅓	..	5 11 1
Notting Hill	100	5	5	101 — 104	..	4 16 2
Oxford	10	7½	8	..	..	6 5 6
St. James' and Pall Mall, Ord.	5	7	7¼	6⅛ — 6⅝	..	5 9 5
Do. 7 % Pref.	5	7	7	9 — 9⅓	..	5 5 3
Do. 3½ % Deb.	100	3½	3½	6⅜ — 7¼	..	4 16 7
Smithfield Markets, Ord.	5	Nil	Nil	84½ — 86½	..	4 0 11
South London, Ord.	4	5	5	1⅜ — 1⅝	..	Nil
Do. 5 % First Mort. Deb.	100	5	5	2 1/16 — 3 3/16	..	6 5 0
South Metropolitan, 7 % Pref.	1	7	7	98½ — 101½	..	4 18 6
Do. 4½ % First Deb. Stock	100	4½	4½	1⅜ — 1⅝	..	5 12 0
Urban, Ord.	5	5	5	97 —100	..	4 10 9
Do. 5 % Cum. Pref.	5	5	5	½ — 1	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	2½ — 3	..	..
Westminster, Ord,	5	10	10	87 — 89	..	5 1 2
Do. 4½ % Cum. Pref.	5	4½	4½	7¾ — 8⅛	..	6 1 3
				5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5¾	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	111 —116	+2	6 0 8
Do. 7 % Pref.	$100	7	7	120 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86½ — 88½	..	5 13 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	13/32 — 15/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2⅝ — 3⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 90	+1½	5 11 1
Mexican Lt. & Power, Common	$100	4	4	86 — 88	+4½	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	109 —111	+2½	6 6 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97⅜ — 98½	+1	5 1 6

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	+ ½	5 9 3
Montreal, Lt., H. and Power	$100	6	7	173 —177	..	3 19 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	44 — 46	+1	10 17 4
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	119½ — 121½	+ ½	3 5 10
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	+ ½	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108¾ — 110½	..	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	142 —144	..	5 11 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3⅜	68 — 70	—1	5 7 2
Do. 6 % Pref.	Do.	6	6	112½ —113½	—1½	5 5 9
Do. Def.	Do.	25/-	30/-	25⅝ — 25⅞	— ⅛	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 — 7¼	+ ⅛	5 12 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17½ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅝ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	4½	7⅞ — 8¾	— ⅜	5 7 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13¼ — 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10¾ — 11¼	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 1/16 — 2 3/16	— ⅛	Nil.

Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	105½ —106½	..	5 12 8
Do. Def.	Do.	6	6	119 —122	..	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1 1/16 — 1 1/8	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	+ ½	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅝ — 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98½ —100½	+ ½	4 9 7
United River Plate Telephone	5	8	8	7 7/16 — 7 11/16	+ ¼	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5½ — 5¾	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	¾	2⅝ — 2⅞	+ ⅜	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10½	+ ⅛	5 11 7
Do. 6 % Cum. 2nd Pref.	10	14½	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅝ — 14⅛	..	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ —102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 25th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— ⅝	..	Nil
Do. 5 % Pref.	1	5	5	⅞— 1	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8— 1⅛	..	Nil
Do. 6 % Pref.	10	1½	1½	3⅜— 4⅛	— ⅛	3 12 9
Do. 5 % Deb.	100	5	5	94 — 97	—1	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 11 1
Central London Railway, Ord.	100	3	3	69 — 71	—2	4 4 6
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	55 — 57	..	3 10 2
Do. 4 % Deb.	100	4	4	102 —104 xd	..	3 16 11
City & South London, Ord.	100	1¾	1½	33 — 34	..	4 8 3
Do. 5 % Pref., 1891	100	5	5	110 —112	+1	4 9 3
Do. Do. 1896	100	5	5	105 —108	..	4 12 7
Do. Do. 1901	100	5	5	104 —107	..	4 13 6
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12¼— 13¼	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅝— 1⅛	+ ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼— 2¾	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire Unitcd, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3⅜— 4⅛	..	Nil
Do. 4 % Deb.	100	4	4	74 — 77	..	5 3 11

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 25th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1	1⅛	47⅞— 48¼	— ¾	2 17 0
Do. Surplus Lands	100	2¾	2¾	68 — 70	—1	3 18 7
Do. 3½ % Deb.	100	3½	3½	92 — 4 xd	..	3 14 6
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	27¼— 27¾	—1/4	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	—1	3 18 5
Do. 4½ % First Pref.	100	Nil	3¾	89 — 91	..	3 11 5
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32— 1 1/32	..	5 6 8
Do. Def.	1	Nil	Nil	1/16— 3/32	..	Nil
Do. 5 % Pref.	1	5	5	29/32— 1 1/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99 —101	— ½	4 9 1
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15 8
Potteries, Ord.	1	2	2	1/32— 1/32	— 1/32	..
Do. 5 % Pref.	1	5	5	1/32— 1/32	..	7 13 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	1/32— 1/32	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	1	64 — 66	—1	1 10 4
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorksbire (West Riding), Ord.	5	Nil	Nil	⅛— ⅜	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜— 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16— 5⅜	..	4 16 5
Do. 2nd Pref.	5	5	5	4 13/16— 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½—101½	+ ½	4 8 8
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅜	+ ⅛	5 4 4
Do. 4½ % Deb.	100	4½	4½	96½— 98½	+ ½	4 11 5
Do. 5 % 2nd Deb.	100	5	5	96½— 98½	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	6⅜— 6⅝	..	5 16 5
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	+1	5 10 4
Do. Pref. Ord.	100	6	6	120 —124	..	4 16 9
Do. 5 % Pref.	100	5	5	106 —119 xd	—1	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	6	5¾— 6⅞	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/32— 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅜— 5⅝	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102 xd	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	13/16— 15/16	..	6 8 0
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90½— 93½	..	5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½	..	4 18 6
Mexico Trams Com.	$100	7	7	120 —122 xd	—1	5 14 9
Do. Gen. Con. 5 % Bonds	..	5	5	98 — 99	+1¼	5 1 0
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5⅛— 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	5/16— 7/16	..	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝— 5⅞	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10 0
Rio de Janeiro Trams	$100	1	4½	116½—117½ xd	+1	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	97½— 98¼	+ ½	5 1 9
Sao Paulo Tram, Lt. and P.	$100	10	10	183 —186	..	5 7 6
Do. 5 % 1st Deb.	$500	5	5	103 —105	+ ½	4 15 3
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 —100	..	5 0 0
Un. Elec. Trams Monte Video	5	5	6	5⅝— 6⅞	— ¼	4 18 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	5/32— 3/32	..	8 0 0
Do. 6 % Pref.	1	10	12	1 1/16— 1 3/16	..	7 7 8
Babcock & Wilcox	1	24	26	5 1/16— 5 7/16	— ⅛	4 15 7
Do. Pref.	1	6	6	1⅜— 1⅝	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞— 7⅜	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅜	..	4 12 4
Do. Deb.	100	4½	4½	102 —104	+1	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32— 15/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8— 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/4— 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	8⅜— 9¼	..	8 2 2
Do. Pref.	5	5	5	4⅜— 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	31/32— 1 1/32	+ 1/32	4 17 4
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2

Dick, Kerr	1	6	5	13/16— 15/16	..	5 6 8
Do. Pref.	1	6	6	1 1/32— 1 3/32	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	9/16— 11/16	..	Nil
Do. fully paid	5	Nil	Nil	1⅞— 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	¾— ⅞	..	Nil
Do. Pref.	2	7	7	1 13/16— 2 1/16	..	6 15 9
Greenwood & Batley, Pref.	10	7	7	7¾— 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8½— 9	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½— 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4⅞— 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3 4
India-Rubber, G. & T.	10	10	10	11½— 13¼	..	7 8
Do. Pref.	10	5	5	10½— 10⅞	..	4 15 3
Telegraph Construction	12	17½	20	35 — 37 xd	— ½	6 7 2
Do. Deb.	100	4	4	99 —101	..	3 19 3
Willans & Robinson	1	Nil	Nil	⅛— ⅜	..	Nil
Do. Pref.	5	1½	Nil	½— 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid.

† Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1911.

The June returns of electrical business, although satisfactory, show some falling off when compared with the excellent figures recorded in the previous month.

The June exports totalled some £366,614 in value, the May figures being £379,050. The former figure includes a larger amount of telegraphic material than in May, and the value of the general business (less telegraphic) consequently reached only £309,559, which is somewhat below the average of the previous months of this year.

The imports amounted to £183,260 in value, as compared with £200,749 in May, while the re-exports rose to £28,688 in value which is the highest amount we have so far recorded in this section.

The June machinery exports reveal a considerable decrease as compared with the previous month, but cable exports remain at a high level, and increases are shown in telegraph, telephone and lamp exports.

Machinery and cable imports were slightly better in June, but lamp and telegraphic and telephonic imports show a falling off.

Our most prominent customer during the month was Japan, with India, and the South American and Australian States following.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,200	1,898	57	81	100	3,174	290	92	...	113	11,182	18,187
Germany	940	1,586	13	460	421	2,334	80	75	...	13	6	5,928
Netherlands, Java and Dutch Indies	537	1,368	269	27	74	898	...	17	...	19	11,332	14,541
Belgium	1,004	465	38	361	53	6,122	94	...	...	3,282	908	12,327
France	1,468	225	792	957	...	4,553	78	21	...	69	189	8,352
Portugal	...	59	37	181	26	53	...	...	...	...	212	568
Spain, Canary Isles, Spanish N. Af. & Morocco	418	...	227	94	682	2,976	270	24	...	...	72	4,763
Switzerland, Italy and Austria-Hungary ...	2,038	98	90	279	32	4,181	15	25	...	98	2,278	9,134
Greece, Bulgaria and Turkey	48	...	53	66	29	675	60	481	23	6	223	1,664
Channel Isles, Gibraltar, Malta and Cyprus ...	138	196	59	10	38	438	...	9	15	30	227	1,160
U.S.A., Philippines and Cuba	18	...	106	280	302	222	...	...	135	27	...	1,090
Canada and Newfoundland	678	3,066	295	1,204	1,005	6,554	645	173	...	183	310	14,113
British West Indies, British Guiana and Falkland Islands	86	56	14	223	45	1,559	9	35	...	118	52	2,197
Mexico and Central America	126	4,507	27	...	...	64	...	...	...	448	311	5,483
Peru and Uruguay	13	372	114	79	...	444	385	246	79	34	45	1,811
Chile	119	73	500	...	...	1,276	7	22	44	374	6	2,421
Brazil	1,093	3,615	558	210	61	8,148	488	101	54	654	5,965	20,947
Argentina	2,739	3,054	559	895	235	16,433	52	3,320	159	1,525	5,318	34,289
Colombia, Venezuela and Ecuador	78	...	4	...	...	1,027	...	3	...	...	60	1,172
Egypt, Tunis and Persia	298	113	48	43	3	373	289	658	...	77	361	2,263
British West Africa and Liberia	151	306	8	179	28	370	...	42	55	138	206	1,483
Rhodesia, O.R.C. and Transvaal	1,612	2,086	395	1,533	25	4,842	423	221	67	183	652	12,039
Cape of Good Hope	1,118	2,644	183	476	130	1,201	...	246	...	156	62	6,216
Natal	1,176	6,566	142	645	94	1,301	...	881	...	28	176	11,009
Zanzibar, Brit. East Africa, Mauritius & Aden	32	78	37	75	...	102	...	6	18	30	11,743	12,121
Madeira, Portuguese Africa and India ...	115	297	58	930	192	351	26	162	...	...	260	2,391
French African Colonies and Madagascar ...	49	...	...	44	25	124	...	...	...	...	...	242
China and Siam	622	1,620	342	782	60	1,975	1,317	153	15	443	...	7,329
Japan and Korea	1,486	4,735	317	70	1,659	13,582	4,835	...	143	14,902	896	42,625
India	2,927	6,735	1,043	1,548	185	3,583	3,220	1,347	129	450	2,360	23,527
Ceylon	196	429	146	60	377	82	578	19	42	219	...	2,148
Straits Settlements and Fed. Malay States ...	393	439	261	24	87	1,025	878	...	...	83	572	3,762
Hong Kong	195	470	172	486	261	699	57	60	...	18	129	2,547
West Australia	166	1,117	20	264	47	1,677	...	24	...	...	75	3,390
South Australia	344	134	188	89	365	5,216	10	11	...	982	19	7,358
Victoria	951	8,173	122	919	242	4,357	79	383	...	4,471	...	19,697
New South Wales	3,454	4,544	591	1,962	837	4,324	8	163	24	4,571	57	20,535
Queensland	206	713	7	392	70	4,755	221	9	...	1,412	162	7,947
Tasmania	66	76	...	26	...	...	...	200	...	1,848	...	2,216
New Zealand and Fiji Islands	1,187	3,113	474	566	356	7,549	275	193	62	1,218	629	15,622
Total, £	29,485	65,026	8,366	16,520	8,146	118,619	14,689	9,422	1,064	38,222	57,055	366,614

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	12	...	...	82	...	3,694	80	597	...	6,621	11,086
Germany	1,634	5,091	2,290	18,793	2,409	54,592	565	905	3,110	23,916	113,305
Holland	...	...	...	1,209	...	5	47	...	73	48	1,382
Belgium	340	1,172	11	175	78	1,494	...	169	227	5,778	9,444
France	1,162	1,050	1,272	2,266	833	1,349	...	666	3,094	1,705	13,427
Switzerland	183	922	77	46	48	796	...	...	7	...	2,079
Italy	...	319	...	11	...	...	3	...	...	3,703	4,036
Austria-Hungary	...	910	...	706	230	153	588	36	149	550	3,322
United States	3,682	452	188	1,663	1,050	11,279	4,847	187	1,011	95	24,454
Total, £	7,013	9,946	3,838	24,951	4,648	73,362	6,130	2,560	7,671	42,416	182,535

Additional imports: Spain, carbons, £235; Canada, goods, £427; Newfoundland, telegraph material, £63.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	15,733	629	...	1,829	...	9,052	...	268	882	295	

Total Exports: £366,614. Total Re-Exports: £28,688. Total Imports: £183,260.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

(*Concluded from page* 86.)

In Section II, on the second day, notes on "The Position and Uses of Engineering Laboratories" were read by Prof. W. D. Dalby, Prof. J. Goodman and Prof. Bertram Hopkinson.

Prof. Dalby said that the outstanding feature of our modern system of scientific education was the laboratory; it was now recognised as an essential instrument in all branches of scientific education. In a lecture-room a student heard things, but in a laboratory he did things; a normal student remembered what he did and forgot the greater part of what he heard.

From the point of view of teaching, the individual items of the apparatus provided should be numerous, typical and small, so that there might be plenty of experiments for small groups of students to carry out for themselves.

In an engineering laboratory the students must do the job, and not look on while the job was being done by the professor on a large and expensive piece of apparatus too costly to be entrusted to them.

From the point of view of research, the chief provision to be made was space, time, and a workshop in which apparatus could be made, to supplement the apparatus often of an expensive kind provided for research.

The fundamental principles upon which engineering practice was based were few in number, but their applications were almost infinite. A principle could only be thoroughly grasped through a study of its applications. Hence to engineering students a principle should be taught by means of applications selected from those which had a bearing upon engineering.

All students of engineering should gain some familiarity with the physical properties of steam and gases and with the materials of construction. The fundamental principles of thermodynamics should be taught through their applications to estimate the efficiency of heat motors of all kinds. A student learnt a good deal by testing heat engines.

Above all, in passing through the course, the student should catch something of the spirit of research which should brood over every engineering laboratory, from the smallest to the greatest.

Prof. John Goodman said it was well at the outset to recognise that the equipment and scope of an engineering laboratory differed essentially from that of a college workshop. The work carried on in the latter was mainly for the purpose of teaching the art or trade of engineering, but the work done in the former had the sole object of teaching the principles which underlay that art or trade. If properly-schemed laboratory work could be arranged to run concurrently with the lectures the student was brought more closely into touch with the concrete side of his subject, and thereby not infrequently discovered his own shortcomings. He should, in the early stages, be left severely alone to worry out his problems, but if actually beaten, then, and not until then, should the director of the laboratory come to his assistance.

The engineering laboratory afforded the student an excellent training in the carrying out of experiments for the purpose of obtaining accurate data, and he could not fail to be early impressed with the paramount importance of keeping all the conditions of the test constant except the two variables under consideration. He, moreover, discovered that absolute accuracy in data was rarely, if ever, attainable, and therefore the use of many significant figures was not only absurd but tended to deception.

It was a mistake in the first instance to insist on students worrying about minute accuracy.

In purchasing apparatus for the equipment of an engineering laboratory, the aim should be to make all apparatus as simple as possible, and each piece should be designed to bring out clearly one particular point, all unnecessary complication being dispensed with. Distinction must always be drawn between apparatus which might be used by the staff for their own education and for research work and that required exclusively for students.

It would be better in every respect to purchase two or three commercial engines of different types for testing purposes rather than to crowd complication on to one experimental engine.

In some cases enterprising firms lent engines and plant to colleges for testing purposes on condition that the results of all tests should be supplied to the makers in return for the loan, and when the firm in question brought out an improvement the obsolete plant was exchanged for the new. The arrangement from the college point of view was, of course, ideal, and the firms in question were not entirely losers by the bargain.

It was an utterly bad system to have the apparatus required for each experiment set out permanently in working order, and to give printed detailed instructions and log sheets to each student, which he mechanically followed. The following of such a system entirely crushed all originality, and made the student into a mere machine. After he had once got over the initial stages he ought to rig up his own apparatus, check it for accuracy, make out his own log sheets, and reduce his results.

It was of vital importance that the director should be a man familiar with practical work, or he might unwittingly encourage students to play with unreal problems, which tended to divert their attention from the actual difficulties that arose in the life of an engineer.

Prof. Bertram Hopkinson said that engineering science must be based on the intelligent observation of things as they occurred in practice. Experiments in an engineering laboratory might be of great assistance, but in interpreting their results, it must never be forgotten that the artificial control of conditions, which was of the essence of experiment, was of itself a disturbing factor. The position of the engineering laboratory as an instrument of education was not quite the same thing as its position in relation to research, but was closely related to it. The student was introduced to phenomena under conditions which in their complexity resembled those of real life, and which could only partially be controlled. Thus he learnt in a simple way to use his judgment in interpreting data, and to recognise how in a complex mechanism it was impossible to vary a single element without at the same time affecting a number of others. This training of the faculties of criticism and observation was valuable to anyone, whatever profession he was going to follow.

Work in the engineering laboratory proper should be preceded by a short course of ordinary physical experiment under the simplest possible conditions. Having thus acquired a knowledge of the fundamental scientific principles, the student's work in the engineering laboratory would be directed largely to tracing their operation under more complex circumstances. For this purpose small units of plant of a simple character were quite adequate. In fact, the smaller and simpler machines were better for this purpose, because they were more easily handled, and he could be left more to himself. But, though small, the machines in the engineering laboratory should be real commercial machines, such as were bought and sold in the ordinary course of business, and the students should use them under ordinary working conditions. Extreme variation of conditions was necessary for the purpose of research; but the ordinary student was not doing research, nor was it his object to learn in detail about the working of a special machine. His use for the engineering laboratory was to learn generally how to extract from an experiment conducted under severe limitations all the information that it was capable of affording.

The discussion was opened by Mr. R. S. Ball, who agreed with Prof. Hopkinson that a multiplicity of small, rough apparatus was much to be preferred to one installation of larger and more perfect apparatus. At Boston they had a large number of students, and a very good equipment; and he was convinced that the best laboratory was that in which the apparatus was not so very fine or expensive.

Mr. Dugald Clerk agreed that a great deal might be done with very simple apparatus. With such there was the advantage that the student had a feeling of personal control. Manufacturers highly appreciated the instruction now being given in the laboratories of this kingdom, and he thought they would all agree with Mr. Ball that the laboratory was as essential to the engineer as the ocean was to the navigator. It was essential that the student should be habituated to the personal conduct of experiments.

Prof. W. C. Unwin said it was quite desirable in a laboratory to have numerous small sets of apparatus; but larger and more complete installations were also very valuable. Small apparatus sent men into the world with somewhat contracted ideas of the magnitude of engineering problems. His experience was that it was of the greatest value to students to take tests on a large scale, such as the contract tests of large engines; for such a 24 hours' trial would give an impulse to students which no amount of laboratory work with small apparatus would ever impart.

The section of practical training, Section III, commenced proceedings with Prof. Archibald Barr's note or paper on how best to employ the time at college. Prof. Barr put forward the alternatives before the colleges as (*a*) the offering to the student of a general course of study which might form a basis for practice in any department of the profession, and (*b*) the provision of a number of courses, from which the student could select the one best adapted to assist him in his particular line. He did not think specialisation should be attempted, owing to uncertainty of the student as to what his ultimate occupation might be. The question as to the order in which the two sections of the engineer's training should be pursued also admitted of no general answer; there were advantages to be urged both for taking the college course first, and the works course first. On the whole he was inclined to think the shorter period, alternating six months' practical, and six months' college training, the most promising arrangement. He disagreed with the 12 months at termination of college course suggestion.

Prof. Henry Louis's note dealt with other qualities called forth by a college training, apart from the actual information gained, such as tact, patience, honesty of purpose, and a sense of fair play. Manual skill was in danger of being rated too highly, and was, he thought, a survival of the old apprenticeship system. A college was the place to learn principles, and not practice. He did not find that the sandwich system, in its true form, was satisfactory on the whole, and it frequently resulted in both classes of work being badly done. He was in favour of the method adopted by coal-mining students. They had often had a little experience of practical engineering before they came to college and took a three years' college course, spending their long vacations at a colliery, a portion of the time underground and the remainder in the drawing and other offices. After taking a college degree the law insisted that they should have three years' practical experience underground before they were allowed to take the examination for a certificate as a colliery manager.

Mr. H. Rolfe said that so far as manual training was concerned, the cases of the civil and the mechanical engineer were not analogous. For instance, in mechanical engineering a good fit was essential, and the students should be capable of appreciating fine

measurements. As regarded practical training at a college, the drawback was that college students were apt to think that their sole duty was to design a machine mathematically and theoretically perfect, instead of one which utilised standard patterns, and effected the object in view at the minimum possible cost. Costs and estimates also required attention. The importance of quick delivery and low prices was apt to be overlooked in the desire to give attention to scientific points. He was in agreement with the course of training proposed by Sir H. F. Donaldson, which formed an excellent introduction to the drawing office.

Mr. W. B. Worthington, speaking particularly of structural engineering, agreed entirely with Prof. Barr as to the impossibility of a hard and fast rule for every case. There was no need to standardise engineering education on this point. It was clearly best for civil engineers to have their college training before apprenticeship. On taking a boy into his office, he first stipulated for a University qualification. When he had ascertained to what extent ability to draw existed, he put the learner on to structural steelwork to give him experience in design. Otherwise, work spent in attempting to design structures would be waste of time. He assumed that one year would be spent in the workshop, either before or after office. For the mechanical engineer the alternative system was more practical than for those engaging strictly in civil work. Alternations of 12 months' duration were not suited to the working of a civil engineer's office.

Prof. Thomas Turner supported Prof. Barr's proposition, but from another point of view. The subject had been under discussion 25 or 30 years without getting any nearer a definite solution. What was required was that students, on entering college, should have some practical knowledge, and also that the value of a practical training should be enhanced by preceding it by a theoretical. They were, therefore, confronted with the problem how to combine the two courses of instruction. The ideal method could be followed by a man who had works of his own, and ample means, and who was putting his sons into the business. They worked nine months at college and three months in the works. After matriculating, they had three months further in the works, then went again to college, and again to the works.

Sir Alexander Binnie said there was not the slightest doubt that an enormous improvement had taken place both in engineering and education. The results, however, so far as the latter was concerned, were not altogether satisfactory. Speaking as one of the selecting committee at the India Office, he had found that a college training was quite inadequate ; it turned out mechanical, but not civil engineers. The workshop was not civil engineering. Many of the men were excellent mechanics, but were not acquainted with the essentials of civil engineering, and needed broader views. His own predilection was in favour of natural philosophy, which made a good foundation. What Prof. Huxley used to call physiography was as important to a civil engineer as geography. There was also a lamentable absence of knowledge of surveying, and of outdoor instruction. A man should go to college and absorb all there was to be learnt there and then get his practical experience. With regard to the skilled use of tools, a man could tell whether a thing was well or ill done without being a riveter. He did wish that a college would fit a young man not for the workshop, but for the world. Let the students know what had been done, and study the actual work of the masters of the profession.

Sir Francis Raeburn said that the type of man whom they had to consider was the man of average attainments. The exceptionally clever man always got on, and the exceptionally bad dropped out. Education should be in the direction of rendering the mind cultivated and receptive. In the higher branches of engineering a broad knowledge of affairs was necessary. Coming to the question of training an ordinary constructional engineer, he did not think that everyone had time to do much training in the shops. He favoured learning as much practical work as was possible in the college. A marked improvement was noticeable in the intelligence and education of the middle classes of the profession, so much so that a man with a receptive mind might well pick up from his foreman what instruction he needed in the shops. He attached great importance to work done on the administrative side. He summarised his views as to the education of engineers as follows :— (1) A good general education, in no sense specialised ; (2) the University training should be good, thorough and scientific, combined with as much practical work as possible ; (3) they should get into works pertaining to their own especial branch as soon as possible, making the works course as general as possible.

Mr. I. A. Brodie, Mr. J. M Moncrieff and Prof. J. J. Welch asked that their papers be taken as read. Mr. Brodie's treated of the importance of a course in the drawing office as part of the works training. An insight into the commercial aspect of engineering was also of great valne. Mr. Moncrieff treated of the numerous educational advantages which could be acquired in the shops by an observant and painstaking student. Prof. J. J. Welch advocated a preliminary workshop course on leaving school, before commencing college training.

The Chairman (Mr. R. Elliott-Cooper) asked for the testimony of employers as to the value of the young student in the works, and how far they had been influenced by their training as civil rather than as mechanical engineers.

Mr. J. Mitchell Moncrieff, as a civil engineer in private practice, said he had met with no jealousy of college education. He dissented from only one view taken by Prof. Barr, viz., that there were no professors who did not consider their students fit for employment as assistants. Some college authorities certainly did give this impression. No civil engineer could be a wage-earner until he had been on real work. It was no good for the civil engineer to take young men direct from college. On the other hand, it was hard on a graduate of 22 to start his pupilage then. The university could only pretend to give practical teaching. It had not the necessary commercial feeling behind it to attend to this important side of the question.

Mr. Gerald Stoney had read the papers with great interest, and welcomed the note as to close contact with the workman. He also was glad to hear Sir Wm. White's remarks as to the one year's "weeding" course. At Messrs. Parsons's works any apprentice could go to college and put in a sandwich course. This could only be done for a few of their 250 apprentices, where about 3 or 4 per cent. took this course. If a larger number wished to do it, it would become impossible.

Mr. C. W. Darley spoke from the point of view of a civil engineer. In his opinion, the sooner a man got out into practical work the better. In Australia, the tendency was to put engineers in charge of constructional work, instead of letting it out to a contractor. To be fit for this kind of work, a young engineer should have as much time on the works as possible. Experience in a contractor's office for three or four years after the college course was desirable. A large number of the best recent papers read before the Institution had been contributed by non-college men, who had derived their knowledge from actual practical work.

Mr. R. J. G. Read said that not sufficient distinction had been made between training for civil and mechanical work. It was a pity for boys to have to go to work immediately on leaving school, they should preferably have from three to six months in the office. He thought that, for civil engineers, it was undoubtedly of great advantage to have a college training, and then go into an engineer's office. The time of apprenticeship might be shorter than formerly, owing to the excellent college training which was now available. He had had several pupils, and found that the college-trained man picked up his work and became a useful assistant sooner than the others.

Mr. Walter Hunter read an extract from a letter from the municipal engineer at Shanghai, in which the English system of training engineers was referred to as superior to the German and American.

Mr. Elliott-Cooper, in closing the discussion, referred to Mr. Burge on training engineers for foreign service. Life was not long enough for a man to study every possible branch of engineering which might subsequently bear on his work. A good broad general engineering knowledge fitted a man for service in any part of the world. Adaptation to the needs of the country in which his career placed him was a matter of a few weeks. Special training could be acquired on the spot. Mr. Benedict had referred to times past in the matter of pupilage. Young engineers now often went to contractors, not to engineers. Money values were often best learnt there. It was a mistake to go straight from college to the contractor's office ; they would then miss a good deal of experience in design. As regarded the sandwich system, he thought the college career should precede the practical. He did not go so far as to say that some practical training might not be sandwiched in.

A final meeting of all the sections was subsequently held under the presidency of Mr. Alexander Siemens.

Mr. A. F. Yarrow, being called upon, said that he did not propose to put forward his points as resolutions, but as embodying proposals on which the Council of the Institution might focus its attention. These were : (1) That the Council be desired to use its influence to secure continuity between school and college courses (2) That with a view to facilitate the above, a closer interchange between scientific scholastic bodies and the Institution is desirable. (3) That an attempt on the part of the Council to systematise the sandwich system is desirable.

Mr. Siemens said that, while no vote was to be taken on these proposals, they would receive the careful consideration of the Council. He would like to give them his personal impressions of what was to be gathered from the Conference. (1) As regarded general education, school-masters asserted that they did not know what would be the ultimate occupation of the boys whom they were preparing. It would appear that they had forgotten the Conference of six years ago, when the schoolmasters had failed to agree as to what the desired syllabus should be. He hoped that some agreement might be arrived at now. The Surveyors' Institution, for one, had drawn up such a syllabus, for an examination which qualified a man to practise as a surveyor throughout the Empire. (2) As regarded the scientific education, that had been well expressed by Prof. Petavel. The student must above all be trained to learn. (3) With regard to practical training, he was afraid the views of the Conference were contrary to what Mr. Elliott-Cooper had just said. He himself favoured 12 months in the works after a standard examination, then college, and then works again after the degree had been obtained.

Efficiency of Ultraviolet Quartz Lamps.—In the *Revue Industrielle*, Mr. Préval quotes experiments made by Messrs. J. Courmont and Ch. Nogier on the progressive diminution of output of ultraviolet rays by quartz mercury-vapour lamps working at high temperature. The results show that the luminous and ultraviolet efficiency of the lamps is far from constant, the diminution beginning directly they are put in service and going on steadily ; the physical, chemical and germicidal properties of the light necessarily fall off correspondingly. The change is internal to the quartz container, and indelible. It is necessary, therefore, in order to prevent this deterioration, to adopt means for cooling the quartz containers while the lamps are in use.

PROCEEDINGS OF INSTITUTIONS.

Tramways and Light Railways Association.

Edinburgh Congress, July 13th and 14th, 1911.

A paper on "Transfer Fares" was read by Mr. C. W. Shepherd, general manager of the Edinburgh and District Tramways. The author declared himself in favour of penny transfer tickets, as used in Edinburgh, on account of the impossibility of running through cars from anywhere to everywhere, and the necessity of meeting the needs of as large a number of passengers as possible. Where halfpenny fares were in operation, he did not consider transfer tickets necessary or desirable. He objected to the exchange ticket system as opening the way to abuse, and preferred a single ticket for the divided journey. The distance covered should be less than that allowed for the same fare on one car.

In the course of the discussion which followed, Mr. Wm. Clough (Bury) said the transfer fares could only be regarded as necessary evils.—Mr. Fitzpatrick (Leith) said that for every additional 100 passengers they carried in Leith the increase in revenue amounted to just over £1, but transfer fares were the lesser of two evils.—Mr. Dalrymple (Glasgow) also spoke.

Mr. G. H. J. Hooghwinkel read a paper entitled "A Few Reasons why Electric Traction in England Remains Stationary." In his view, certain features would have to be radically altered if tramway enterprise was to be continued in England on a sound commercial basis. Our tramways cost too much to construct and to run. Light single-deck cars were used practically all over the world, and allowed of cheaper track construction, quicker and more frequent service, less noise, the use of the sliding bow, and therefore cheaper overhead construction, and better supervision by the conductor. The greater space occupied would be of importance only in exceptional cases; the traffic in this country was not more dense than in large towns abroad where single-deck cars were used successfully. Passengers should be allowed to ride on the platforms of single-deck cars. The lighter cars would depreciate the track less rapidly, and the heavier wages bill anticipated was less serious than was imagined. Trailers could be used to great advantage, especially on suburban lines. The English track construction was excessively costly and also unsuitable, for it was a mistake to run heavy rigid tracks on a "would-be" rigid road-bed. A return to an improved flexible track was urgently necessary. Anchors and sole-plates only accentuated the evils of present practice. A concrete bed should only be used where asphalt paving was employed. The rails should rest on wooden sleepers. Other changes advocated by the author were the use of the sliding bow, the greater use of wall rosettes, the use of a flexible truck (Warner type or other), the introduction of "pay-as-you-enter" cars, and the use of trailers.

On the second day, a paper by Mr. C. W. Mallins, general manager of the Liverpool Corporation tramways, was read, entitled "Notes on Tramway Problems." The author referred to the "amazing variation" in the cost of construction of permanent way on different systems—from £3,255 to £9,877 per mile of single track (average £6,719) in the case of 12 typical undertakings, the overhead equipment similarly varying from £640 to £2,788 per mile (average £1,790). The cost of maintenance per mile per annum ranged from £21 to £300 (average £99). The author pointed out the injustice of charging the tramways with the cost of widening the roads, in addition to requiring them to pay rates and taxes and to maintain the road surface. He preferred the single-truck car to the bogie truck, as the former would carry 70 passengers, which was as great a number as a single conductor could attend to. The cost of energy sold to tramways varied more than was justified by the difference in local conditions—from 1·3d. to 2·149d. (average 1·651d.) in the case of 12 undertakings which purchased energy, while it was only from 0·405d. to 0·96d. (average 0·684d.) to 12 undertakings which generated energy for themselves. The continual demand for cheaper fares was becoming one of the most serious problems in connection with tramway management. Certain undertakings which had given preferential treatment on a large scale to various sections of the public had incurred a tremendous loss on that portion of their business. Penny stages varied from 2 miles 40 yards to 2 miles 1,320 yards in the case of eight large undertakings, and from 1 mile 1,115 yards to 1 mile 1,710 yards in eight smaller ones. It was the opinion of experts that even on the largest systems a passenger could not be profitably carried 2 miles for a penny, and on smaller systems the distance would be proportionately less. The annual loss to 29 undertakings through preferential treatment in various forms was £165,000. Much might be done to develop the transport of goods by tramway, affording a saving to the owners and bringing in a revenue of several millions sterling per annum.

In the discussion which followed, Mr. C. W. Shepherd (Edinburgh) referred to the question of carrying parcels, and said that while he was not an advocate of the carrying of heavy goods on tramways, he had been struck with the amount of profit secured at Dublin in this way. The Edinburgh company had adopted the system, and their experiences had been the experience of Dublin—they were getting 50 per cent. of their seats and parcels as profit. He did not think there was anything so easily managed as a small light parcel express service on a tramway.

A paper by Alderman W. Ivey, of West Ham, dealt with "Tramways and Light Railway Legislation of the Future." Their chief cause of complaint, he said, was that in actual practice the Acts of 1870 and 1896 did not provide facilities for what, in the first instance, was essential, viz., promotion of the powers necessary to bring them to that stage when the Parliamentary provisions for construction, in the first place, and regulation and working in the second, became of any value. If one-half of the money spent in applications had been used for the purpose of laying down installations there would have been a far different aspect to-day. The laws should be made to encourage national industries and not to restrict them. Tramway Bills were usually condemned to death by their accusers, for what other interpretation could be placed upon the local authorities' veto? The most elementary principle of justice demanded the abolition of the veto. Many other desirable reforms were dealt with in the paper.

High-Tension Mining Switchgear.

By F. B. Clark, B.Sc.

(*Abstract of paper read before the* South Staffordshire and Warwickshire Institute of Mining Engineers, *July 4th*, 1911.)

High-pressure current tends towards the use of less cumbersome apparatus and cables, and generally in the direction of superior construction; for, whereas medium-pressure apparatus can generally be got to work, however faulty its condition, high-pressure apparatus must be kept in good order, or it cannot be got to work at all. For installations where the power has to be conveyed some considerable distance before it is used, high-pressure alternating current is undoubtly the best. At pressures in the neighbourhood of 3,000 volts, it is advisable to transform down to 500 for motors under 50 h.p., and at higher pressures it is better to reduce the voltage for motors under 100 h.p. This is because there is considerable difficulty in winding a small motor for a high voltage, as it necessitates a great many small wires per slot.

Switches should be capable of breaking with safety and certainty the maximum power which may instantaneously pass through them under any conditions. For use underground, all circuit-breakers should be oil-immersed, even for low pressures; but, at the surface, it is not necessary to use switches of this type for circuits of 500 volts and lower, unless the circuit-breaker controls a large amount of current.

For use both above and below ground, fuses should be avoided, and overload trip-coils employed in their place. Only small lighting circuits and instruments are best protected by fuses. The overload coils are either supplied with current at the same voltage as the circuit, or else small transformers are employed and the coils supplied with low-tension current. The latter method is certainly the more sound, and should undoubtedly be employed in the generating station; but, in order to reduce the number of parts to a minimum, many makers are fitting high-tension tripping mechanisms to switches other than those used in the main station.

No-Voltage Coils should be fitted to switches operating motors that are not under the constant supervision of an attendant, but are left to run by themselves.

For motors under 200 h.p., where a large starting torque is not necessary and speed variation not required, the squirrel-cage type may be advantageously employed. Where the squirrel-cage type cannot be employed, and the motor is to be used for continuous running, it generally has its rotor connected to a liquid starter; these starters may be used for motors driving pumps, endless haulage, fans, &c., but for those that are continually being started, stopped and reversed, as in main-and-tail haulage, liquid starters are not to be commended; the rotor-circuits in such cases should be connected through a controller to metallic resistances, generally of the cast-iron type. In wet and very dusty places, oil-immersed resistances are recommended.

For underground use the horizontal type of controller, with the drum fixed to the cover, is preferable to the vertical type, as the latter, when oil-immersed, does not lend itself so readily to inspection as the former. Controllers should be of the type that cuts off the current completely from the stator when the operating handle is in the "off" position.

Experience has shown that the contact-fingers on air-break controllers do not wear so badly as those on oil-break controllers, owing to the fact that the oil, although it diminishes the arcing, yet concentrates it on one point of the fingers; moreover, since controllers are not of the quick-break type, as are oil-switches, there is more time for arcing. Consequently, although it is better to employ oil-immersed controllers underground to prevent open sparking, it is perhaps advisable to use air-break controllers on the surface; and in this case the vertical type will be found to be more suitable, on account of the ease with which it can be inspected and the small floor space which it occupies.

It is generally advisable where the installation is large, the system extensive, and power is being transmitted from a central generating station to the various collieries, to use some form of automatic leakage protective device, in addition to the overload trip-coils, more especially if aerial transmission is used. The Merz-Price system has been extensively used, and has given excellent results.

In the underground use of electricity simplicity is essential, and the only reason, therefore, for considering whether leakage protective devices should be adopted underground is to prevent external arcing. When cables are conveyed along roads that are dry and dusty, or likely to contain gas, the use of lead-sheathed and armoured cabling, or other double-sheathed cabling, constructed in accordance with the advice given in the Report of the Electricity in Mines Committee (Rule 12, Sub.-Sec. *c*) will do much to prevent external arcing. The safest method is to place them in steel troughing filled with sand, and bury them on the side of the road. By so doing an armoured cable is absolutely safe, for even if arcing does appear outside the armouring, it is still covered by the sand, troughing and earth. If it is not desired to bury the cables, leakage protective devices (preferably of the type which does not need pilot

wires) may be employed to advantage. In such a case it is wise to avoid taking the cables along main haulage roads, and also to avoid high-pressure transmission, as leakage protective devices act better on medium and low-pressure circuits.

Where cables are taken along roads that are naturally wet and free from gas, it is not necessary to bury them or to use leakage protective devices.

One of the leakage protective devices which do not need pilot wires and are suitable for underground use, is that generally called "Wedmore's." Its action is based on the fact that the amount of current entering and leaving the three phases at the supply end must at every instant of time be equal, unless there is leakage ; and so it gives an absolute indication of leakage without regard to the balance of power in the three phases.

Underground switchgear for motors and sub-stations should be compact and simple, with a minimum of instruments, absolute protection being more desirable than immediate accessibility. It should be interlocked, so that no part can be got at unless "dead." It should be waterproof, dust-proof and so constructed that open sparking cannot occur, and the details should be accessible when protecting covers are removed. Furthermore, it should have all its parts interchangeable, and should require the minimum amount of attention. To meet these conditions, marble and slate switchboards are being superseded by switchgear completely enclosed in strong metal cases, even for surface use. In order to make the gear more compact, makers have, on the whole, erred on the side of too little clearance. In the generating station more space can be given to each item ; it is always an advantage to avoid cramping, accessibility in conjunction with safety being the object in view.

Owing to the unevenness of the load in most colliery work, it is often necessary to employ some form of automatic voltage-regulator. The form that has given the best results is the Tirrell regulator.

Lately ironclad switchgear, very similar to that used underground, has been employed largely for surface sub-stations of small and medium power, while the cellular type has found favour for large power sub-stations.

The writer prefers lead-sheathed, paper-insulated, armoured cables for underground use, although where the pit-water attacks the lead it is better to use cables insulated by vulcanised bitumen, copper-sheathed and armoured.

The question whether it is better to earth the neutral point of a generator or a transformer has often been fully discussed. The conclusion generally arrived at is that for absolute safety it is better to earth the neutral point ; but this has one disadvantage, for if a fault develops on one of the three phases of a cable, the faulty cable is immediately cut out, and the motor supplied by that cable cannot be used again until the faulty cable is repaired, unless a duplicate feeder is installed, which is an expensive item. But with an insulated neutral point the motor can be supplied despite the fault, which can be repaired at the end of the shift. Consequently, if duplicate feeders are used, it is advisable to earth the neutral point ; but where apparatus is supplied by a single feeder, it will be found better to insulate it from earth. If the neutral is earthed, however, in order to limit the leakage-current to earth in case of a fault, it is desirable to earth through a resistance, which must be able to pass at least enough current to enable the circuit-breaker which has the highest setting to operate, otherwise if a fault developed in that feeder the neutral-point resistance might keep the current down to such a point that the breaker would not cut out the fault. It is advisable to paint each phase a separate and distinct colour, and to keep that colour for that particular phase throughout the entire system. By treating bus-bars and connections in this way, much time and trouble can be saved in rectifying a fault, breakdown, or leakage in any phase. Where high-pressure alternating current is installed, the use of inferior material is foolish in the extreme. The best advice, therefore, should be obtained on the design of an installation and on the purchase of apparatus, and only those firms that have had experience in making such electrical apparatus as is required should be dealt with. It will be found advisable not only to purchase the best apparatus, but to install it with great care and accuracy, and then by intelligent and regular inspection to keep it in good working order.

Discussion.

Mr. A. Hall (Nuneaton) wrote that his views, generally speaking, coincided with those put forward by Mr. Clark. In his introduction Mr. Clark, speaking of coal cutters, said :—"There is nearly always some commutation trouble in underground direct-current work." He did not think this obtained to nearly the same extent now as formerly. Having had to do with the working of direct-current coal cutters for over a dozen years, he could testify to the fact that nowadays there was very little commutator trouble experienced, as the vibration had, he thought, been brought down to about the minimum. He agreed that direct-current coal cutters did possess an advantage over those driven by alternating current—even if the starting torque alone was considered. He was also in entire agreement with the earthing of the neutral point ; to his mind the advantages of so doing greatly outweighed the disadvantages. He agreed mostly with Mr. Clark's views on the cable question, but, unfortunately, some of the suggestions were somewhat difficult to carry out satisfactorily. For instance, in a great many collieries it would be almost absolutely impracticable to keep intact the buried steel troughing filled with sand, and containing the cable—however effective it otherwise might be. Again, it would be decidedly risky to put cables in a steep haulage incline, which might be of restricted sectional area. In such a case the danger of damage by reason of runaway or derailed tubs would be very great. On the other hand, there were many collieries where circumstances would make it very inconvenient to carry the cables entirely in the returns, so that any hard and fast rule on the subject could not be made generally applicable. Personally, he had always considered the cable danger to be the greatest in underground electrical work, the switchgear, to his mind, being secondary. He was of opinion that the last paragraph of Mr. Clark's paper was the most trenchant and powerful one of the whole. The installation only needed to be adequately carried out to ensure the satisfactory and successful working of electricity underground, with a high factor of safety.

Owing to lack of time, further discussion was deferred.

The Faraday Society.

Allotropic Forms of Metals.

The Faraday Society closed its session on June 13th with a lecture by Prof. Ernst Cohen, of the University of Utrecht, on "Allotropic Forms of Metals." Mr. G. T. Beilby, F.R.S., was in the chair.

It is generally supposed that only very few elements can exist in allotropic forms, but the researches of the past few years, reseaches in which Prof. Cohen and his colleagues have played a notable part, make it appear probable that allotropy is a property of most, if not all, of the elements. As regards the metals, only three or four cases of allotropic forms have up to the present been studied, notably iron, tin and antimony, although modified forms of zinc and lead are also known to exist. The theory of the existence of α, β and γ forms of iron is of course at the basis of the modern theory of the constitution of steel, but Prof. Cohen mainly confined his attention to the less well-known varieties of tin and antimony, and his account of the properties of the different forms of these metals was of exceptional interest, whether from the theoretical or practical standpoint.

Thanks to recent advances in our knowledge of chemical and physical equilibrium, it is now possible to understand the phenomena of allotropy much more clearly than was the case some years ago. Take the case of tin, for example. Here the equilibrium conditions are exactly similar to those obtaining between ice and water. It is only at one definite temperature, 0° C., that ice and water are in equilibrium together. Above that temperature only water can exist ; below it only ice, in a stable form. Water, it is true, may be cooled below 0° C. without solidification setting it, but its condition is then unstable, or *metastable*, and if a fragment of ice be thrown into the water, complete transformation to ice immediately follows. So with tin. We have the ordinary white reguline variety existing above 18° C. and the grey powdery form existing in a stable form below that temperature. It is clear, therefore, that, if ordinary tin be cooled below 18° C., it will be in a metastable condition, and a gradual change to the grey powdery variety is bound, sooner or later, to set in.

The mysterious appearance of this grey powder or *tinpest* on articles made of tin has for long been the source of much speculation as to its cause, and Prof. Cohen showed at the meeting some striking examples and illustrations of the very strange way in which old objects of tin have at last succumbed to the disease that must in time inevitably follow cooling below the fatal transition temperature of 18° C. Thus, on certain organ pipes, many centuries old, strange excrescences gradually made their appearance, and in time some of the pipes entirely fell to pieces. A Roman vase in the British Museum, some 2,000 years old, has recently shown signs of distintegration, and the cause is likewise to be ascribed to the fact that the vase is made of tin, and the transition to the grey form has at last set in. The pest has lately been observed in some American tin cans containing preserved food, with a result that the iron base of the tin sheet was laid bare and electrolytic action set up, which perforated the can right through. This was the result of keeping the tinned food in a refrigerating chamber, and a general appreciation of the phenomenon of "tinpest" is, therefore, of great public importance.

The explosive variety of antimony was discovered many years ago by Dr. G. Gore, of Birmingham, but it has only recently been studied from the point of view of equilibrium conditions. Unlike tin, in the case of antimony there is no transition temperature at which the two forms are in equilibrium ; the explosive form is always "metastable," and at every temperature tends to change into the ordinary stable form. Explosive antimony is prepared by electro-deposition from the chloride, bromide or iodide solutions, and there is always a small quantity of the salt present in the deposited metal in a state of solid solution. If a solution more dilute than about 4 per cent. be used, the metal does not come down in the explosive form. When a rod of explosive antimony is scratched, it immediately returns to the stable form accompanied by a great evolution of heat that sends the temperature up to about 370° C., but if left to itself the explosiveness will gradually disappear, the metal slowly changing to its normal form.

Electricity in Cyaniding.—The *South African Mining Journal* learns "that some experiments in connection with the application of electricity to cyaniding are being carried on by a private syndicate at a site of the old Stanhope Works. The trial is said to have reference to the hastening of the time in which the gold is dissolved."

MISCELLANEOUS LAMP CHARACTERISTICS.

By M. TAPPLEY.

(*Concluded from page* 112.)

In carbon and "flame" arcs, however, wholly different conditions are met. The main difficulty is that the candle-power is constant neither in maximum nor mean value nor in distribution: the rapidity of its variation in every respect is so great that it is with extreme difficulty that any consistent arc lamp observations can be made. It naturally follows that extraordinarily high candle-powers may be *momentarily* observed during tests on any arc, and, in the early days of arc lamp development, makers carefully sought after these "snatch" readings, and, obtaining from them extraordinary efficiencies, promptly adopted the latter as the basis of their standard lamp ratings. These, correct and legitimate so far as they went, were, like the data on which they were based, "snatch" ratings, and the fictitious significance attached to them led to the development of what was practically an arbitrary system of rating. Thus for a number of years a "2,000-c.p." arc lamp consumed 400-500 watts, and was really of about 750 m.h.-s.c.p. Such a state of affairs naturally caused much confusion, not to say deception, and it is fortunate that makers and consumers alike now realise the advisability of a straightforward rating, based on m.s.c.p. or m.h.-s.c.p., *measured under normal and definitely stated conditions*. The necessity for the italicised clause will be apparent from the following data. A certain Westinghouse-Bremer flame arc gave efficiencies:—

	With globe.	*Without globe.*
Watts per maximum c.p. ...	0·180	0·081
,, m.h.-s.c.p.	0·287	0·133

The possibility of accidental misunderstanding or wilful misrepresentation of these figures, were the conditions of their application not definitely stated, needs no explanation.

Mean hemispherical candle-power is a convenient and usual rating for most arc lamps since the commonest application of the latter is to street lighting and similar duties, in which any light leaving the complete lamp (including its globe and reflector fittings) in an upward direction is useless. Otherwise the mean spherical c.p. is the rating to be employed: the candle-power in any individual direction is of no real value, though the *maximum* c.p. of an arc is often cited (it is, alone, of no value, but is an interesting figure and one which forms a useful "catch" number for advertising purposes).

The ideal rating for lamps of every kind would include a polar diagram of candle-power distribution and the mean horizontal, mean hemispherical and mean spherical candle-powers of the unit, together with a sufficient explanation of the conditions under which these were determined. Such a complete rating can hardly be generally expected as yet, though many makers—particularly of arc lamps—closely approach it.

The advisability of substituting a wattage for a candle-power rating has been widely discussed (especially in connection with metallic-filament lamps), and though the addition of the wattage to the candle-power rating would be extremely valuable in all cases, it is hardly desirable to allow its substitution for the latter.*

An interesting attempt to obtain a rating figure, which should indicate the illuminating value of arc lamps, was inaugurated by the National Electrical Association (America) in 1908. The rating number for any particular arc was defined to be the ratio of 250 ft. to the distance at which a 16-c.p. lamp would give the same normal illumination (as given by the arc at 250 ft.). This rating does not take account of the polar distribution of the lamp, and might easily rate unfairly such lamps as the intensive gas burner, the American Nernst lamp, the Jandus arc, and others in which a special distribution suitable to particular services is deliberately arranged. While inferior to a m.h.-s.c.p. or m.s.c.p. rating—particularly if the latter be accompanied by a typical distribution curve—the N.E.A. rating has the merit of simplicity, and should certainly be employed in preference to the old arbitrary "nominal candle-power" ratings. Typical rating numbers, determined on the above basis, and published by the N.E.A., are:—

TABLE III.—N.E.A. Rating Numbers.

	Type of lamp.	*Amperes.*	*Rating number.**
D.C.	Series magnetite	4·0	5·5
	,, open	9·6	4·0
	,, enclosed	6·6	4·0
A.C.	,, ,, ...	7·5	4·0
	,, ,, ...	6·6	3·5
D.C.	,, open	6·6	3·5
	,, enclosed	5·0	3·5
A.C.	,, ,, ...	5·5	3·0

* If a lamp has a rating number = 5, the interpretation intended is—the normal illumination due to the lamp at a distance of 250 ft. equals that due to a 16-c.p. lamp at 50 ft.—an interpretation clear enough in itself but obviously vague in its absolute meaning.

Candle-Power of Units.—This is, of course, largely determined by the candle-power *desired* in various applications, yet more or less standard candle-powers have been evolved to suit convenience of manufacture and utilisation: candle-powers, that is, which are employed to a far greater extent than those of intermediate value. In Table IV are given the most usual candle-powers of various filament lamps and the approximate candle-powers of various arc lamps (which however, vary enormously in size and type, and are usually built for standard *current capacities*; since the terminal voltage is fixed in each case, this amounts to a wattage rating). Working on a current basis, the m.h.-s.c.p. of various arc lamps is much as follows, the lower limit being approached by A.C. and the upper by D.C. lamps:—

Open arcs (pure carbons) ...	50—100 m.h.-s.c.p. per ampere.
Enclosed arcs (pure carbons)	60—120 ,, ,,
Flame arcs, white	180—250 ,, ,,
,, ,, yellow	250—300 ,, ,,

TABLE IV.—Candle-Power of Lamps.

Type.	Usual c.p.
Carbon-filament	8,16,32,64,100,200 m.h.c.p.
Metallic-filament	20, 50, 100, 200, 400 m.h.c.p.
Nernst filament	40, 100, 250 m.h.-s.c.p.
Mercury arc (low voltage)	400—500 (3½ amps.), 1,60
,, ,, (quartz)	(10 amps.) m.h.-s.c.p.
Moore tube	10—12 per ft. run
Open arcs	750—1,000 m.h.-s.c.p.
Enclosed arcs	500—800
Flame arcs (vertical)...	500—1,000 (mean 800)
,, ,, (inclined)...	1,500—5,000 (mean 2,500)
10-amp. open arcs (D.C.)	800—1,000 m.h.-s.c.p.
5-amp. enclosed (D.C.)	500
10-amp. flame arcs (D.C.)	2,500—3,000
Bremer flame arcs, with globe ...	1,500
,, ,, without globe ...	5,000
Aurola flame arcs	3,000
Average small arcs, open, no globe ...	300—500 m.s.c.p.
,, ,, open, with globe	230—430
,, ,, enclosed, no globe	200—250
,, ,, enclosed, with globe	150—200

Ageing, Burning Hours, &c.—It is well known that gas mantles and electric filament lamps deteriorate in candle-power as they grow older: this decadence is general referred to as "ageing."

There will clearly be a critical state of decay—varying with the initial cost of the lamp, its wattage and the price of energy—at which it would pay to discard the lamp (or mantle) in favour of a new one; the cost of renewal being balanced by the increased light obtained. This "economic life" is merely that which gives a minimum average cost per c.p.-hour, allowing for all renewals, &c.

In the case of carbon-filament lamps, the deterioration is comparatively rapid, and usually, after some 800-1,000 burning hours, the candle-power of the lamp has fallen some 20 per cent. below its initial value, and the ultimate life of the filament being (frequently) still far distant, it nevertheless pays to scrap the lamp on the above ground. The life of a gas mantle is, however, so very curtailed that it does not pay to seek a "smashing point"; the considerable drop in candle-power which occurs as the mantle ages (s

* For a more detailed discussion of this matter the reader may refer to Electrical Review, January 14th, 1910, pages 76, 77.

g. 1) is mainly confined to a very rapid decadence occurring the first 100 or even 50 hours of life—a fact which rther discounts the advisability of any deliberate smashing. n the other hand, the life of metallic-filament lamps, ough still less than that of carbon-filament lamps where w candle-power, high voltage units are concerned, has been

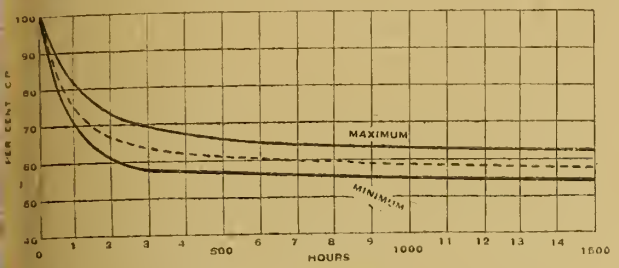


Fig. 1.—Ageing of Incandescent Gas Mantles.

far extended that the necessity for discarding must be nsidered. It is found, however, that the decadence in ndle-power is so small in the case of many metallic-filament mps (see fig. 2, which is, however, unduly severe on ntalum lamps) that, in view of the high cost of renewals, ost lamps of this type are best "burnt to destruction," *i.e.*, n till failure occurs naturally.

Experiments with the latest metallic-filament lamps have own that after 1,500 hours' life the candle-power may be only per cent. to 4 per cent. below its initial value, and to detect

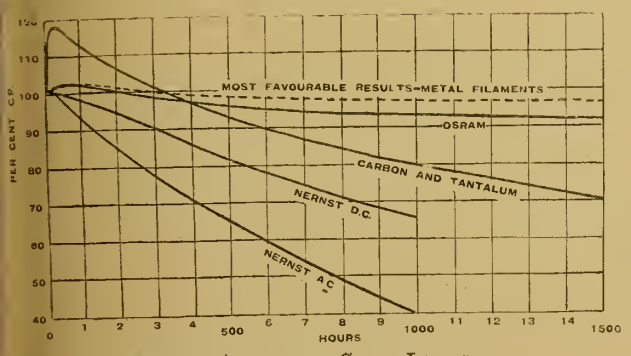


Fig. 2.—Ageing of Glow Lamps.

ich a decadence at all clearly requires considerable care in sting. Photometric errors of 2 per cent. to 3 per cent. eing quite common, the mere margin of experimental error ight lead to the rejection or retention of a metallic-filament mp many hours too soon or too long respectively.

Tungsten metallic-filament lamps and incandescent gas antles may well be used till they fail naturally, but carbon-lament lamps may economically be replaced after their ndle-power falls to, say, 80 per cent. of its initial value. antalum lamps on direct current may be rejected when eir candle-power falls to, say, 85 per cent. of its original value, ut on alternating-current circuits they should be burnt to estruction. In many instances, however, glow lamps, even hen deteriorated as above, give ample light for the purpose equired, and in such cases it would be absurd to deliberately rap the lamp.

Where minimum cost per C.P.-hour is to be attained, scrapping" may be practised under the above limitations, ut where the desideratum is a maximum number of sufficient light-hours" for a given expenditure, lamps (so ng as above the critical sufficient candle-power) should be ed till natural failure occurs. In many cases, lamps dis-rded from situations subject to the first requirements can e utilised in those coming under the second.

The deliberate discarding of lamps, particularly by users ot possessed of photometric or other means of judging minous decadence or cognisant of the peculiarities of arious types, is a practice to be adopted with extreme ution.

The following formula for the most economical life of a lament lamp assumes constant wattage and steady decay of ndle-power (see fig. 2): it may be applied to gas mantles y the substitution of appropriate units, though its accuracy somewhat impaired by the non-linear candle-power decay this type of source (fig. 1).

$$\text{Best life}^* = \frac{1{,}000 \cdot k}{p \cdot W}\left(\sqrt{1 + \frac{0{\cdot}002\ c \cdot r}{k \cdot s}} - 1\right) \text{ hours,}$$

where W = wattage of lamp; p = pence per B. of T. unit; k = cost of lamp (pence); C = initial candle-power: c = candle-power after t hours; $r = p \cdot W \cdot t$.; $s = (C - c)$.

The working life of gas mantles is usually about 350 hours; of carbon-filament lamps 800-1,000 hours, and of metal-filament lamps till breakage occurs—a somewhat indeterminate and chance-governed period, usually varying from 800 to 1,200 or even 2,000 hours.

Though arc lamps, of the carbon or flaming types, are free from any decadence in candle-power, this immunity must be balanced against the cost of "trimming" and supplying their carbon consumption. The burning hours of arc lamps can be almost indefinitely extended by the use of "magazines" containing spare carbons, but for single-carbon lamps, which are still the most commonly employed, 10-15 burning hours are usually obtained in open arc types, 10-12 hours in "flame" lamps and 100-150 or even 300 hours in enclosed lamps. In the case of enclosed arcs it is not advisable to go above 150 burning hours since the globe becomes very foul if left longer unattended, and when opening the lamp for cleaning purposes it is a simple matter to re-carbon its holder.

The candle-power of the Cooper-Hewitt mercury arc lamp falls to about 75 per cent. of its initial value after 1,000 burning hours (mainly owing to a grey film deposit inside the tube) while the quartz pattern has a guaranteed life of 1,000 hours with inappreciable deterioration. Owing to the high cost of both these types, they should be used till natural failure occurs and then returned to the makers in part payment for renewals.

The Moore lamp does not appear to age appreciably, but its breathing valve and phosphorus chamber require overhauling and replenishing once in one or two years, the tube itself being inspected, cleaned and blown through at the same time. Those tubes employing carbon dioxide require more frequent attention.

Supply Characteristics. — The most important supply characteristic, where electric lamps are concerned, is the voltage applied to the lamp terminals. Few lamps can stand variation in the latter without serious change in efficiency and candle-power and even refusal to operate or destruction. The candle-power of filament lamps is very susceptible to voltage changes, and in general the relationship between these quantities may be expressed by an equation of the type—

$$\text{C.P.} = \text{K}\ \text{V}^n,$$

where C.P. = candle-power; K = constant; V = terminal volts; and n is an index having the following values for various materials (almost independent of the actual filament size).

	Normal value of n over commercial voltage ranges.	n at abnormally low voltages.*
Ordinary carbon	6·0	7 —8
Metallised carbon	5·0	5 —6
Tantalum	3·5—4·0	4 —4·5
Osmium	3·5—4·0	4 —6
Tungsten	3·5—4·0	3·5—4

* Say 20 per cent. below normal, but filament still incandescent.

Ordinary arc lamps require comparatively close voltage regulation for their satisfactory operation: a certain critical voltage for mercury arcs, 13 volts; magnetite arcs, 30 volts; carbon arcs, 36 volts, must be exceeded, but excessive pressures must be avoided or the automatic feeding coils will give long, unstable and inefficient arcs. The actual average voltages, required by various arcs are shown in Table V, and, though small variations produce a less evident effect than is the case in filament lamps, the rated supply voltage should be adhered to as closely as possible.

Tube lamps employing a mercury arc need a tilting device to strike the arc mechanically or a momentary high-tension discharge to complete the circuit; thereafter a certain critical voltage must be exceeded, but (in the case of the mercury arc) the maintenance of the rated current flow is the important factor controlling the efficiency of the

* For minimum cost per C.P.-hour.

TABLE V.—Voltage and Current Characteristics.

Lamp.	Voltage across Arc.*	Voltage across Terminals.†	Current, Amperes.	Remarks.
Open carbon arc	35-40‡	circa 50	5 to 10	Miniature arcs are being replaced by metallic-filament lamps: 6-7 amp. arcs popular in America.
Enclosed ditto ...	70-80‡	circa 100		
"Carbone" arc ...	90-95	100-120	10	Usual size.
Flame (impregnated)	30-40	40-50	5 to 10 & 10 to 20	Two usual ranges of size.
Magnetite	60-65	90	4	Comparable with enclosed rather than with open arcs.
Titanium	50	60	4	
Cooper-Hewitt mer.	circa 30	50	3½, 7, 10	Three usual sizes.
Quartz mer.: Starting	25-30	200	10	—
,, ,, Running	180	200	3½	—
Moore Tube	—	10,000-12,000	0·3	—
Filament lamps.—			*Amperes per c.p.*	100 volts chosen for simplicity and ease of conversion. Current varies inversely with voltage. For usual candle-powers see Table IV.
Carbon (4 W./C.P.)	—	100	0·040	
,, (at 2½ W./C.P.)	—	100	0·025	
Metallic (at 1½ W./C.P.)	—	100	0·015	
,, (at 1 W./C.P.)	—	100	0·010	
Nernst (at 1 W./C.P.)	—	100	0·010	

* This voltage amounts almost to a physical constant in each case.

† This voltage may be varied to suit supply and circuit arrangements.

‡ Lower voltage generally required on A.C. than on D.C. circuits; also a lower terminal voltage is allowed for series than for parallel running.

lamp, the voltage required varying with the temperature of the tube. Like other arcs, the mercury lamp requires a ballast resistance. In the case of the quartz lamp, the different voltages required during starting and normal running are automatically obtained by using an iron ballast resistance. Instead of running the latter permanently at near red heat (as in the Nernst lamp), it is run thus only during starting; its high resistance then absorbs 130 volts, but as the lamp heats up, its own resistance rises, cuts down the current flowing, and thus enables the iron ballast to cool and absorb, by its then much lower resistance, only about 14 volts.

The Moore lamp is essentially a high-voltage type, and, requiring about 10,000—12,000 volts at its terminals, is naturally supplied through a step-up transformer from 100—200-volt A.C. mains. The terminal voltage doubtless affects the efficiency of the lamp, though to just what extent appears uncertain.

The usual current capacities of various lamps are also included in Table V as a matter of interest and, in some cases, importance. No special comment is needed on these figures.

Frequency.—The highest frequencies usual on commercial supply circuits (say 150 cycles per sec.) have no adverse effect on the efficiency or working of electric lamps; on the other hand, if the frequency falls much below 30 cycles / sec., flicker is almost certain to be noticeable in the resultant illumination. This is so intolerable that 25 cycles / sec. forms the lowest frequency at which the lamps at present in use can be operated (apart from any inherent properties of the lamp).

There appears to be little advantage in working at frequencies above 60 or 100 cycles per sec., and, indeed, A.C. arc lamps, however carefully constructed, are liable to operate noisily on circuits of higher frequency than, say, 70 cycles / sec. Filament lamps are necessarily (owing to the frequencies available), but without harm, often worked at 100, 120 or 150 cycles / sec., and the mercury arc may be operated on such circuits, though a lower limit is usually desirable.

From 50-70 cycles / sec.* thus appears to be a convenient frequency for lighting circuits in general, and particularly for arcs (open, enclosed and flame) and Moore lamps.

* Such a frequency has the added advantage of being more suitable for motor circuits than 100 or more cycles / sec. supply.

Power Factor.—It is not generally realised how considerably a purely lighting load may depart from unity power factor (on A.C. supply). The power factor of filament lamps is practically 100 per cent., but few arc lamps have a higher power factor, terminal to terminal, than 85 per cent., or rarely 90 per cent., while in many instances the figure falls to 70 per cent.; the power factor of the arc itself is usually 85-90 per cent. In general, 80 per cent. may be assumed for the power factor of the whole arc lamp and 90 per cent. for that of the arc alone. The power factor of a mercury arc is from 80 to 85 per cent., while that of a Moore tube may be 90 per cent. or more. Needless to say, these facts must be allowed for in the layout of any arc lighting scheme.

Conclusion.—The only conclusion the author deems to be necessary is a further apology for the somewhat heterogeneous nature of these notes, and a reiteration of their utility as vindication for their assemblage.

THE PHASOPHONE.*

In spite of the excellence of modern cable construction, it is probable that 99 per cent. of the total cessations of high-tension supply are attributable, directly or indirectly, to insulation failure on the mains. It has been recognised for some time that a insulation test at double the normal working pressure does not sufficiently cover the risks of practice and tests at triple pressure have, therefore, been adopted in many cases. Unfortunately, such vigorous tests are liable to injure the cable permanently, and that without infallibly detecting defects at the time of the test.

The water submersion test for proving the continuity of the lead sheathing on cables (a method too well known to need recapitulation), has two serious defects:—(*a*) It is difficult to test the extreme ends of the cables by this means; (*b*) The lead sheathing frequently has fissures so fine that moisture does not penetrate them to a dangerous extent till the cable has been exposed to damp for weeks or months. (Damaged insulation due to soil subsidence is another prolific cause of gradual breakdown on high-tension

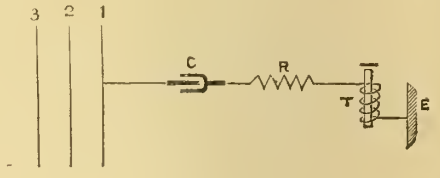


Fig. 1.

cables.) It is thus impossible to ensure perfection in lead-sheathed cables before installation, and what is needed is a device which shall enable the detection of faults before these become absolute. In spite of the fact that the breakdown of a high-tension cable is usually a gradual process—minute sparks slowly heating and destroying the insulation at the faulty place, till at length a "power" discharge occurs—all alarm devices hitherto in use have merely signalled the completion of a fault. By the time such an alarm is

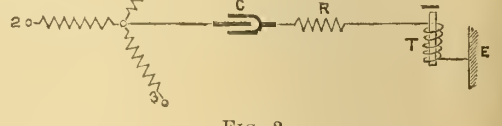


Fig. 2.

given several yards of cable are probably burnt up, supply is cut off, and all traces of the cause of the fault are destroyed.

To enable the early detection and localisation of a potential fault and a careful examination of its genesis with a view to preventing its recurrence, a new apparatus, the "Phasophone," has been recently introduced. The principle of the instrument is simplicity itself, and there seems no reason why it should not permanently do all that is claimed for it. The essential components are a high tension mica condenser C, a non-inductive resistance R (of over one megohm resistance), a spark micrometer *f*, and a telephone receiver T. The manner of connecting these is shown diagrammatically in fig. 1, the actual arrangement being as in fig. 3 (which is a plan of the essential parts of the apparatus; dotted connections are internal; low-tension terminals are shown by single and high tension terminals by double rings).

* Abstract from *L'Industrie Electrique*, May 25th, 1911, pages 250-252.

Referring to fig. 1, the condenser, non-inductive resistance and lephone are connected in series between one line wire and earth. ıe capacity current then flowing through this auxiliary circuit ts up a note in T, of pitch dependent on the frequency of the ain current. So long as the whole installation is in perfect order, e note emitted by T is uniform, but, should the slightest irregu- rity arise (such as current leakage, sparking to earth, bad con- cts, faulty operation of paralleled machines, load oscillations, ıbalanced phases, excessive discharge at spark gaps and so on), dication thereof is at once given in a definite and recognisable anner in the phasophone.

The current taken by the phasophone at 5,000 volts line pressure rresponds roughly to an equivalent resistance of 15 million ıms, so that the leakage or sparking at any fault offering less than , megohms resistance strongly affects the telephone note. Other ults of a similar magnitude are as easily detected.

The connections shown in fig. 2 are quite permissible, but are ldom employed, it being found that all possible derangements e notified by the arrangement of fig. 1. The most frequently quired connections are shown in fig. 3 (also fig. 1); these enable

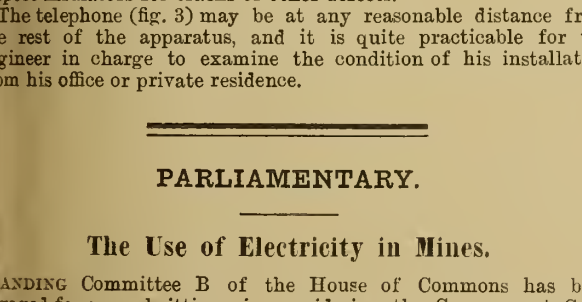


Fig. 3.

e examination of an A.C. network for the correct working and tisfactory condition of all rotary machines, transformers, cables d switchgear connected. Indication of any irregularity is given ıg before the latter becomes dangerous. It is obviously neces- ry to secure a good earth contact or the phasophone will indicate own fault!

Aerial transmissions are examined as readily and as perfectly as derground networks and, where the phasophone is employed, it s been found possible to dispense entirely with the tedious and satisfactory process of sending out linemen with field glasses to spect insulators for cracks or other defects.

The telephone (fig. 3) may be at any reasonable distance from e rest of the apparatus, and it is quite practicable for the gineer in charge to examine the condition of his installation ɔm his office or private residence.

PARLIAMENTARY.

The Use of Electricity in Mines.

anding Committee B of the House of Commons has been gaged for several sittings in considering the Government Coal- nes Bill, Clause 60 of which is as follows:—"(1) Electricity all not be used in any part of a mine where, on account of the k of explosion of gas or coal dust, the use of electricity would dangerous to life, and if the owner of a mine, on being required an inspector of the division not to use, or to desist from using ctricity in the mine or any part thereof on such ground as oresaid, refuses to do so, the question as to the application of is section to the mine or part thereof shall be settled in manner ovided by this Act for settling disputes. (2) The use of elec- city in any mine shall be subject to general regulations under s Act."

At the sitting of the Committee last week, Mr. Walsh proposed amendment to this clause with the object of restricting the of electricity to those parts of the mine where safety lamps re not in use.

Mr. Wadsworth said he thought that the use of electricity in nes should be prohibited entirely.

Mr. Laurence Hardy, speaking against the amendment, said believed that if it were adopted it would lead to the withdrawal safety lamps from mines where they were not imperatively cessary.

Sir A. Markham said the amendment, if it were carried, would an that nearly every mine where the pumping plant was worked ctrically would have to be shut down, and that was unthink- e. Such plant was to be found in many collieries in South les, but there was only one recorded case where an electric rk had ignited gas.

Mr. J. Wilson dissented from this view, and said that the aster at the West Stanley mine was entirely due to electricity.

Mr. E. Jones said that while he thought that electricity should used for signalling and lighting the bottom of the pit-shaft, he ought it should be absolutely forbidden as a means of working ulage and coal-cutting machinery at the face.

Mr. S. Roberts hoped the amendment would not be carried, for it were, electricity would be swept out of every colliery where ety lamps were used, and that would apply to nearly every mine the country.

On a division the amendment was defeated by 26 votes to 13.

Sir A. Markham moved the following amendment: "(1) If in place of a mine, or part of a ventilating district of a mine, amount of inflammable gas in the air currents exceeds one-half cent. or upwards, the use of electricity shall at once be dis- continued in such place or part of such ventilating district where the inflammable gas exists till the air current is clear of the same, or shall not exceed one-half per cent. A hydrogen or other type of safety lamp approved by the Secretary of State, in which low percentages of gas can be readily observed, shall be provided and used for testing for inflammable gas at least twice during every working shift by a competent person appointed by the agent or manager at the place or places where electricity is used, and a daily record signed by the aforesaid competent person or persons shall be kept at the mine of all such tests and the occasions on which, in accordance with this rule, it has been found necessary to discontinue the use of any electrical plant. (2) Every person appointed to work, supervise, examine, or adjust any apparatus shall be competent for the work that he is set to do. No person, except an authorised person or a competent person acting under his immediate supervision, shall undertake any work where technical knowledge or experience is required in order adequately to avoid danger. (3) On and after the passing of this Act a person shall be appointed in writing by the owner, agent, or manager to supervise the apparatus. The person so appointed, hereinafter called 'the electrician,' shall be over 21 years of age; if necessary, the owner, agent, or manager shall appoint for the proper fulfilment of the provisions of this section an assistant or assistants to the electrician. (4) The electrician shall be in daily attendance at the mine; he shall be responsible for the fulfilment of the following duties, which shall be carried out by him or by an assistant or assistants duly appointed under sub-section (3) of this section:—(*a*) The thorough examination of all apparatus (including the testing of earth conductors and metallic coverings for continuity) as often as may be necessary to prevent danger; (*b*) the examination and testing of all new apparatus, and of all apparatus removed from one position in the mine to another before it is put into service in the new position; (*c*) the electrician shall keep at the mine a log book made up of daily log sheets kept in the prescribed form; the said log book shall be produced at any time to an inspector of mines; (*d*) should there be any fault or leakage of current in any circuit the part affected shall be made dead without delay and shall remain so until the fault has been remedied; (*e*) inflammable or explosive material shall not be stored in any room, compartment, or box containing apparatus or in the vicinity of such apparatus. (5) Where electricity is used for signalling, the pressure in any one circuit shall not exceed 25 volts. (6) A proper plan on the same scale as that kept at the mine in fulfilment of the requirements of this Act shall be kept in the office at the mine, showing the position and size of all fixed apparatus in the mine. The said plan shall be corrected as often as may be necessary to keep it reasonably up to date and it shall be produced to an inspector of mines at any time. (7) Haulage by electric locomotives on the overhead trolley wire system is prohibited in any part of a coal mine." He said that his object in moving the amendment was that the use of electricity in a mine should be made subject to the same standard as was imposed in respect to naked lights. He felt confident that if the amendment was carried they would see an end to nearly all explosions in mines resulting from electricity.

Mr. Hunter said that on behalf of the Government he could not accept the amendment so far as the use of electricity at the face of a mine was concerned. If carried, the proposal would practically amount to its prohibition, not only in regard to all mines where safety lamps were used, but also in those collieries where naked lights were employed. It would be practically impossible to enforce the proposed condition, and he hoped the hon. member would allow them to deal with the matter by regulation.

The amendment was agreed to on a division by 15 votes to 12.

A new sub-section was added to the Bill providing that when any question arising under this section had to be settled by arbitration, the owner of the mine, pending the settlement of the matter, should comply with the requirements of the Inspector, subject to an appeal to the Chief Inspector.

The clause as amended was ordered to stand part of the Bill.

Bills Advanced.—On July 19th, in the House of Lords, the East Kent Electric Power Bill was read a third time and passed.

After several sittings, the Committee of the House of Lords, under the Chairmanship of Lord Welby, which had been considering the Tramways and Improvements Bill of the L.C.C., ordered the Bill, with slight amendments, to be reported to the House.

International Electrical Congress.—Official delegations to the Congress to be held at Turin in September have been appointed by the Institution of Electrical Engineers and various other leading electrical societies; membership of the Congress can be obtained on payment of 20s., and this ensures the receipt of the doubtless valuable record of the proceedings, even if a member is unable to attend in person. In view of the importance of the occasion, it is hoped that many British engineers will either attend, when they will be amply repaid for their trouble by the professional and social advantages offered, or will, at least, support the Congress by forwarding their subscription to Mr. Semenza, who is so favourably known to many of our readers.

Rochdale Electricity Supply.—The Electricity Committee, on the 20th inst., decided to adopt a recommendation that the flat rate for lighting be reduced from 4½d. per unit to 1d. It was explained that it would mean a loss to the department of £700. Some time ago a reduction, involving £1,000 a year loss to the department, was made on energy supplied for tramways.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

JAPAN.—As the result of a new commercial treaty between Germany and Japan which came into force on July 17th (the date of operation of the new Japanese Tariff), the following reductions in the duty leviable in Japan on certain electrical and similar goods have been made; the reduced rates will be applicable to British goods in consequence of most-favoured-nation arrangements :—

	Old rate. Yens per 100 kin.	New rate. Yens per 100 kin.
Gas engines, petroleum engines and hot air engines, each weighing more than 5,000 up to 50,000 kg.	5·00	4·50
Each weighing more than 50,000 and up to 100,000 kg. ...	5·00	4·00
Each weighing more than 100,000 kg.	5·00	3·50
Dynamos combined with gas engines, petroleum engines or hot air engines.		
Each weighing more than 10,000 and up to 50,000 kg. ...	5·80	5·50
Each weighing more than 50,000 kg. and up to 100,000 kg.	5·80	5·20
Each weighing more than 100,000 kg.	5·80	4·90

AUSTRALIAN COMMONWEALTH.—The following decisions as to the duties to be levied on certain electrical and similar goods have recently been issued by the Australian Customs Authorities :—

Electrical appliances, &c. :	
Mercury arc rectifier, mounted on a board with other apparatus	20 per cent.
Spare tubes for above, if imported separately. (As electric vacuum tubes)	Free
Electro-medical apparatus, for utilising currents from dynamos, for galvanisation, electrolysis and faradisation. (As an electro-medical apparatus)	10 per cent.
Lamps, switchboard signal	Free
Lamp caps, lamp sockets, and lamp cap guards, for above	Free
Ear-phone, globe	10 per cent.
Meters, electric current	Free
Morse telegraphic instruments of brass, *e.g.*, keys, sounders, &c.	25 per cent.
Bells, electric, if of brass or gun-metal	25 per cent.
Holders, brush, for dynamo-electric machines ...	20 per cent.
Draegerwerk rescue apparatus for mines.	
Accessories therefor, as under, imported separately :	
Accumulators for lamps	Free
Electric safety lamps (self-contained)	15 per cent.
Flying telephone station	Free
High-pressure refill pump (if security furnished)	Free
Transportabler Wechselstrom Anschlussapparat, an electrical appliance used by doctors	Free

N.B.—The rates given above are in all cases those of the British Preferential Tariff.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,933. "Control of electrically-operated lifts, elevators and the like." H. C. WALKER and R. WAYGOOD & Co., LTD. (Divided application on 20,118/10, August 29th.) July 10th.

15,959. "Production of electro-deposits." B. LOWY and F. MULLER. (Convention date, June 1st, 1911, Austria.) July 10th. (Complete.)

15,999. "Dynamometers." G. WAZAU. (Convention date, July 10th, 1910, Germany.) July 10th. (Complete.)

16,007. "Automatic control of dynamo-electric machines in direct-current distributing and consumption systems." W. F. GRAHTON and E. P. PRIOR. July 10th. (Complete.)

16,026. "Sparking-plugs such as used on internal-combustion engines." E. VAUGHAN. July 11th.

16,065. "Electrocuting trap." H. HERTZBERG, A. A. LOW and M. J. WOHL. July 11th. (Complete.)

16,068. "Variable-speed dynamos, such as those employed for train lighting." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., J. ETCHELLS and E. W. PRICE. July 11th.

16,075. "Telephone exchange systems." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States). July 11th. (Complete.)

16,078. "Switches." H. THIEL. July 11th. (Complete.)

16,081. "Electric plug connection." A. A. PRICE. July 11th.

16,088. "Systems for electrically controlling or operating clocks or like." L. J. ARON. July 11th.

16,095. "Dynamometers, watt-hour meters, and the li A. E. MOORE, T. E. GAMBRELL and C. T. GAMBRELL. July 12th.

16,096. "Contact-breakers for induction coils and other purposes." ELFORD. July 12th.

16,110. "Apparatus for the sterilisation of milk, beer, water, or o liquids by means of the ultra-violent rays." W. R. WALKEY. July 1 (Complete.)

16,143. "Envelopes or supports for the resistances in electric-hea apparatus." C. O. BASTIAN. July 12th.

16,152. "Electrolytic preparation of sulphuric acid." B. BEAL July 12th.

16,163. "Electric lamps." BRITISH THOMSON-HOUSTON Co., LTD. (Gen Electric Co., United States.) July 12th.

16,187. "Mercury or other vapour electric apparatus." J. S. ANDE and G. B. BURNSIDE. July 13th.

16,195. "Electric incandescent lamp." O. SCHALLER. (Convention d July 13th, 1910, Germany.) July 13th. (Complete.)

16,228. "Fuses for electric circuits." E. A. GRAHAM. July 13th. (C pletc.)

16,230. "Method of and apparatus for regenerating burnt-out carbon metal-filament electric lamps." S. BLOCH. July 13th. (Complete.)

16,298. "Electric oscillographs." G. BOWRON. July 14th.

16,308. "Manufacture of metal filaments for electric lamps." E. R. GR July 14th.

16,318. "Type of electric lampholder." J. WILSON and P. E. A. WAR July 15th.

16,343. "Method of and apparatus for controlling the speed of ele motors." ELECTROMOTORS, LTD., and E. GRENHALGH. July 15th.

16,352. "Telephone call apparatus and the like." F. B. MITCHELL. I5th.

16,355. "Direct-current transformers and the like." F. A. FRASER. 15th.

16,361. "Control of alternating-current electric motors." R. H. BARB July 15th.

16,367. "Electric arc lamps." A. OGILVY-WEBB and R. C. A. REINE July 15th. (Complete.)

16,374. "Traction electromagnets." H. W. LAKE. (D. L. Lindq United States.) July 15th. (Complete.)

PUBLISHED SPECIFICATIONS.

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1910.

ELECTRIC SWITCH. A. H. Johnson. 12,184. May 18th.

AUTOMATIC CONTACT DEVICE FOR USE IN CONNECTION WITH THE OVER EQUIPMENT OF ELECTRIC TRAMWAY INSTALLATIONS. J. Mathieson. 1 June 16th.

METHOD OF OBTAINING RAPIDLY VARYING ELECTRIC CURRENTS. J. T. M R. M. Ellis and F. Murphy. 14,588. June 16th.

SLOW-MOTION DEVICES FOR USE IN CONNECTION WITH ELECTRIC CONTROL STARTING SWITCHES AND THE LIKE. Electric and Ordnance Accessorie and N. Collins. 14,625. June 17th.

COMBINED SPEED AND CURRENT REGULATORS FOR DYNAMO-ELECTRIC S MACHINES. Campagnie de L'Industrie Electrique et Mecanique. 1 June 18th. (May 19th, 1910.)

CONTROLLERS FOR ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Co.) 14,851. June 20th.

CONSTRUCTION OF SMALL OR POCKET ELECTRIC LAMPS. W. Thomson. 1 June 22nd.

ARC LAMPS. F. Klostermann. 15,143. June 23rd. (June 26th, 1909.)

ENCLOSED ELECTRIC ARC LAMPS OF THE INVERTED TYPE. B. Quint. 1 June 30th.

INTERLOCKING SWITCH BOX FOR ELECTRIC LIGHTING OR POWER TRANSMI CABLES. W. Paton. 16,486. July 11th.

ELECTROLYTIC REDUCTION OF ORGANIC BODIES. H. Higgins. (Higgins) 1 August 12th.

GALVANIC BATTERY. D. W. John and J. H. Berry. 19,729. August 24th.

RECEIVING METHOD FOR WIRELESS TELEGRAPHY. W. O. Smith. (Huth.) 2 October 21st.

COLLECTORS FOR OVERHEAD CONDUCTOR ELECTRIC TRACTION SYSTEMS. H. Se Jones. (Oesterreichische Daimler-Motoren Ges.) 25,012. October 27t

PROCESS FOR PRODUCING ELECTRIC INCANDESCENCE BODIES. J. Krannich 26,045. November 9th.

MANUFACTURE OF ELECTRIC ACCUMULATOR PLATES. J. Apoznanski. 2 November 22nd.

STREET OR STATION INDICATORS FOR ELECTRIC TRAINS, TRAMCARS AND THE H. Alweis. 27,652. November 28th. (November 26th, 1909.)

GOVERNING OR CONTROLLING DEVICES FOR DYNAMOS. W. Gray. 2 December 5th.

ELECTRIC CURRENT GAUGES OR APPARATUS FOR MEASURING THE STRENGT ELECTRIC CURRENT. W. Frisby. 28,994. December 14th.

ELECTRICAL ARRANGEMENTS FOR PROTECTING SHIPS' BOTTOMS AND SUBME STRUCTURES FROM BARNACLES OR AQUATIC LIFE AND SUCH LIKE. J. E. Ja 14,181. June 11th.

MAGNETO IGNITION DEVICES FOR INTERNAL COMBUSTION ENGINES. C. B. Re 15,134. June 23rd.

TROLLEY POLES FOR ELECTRIC TRACTION ON THE OVERHEAD CONDUCTOR SY A. R. Christian. 15,414. June 27th.

1911.

MEANS FOR ASCERTAINING THE POSITION OF THE CURRENT DISTRIBUTOR IN I TROMAGNETIC IGNITION DEVICES FOR EXPLOSION ENGINES. W. Sauer 790. January 11th. (January 12th, 1910.)

SENDER WITH DIRECT EXCITATION FOR RADIO-TELEGRAPHIC PLANTS. E. Guar 3,949. February 16th. (July 30th, 1910.)

MEANS FOR FIXING AND INSULATING CONTACT SPRINGS FOR ELECTRICAL APPAR Siemens Bros. & Co. and C. R. Ribber. 6,736. March 17th.

MEANS FOR FIXING AND INSULATING CONTACT SPRINGS FOR ELECTRICAL APPAR Siemens Bros. and C. R. Ribber. 6,737. March 17th.

DEVICE FOR INSULATING THE TWISTED ENDS OF ELECTRIC WIRES. J. Kran feldt. 7,511. March 27th.

THE

ELECTRICAL REVIEW.

VOL. LXIX. AUGUST 4, 1911. No. 1,758.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE EDUCATION AND TRAINING OF ENGINEERS.

IN our last issue we brought to a conclusion our account of the papers and the discussion accorded to them by the several sections into which the "Conference on the Education and Training of Engineers" was divided. The subject itself is without finality, just as there is no finality in engineering development. In the aggregate mass of wisdom rendered by a multitude of counsellors there must be difference of opinion. Prof. Barr's plea for a wide latitude in the systems of training is one which we must not lose sight of in these days of standardisation. "Let it not be forgotten," said Prof. Barr, "that no two men who have made our profession what it is have entered it by the same path, and that many of the most eminent of them have had no training that would to-day be regarded as a normal one, either in respect of education or of practice. . . . There is need in the profession for men of widely different qualifications; let us not aim at turning out our recruits like so many forgings stamped in one set of dies."

There is no conceivable specification for a course of training and study which will meet every case successfully. Physique, temperament and incentive all play modifying parts. Some types of mind are fostered and others fettered by the same environment. The first essential to which end all teaching must be directed, whether in the public school or college, is that of training the student to teach himself. The development of the reasoning faculties and of the ability to draw sound deductions is of paramount importance.

We cannot but regard some phases of the examination system as inimical to this. So long as it is possible for men to cram for examinations, so long will the satisfying of the examiners by a set of answers to a set of questions involve at least as much of the accidental as the intentional. No examination has been invented which will eliminate the unsuitable, nor is there one in existence (fortunately) which will prevent the progress of the exceptionally gifted. The examination may be regarded as a simple—one had almost said primitive—method of automatically causing the few to select themselves from the many. Entirely ignoring, as it must of its nature do, qualifications of physical fitness or financial incentive, it can only be regarded as a species of gate-keeper appointed to prevent the profession from becoming absolutely over-crowded. Ultimately, of course, the over-crowding must remedy itself; at present it is questionable whether the second period of education, by encouraging the fallacious idea that it is more or less synonymous with employment, is not worse than the first. If a man has to earn his own living—even if he has to earn the major part of his income—let him as soon as possible start on actual employment, at however small a salary. He will learn orderly habits, accuracy, and the practice of those small self-denials which make up a tactful

dealing with others engaged in a like pursuit. The most valuable part of education is that which is derived in daily life from an actually productive occupation.

The chief aim of education (except in the case of the moneyed few, who can afford to take it for purposes of culture) must be to fit the pupil to compete with his fellows in his endeavour to obtain a secure position in life, and to spend time in cramming for subjects which are known to be pleasing to the Olympian mind of this or that examiner, is only justifiable when the entrance ticket conferred by an examination is an absolute necessity, as in the case of many Government services. The latter, however, are specialised instances, with which the outside world has no business relationship and over which it exercises no disturbing influence. The engineering profession, however, is very intimately connected, both physically and mentally, with the doings of the world in general, so much so that the present time has been called the "Age of Engineering." In fact, any observant youngster must, of himself, from the surrounding objects of daily life, receive an education in engineering which would have been a liberal equipment to the pupil of 60 years ago. The college training should certainly be of use where carried out in so rational a manner as that commented on by Prof. Wertheimer, where it enabled the student and his guardians to determine at an early stage whether or no he were really fitted for the profession, thereby saving him and them considerable time, and very likely a large expenditure. Too often a college training is apt to be regarded as a method by which, in return for a certain sum deposited in the slot, a certain amount of knowledge is transferred to the student. The total absence of the commercial element from the college atmosphere often has a highly deleterious effect on the student, leading him to suppose the world a pleasant place where everyone is anxious to give full value for the highest possible quality, whereas it will take him a considerable time before he has educated even his own small circle up to that pitch of perfection. To aim high is, no doubt, a very excellent motto, but, until skill in shooting is attained, a certain amount of time must be spent in entrapping the smaller ground game necessary to the support of the hunter, otherwise he will not find himself in any condition to bring down the loftier trophies of the chase.

The summing-up of the matter, as conducted by Mr. A. F. Yarrow and Mr. Alexander Siemens, took the form of a series of proposals from the former, and some illuminating comments from the latter. Mr. Yarrow's clauses, which, with the caution of Royal Commission recommendations, were not put to the vote, but suggested as food for thought, embodied the following :—A proposal that the Council should endeavour to secure greater continuity between school and college courses, apparently a feeler towards an organised system of education, such as obtains in the leading Continental countries ; alteration of the length of University terms, to allow of the sandwich system ; and the recommendation as to co-ordination between colleges and employers, referred to previously as leading to a desirable solution.

Mr. Siemens pointed out that the professors and schoolmasters who had complained that they could not prepare a boy for a career unless they knew what that career was, were unable themselves to agree upon a syllabus for a standard examination to be accepted by the Universities and the learned professions as an entrance examination. Thus, in the most important department of education, the general fitting of a man for his start in life, a general disability to decide appears to have been evinced by the educational representatives. He was in favour of sending a boy direct to the shops for a year on his leaving school, and passing him into the university afterwards, and this impression, being the outcome of so wide an experience, may be taken as embodying the gist of the discussion.

Registration of Telephone Calls.

An animated correspondence has been taking place in the *Times* during the past three weeks on the subject of the registration of telephone calls by the Post Office, on the message-rate system. It arose out of a question put to the Postmaster-General in the House of Commons as to the method of registration ; Mr. Samuel replied that no call could be registered on a line unless it were connected with another line, and said, "The registration is not entirely automatic, as it does not take place unless the operator depresses a key which controls the meter." We may point out that the phrase "not entirely automatic" is misleading ; the registration is not automatic at all, being effected solely at the will of the operator, just as one rings an electric bell or switches on an electric lamp. The general complaint, expressed often in bitter terms, is that heavy overcharges are made — as much as 30 per cent. in excess of the actual number of effective calls made—and it is alleged that the operators are in the habit of recording ineffective calls and wrong connections. It is even averred that when the meter is read a percentage is added to the actual number of calls registered, to cover omissions on the part of the operator : we cannot suppose, however, that there is any valid ground for this charge, for it amounts to an accusation of deliberate fraud on the part of the Post Office. Complaints and protests, it is said, are unavailing ; Lord Russell writes : "It is useless for subscribers to complain or to take legal action against a Government department, and only Parliament can help us." But that is the inevitable consequence of the establishment of bureaucratic control, as history has shown for ages past. The remedy is obvious.

Anglo-German Finance and Scandinavian Water-Powers.

It is reported from Berlin that negotiations are being conducted by an Anglo-German-Scandinavian financial group with regard to the consolidation into a company of a number of Norwegian and Swedish water-powers, under the title of the Hydraulic Power and Smelting Corporation, and with a share capital of £1,000,000 and debentures of £1,000,000. The scheme relates to waterfalls already in use and yet to be used, as well as to some of the establishments supplied by them. The assets to be brought into the undertaking include the zinc smelting works and zinc refinery at the Trollhättan Falls and in Sarpsborg, and the water-power of 126,000 H.P. at the mouth of the Tysse mountain stream in the Hardanger Fiord. The latter installation is already equipped, or in process of being equipped, for 57,000 H.P., and the turbo-generators have been used for years past for supplying the carbide and cyanamide works in the neighbouring Odda, in which the German Siemens group is interested. As concerned with the scheme in Germany are mentioned the A.E.G., the Siemens-Schuckert Works and the Berlin Electrical Enterprises Co., together with the banks associated with them under the lead of the firm of S. Bleichroder, and it is said that the formation of the company should afford opportunities for employment for the Teutonic electrical industry. The question arises whether, as in the case of the Victoria Falls Power Co., this means that an English company is to be constituted largely with English capital to provide orders for German works. If so, it is about time that those who supply most of the capital should also determine the allocation of the contracts which may have to be concluded.

SOME PROTECTIVE RELAYS FOR ALTERNATING-CURRENT CIRCUITS.

By KENELM EDGCUMBE.

(*Continued from page* 128.)

Minimum or No-Voltage Relays.—These relays, which are usually required to be instantaneous in their action, are mainly of one or other of the patterns already alluded to, with this difference, however, that the contact is normally held open, and so soon as the current energising the coils falls *below* a certain minimum value, the mechanism is released and the contacts are closed. In other respects no-voltage relays are similar to those of the overload type, and need not be further dealt with.

Reverse or Discriminating Relays.—There has been considerable controversy in the past on the subject of reverse relays: some engineers being at one time of the opinion that such instruments were liable to become a greater evil than that which they were intended to cure. The cause of this feeling was not far to seek. The majority of the reverse relays on the market were, and still are, merely induction wattmeters carrying contacts, which are held open so long as power is being transmitted in one direction, but close as soon as a reversal of power takes place. They are, in fact, frequently called "reverse-power" relays.

In the writer's opinion, this indicates an entire misconception of the function of such instruments, which is not that they should be brought into action by a reversal corresponding to a definite amount of *power*, but to a definite value of *current*. The voltage is, in point of fact, only involved in so far as it determines the direction of current flow, and the question of this voltage falling or rising should have no effect whatever upon the action of the relay. As an example, one of the most common uses to which reverse relays are put may be cited, viz., the protection of a number of alternating-current generators running in parallel on the bus-bars. Should a fault develop in one of them, the remaining machines will feed current back into the faulty generator, and it is the duty of the relay to remove this latter machine from the bus-bars before any damage is done. If the fault is a bad one, it will almost certainly be accompanied by a very considerable drop in pressure, and a reverse-power relay will, under such conditions only act with a correspondingly increased current. For example, it is no uncommon thing, under such circumstances, for the pressure to fall to one-tenth of its normal value, or even less, and in that case the relay will not cut out until the current has risen to 10 times that for which it is set.

To meet these conditions, it is usual to specify that a reverse relay shall act with not more than 10 per cent. or 20 per cent. of the full-load current, even if the pressure falls to 50 per cent. of its normal value. In the case of a reverse-power relay, the designer has no alternative but to reduce the working forces until the relay will act with one-tenth (or one-twentieth, as the case may be) of the full-load power. This necessarily means that the control has to be so far reduced as to make the relay extremely delicate, and mercury contacts become almost a necessity. But there is a still more serious disadvantage attending this solution of the problem, viz., that a comparatively small momentary reversal, such as that due to a bad parallel, or, still more, to a surge on the line, may be quite enough to trip the relay, seeing that these instruments to be really effective should, in most cases, be of the instantaneous type, in order that a faulty generator may be rapidly removed.

It is this liability to cause the circuit breakers to come out unnecessarily which has led some engineers to express the unfavourable opinion on the subject of reverse relays, already alluded to. With a view to preventing the tripping of the relays in the event of a "bad shot" in paralleling, a press button is sometimes provided which temporarily cuts them out of circuit, but this affords no protection against surges.

As has been said, the writer's view is that a reverse relay should be a reverse-*current* relay, and not a reverse-power relay, and the instrument shown in figs. 10 and 11 is designed in accordance with this conception. It consists, essentially, of an iron-cored dynamometer movement having a pivoted pressure coil M C and a fixed current coil C C. On the limbs of the magnet are two coils O C connected across the mains through a resistance R, in series with one another, and with the moving coil M C. A weight W normally holds the contacts C open, and current is sent through O C in such a direction as to assist the winding C C when a forward current is flowing through the latter, thus assisting the weight W to

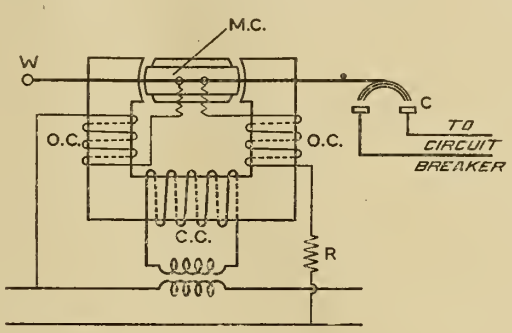


Fig. 10.

hold open the contacts C. Upon a reversal, O C opposes C C, and if the reverse current in the latter is gradually increased it will, first of all, neutralise the ampere-turns of O C, thus wiping out the flux in the electromagnet, and finally

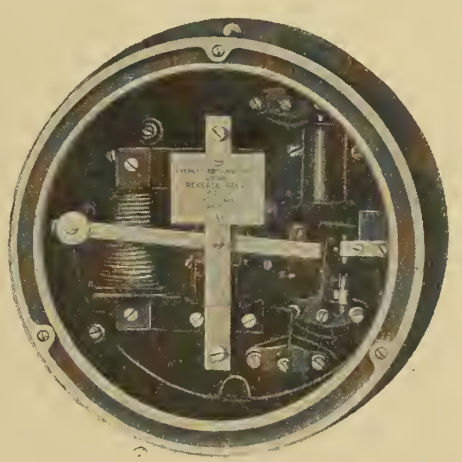


Fig. 11.

reverse it. So soon as a pre-determined value of reverse current is exceeded, the torque so produced will overcome the weight W and close the contacts C. It will be observed that if the pressure falls, the opposing ampere-turns due to

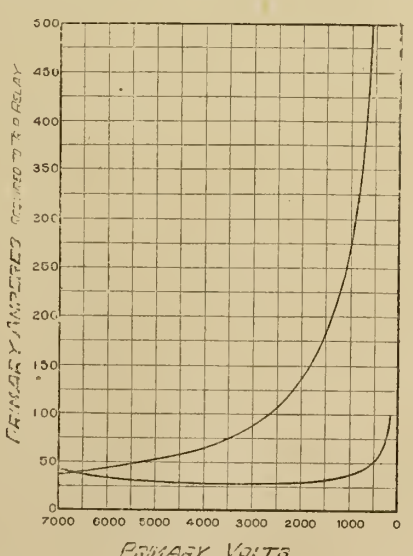


Fig. 12.

O C also decrease, so that a smaller reverse current in C suffices to produce a given flux, or, what comes to the same thing, a given reverse current in C C produces a larger effective flux.

D

The effect of this is very clearly seen in the lower curve of fig. 12, which represents a typical curve obtained with one of these relays, and shows the relation existing between the bus-bar voltage and the current necessary to trip the relay at that particular pressure. The normal primary voltage in this case was 6,600 volts, and the full load primary current 40 amperes. The relay was set to trip with this current at normal voltage, and as the pressure falls it will be noticed that the current necessary to actuate the relay at first falls slightly (at 3,000 volts it is approximately 30 amperes), and then gradually increases until at 660 volts (or one-tenth of the normal) it is something under 50 amperes.

Thus it may be said that for all practical purposes the relay in question *responds to a given reverse current, irrespective of the pressure*, and, as a consequence, this tripping current may safely be made the full load current of the circuit, or, at any rate, need never be made less than half this value. Hence it follows that such a relay can be made very robust, and may be provided with carbon contacts in place of mercury. Besides this, it is self-resetting so soon as the circuit has been opened by the breaker, and, above all, it has no tendency to act with a trifling reversal, such as often occurs, as has been said, through a local surge on the system.

The upper curve in fig. 12 shows the corresponding curve for a reverse-*power* relay of well-known make, and the contrast is remarkable. In this case, the increase of current with a falling voltage is enormous. For example, at 3,000 volts it amounts to 90 amperes, and at 660 volts (that is, at one-tenth the normal pressure) it is increased to no less than 500 amperes, or, in other words, the relay will not operate under these conditions with less than 1,000 per cent. overload.

In view of these facts, the statement, still sometimes made, that the working of a reverse-power relay is practically independent of the voltage, is, to say the least of it, misleading. What is most probably meant, is that such a relay will trip with a given amount of power irrespective of the voltage. Unfortunately, however, it is an excessive *current* which does the damage. To take, as an example, the case already cited of a number of generators running in parallel and each protected by a reverse relay: on the occurrence of a short in one of the generators, the healthy machines will at once send current into the faulty one which represents a dead short across the bus-bars. The voltage may well fall to something like 10 per cent. of its normal value, and under these conditions the relay will not act until the current flowing into the faulty machine amounts to more than ten times the full load, great damage being done in the meantime.

The trouble is often aggravated by the fact that the current and voltage may be out of phase with one another, and as the tripping of the relay depends upon volts × amperes × power factor, the necessary current is still further increased. In fact, as was first pointed out by Mr. Leonard Andrews, to whose initiative the use of reverse relays in this connection is largely due, it is possible, under certain conditions, for a generator which has lost its field to give a forward current of extremely low power factor, instead of taking a reverse current at all. Although the current is a forward one, it has the same effect on the system as a short-circuit, and for this reason he suggested that reverse relays (or "discriminating relays" as he preferred to call them) should be given a spurious phase displacement so as to make them act, not only with a reverse current, but also with a forward current of very low power factor. This is easily done with most forms of reverse relay, but a very simple arrangement, and one often adopted, is to place a small trip coil in the generator field circuit, so arranged that should the exciter current fail from any cause, the circuit-breaker will be opened and this particular generator isolated.

Some engineers prefer that, instead of the relay opening the circuit-breaker direct, it should light up a signal lamp so as to give warning to the attendant that something is wrong with that particular circuit, it being then left to him to clear the fault.

Another position in which reverse relays are very frequently used is at the further end of feeders where they enter a sub-station, to prevent current from the motor-generators installed there from flowing back along the feeder into a fault, should one develop. In such cases, the low settings already alluded to are particularly inadvisable, owing to the surges often set up by the hunting of the sub-station plant with any sudden change of load. Such hunting is usually quite temporary and harmless, and it is most undesirable for the feeder circuit-breaker to be opened thereby. On the other hand, owing to the resistance of the feeder, it is probable that on the occurrence of a bad fault, the pressure will fall to a very serious extent, so that a relay such as that illustrated in figs. 10 and 11, which is practically independent of the pressure, is clearly called for.

Differential or Balanced Relays.—For the protection of inter-connectors and ring mains, a reverse relay is unsuitable, owing to the fact that the current may normally be flowing in either direction. On the occurrence of a fault in such a feeder, however, more current will naturally flow in at one end than flows out at the other, or if the fault be a bad one current may even flow in at both ends, and in the Merz-Price balanced system, this fact is made use of. Roughly, this system may be said to consist in placing a current transformer at each end of the line, with their secondaries connected in opposition to one another, and in series with the tripping coils of relays at each end of the feeder to be protected.

This arrangement is shown in fig. 13 as applied to the protection of a three-phase feeder; C T_1, C T_2, &c., represent the six current transformers, three being connected at either end of the line, with their secondaries in opposition as just described. So long as the currents flowing in at one end

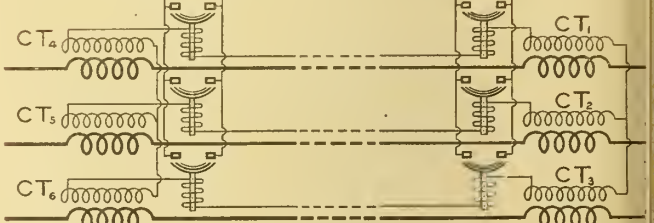


Fig. 13.

and out at the other end are the same, the secondary E.M.F.'s of the current transformer will be equal and opposite and no current will flow through the relays. If, on the other hand, some of the current finds its way back through a fault, this balance is disturbed and current flows round the secondary circuit and so trips the relays.

This arrangement, though extremely simple in principle, entails considerable complication in practice. In the first place, a number of pilot wires are required running from end to end of each feeder, and again extreme care is necessary in the design of the current transformers. It is essential that they should balance correctly, not only between zero and full load, but up to a very considerable overload, since it is a fundamental principle of this system that, no matter how great may be the overload, the relays shall not act. With the arrangement shown in fig. 13, moreover, in the event of a severe earth on the feeder destroying one or more of the pilot wires, the relays will be thrown out of action, and although other methods of connection are available, whereby this objection may be overcome, the possibility has to be carefully borne in mind.

For these and other reasons, many engineers prefer to rely upon overload relays for the protection of their inter-connector feeders and, provided proper discrimination is obtained so as to ensure that the feeder relay shall trip before that at the generating station, adequate protection is afforded, and this with a minimum of expense and complication. On the other hand, for the protection of ring mains, the Merz-Price system undoubtedly affords a very satisfactory solution, but unfortunately enthusiasts have advocated its use in season and out of season for every kind of protection, and in many cases where it is by no means so suitable.

For example, its use is suggested for the protection of generators running in parallel in place of the reverse relay arrangement already dealt with. According to this scheme no less than six current transformers are required for each

nerator as well as the three-pole relay, besides which the nding of the generator has to be broken into on each phase tween the coils and the neutral point for the insertion of ree of the current transformers, which is not always, by y means, convenient.

Fig. 14 shows the primary connections in a diagrammatic y. C T_1, C T_2, &c., represent the six current transformers, e secondaries of which are connected in opposition, pair by

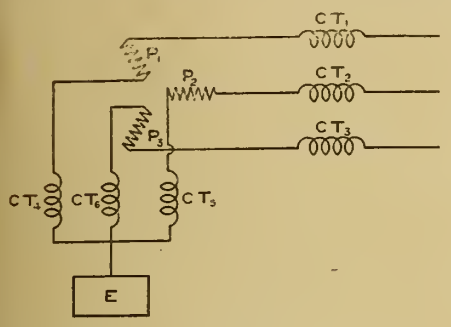


Fig. 14.

ir, and are also joined up to a three-pole relay. P_1, P_2 and represent the three phases of the generator windings. nder normal conditions, the currents in the transformer condaries balance, as has already been explained, so that no rrent flows through the relay. On the occurrence of a ort circuit between phases, however, this balance is dis-bed and the relay trips.

Apart from its unnecessary complication, it will be served that, although this system is effective against a ort circuit between windings in different phases, it ords no protection whatever against a short between the ndings of a given phase, which may constitute a very ious fault. Practically the only advantage which can be imed for this, as compared with the more usual form of otection by means of reverse relays, is that it is unaffected a fall in the bus-bar voltage, but while this argument may valid when speaking of reverse-power relays, it does not ply when considering those of the reverse-current pattern, already explained.

The differential balanced relay can also be employed for e protection of duplicate feeders, but in this case it appears possess no advantage over the reverse-relay arrangement ne of the latter being connected at the further end of ch feeder), and labours under the very serious disadvantage requiring pilot leads for each phase, running from end to d.

In some cases the differential balanced system has been ployed throughout the entire system, each individual part ng protected by a pair of current transformers, in the y already described. There are, however, two very serious jections to this course. In the first place, it is extremely ficult to protect against a bus-bar fault, either at the erating station or in a sub-station, and in the second ce, the failure of a single relay out of the very large mber connected in series leaves the whole system absolutely hout protection right back to the main generators. That s is the case will be clear when it is remembered that each k in the chain forms a perfectly independent unit, igned to protect the particular section allotted to its e, without reference to those in front of or behind it. This is such a serious disadvantage that many of the most husiastic advocates of the balanced system recommend the lusion of overload relays as an extra safeguard, and this ng the case, it would seem better to rely upon the latter clusively, with the possible exception of the protection of erconnectors. By this means perfect discrimination can be vided, and each "protection point" has a second line of ence behind it.

(To be continued.)

Strike in Manchester.—A strike is in progress at eral engineering works in Manchester, owing to the labourers anding a minimum wage of £1 per week instead of the present e of 17s. or 18s. About 9,000 men are idle.

DAY-LOADS FOR CITY ELECTRIC LIGHT AND POWER STATIONS.

By JOHN B. C. KERSHAW.

III.—Ozonisers for Ventilating and Similar Purposes.

The writer in the two previous articles of this series* has discussed applications of electricity in two distinct types of works found in all large centres of population and industry, namely, in iron foundries, and in laundries and dry-cleaning works. In this article, it is his purpose to discuss an application of another character, that has already progressed beyond the experimental stage, and is likely in time to become a regular feature of all large offices, and of all well equipped public buildings and institutions in the country.

This application is the use of electricity for purifying foul and vitiated air, by producing within it small percentages of that most active oxidising agent, ozone. This gas, it may be stated here, for the benefit of the uninitiated, is a condensed form of oxygen, and can be produced from the latter gas in various ways, chief of which is the electrical method by silent (*i.e.*, sparkless) electric discharges through dry air. Ozone is formed electrically, when a static electrical machine is worked in dry air: during thunderstorms; and also in some unexplained way by the action of the sun and tides on long stretches of sandy shore, and by the movement of clouds and air around mountain summits. In all these cases it is supposed a silent discharge of electricity is occurring through the air, and ozone is produced in large or small amounts according to the surrounding conditions. The amount of ozone found in the air is never great, but when one considers the extent of the atmosphere, the aggregate amount of ozone formed by natural agencies under favourable conditions must be exceedingly large. Ozone can always be detected by its peculiar odour in the air of many seaside and mountain resorts, and the invigorating character of these places is generally ascribed to the continual presence of the gas.

Although it is quite impossible by artificial means to give the air of closed and crowded halls or rooms the freshness and bracing characteristics of the air of health resorts, there is no doubt whatever that much more might be effected in this direction than is yet attempted, and that by the installation of more efficient systems of ventilation and purification, the fœtid and germ-laden air which we are at times called upon to breathe in crowded tramcars, motor-'buses, railway carriages, theatres, concert halls and other public places and buildings, might be rendered far less poisonous and dangerous to the average man and woman.

The ozone, when produced by artificial means and added to foul air, acts in two ways. As a concentrated form of oxygen it restores the balance between the oxygen and the inert or useless gases of the atmosphere, and thus renders breathing easier for those affected with any heart, bronchial, or lung troubles. Its more important services are, however, as a most active oxidising agent and as a germicide. The minute particles of organic matter floating in the air of all places and buildings crowded with men and women, due to the exhalations from their lungs and bodies, are burnt up and rendered harmless by ozone, while a large number of bacteria and of disease-producing germs are also rendered inactive or killed outright by this health-giving gas. If a sufficient supply of ozone can, therefore, be maintained in any place where men and women are herded together in a confined space, the harmful results will be reduced 50 per cent. and many serious illnesses will be entirely avoided.

It is not the writer's purpose in this article to deal with systems of ventilation, though these provide a fine field for the application of scientific principles, and for the installation of electrical machinery. The installation of one or more electric fans, churning up air already foul and creating draughts where they are least wanted, is not "scientific ventilation," but the reverse, and the sooner this is recognised, the better for all concerned. The first essential of all systems of ventilation is that they shall substitute pure air for foul air.

* See Electrical Review for May 12th and May 26th.

The aim of the writer in this article is to describe the more up-to-date and practical forms of electrical ozonising apparatus, designed specially for the duty with which he is dealing. Although this particular application of electricity has been slow in developing, and has been disappointing for some who entered into it in the early days, the progress made in recent years has been considerable, and quite justifies the writer's claim that in time no public vehicle or building will be considered well-equipped, which does not possess adequate and efficient ventilating and air-purifying machinery and apparatus.

In Germany the well-known firm of Siemens & Halske is making a speciality of this application, and has brought out several designs and sizes of ozoniser for air purification and

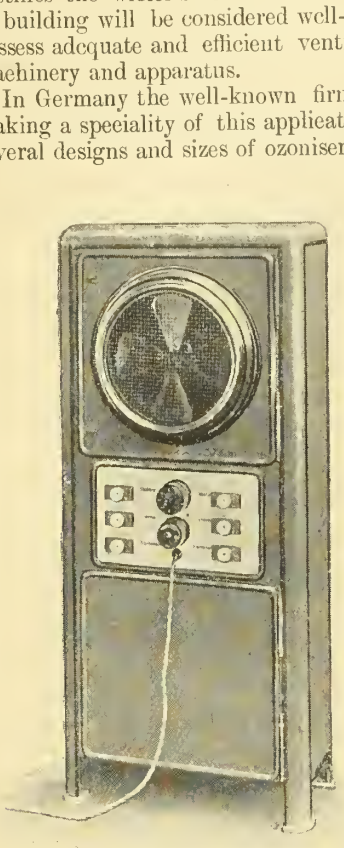


Fig. 1.—Ozoniser for d.c. Circuit.

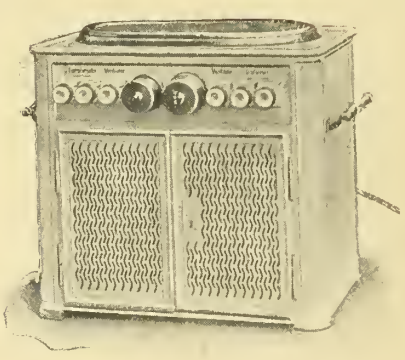


Fig. 2.—Vertical d.c. Type. Siemens Ozonising Apparatus.

ventilation purposes. These are, as regards the ozonising element, modified forms of the original tube ozoniser constructed by Werner von Siemens in the year 1875. This ozoniser consisted of two glass tubes, one slightly larger than the other, fixed concentrically, and coated evenly with tinfoil on the two faces most distant from one another. The metallic coverings were then connected with the terminals of a high-potential electric machine, and a current of filtered and dry air was passed through the annular space between the two glass tubes where the sparkless discharge occurred. Under these conditions ozone was produced in quantities dependent upon rapid withdrawal of the air to avoid overheating, and upon the absence of sparking, over-heating and sparking being conditions which have an unfavourable effect upon the output of ozone. The present day ozoniser of Siemens & Halske is still of the tube type, but the inner glass tube has been replaced by a metal cylinder, and the outer tube is surrounded by water. The sparkless electrical discharge occurs between the inner metal cylinder which is connected to the source of high-tension electricity and the external metal coating of the surrounding glass tube, which is kept at the earth potential. The oxygen of the air, passing through the annular space separating the metal and glass tubes, is thus ozonised. The ozoniser is increased in capacity simply by adding to the number of tube units, and figs. 1, 2 and 3 show the forms in which it is used for ventilating purposes. In their latest publication relating to this application, Messrs. Siemens & Halske give a list of 34 large installations of ozonisers for ventilation and air purification in Berlin and other towns in Europe, the list including the German Parliament House, the Town Hall at Amsterdam, the freezing chambers of the slaughter houses at Cologne, Dusseldorff, Potsdam and Erfurt, and a large number of theatres, concert rooms, hotels and banks, &c. The largest of these installations is that of the Reichstaggebäude, in Berlin, which has a capacity of 200,000 cb. metres (7,070,000 cb. ft.) per hour. The ice skating rink at the Admiral Palast, Berlin, is another big installation, producing 30,000 cb. metres (1,060,500 cb. ft.) of purified air per hour.

The "Playing Hall" at the Monte Carlo Casino is, however, likely to be better known in this country than either of the above. An ozonising installation producing 2,121,000 cb. ft. of purified air per hour is attached to this public gambling saloon for the comfort of its patrons, who cannot therefore, in future ascribe their ill-luck to any form of cerebral disturbance produced by the vitiated and overheated atmosphere they were formerly called upon to breathe.

The Ozonair Co., of London, appears to be the only company in this country which has made a permanent success of the manufacture and application of ozonisers for various purposes, including that of air purification. Many of the earlier inventors and experimenters in this field of research (as so often happens) have failed to weather the trying period which usually separates the introduction of an new invention or application from its ultimate success.

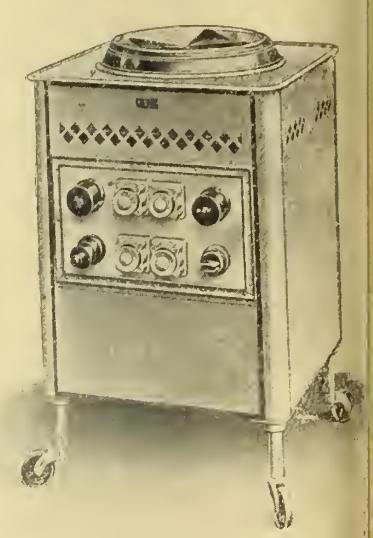


Fig. 3.—Portable Set.

The Ozonair Co. owns the patents of the Rosenberg type ozoniser, which differs from that of Siemens & Halske in several important details. The ozoniser is of the plate type, no dielectric of glass or other material separates the two

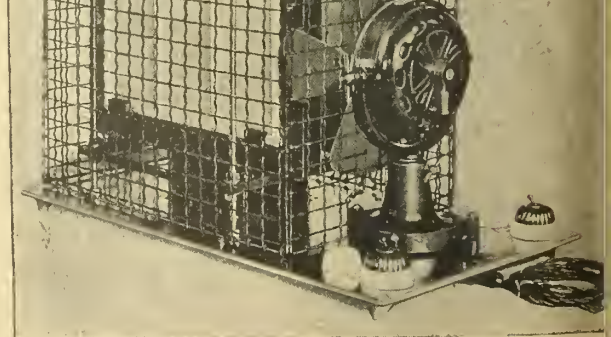


Fig. 4.—"Ozonair" Large a.c. Self-Contained Generator

discharging surfaces, and sparking is avoided by employing copper gauze as the electrode material. Each complete element of the Rosenberg ozoniser is composed of a thin sheet of micanite, covered on each side by copper gauze, of 40 mesh to the inch. The air is passed between two or more of these gauze ozonising elements placed at a distance apart of 4 in., electricity at 4,500 volts being employed to give the silent discharge. The absence of sparking under these conditions is ascribed to the large number of rounded projections

230,000 to every sq. ft. of gauze surface) from which the ischarge occurs, no single point of this being at a ufficiently high potential to bridge the space with a spark. The Rosenberg ozoniser is made in various sizes and forms, s shown in figs. 4, 5 and 6. The company is able to give list of 26 firms, &c., who are now using its ozonisers nd apparatus for air purification in the United Kingdom, nd states that a large number of equipments of ventilating

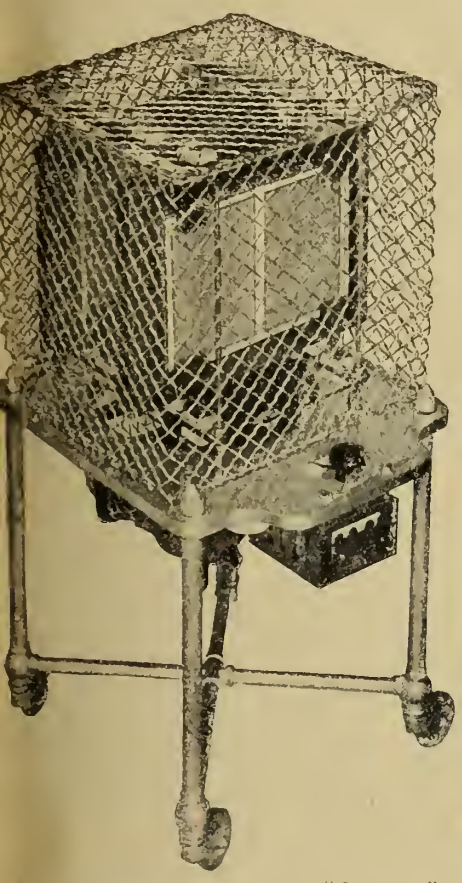


Fig. 5.—Large Portable d.c. "Ozonair" Generator for Hospitals.

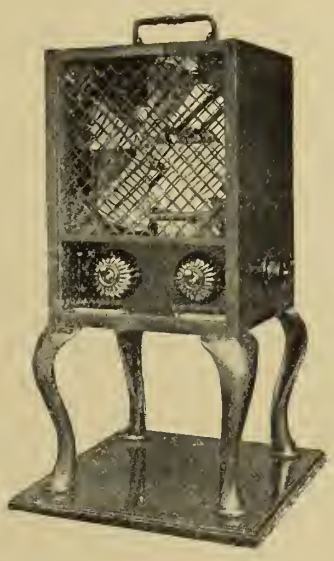


Fig. 6.—Small Portable Generator.

nd ozonising apparatus have been sent to clients in the Colonies and abroad. Included in this list of English users re the following :—D. H. Evans & Co., Oxford Street ; Lloyd's ; the Royal Exchange ; His Majesty's Theatre ; the Piccadilly Hotel ; and the Royal Courts of Justice.

As regards the yield and working costs of the two types f ozoniser described in this article, the only tests that have ome under the writer's notice give 184 grammes of ozone er H.P.-hour for the Rosenberg type of ozoniser, and 0 grammes for the Siemens & Halske type. It is quite robable that the first named yield is too high, and the econd too low for the present-day machines, and that from 5 to 100 grammes of ozone represents their average yield nder normal working conditions. These figures represent n efficiency of from 7·5 to 10·0 per cent. The cost of ,000 grammes of ozone depends chiefly, therefore, upon he cost of electrical energy, and will vary from 7d. pwards, according as the KW.-hour costs 1d., or more. Coming to more practical figures of the cost of air purifica- ion, Messrs. Siemens & Halske state that the electrical power equired for an ozoniser dealing with 1,000 to 5,000 cb. netres (35,000 to 175,000 cb. ft.) of air per hour lies between 0 and 150 watts, and that a complete ventilating equip- ent, including the fan, for a building requiring 21,000 cb. ft. f purified air per hour could be run with a power con- umption of 175 watts. Ozonair, Ltd., give 70 and 130 watts s the power required for installations producing 30,000 and 0,000 cb. ft. of purified air per hour respectively.

The power consumption decreases with the size, and a omplete Siemens & Halske equipment yielding 189,000 b. ft. of ozonised air per hour could be run with a power onsumption of 590 watts.

These figures do not allow the cost of the actual ozone to e calculated, as the concentration of the ozone in the treated ir is not stated ; but they show that the cost of air purifica- ion by means of ozone is not prohibitive, and that, in view of the benefits which may be obtained in health and freedom from illness, the cost may be regarded as trifling. It is important, however, that the air should be filtered and dried before passing into the ozoniser, and some of the past failures have been due to neglect of these essential conditions of success.

Postscript.—In Article I* of this series, the writer regrets that no mention was made of the fact that the Rapid Magnetting Machine Co., of Birmingham, have for some years manufactured and placed on the market in this country electromagnetic machines for recovering iron from all kinds of waste materials, including cupola slag and ashes, foundry sand and box-makers' waste and sweepings. The company named have supplied machines of this character to many of

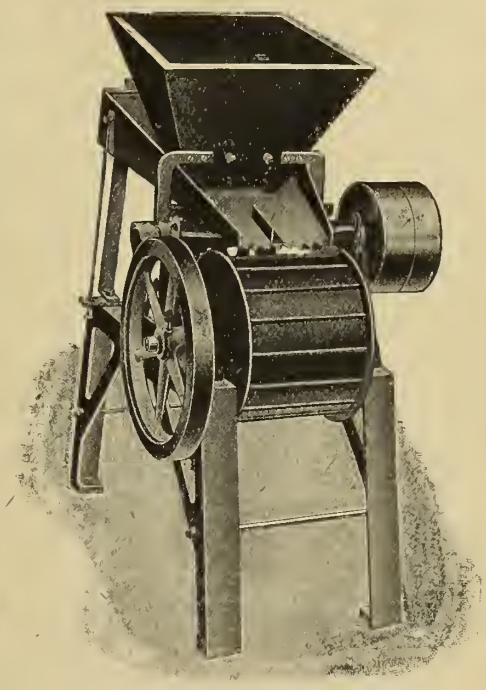


Fig. 7.—"Magnetting" Machine, Standard Type.

the largest firms in the general engineering and metal industries in the United Kingdom, and also to many firms engaged in other manufactures, H.M. Government, at Woolwich Arsenal and Dockyard, being among the users of

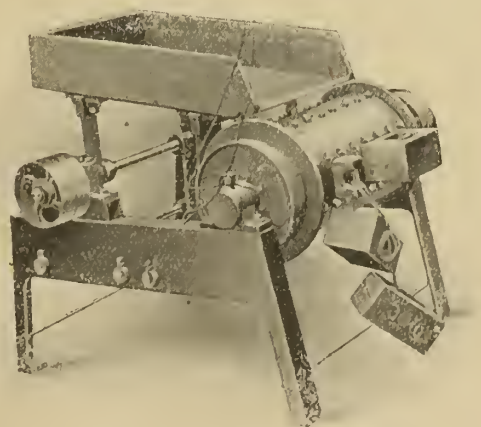


Fig. 8.—"Magnetting" Machine, Type E.

the machines made by the Birmingham firm. This fact cuts the ground from under the implied reproach that manufacturers in this country were not alive to the value of these important and waste-saving devices, and were neither manufacturing them nor using them.

Two of the machines made by the Rapid Magnetting Machine Co. are illustrated herewith in figs. 7 and 8 ; they differ from those described in Article I only in the arrange-

ment of the internal electromagnets which produce the external magnetic field. These electromagnets are placed radially with their poles towards the inner surface of the revolving drum, which is made with lateral ribs or with studs to assist in retaining the magnetised particles or pieces of iron.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Battery Maintenance.

I notice under your "Correspondence" columns in the ELECTRICAL REVIEW for the week ending July 28th, a letter on battery maintenance, signed by "J. S." Your correspondent objects to a graduated system of payments being adopted, but it must surely be obvious that, particularly with new stations, it is not only desirable, but quite sound financially, to keep the payments for maintenance during the first few years low, increasing them as the wear on the battery increases, and, incidentally, as the revenue of the station is better able to afford the increased expenditure. This argument is so logical that I should not have referred to the letter from "J. S.," but for his remarkable final statement, where he says: "It seems to me a most reprehensible practice to maintain under such a scheme as this, as it necessarily means penalising the future ratepayers for the sake of the present ones."

What can "J. S." mean? Surely he understands that the revenue of an electric power station, whether company or municipally owned, is contributed by the consumers, and that all such charges are paid out of the revenue thus received.

What, then, has the ratepayer, unless he is also a consumer, got to do with the matter, either at the present or in the future?

I fear that "J. S." has, perhaps unwittingly, used one of those expressions which sound so glib and mean so little, but the "grievances" of the ratepayer, particularly where municipal electrical undertakings are concerned, have, during the past, been so very much overrated that it seems a pity for such a misleading expression to be allowed to circulate in a technical journal.

Percy E. Rycroft,
Engineer and Manager.

Electricity Works, Hounslow,
July 31*st*, 1911.

Representatives Abroad.

It is good to see your leader of July 14th emphasising the importance of our manufacturers maintaining expert engineering representatives abroad. This happens to be a matter which some amount of travel and residence in the Colonies has brought prominently to my notice.

With many manufacturers the usual plan appears to be to appoint some firm of general agents, whose principal business is handling goods of a character remote from engineering apparatus. Now such appointments defeat their object, because the qualified engineers who may have orders to place want to discuss engineering matters with engineers. To send non-technical men out from home is still worse, for there are more than enough of that type already abroad.

It is by meeting in business and at engineering societies that engineers learn much from each other, and those already abroad are more dependent on this method of keeping in touch with what is going on than we are in England. If anything, therefore, the representative abroad should be a better man than would be appointed to a similar position in, say, London.

Some time ago, I ventured to define the trader engineer for abroad as follows: In addition to a workshop training he must have drawing office and estimating office experience. He should be of good address, athletic, tactful, and be socially inclined. He must be equally at home in discussing an engineering paper before a scientific society and in talk over financial matters with the manager of a shipping ho or bank. He should not only be able to follow up a clinch a Government or municipal contract where the mo is safe, but he must have the "nous" to assist those of long-credit customers who he thinks will succeed. M a firm's success has been due to the fact that it helped al some "battler" in his early days.

Further, the representative should be able to talk t possible customer in such a way that the customer can ea follow the argument. To "snow" one man under wit technical description may be as wrong as talking in elementary a way to one who is highly trained technically.

Our present methods of training young engineers are calculated to turn out quite the right sort of man, pa because they have so few facilities for gaining knowledge estimating and commercial work. It should not be diffic however, to make the necessary change, for we have splen material to work upon.

E. Kilburn Scott

Bromley, *July 27th*, 1911.

LEGAL.

Electric Lamp Trade Mark.—Registration of Name Refused.

In the Chancery Division on Thursday, July 27th, Mr. Jus Warrington heard an application by Pope's Electric Lamp Co., L to be allowed to proceed to the registration of the name "Po in connection with their incandescent electric lamps. From time of the commencement of their business, or very shortly af wards, the company adopted the practice of putting the n "Pope" on their lamps, the packages in which the lamps w enclosed, their circulars and advertisements, and used the nam connection with their lamps in many other ways. By this me in the trade, and with those who were familiar with the name the various manufacturers of incandescent lamps, the lamp bear the word "Pope" had come to mean a lamp manufactured by Po Electric Lamp Co., Ltd.

Mr. A. J. Walter, K.C., who appeared with Mr. J. H. Gray the applicants, said the application was made to the Board Trade in accordance with the usual practice, and the Bo referred the matter to the Court. There were two questions to considered; first, was the word distinctive; and second, if not, it acquired a distinctiveness in prior user.

The Attorney-General, who appeared with the Solici General, and Mr. Sargent for the Board of Trade, asked Court in the exercise of its discretion not to allow the name manufacturer to be deemed to be a distinctive mark. This entirely a matter of discretion, assuming that the applicauts brought themselves within the section of the Trade Marks 1905. If they were within the section, if once they established the name was a distinctive mark—that it was adapted to distingu they had still to satisfy the Court that it was a right case in wh the Court ought to allow the mark to be deemed a distinctive ma The applicants must not have a monopoly of the use of a partic name any more than they could have the right to the use o laudatory epithet. If the Court should exercise its discretion favour of permitting the applicants to proceed to registration would follow that the trade marks of the future would consist t very large extent of names.

His Lordship said that, in his opinion, the name being for essential purposes the name of the manufacturer was not adapte distinguish the goods of the manufacturer from the goods of ot persons. There were many persons of the name of Pope, and name of one man named Pope was not adapted to distinguish goods from those of another manufacturer of the name of Pc If it was not in its nature so adapted, then it seemed to Lordship it could not become adapted by any amount of u Even if it was, and the evidence established that the name distinctive, in either view of the case the Court ought not to m the order asked for. He must, therefore, refuse the application.

The Solicitor-General said as this was the first case of kind under the section of the Act, the Crown did not ask for co but this was without prejudice to any future application of same kind.

Municipal Undertakings and the Income Tax.

On Saturday last, in the Second Court of Appeal, the Master of Rolls and Lords Justices Farwell and Kennedy delivered th reserved judgment in an appeal in the case of Leeds Corporation Another *v.* Sugden (Surveyor of Taxes), disputing the met adopted by the Income Tax Commissioners in assessing the inco tax payable in respect of the Corporation's undertaking properties. Prior to 1901 the Corporation had raised money various undertakings, and in respect thereof had given spec charges on specific undertakings. In 1901 the Corporat obtained a private Act consolidating the various loans and cre

ing a fund out of which the interest on the loans was to be paid. Into that fund the profits arising from the various undertakings were to be paid, and in so far as this fund was insufficient to meet the total amount payable by the Corporation in dividends, it was to be augmented by contributions from the ratepayers. Prior to 1901, the Corporation had an electricity undertaking, tramways, water works, gas works and markets. Some of those were now being run at a profit exceeding the amount of dividend payable as interest on the loan, while others were not making sufficient profits for the purpose, and the ratepayers were taxed to meet the deficiency. The total amount of the dividends payable by the Corporation was £285,446, and the revenue paid into the consolidated fund from the various undertakings was £270,000, leaving £15,000 odd to be made up by the ratepayers. With regard to the £15,000 no question arose, but the Commissioners had assessed each undertaking separately, and with such regard to the consolidated fund as the Corporation contended, that on certain of their undertakings they paid the income-tax twice over. Though the Act of 1901 required that separate accounts should be kept with regard to each undertaking, the Corporation contended that it was merely for the purpose of book-keeping and adjusting the accounts between one class of ratepayer and another, and the intention of the Act was that all the various undertakings should, as regards revenue and expenditure, be treated as one, and the profits from one would go to meet any deficiency on another. The result of treating them separately for income-tax purposes was that the Corporation were required to pay income-tax on £78,519 more than they should. The Corporation claimed the right to take the sum necessary to make good any deficiency on one undertakiug from the excess of profit made by another, before such profits were assessed for income-tax. The matter was brought before Mr. Justice Hamilton, who upheld the contention of the Commissioners against the Corporation, and from that decision the Corporation appealed.

The Appeal was argued by Mr. Danckwerts, K.C., Mr. Ryde, K.C., and Mr. Jeeves, for the Corporation; and the Attorney-General (Sir Rufus Isaacs), the Solicitor-General (Sir John Simon), and Mr. Finlay for the Crown.

In giving judgment, the Master of the Rolls said the question the Court had to determine was whether the Leeds Corporation could, as against the losses on certain of its undertakings, put the profits and gains arising from other municipal undertakings, and deduct a sum equivalent to the amount for the purpose of assessment of the income-tax payable in respect of the Municipal Corporation loans. In respect of each of the five undertakings large loans had been contracted which were chargeable either on the city fund or the consolidated fund, but in no instance did the security extend to both. Though the ratepayer contributed to both funds, the proportions payable differed, and there was express provision for carrying over the balance and net receipts after paying the interest on the money borrowed for the undertaking, to the city fund or the consolidated fund as the case might be. The Leeds Corporation Act of 1901 was certainly one of the most remarkable Acts that had ever fallen to him to attempt to understand. He said attempt, because he thought it passed the wit of man to understand it. By it, however, all the loans were charged indiscriminately on all the assets of the Corporation. All the charges were to rank equally, and *pari passu* without priority or preference. That, in his opinion, was the meaning of the Act, though one section seemed to contradict another. He came to the conclusion that the obligation on the Corporation was to pay the interest due on the various amounts without reference to the sources from which they were derived. Once they had decided that the whole of the interest was payable out of one common fund, the judgment of Mr. Justice Hamilton could not be supported, and the appeal must be allowed with costs, both of the appeal and in the Court below.

Lord Justice Farwell, in giving judgment to the same effect, said that he could see nothing in the Corporation Acts or the authorities cited to support the contention of the Crown that the Corporation was liable to be assessed on the profits of each separate undertaking.

Lord Justice Kennedy dissented in his opinion, he said the Act of 1901 in no way affected the Corporation's obligation, but was only to widen the scope of the security. He thought that the obligation to keep separate accounts was not imposed merely for book-keeping purposes. He came to the conclusion that not only were the profits and gains from one undertaking not used for another, but that they could not have been lawfully so used. He thought the judgment of Mr. Justice Hamilton was right and the appeal ought to be dismissed.

In accordance with the view of the majority of the Court the appeal was dismissed with costs.

Compensation for an Electrician.

On Thursday, last week, in the West London County Court, his Honour Sir W. Lucius Selfe was applied to for an award under the Workmen's Compensation Act, in favour of George Lane, an electrician's mate, of Leathwaite Road, Battersea, S.W., the respondents being Messrs. Garrett, Hunt & Co., electrical engineers, Central Parade, Catford, S.E. Mr. Engelbach, on behalf of the applicant, stated that while at work at a private house in Pembroke Road, Earl's Court, W., Lane was knocking a nail into a floor-board which had been removed to allow the wires to be laid, when part of the nail broke off and flew into his right eye, which it permanently injured. He put his earnings at 28s. per week. Applicant bore out this statement, and added that his left eye was now being affected, and he could not make much use of it without spectacles. The right eye was now practically useless, he being able to distinguish light and dark only. Answering Mr. Douglas Knocker (instructed by Vandam & Co.) for the respondents, Dr. Pouck said that the applicant could work as usual, but he must not do it for a full day, or without spectacles. Mr. Daniels, managing director of the respondent company, proved that since the accident applicant had earned a higher average wage than before, at a different class of work. He had completed his jobs in a workmanlike manner since the accident. —His Honour made an order for 4s. a week since January last till June, when the applicant resumed his employment.

Thermal Syndicate, Ltd., *v.* Silicaware, Ltd.

In the Chancery Division on July 31st, Mr. Justice Swinfen Eady gave judgment in this action, which was reported in our issues of July 21st and 28th.

His Lordship said the action was brought in respect of alleged infringement of letters patent granted to J. T. Bottomley and Arthur Paget for improvements connected with the working of silica. The patent disclosed a process whereby silica could be worked on a commercial scale. The great utility of such an invention was beyond question, but defendants disputed its validity and denied the infringement. The defendant company imported and sold in England articles made abroad from silica, the articles complained of by plaintiffs were said to be made on the Rhine. He had had great difficulty in ascertaining the actual process used in the manufacture of defendants' articles, but it appeared that they were made by semi-fused silica, so semi-fused by means of an internal resistance core. Defendants denied that their process made use of the pressure of internal gas in the same way as the plaintiffs. Their fusions, they said, were not cigar-shaped, but were cylindrical, the upper end open-mouthed or trumpet-shaped, from which the gases readily escaped. The hollowness was obtained by capillary action, the sand molecules receding from the carbon core. It was clear from the evidence that the plaintiffs' process, as described in their specification, was sufficient to achieve the purpose desired, whilst, on the other hand, the evidence of the defendants in regard to their exhibits was extremely unsatisfactory and unreliable. He was of opinion that the articles complained of were made by a process the same, or substantially the same, as that of plaintiffs' invention, and the separation of fused silica at the core was obtained by gas pressure. In his judgment the plaintiffs' patent was a valid one, and the defendants had infringed it. He would grant the injunction asked for, with costs, an inquiry as to damage, and a certificate of validity. He also made an order for immediate delivery upon terms that the plaintiffs undertook in case of appeal not to dispose of the articles so delivered up; or, in the alternative, an order for destruction.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Igranic Remote-Controlled Starter.

The Adams Manufacturing Co., Ltd., of 106, New Bond Street, W., have placed on the market an interesting starter, which we illustrate in fig. 1.

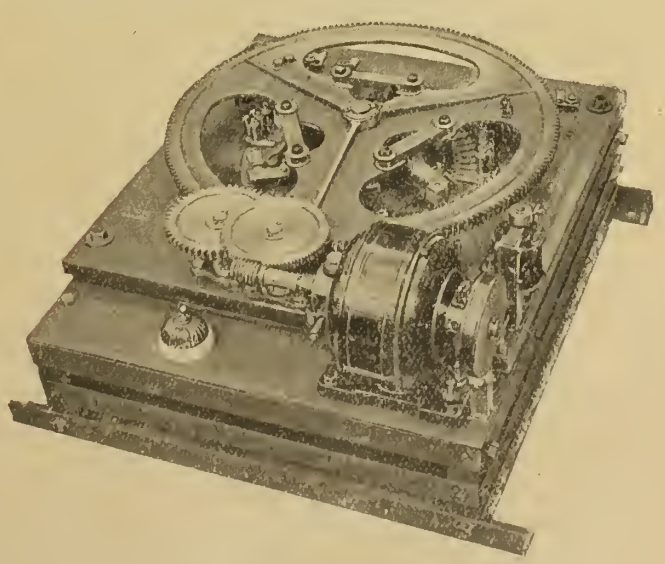


Fig. 1.—Igranic Motor-Driven Starter.

This starter is of the motor-driven three-phase remote-controlled type for use with slip-ring induction motors, and is operated by a tumbler switch fixed in any convenient position. With the switching "off" of the tumbler switch, the control motor brings

the controller into the off position, and it is ready for starting up again when required.

Our view shows the control motor geared to the spur-wheel carrying the brush contacts, &c.

G.E.C. Knife Switches.

The General Electric Co., Ltd., of 67, Queen Victoria Street E.C., have recently put on the market a complete line of chopper-type switches, which are manufactured at the Witton Works. The switches are made and stocked for maximum 30, 60, 100, 200, 300, 400, 600, 800, 1,000, 1,200, 1,600, 2,000 and 3,000 amperes, and any larger capacities up to maximum 10,000 amperes capacity can be made up at short notice. The advantage of the many sizes is that it does away with the necessity to pay for a 600-ampere switch for, say, 350 amperes, because the 600-ampere switch happens to be the nearest larger size.

The same general design has been carried through the whole range, and the appearance of the switches of different capacities is therefore quite similar, an advantage which will be readily appreciated by switchboard makers, because it certainly improves the appearance of a switchboard if the apparatus mounted thereon is of a uniform type.

The switches are amply dimensioned; the current density nowhere exceeds 1,000 amperes per sq. in. of sectional area for high conductivity copper, and 60 amperes per sq. in. of surface area in the contact clips. With regard to surface density, the makers believe

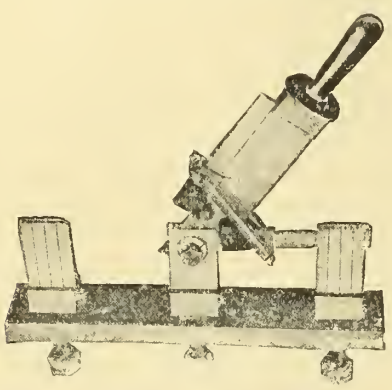


Fig. 2.—G.E.C. Change-over Switch.

these switches are the most amply rated of any obtainable; this is a decided advantage, as most losses in switches are due to insufficient contact surface in the clips, and in addition, this allows of the switches being overrated as much as 50 per cent. permanently without dangerous heating, and much higher for short periods, which may be handy in an emergency.

The illustrations explain the design very well. The flipper blades, which cause the quick break, are fitted with a steel stamping where they are hinged and the main blade is bushed with a steel bush for the hinge pin. This makes the actual wearing parts very strong. At the handle end, the main blades are provided with solid square steel blocks in which the handle is screwed. To hold

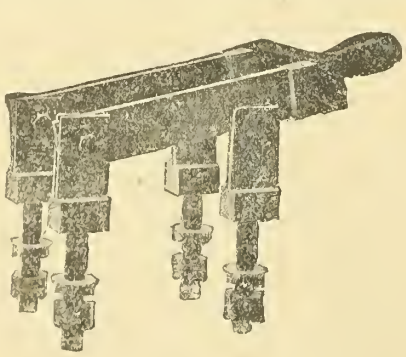


Fig. 3.—G.E.C. Double-pole Switch.

the blade in the "off" position in change-over switches, or where there is no room to swing the switch right over, shaped steel springs are provided, which are fixed to the side of the hinge contact and act on the rounded end of the flipper blade pivot pin. The switches are stocked "single," "double" and "triple" pole for front and back connections. A larger number of poles can be made up on short notice. The switches are jig made, and all parts are interchangeable. The finish is copper and black.

Vulcan Reducing Valve.

Messrs. Wm. Geipel & Co., of Vulcan Works, St. Thomas Street, S.E., have recently introduced a reducing valve, which they claim is both extremely accurate and durable. It is made in sizes ranging from ¾ in. diameter inlet to 10 in. inlet, and for medium and high pressures, the latter with and without superheat. Referring to fig. 4, it will be seen that steam enters at E, impinging on the bottom of valve V and top of the floating piston K, which is of larger diameter; a slight leakage is provided round the piston into the space r, past the valve k, controlled by the steel diaphragm p, and through channel c to the low pressure side A, and this controls the working of the main valve, as a drop in pressure at A results in the diaphragm valve closing, and the pressures on either side of the piston becoming equal, when the

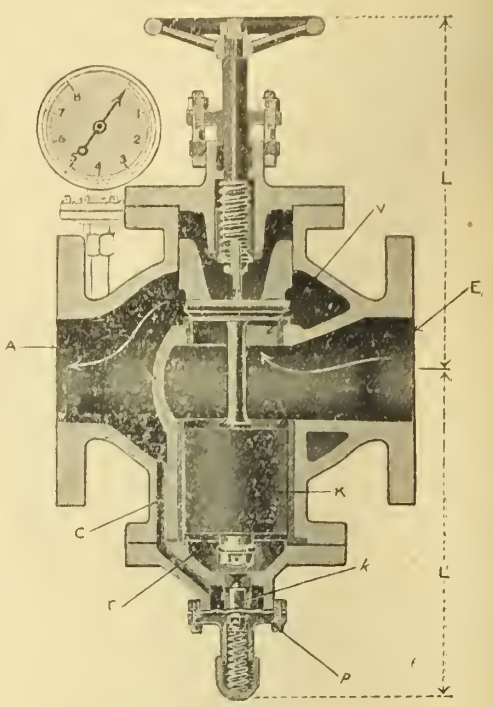


Fig. 4.—Vulcan Reducing Valve.

main valve V opens; while with an increase of pressure at A the diaphragm valve opens, reducing the pressure beneath the piston, which moves down closing the main valve V. A small spring below the diaphragm is provided, by means of which the outlet pressure can be adjusted with accuracy. The combined dimensions L L range between 13 in. and 42 in. in the smallest and largest valves.

Locking Spring Terminal.

A useful device, the invention of Mr. H. D. Thomas, is being introduced by Messrs. Bell Bros. & Co. (London), Ltd., of 104, Bishopsgate, E.C. As shown in the accompanying illustrations, it consists of a spring contact of phosphor-bronze, with a hump on its upper surface; the terminal nut is provided with a groove engaging with the hump, so that it is impossible for the nut to

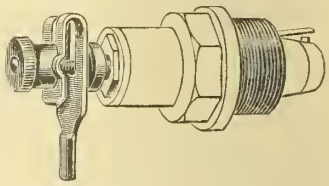


Fig. 5.—Locking Terminal for Ignition Purposes, &c.

slack back, or for the contact to slip out of the terminal. In the smaller sizes such as are used for motor-car sparking plugs, &c. (fig. 5), the spring is slotted so that it can be pushed on without disturbing the nut, and it can readily be detached by pressing the



Fig. 6.—Heavy Locking Terminal.

end of the spring with the thumb. Larger terminals (fig. 6) are drilled, and cannot be removed without taking off the nut; in this case the shape of the hump and groove is such that the nut can be turned with a spanner. Ample contact surface and spring pressure are provided.

Electric Device for Meat Marking.

In the course of his presidential address to the Conference of Veterinary Inspectors, at the Royal Sanitary Institute Congress at Belfast, on July 28th, Mr. J. A. Jordan (Belfast) urged the necessity for meat inspection and meat marking. He discussed the difficulties of meat branding, and said that a few months ago he succeeded in producing an electric device, of which the following was a description. The invention related to a portable electric

branding or stamping apparatus which would be instantly ready for use, and which would make a clear, absolutely indelible and unobjectionable mark upon the meat. It consisted of a portable stamp or brand-holder, preferably a rectangular box made of metal or other suitable material, and having a plate secured to it by means of bolts screwed into sockets provided in the bottom of the box. Holes were provided in the plate, and above it resistance coils were arranged and wrapped round mica, or equivalent strips encased in mica or other suitable covering. The resistance coils were at one end, suitably connected together, and at the other end they were connected to terminals joined to the source of supply of electricity by means of flexible wires. The stamp or brand might be of any desired shape, and made to give any desired mark on the meat: it was arranged above the resistance coils and secured to the holder by means of studs so that it could, if desired, be replaced by another brand. The box was provided with a handle, whereby the device might be carried about and be held against the meat for the purpose of branding. The arrangement of the device described was such that when the electric current was passed through the coils the brand above or in front of the coils would be heated to the desired degree, so that on placing it against the meat a corresponding mark or brand would be obtained thereon.

Neville Illuminated Sign.

We recently had an opportunity of inspecting the Neville electric sign at the offices of Messrs. Lund Bros. & Co., 78, Queen Victoria Street, E.C., who have the British rights for disposal. As will be seen from the accompanying illustrations, the sign is of very simple construction; it consists of two saucer-shaped disks, on the faces of which are the letters to be shown, and both faces are simultaneously illuminated by a single lamp, in the case of a



Fig. 7.—Neville Illuminated Sign.

circular sign. For this purpose suitable conical reflectors are fixed in front of the lamp on each side, preventing it from being seen directly, and throwing the letters into strong relief. Rectangular signs can be made on the same principle, with lamps at intervals, and the reflector screen can be fitted with transparent letters; the sign can also be made one-sided, and otherwise modified in various ways, for indoor and outdoor use. It is exceptionally economical, owing to the ingenious method of illumination, and is of inexpensive construction. We understand that it has attained wide popularity in the United States.

"C. & P." Silent Auto-Transformers.

The accompanying illustration shows an auto-transformer made by Messrs. Carney & Pearn, Ltd., of Nutsford Vale Works, Manchester, S.E., in whose designs special attention has been paid



Fig. 8.—"C. & P." Auto-Transformer.

to securing small iron losses and low-voltage drop, and in waterproofing the coils: the insulation is tested with 2,000 volts A.C. Balancers, and two-circuit transformers are also made by the firm.

The Bristol Tramways and Carriage Co., Ltd.—An interim dividend has been declared at the rate of 4 per cent. per annum for the half-year ended June 30th, as last year.

BUSINESS NOTES.

Book Notices.—"Shop Management." By Frederick W. Taylor, M.E., Sc.D. London: Harper & Brothers. Price 5s. net.

"The *Journal* of the Franklin Institute." Vol. CLXXII. No. 1. July, 1911. Philadelphia, Pa.: The Franklin Institute. Price 50 cents.

Bulletins 12 and 14, of the Bureau of Mines. 1911. Washington: U.S. Government Printing Office.

Journal of the Western Society of Engineers. Vol. XVI, No. 6. June, 1911. Chicago: The Society. Price 50 cents.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders. Vol. XXVII. Parts 7 and 8. July, 1911. London: Andrew Reid & Co.

Annuary, Proceedings of the Annual Convention, and Quarterly *Bulletin* of the American Institute of Architects. 1911. Washington: The Institute.

An Ozone Undertaking.—The Ozone Gesellschaft has just been formed in Berlin by the A.E.G. and the Siemens & Halske Co., with a share capital of £100,000, for the purpose of purifying and sterilising water. In addition to the patents of the promoting firms and those of the Felten & Guilleaume Co., the company will take over the patents of the Compagnie l'Ozone and the Otto and De Fries patents for all countries excepting France, the United States and Canada.

Trade Announcements.—The Armorduct Co. have opened a depôt at 32, King Street West, Manchester, where large stocks of their specialities, cables, conduits, metal and carbon-filament lamps and general accessories will be kept for the convenience of their customers in Lancashire, Cheshire, North Wales, &c. Their representative is Mr. H. H. Hopkins.

Midland Electric Corporation for Power Distribution, Ltd.—The registered offices of this company have been removed from 14, Dale Street, Liverpool, to the company's offices at 21, Waterloo Street, Birmingham, to which address all future communications should be sent.

Messrs. Crompton & Co., Ltd., Bombay, announce that owing to the expansion of their business they have moved to larger premises at 35-37, Apollo Street, Bombay. Telegraphic address, "Cromptonco." Telephone No. 557.

The Falcon Iron Works, Ltd., colliery engineers, Oldham, have appointed Messrs. H. Mackay & Co., 4, Southampton Row, W.C., their sole agents in London and District, for the sale of the whole of their specialities, including hauling and winding engines of every description, and other colliery machinery.

The Magnus Engineering Co. announce that they have opened offices at 209, Hackney Road, N.E., and would be glad to receive catalogues and lists from manufacturers, particularly of electrical and mechanical novelties, for inclusion in a retail catalogue.

Annual Holidays.—Engineering and Arc Lamps, Ltd., St. Albans.—The offices and works will be closed from noon Saturday, August 5th, until Wednesday morning, August 9th.

The Crypto Electrical Co., 155, 157 and 159, Bermondsey Street, London.—The works and offices will be closed from noon on Saturday, August 5th, until 8.45 a.m. on Monday, August 14th.

Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden, N.W. —The works will be closed from August 7th to August 12th.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—The Dalston offices and stores will be closed from August 7th to 12th.

Messrs. Gilbert Gilkes & Co., Ltd., Kendal.—The works will be closed from Saturday noon, August 5th, until Monday morning, August 14th.

Catalogues and Lists.—Messrs. Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.—Pamphlet No. B 513, dealing with the Siemens bell signal indicator, a dial instrument showing the number of bell strokes given, for use in connection with shaft winding and haulage in mines, so as to ensure freedom from error; and pamphlet No. A 508, on the "Vibragraph," a new instrument—and the first of its kind—for measuring and recording vibration in definite units. This instrument is very small and light, exceedingly sensitive, and gives permanent photographic records.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, E.C.—Price list (Section B) of electric bells and accessories—a bulky volume, divided into five sections, and dealing with an extraordinary variety of apparatus. Section I covers all kinds of bells, relays, &c., for indoor and outdoor use, mining and other purposes; Section II relates to indicators of various types; Section III, to pushes, contacts and switches; Section IV to testing instruments, batteries and wiremen's accessories; and Section V gives diagrams of connections. There is also a general index. The great diversity and profusion of patterns contained in this catalogue should render it most useful to contractors, to whom it will be sent on application.

Derome Standard Pulley-Block and Crane Manufacturing Co., 78, Southwark Street, S.E.—Booklet 77, describing, with prices, the "D.S." improved pulley blocks, hand travelling crane, electric travelling pulley block and overhead travelling crane, and hand-controlled and electric runways. The pulley blocks can be had on approval.

The Falcon Iron Works, Ltd., Oldham.—Leaflets showing electrically-driven and other haulage gears, friction clutches, &c.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester.—Catalogue No. 2,710 of "Bailey's power pumps," covering three-throw ram pumps to suit various requirements, some of them electrically driven, as well as double-acting and quadruple-acting ram and piston pumps and special purpose pumps; also No. 1,311 relating to "Köster" air compressors, two-stage and compound, and vacuum pumps.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.—List No. M60 of "Multax" long-burning flame arc lamps, D.C. and A.C., with deposit-free outer globe and light-distributing deflector. By the patent method of enclosure, the burning hours have been increased by a further 25 per cent.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—Leaflet describing the "Cyclone" electric fans and exhausters, D.C. and A.C., of the propeller and centrifugal types, and the "Cyclone" D.C. motor made by the firm.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—List No. 7,023, relating to the "Excello" arc lamp and accessories. The list has been drawn up with particular care to make it complete, and is provided with an index cutting, a feature which the company are introducing into all their arc lamp lists to facilitate reference in their standard binders. Besides various patterns of D.C. and A.C. Excello lamps, the list explains the advantages of dioptric inner globes for lighting large areas evenly, and gives details of reflectors and covers, resistances and chokers, transformers, adapters, winches, &c., with dimension sheets at the end.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets showing aluminium battery connections, and the process of butt-welding heavy aluminium feeder connections on site, to the specifications of Sir A. B. W. Kennedy.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Catalogue of fans and small motors, including several new lines. Table standard fans, ceiling fans, special cabin fans, and port-hole, chimney-shaft and box blade fans are illustrated and described. Besides ordinary motors, of $\frac{1}{10}$ to $\frac{2}{3}$ B.H.P., a variety of new types of motors for polishing and buffing, &c., motors with vertical spindles, motors for driving looms and gramophones, and small dynamos are listed. The motors are made for D.C., A.C. and polyphase circuits.

Messrs. O'Reilly & Macmillan, Clun House, Surrey Street, W.C.—Card relating to portable electric drilling, reaming and tapping machines, with mechanical overload release, and electric grinders.

Messrs. Perry & Grinsell, Ltd., 1 and 2, Leopold Street, Birmingham.—Leaflet C1, relating to patent petrol-electric sets for country houses, &c., with automatic control—the engine starting when the battery is discharged, and stopping when it is fully charged; E1, about the use of wind power for generating electricity; and R1, describing the "Dallett" patent electric clocks, with dials controlled by a master pendulum.

Messrs. Phœnix Electric Heating Co., 17, Morwell Street, London, W.C.—Catalogue of Phœnix electric heating and cooking apparatus of all kinds, all British made, with increased discounts. The large variety of applications of electric heating here exemplified clearly shows that the demand for, and popular appreciation of, such devices is rapidly growing.

The Electric Construction Co., Ltd., Wolverhampton.—Leaflet B/276 describing the "S.V.P." continuous-current motor, which is provided with a vertical commutator, effecting a saving in cost, and increasing the accessibility of the brushes. The motor is made for $\frac{3}{4}$, 1 and $1\frac{1}{2}$ B.H.P.

Dissolutions and Liquidations.—Under a compulsory winding-up order made against J. G. Childs & Co., Ltd., electrical engineers, Hawthorn Road, Willesden Green, N.W., the first meeting of the creditors and shareholders was held on Tuesday at the Board of Trade Offices, Portugal Street, W.C. Mr. H. E. Burgess, Assistant Official Receiver, reported that he did not propose to enter at any length upon the history of the company, but would shortly issue his observations to the creditors and shareholders. The position of affairs as sworn to by the directors disclosed unsecured liabilities, £20,640, and assets valued at £3,410, but as the latter were subject to a debenture charge of £5,000, there would be absolutely nothing for the unsecured creditors or the shareholders. Mr. H. W. Freshwater (A. C. Palmer & Co.), chartered accountant, had been appointed as Receiver on behalf of the debenture-holders, and that gentleman had valued the assets at between £2,000 and £2,500. He had stated that he was at the present time nearly £1,000 out of pocket on contracts. When he went into possession, he kept the works going in order to complete those contracts which he hoped would bring in a profit. A large loss, however, had ensued, and it really fell on two directors, Mr. T. S. Hill, who had advanced very considerable sums of money, and Mr. H. Turnbull. Together those gentlemen had invested several thousands of pounds, with the result that they had lost the whole of the advances. The company was formed in December, 1901, with an original nominal capital of £20,000, and was registered for the purpose of taking over the business of electrical engineers carried on by Mr. J. G. Childs. To enable a company to be formed that gentleman was joined by Mr. Turnbull, and they were appointed as directors, whilst Mr. Hill subsequently joined the board. The business taken over by the company had been in existence a little over two years, and during that time there had been a profit of £500 odd. It was thought that with more capital the business could be successfully extended, and with that view this company was formed to take over the business for £5,300 in shares and an undertaking for the company to discharge debts existing to the amount of nearly £2,000, thus making the purchase price a little more than £7,000. The trading by the company had throughout resulted in a loss averaging about £2,000 a year, or a total loss of £15,000. The Official Receiver was informed that patents had been taken out by Mr. Childs in respect of a wind turbine. That gentleman went to America to arrange for the flotation of a company to develop the invention in that country, but the negotiations fell through. It was considered that the patents were very valuable, and that something might be received for them, and the Official Receiver would be glad to receive an offer. The creditors decided to leave the liquidation in the hands of the Official Receiver, but in the absence of a quorum the meeting of shareholders was formally adjourned for one week.

Mr. Joseph Wm. Simpson has, owing to the retirement of Mr. Chas. Wm. Stanley, taken over the business of Stanley & Simpson, electricians, 9, Fort Road, and 5, King Street, Margate.

Bankruptcy Proceedings.—Alfred Sitch, electrical engineer, Brecknock Road, Finsbury Park, N.—The first meeting of creditors was held on Wednesday last week, before Mr. Egerton S. Grey, Official Receiver, at the London Bankruptcy Court. It transpired that the debtor's father carried on the business from 1860 until 1887, when he died and left it to his widow. The debtor continued the trading in partnership with his sister, under the style of W. Sitch & Co., until March, 1909, when they formed a company, registered as W. Sitch & Co., Ltd., for the purpose of taking over the business. The debtor received £250 in cash and £2,500 in shares for his interest, and his sister was allotted £750 in debentures. During the existence of the partnership the turnover had averaged from £4,000 to £5,000 per annum, but the company last year sustained heavy losses by reason of bad debts, and the sister ultimately appointed a Receiver under the powers of her debentures. The debtor attributed his present position to liabilities incurred on behalf of the company and to the collapse of the company. He returned his liabilities at £1,339 10s. 3d. (unsecured £239 10s. 3d.), and assets consisting of 2,450 shares in W. Sitch and Co., Ltd., regarded at present as of uncertain value. In the absence of any proposal the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

William Henry Ridpath (trading as Ridpath & Wells), electrical engineer, 20, Bath Street, Ilkeston, Derby.—The first meeting of creditors in this matter was held at the Official Receiver's offices, 5, Victoria Buildings, London Road, Derby, on Monday last. The statement of affairs showed liabilities amounting to £1,352 and a deficiency of £1,212. The failure was attributed to bad debts, want of capital, and keen and increased local competition. The debtor stated that he had lost £1,100 in 15 months on a business at Bridlington. This sum had been advanced by the debtor's father, and had not been repaid. The debtor started business in 1907 under the style of Ridpath & Wells, having at that time a capital of £11. On a turnover of £830 his average net annual trading profit had been £78. The debtor admitted knowledge of his position since June, 1909. The Official Receiver remains trustee.

John Dennis Carlmark, 402, High Street, West Bromwich, electrical engineer.—Notice is given in the *London Gazette* of intended dividend; last day for receiving proofs, August 12th; A. S. Cully, Official Receiver, Ruskin Chambers, 191, Corporation Street, Birmingham.

LIGHTING and POWER NOTES.

Amersham.—The Chesham E.L. and Power Co., Ltd., has applied to the R.D.C. for consent to erect overhead mains in Station Road for the supply of current.

Barrow.—Messrs. Burt, Boulton & Haywood, of London, have taken over the Devonshire Dock saw mills, at Barrow, and subject to them guaranteeing a return of £100 per annum for a period of five years, it has been decided to provide them with a supply of electricity from the Corporation mains, the extension of which is estimated to cost £913.

The Electricity Committee has authorised the engineer to have a mechanical stoker installed at the electricity works: estimated cost, £200.

Beaconsfield.—The B. of T. has informed the U.D.C. that the promoters of the Uxbridge and District E.L. prov. order have decided not to proceed with the application, which was opposed by the Council.

Beckenham.—The balance-sheet of the U.D.C. electricity undertaking was adopted at the last meeting, and according to the statement of the chairman of the Committee, the actual loss on the year was £842, but to this had to be added a previous debit balance of £251, making a total deficit of £1,093, which, however, they hoped to wipe off in two years' time. The revenue from lighting consumers was higher by £113, but the tramway supply was down by £433, due to the introduction of meters on the cars. There was an item in the accounts of £234 for the new showroom, which had popularised electric lighting at Beckenham and brought a good many customers.

Bispham.—The U.D.C., at the monthly meeting on July 26th, unanimously adopted the recommendation of the Lighting Committee that tenders from the firms specified be accepted for the supply of electrical plant in connection with the Council's proposed electric lighting undertaking.

The U.D.C. has received the sanction of the L.G.B. to the borrowing of £10,800 for the electric lighting scheme.

Bolton.—At a meeting of the Electricity Committee held on July 27th, it was decided that the Finance Committee be requested to apply to the L.G.B. for sanction to borrow £20,000 for electricity purposes. The electrical engineer (Mr. A. A. Day) reported upon the charges made for current for motive power purposes at the cold stores, and the report was approved. the recommendations contained therein to be carried out. Tenders are to be obtained, by advertisement, for the supply of 25,000 tons of coal. The Committee's inspection of the electricity works will take place early in October.

Burnley.—The town clerk has reported to the Electricity Committee that he had received from the L.G.B. sanction to the borrowing of £8,552 for extensions to the electricity plant to be repaid in 17 years, and that the board had deducted from the amount of the loan, £471, representing the difference between the proceeds of the sale of the plant superseded, namely, £380, and the amount of debt outstanding on such plant, £851, and that the sanction was given on the undertaking that whatever might be the total cost of the new plant it would be defrayed to the extent of £471 out of current income, and that the balance only should be charged against the loan.

Canada.—The Prince Rupert Hydro-electric Co. has been incorporated and organised by interests controlling the Western Canada Power Co., of British Columbia. The company has acquired control of the Timpsean Light and Power Co., the Continental Power Co., and the water rights on the Khtada and Falls Rivers, branches of the Skeena River. The water-powers are located about 42 miles from Prince Rupert, and are said to be capable of developing at least 25,000 H.P. The company proposes to develop 1,500 H.P. at once by means of a provisional power plant to supply the immediate demands of Prince Rupert, and to proceed with the construction of a permanent installation capable of supplying 15,000 H.P., to be completed within three years or as soon as the Grand Trunk Pacific Railway shall be completed to the Pacific Coast.—*Electrical World.*

The *Financial News* states that the first two 4,000-H.P. units at the Winnipeg hydro-electric plant at Point du Bois, will be started on August 15th, and three more units, making 20,000 H.P. in all, will be ready by December 1st.

Chester.—The City Council has approved of the Lighting Committee's recommendation :—(1) That Mr. A. C. Hurtzig be requested to report upon the Dee Mills water power scheme for a fee of 100 guineas and his out-of-pocket expenses ; and (2) that in the event of Mr. Hurtzig's report being favourable to the adoption of the scheme, application be made to the L.G.B. for sanction to borrow the entire sum of £10,000, the estimated cost of executing the works.

Continental Notes.—France.—A company has lately been formed in Douai with a capital of £20,000 and the title of La Compagnie Eléctrique du Canton de Marquion (Pas de Calais) to establish a central electric lighting station in the district.

Spain.—La Sociedad Electrica de Sonseca is the title of a new company which has lately been formed in Madrid with a capital of £60,000 to establish a water-power driven station for the supply of electrical energy for lighting and power purposes to the little towns of Sonseca. Ajofrin and Marjalisa, as well as several villages in the district.

Ewell.—The P.C. has decided to ask the B. of T. to consult the ratepayers before giving any licence to a company or Council for supplying electricity to the district. The Epsom U.D.C. is applying for electric supply powers for a portion of the parish.

Fife.—The contractors at Rosyth Naval Base have decided to sub-contract the building of the electric power station for the new Dockyard, and have issued schedules for intending offers. It is understood that the value of this sub-contract, which includes other structures besides the station proper, will amount to nearly £250,000.

Hanley.—The L.G.B. has sanctioned a sum of £13,094 required for cables, but has deferred sanction to the remainder of the £60,000 loan applied for recently by the T.C.

Haslingden.—The L.G.B. has given its sanction to the borrowing by the Corporation of £8,188 for equipment to enable it to supply electricity to consumers in its own area, current being taken in bulk from Accrington for this purpose.

Heston and Isleworth.—The Council has decided, in view of the recent reduction in the price of current to ordinary consumers, to reduce the price to free-wired premises from 5½d. to 5d. per unit.

Hoyland Nether (Yorks.). — Notice having been received from the Electrical Distribution of Yorkshire, Ltd., stating that it is the latter's intention to apply for a provisional order for the urban district, and asking for the Council's consent, the U.D.C. has decided to inquire from three electrical engineers what their charge would be for reporting upon the advisability and cost of an electric supply to the district.

Ilford.—In presenting the annual report of the electricity undertaking for the year ended March 31st last, Mr. Philpot said that the mechanical stokers had acted so efficiently that while 147,000 more units had been generated the cost of coal had only increased by £5 ; £2,000 more had been received from their consumers on the year. The undertaking had been in existence just 10 years. Up to date they had borrowed £181,000, and had repaid £37,000 of capital and £42,000 interest. The chairman of the Committee was congratulated upon the position of the undertaking by several Councillors.

Itchen.—The U.D.C. has decided to take steps to obtain a provisional order under the Electric Lighting Acts, and the Works Committee is empowered to make inquiries as to the cost of installation and plant.

Japan.—By the last Japanese mail we learn that the projectors of the Inawashiro Hydro-Electric Power Co. have at last received a charter from the Japanese Government. The object of the company is to put down a plant to utilise the water power of Lake Inawashiro, about 50 miles from Tokio, for the generation of electrical energy, and to transmit the same to the city for lighting and power purposes. It is stated that the new concern will undertake to supply any quantity of current from 100 H.P., whereas none of the existing companies will supply less than 150 H.P.

Lewes.—The East Sussex C.C. has decided to have the electric light installed at the Lewes Courts at a cost of £128.

Liverpool.—The L.G.B. has given its sanction to the borrowing by the Corporation of £25,000 for meeting expenditure on electricity mains.

London.—In his annual report to the City Corporation, the engineer states that there are 460 electric lamps, compared with 447 12 months before. Of these lamps 32 are centrally hung, while 374 are of the column type, and 54 of the bracket class. The arc lamps total 424, of which 334 are open type, and 90 flame ; and the metallic-filament lamps number 36. The number of gas lamps is stated at 2,659, a decrease of 61 compared with the total in the previous year. The number of defective electric lamps is given as 89, and of gas lamps as 1,763. On 27 occasions the electric lamps were lit during the day on account of fog or unusual darkness at an additional cost of £182. The gas lamps were similarly lit on 34 occasions at an additional cost of £200.

Manchester.—At the quarterly meeting of the Manchester City Justices on Monday, Mr. Bradley, chairman of the Gas Meter Testing Committee, moved that the report which had been presented be passed, which would bring the sellers of electricity under the same conditions as the sellers of gas, so that purchasers of electricity might have an independent authority to test and stamp their meters, and have the same opportunity of seeing that they got fair measure. The City Council were sellers not only of gas but electricity, and the Committee felt there should be the same control with electricity as with gas.

Mr. G. Howorth, chairman of the Electricity Committee, said he was surprised at this, as the Electricity Committee rather prided itself on the way the work was already being done. It had had no complaint as to the accuracy of the meters. At the present time there was no borough in the kingdom where there was a separate plant for the testing of electricity meters, and the Justices had no power to enforce what was proposed.

Mr. Royse said it would be an expensive business to put down electrical-testing apparatus. He thought the probable cost should first be ascertained.

Col. Crook said electricity meters were liable to err in favour of the consumer as against the producer, so that the Corporation, for its own protection, should have a testing station. The question was whether Manchester should show the way to the rest of the country in the testing of electricity meters, by securing legislative powers. He certainly thought an independent authority was desirable.

Mr. Bradley said the public required an independent authority in the event of disputes between them as purchasers of electricity and the Corporation as sellers.

Eventually it was resolved on the motion of the Lord Mayor, seconded by Mr. Alexander Porter, that the report be received and referred to a Committee representing the Justices and Electricity Committee.

Loughborough.—A meeting of the T.C. was held on Monday last, when the town clerk reported that he had received from the L.G.B. sanction to the borrowing of £2,200 for the purposes of the electricity undertaking. The sum of £1,930 was for turbines, &c., repayable in 19 years, and £270 was for instruments and apparatus, repayable in 15 years.

The statistics of the undertaking for June showed a decrease of 4·6 per cent. in the units delivered, and an increase of ·115d. in the cost per unit.

In their estimates for the half-year to March 31st next the Finance Committee included an item of £375, estimated deficiency on the electricity undertaking.

Newcastle Emlyn.—The U.D.C. has entered into an agreement with the electric light company for public lighting in Newcastle Emlyn district and Aberarad for £45 a year.

Paisley.—The treasurer of the T.C., in presenting his annual budget to the Council last week, had again to report a deficiency on the year's working of the electricity department. The actual deficiency this year is £3,540, part of which is the recent arbitration expenses, which amounted to £1,458. To square the deficiency it is proposed to take £2,126 from the reserve fund, which exhausts it, and to give a grant of £1,414 from the gas department. The treasurer, in the course of his statement, said : "We seem to have come very badly out of this arbitration with the tramway company, and, unless something is done to get a flat rate, I see very little prospect of a better service or revenue."

Perthshire.—The owners of mansion houses in the county are going in extensively for electric lighting. The latest convert is Lieutenant Malloy, who since becoming proprietor of the Strone Estate in the beautiful Bridge of Cally district, has carried out many improvements. On Wednesday last week an electrical installation, which lights the mansion house, stables, coach house, and motor house, was switched on. The current is generated by a 5-H.P. engine, and in an adjoining room a battery is provided. Messrs. G. H. Nicoll & Co., Bank Street, Dundee, were the contractors for the work.

Reigate.—On July 25th a L.G.B. inquiry was held into the application of the T.C. for a loan of £8,400 for E.L. purposes, viz.:—Excess expenditure, £2,000; engines and alternators, £4,547; switchboard, £485; consulting engineer's commission, £250; future extensions, £1,118; transformers, £100; mains, £500; house services, £518. There was no opposition.

St. Boswells.—The Electric Supply Corporation, Ltd., has an important scheme on hand in the Scottish Border district. It will erect a power station to supply electricity to St. Boswells, Newtown and Bowden; and is to erect overhead wires from Melrose to Gattonside and Darnick.

Society Islands.—An electric lighting system has just been installed in Papute, the chief city of the Society Islands, in the Pacific Ocean, and according to Consular reports the new lamps are productive of the greatest curiosity among the natives, who come in from miles around to see them. Fifty KW. of generating capacity is installed in the new plant, which is owned by a progressive American resident.—*Electrical World.*

South Africa.—A very successful exhibition of electric cooking and applications of electric power for domestic purposes was one of the features of the Durban and Coast Agricultural Show, held early in July, which was provided by the Durban Corporation. Great interest was shown by the public in the collection of the various appliances for heating and cooking, from a flat iron to a fully-equipped kitchen range, as well as the various means of applying power to sewing machines, carpet sweepers, hoot cleaners, knife cleaners, &c.

The demonstrations given in the lecture hall by Mr. John Roberts, borough electrical engineer, were well attended, and it is hoped will result in such applications of electricity being taken up in Durban on a large scale before long, as a cheap tariff for such purposes is now under the consideration of the Council.

Arrangements have been completed for the Ladysmith Corporation to supply electrical energy to the South African Railway Administration at Ladysmith, O.F.S., Junction and the new yard, with a guaranteed consumption of 168,000 units per annum. This will mean that the municipality will run their station during the 24 hours, which has not hitherto been the case.

The Johannesburg T.C. has sanctioned an amended tariff for domestic electric lighting, by which dwelling houses are to be rated on a basis of six units per room per month at 6d. per unit, and the balance at 1½d. per unit. As an alternative, an extra meter with time switch can be fixed at the consumer's cost and energy consumed between 5 p.m. and 11 p.m. charged at 6d. per unit, and during the remaining hours at 1½d. Consumers are warned that the existing circuits will not permit of the simultaneous use of both electric lighting and heating appliances.

Southampton.—Owing to the increased load on the Northam main, the engineer reports that it will be necessary to have this doubled before the winter. The cost for cables for this work is put at £1,156. Mains are to be extended in the Bassett district at a cost of £155. Sanction has been received from the L.G.B. for the borrowing of £5,700 for enlarging the trunk mains at Portswood and Shirley. A report has been received to the effect that the last engine which was brought from the Back-of-the-Walls was still running non-condensing: the engineer suggested that he should be allowed to obtain prices for a suitable condenser for the engine at an approximate cost of £710 and purchase the necessary air pump. The cost of this would amount to about £262. The Committee agreed. A Sub-Committee has had under consideration the question of increasing the staff on the commercial side of the electricity undertaking, thus following in line with other large undertakings. It was no use, the engineer and manager stated, expecting business to come in without asking for it, and therefore the Council should inaugurate a business-getting staff. It was no good getting a junior, because while they were teaching him his work, the Council's competitors were going ahead fast, and unless they offered a commencing salary of at least £4 10s. a week, they would not get a good man. He had communicated with four undertakings in the country (outside London) with regard to what they were doing in this matter, with the following results:—(1) Sales manager, £425 per annum, plus bonus; assistant manager, £260 per annum; constructional engineer (outside), £4 10s. per week; assistant engineer, £2 10s. per week; 11 outside representatives (canvassers). (2) Total salaries paid in business-getting department, £900, no details given. (3) Sales manager, £300 per annum; total salaries paid in this department, £1,784; six outside representatives (canvassers) employed. (4) Total salaries paid, £202 per annum. (This is quite a small undertaking.) In accordance with the engineer's suggestions, the Committee has interviewed Mr. H. Bennett from the Westminster Electric Supply Co., for the position of head of the business-development department of the electricity undertaking, and has decided to appoint him at a salary of £225 per annum, rising at the end of 12 months to £250 per annum, subject to his services being to the satisfaction of the Committee. His designation is to be "commercial engineer."

Tunbridge Wells.—The T.C. has decided to supply current to the General Hospital for the X-ray and Finsen apparatus at the usual power rate of 2½d. per unit.

U.S.A.—Figures given in the recent annual report of the department of electricity of Chicago show that the total number of public street lamps in service on December 31st, 1910 was 37,994. Of these, 12,366 were municipal electric arc lamps, 893, rented arc lamps; 11,990, gas-mantle lamps; 5,426, gas flat-flame lamps and 7,319, gasoline lamps. The cost of rented arc lamps is $75 a year, municipal arc lamps $61.95 a year, mantle gas lamps $18.91, open-flame gas lamps $15.41, and gasoline lamps $26.40. There are 763 isolated electric plants in that city supplying 19,677 arc lamps and 788,034 incandescent lamps.—*Electrical World.*

The Indiana Steel Co., has just completed at its Gary plant, the first section of the coke oven equipment, all the auxiliary operations of which are performed by electric motor; coincident with the above, the duplication of the gas engine power house (which was described in this journal) has been taken in hand.

Wednesbury.—Application is to be made to the L.G.B. for sanction to borrow £333 in respect of extensions on small mains.

West Hartlepool.—Waste Heat Inquiry.—The inquiry which was commenced in the latter part of February into the application of the Corporation for sanction to borrow £38,650 for the purpose of establishing a waste heat and exhaust steam electricity supply, was concluded on July 21st, before Mr. H. E. Hooper, representing the L.G.B. The Corporation proposed to enter into an arrangement with the Seaton Carew Iron Co. for the utilisation of its exhaust steam and waste heat, and a new station is to be erected near the company's works. When the proceedings were re-opened on the 20th inst., Mr. W. E. Clode, K.C., represented the Corporation and Mr. Tyrrell, K.C. appeared for the Cleveland and Durham Electric Power Co. The hearing of evidence was continued.

Capt. Sankey gave evidence as to various tests he had made at the Seaton Carew Ironworks. These tests indicated that there were over 50,000 lb. of exhaust steam per hour now going into the air. Different tests gave actual calculations of 51,600 lb., 53,850 lb. and 56,100 lb. The full-load requirements of the turbine to which the steam would be conveyed, were 48,400 lb. per hour, average figures. He added that the agreement between the Corporation and the company was for 30 years.

Mr. J. F. C. Snell said the Corporation were to take all the waste gas or all the waste heat in any other form—whether from the coke ovens or the blast furnaces, under a certain guarantee to be given to the Corporation. One clause of the agreement provided that in the event of any catastrophe and the company closing down, and the Corporation being driven to supply the turbines by coal fired boilers, during that period the company would agree to pay to the Corporation 70 per cent. of the actual cost of their coal. That was an extremely important guarantee.—The Inspector: Supposing the Seaton Ironworks do not stop working, but at the end of 30 years they tell the Corporation to go. What is the position of the Corporation then?—The town clerk stated that the lease was one for 30 years, and in the absence of terms being arranged the Corporation would have to comply.—Mr. Snell said that if, with all these guarantees, the Corporation were not going to be in a position of safety and security to maintain a proper supply, under the terms of the Cleveland and Durham Co.'s Act they could fall back upon the company, and the company would be bound to supply them.

When the proceedings were resumed on the 21st ult., Mr. Clode stated that the N.E. Railway Co. had withdrawn their opposition to the proposals, and he produced a letter to that effect. This closed the case for the Corporation.

Mr. Charles H. Merz, consulting engineer to the Cleveland and Durham Co., said there were six waste heat stations in existence, and seven more in course of construction. A stand-by plant with coal always burning under the boilers was a necessary, complementary, part of a waste heat station. The capital expenditure on a combined system of waste heat plant and stand-by plant was necessarily very much higher per kilowatt than the capital expenditure for a coal fired plant, because to a certain degree the machinery must be in duplicate. He described the Corporation's scheme as unsound and unworkable. On the other hand, referring to the offers that the Cleveland and Durham Power Co. had made to the Corporation, he stated that if the company took over the Seaton Iron Co.'s supply and joined it on to their general supply, they could supply the Corporation with current at a lower price than the Corporation could produce it themselves. In the course of a long examination by Mr. Clode, witness said that the Power Co. were not bound to give a supply to the Corporation at a moment's notice.

Mr. Greville Jones, works manager at Messrs. Bell Bros. and Messrs. Dorman, Long's works at Port Clarence, described in detail the various stoppages to which blast furnaces were liable, and stated that for longer or shorter periods the supply of waste gas could not be relied upon.

Mr. H. E. Wright, works manager at Messrs. Sir B. Samuelson and Co.'s works at Middlesbrough, gave similar evidence.

Mr. Tyrrell, in his address on behalf of the power company, said there were three courses open to the Corporation. One was to put down their own coal-fired plant, but that had apparently been ruled out by both sides. That left two alternatives, either to take up the scheme now proposed, or to go to the company. If the waste steam at the Seaton Carew Iron Co.'s works was to be used to the best effect, it ought to be used with a constant load. The position of the Corporation was that they were entitled to neglect all the waste over and above the quantity they

quired. The Corporation would get a supply better suited to their irpose by letting someone else take that steam and use it as the ›wer company could use it with a constant load, giving a varied, ut always sufficient, supply for the purposes for which they re-ired it. If the Corporation insisted upon setting up this plant, ey would run a risk which no Corporation had ever run before, of tablishing a business that might never be satisfactory. It ›uld be waste of money to run the risk, and doing the power mpany a great injury.

Mr. Clode, in concluding his speech, on behalf of the Corporation, id that temporary interruptions from various causes were met by e system under which the Corporation would work. Coal firing d gas firing already in existence at these boilers, could be resorted , and was resorted to at present.—The Inspector: One must not lose ght of the future. It is every bit as much important as the esent day. Indeed, the conditions of the future are far more portant than those of to-day.—Mr. Clode said that assuming at coal-firing were abolished, and gas engines were put in, he ›uld have a larger proportion of gas. The Corporation were operly safeguarded in the agreement against every contingency at might arise.—The inquiry then terminated.

Worthing.—A public inquiry was conducted by Mr. H. Hooper, on behalf of the L.G.B., on Friday last, respecting the plication by the T.C. for sanction to borrow £4,950 for suggested tensions of the buildings and generating plant at the Corpora-›n electricity works. The town clerk (Mr. W. Verrall) explained e proposed extensions were necessitated by the growth of the rough, the population of which had shown an increase of 10,385 ring the past ten years, while the assessable value had increased £65,304. The last generator was put in in 1903, and the total pacity of the four now in use was 538 KW., of which 500 KW. re available for supply purposes. The maximum demand last nter was 412 KW., and this had since risen to 423, 63 additional nsumers having been connected with the mains during the last ur months. It was proposed to put down two new generators, ch of 125 KW. capacity, and driven by Diesel oil engines, and it s anticipated that with these additions the plant would be equate for the next five years. Technical evidence in support of e application was given by the resident electrical engineer, and was stated that the proposals had received the complete approval Mr. Snell, of Westminster. In the course of some comments on e present position of the undertaking, the Inspector remarked at the charges for public lighting seemed rather stiff, but during e last four or five years there had not been any call upon the es, and he saw they had a reserve of £3,327, which was a sound lance to have on the credit side of the undertaking. Mr. E. W. nnet wished to get a condition inserted for the provision of a oke consuming apparatus, but expressed his willingness to with-aw his opposition on recciving an assurance that every attempt ›uld be made to abate any nuisance from the smoke. The only ner opposition to the proposed loan came from Councillor Cook, ho criticised the street lighting as a wasteful extravagance, ging that public lighting should be done by an up-to-date stem of gas lighting; but the chairman of the Electricity Com-ttee stated that so far, Councillor Cook had failed to make any pression on the T.C. in favour of any alteration in the system of blic lighting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramway department shows, r the year to May 31st last, the highest revenue in the history the undertaking. The income was £73,470, compared with 1,121. The total revenue, remarks Mr. Pilcher, the general nager, in his report, had been practically stationary for the evious four years, and it is very gratifying to see a substantial crease this year. This increase, the manager says, may be ributed to the weather, the winter having been exceptionally ld, there being practically no snow or severe frost. The rking expenses amounted to £39,674, a decrease of £776 com-red with the previous year.

Algeria.—The construction of an electric tramway tween the town of Oran and El Ancor has been decided upon.

Australia.—The acting Victorian Premier is stated to ve promised to submit to Parliament a definite electrification ieme for the Melbourne suburban railways.

Birmingham.—On the recommendation of the Tram-ys Committee, the City Council has decided to enter into an reement with the City of Birmingham Tramway Co., Ltd., for e purchase for £151,500 of the whole of the interests of the com-ny and of the British Electric Traction Co., Ltd., in the tramways Aston Manor, King's Norton and Northfield, and Yardley, together th the lands, rolling stock, generating stations, &c.

Continental Notes.—Austria.—The question of the nsformation of the Vienna City Railway to electric traction, ich has been under consideration for a number of years past, has w entered upon a new stage inasmuch as it has just been decided invite tenders from home and foreign firms for the execution of e work, which is estimated to involve an expenditure of from ,000,000 to £12,000,000. Built over 20 years ago as a circle line nd the enlarged city, and more for strategic purposes than for se of meeting the general needs of the traffic, the Vienna City Railway has never been successful, and the traffic has decreased since the Vienna tramways were converted to electric traction. The railway belongs, although not in equal shares, to the State, the Province of Lower Austria, and the City of Vienna, and the working results not only do not pay the whole of the interest on the invested capital of £5,600,000, but they also leave an annual deficit of £60,000, which falls upon the State Railway Administration, which undertakes the working of the railway. The Traffic Commission, which is composed of representatives of the three authorities mentioned, including the Minister for Railways, has now conceived the idea that the re-organisation of the railway might be carried out by the introduction of electric traction and the construction of three or four new lines of the underground class, and that it might be left to private enterprise to undertake the work and also the future operation of the modernised and extended railway. It would seem as if the disposition exists, owing to the unremunerativeness of the railway and the complications which would arise from any attempt to electrify the undertaking under existing conditions of triple ownership, to make a free present of the railway to any firm or group which would agree to bring an electrical scheme to a successful conclusion. The actual electrical work would only represent a portion of the expenditure previously mentioned, as the major portion of the outlay would be for costly tunnel and other works in connection with the proposed new underground lines. Although the project is to be thrown open to foreign competition, it has to be remembered that the tendency in Austria is to give preference to native firms for the execution of public works. In the present case three companies come into consideration—namely, the Austrian Siemens-Schuckert Works, the Austrian A.E.G.-Union Co. and the Austrian branch of Ganz & Co., whilst Kolben & Co., of Prague, and Fr. Krizik, of Prague, have also carried out noteworthy electric railway work, and the firm of Stern & Haffert, of Gmunden, has received the order for the conversion of the State line—Attnang-Ischl-Steinach—to electric traction. Nevertheless, it is said that the Berlin A.E.G. and the Siemens-Schuckert Works intend to take an interest in the Vienna scheme in conjunction with their branch companies in Vienna. A Vienna correspondent, in commenting on the conversion project, remarks that electrical companies will doubtless be found ready to undertake the work in association with their friendly banks, if the Traffic Commission is able to offer a guarantee of the interest on the capital to be invested, but the triple composition of the Commission excludes this possibility. Many schemes will be submitted for the carrying out of the work. The less important companies will underbid the leading firms in order to secure the business, until they perceive that they could not undertake the work according to the original estimates and with the capital at their disposal, whilst the large firms will then decline to accept the risk at the minimum prices. It is, therefore, concluded that in this way the negotiations will be protracted over a long period, and Vienna continue to be deprived of improved traffic facilities until the remote future.

Italy.—It is announced from Rome that a provisional agreement has just been signed in relation to the formation of a company for the construction and working of a high-speed electric railway from Rome to the seaside town of Ostia. The capital has been temporarily fixed at £800,000, and those interested are declared to be the Paris Metropolitan Railway Co. and another French group. It is proposed to build the railway underground from the centre of Rome in the Piazza Venezia to the Porta San Paolo, in order to be able to work the line at the high speed in contemplation. A second underground section is to proceed under the Borso Umberto and the Piazza del Popolo, and thence form a connection along the Tiber with the Porta Salaria. The promoters of the company have concluded an agreement with the City of Rome whereby the latter will place land at the company's disposal, and also furnish a supply of power for working the railway. A period of two years is to be occupied in constructing the line to Ostia, and three years for the underground sections in the city.

La Société del Tramvie di Mestre has secured the concession for the construction and working of electric tramways between Mestre and Carpenedo, and between Mestre and Treviso.

Spain.—La Société des Tramways Electriques en Castille, is the name of a new company which has just been formed in Brussels with a capital of £60,000 to acquire and work the electric tramway system in the town of Santander, and also the steam tramway between the town and the sea coast, a distance of about 4½ miles; it is proposed to convert the latter to electric traction.

Switzerland.—The labours of the Swiss State Committee of Inquiry into electric railway working are proceeding so rapidly that a report will shortly be published dealing chiefly with the proposed conversion of the St. Gothard Railway. A Sub-Committee has investigated the suitability of the various systems of working from an economic point of view, and has decided in favour of the superiority of the single-phase method at 15 periods. A scheme has been worked out on this basis, and a second sub-committee has prepared a project for hydro-electric works. It is considered that the first line upon which electric traction will be introduced will be that from Ersefeld to Biasca, and the expenditure is estimated at £800,000.

Russia.—According to a Russian newspaper, a company at Krestowskipor has submitted to the City of Moscow, a scheme for the construction of an electric railway with a length of 46 miles to Lossinostrowkaja and Puschkino. The expenditure is estimated at £867,000, and the company proposes to raise £240,000 in shares, and £820,000 in debentures. A second railway, with a length of 83 miles, is projected in the Crimea. It is to extend from Sebastopol *via* Jalta to Aluschta, and to have a branch to Balaclava. The outlay is computed at £2,815,000, and shares of £590,000, and debentures of £2,950,000, would be issued for the purpose.

Egypt.—According to the *Daily Telegraph*, the Cairo tramway employés struck work on Sunday. Two thousand eight hundred men are at present affected, and the entire service is suspended, to the great inconvenience of the public. The company declares it will make no further concession.

Halifax.—The Tramways Committee proposes to erect shelters at Boothtown, West End, Stump Cross, Bradshaw, near St. Jude's Church, and at Southowram. It is intended that the work required in connection with the laying of tramways in Orange Street, between Broad Street and Corporation Street, in Northgate, between Woolshaps and Victoria Street East, and in George Street, should be proceeded with as soon as Parliamentary powers are obtained. The construction of the lines is estimated to cost £2,481, apportioned as follows:—Orange Street, £840; Northgate, £684; and George Street, £957.

Haslingden.—The Union Assessment Committee has declined to join the Accrington Corporation in asking the umpire in the tramway assessment inquiry to give the basis of his award, which was not satisfactory to Accrington. The Haslingden Committee regard the umpire's award as binding and final.

Liverpool.—An open-air meeting, attended by 700 drivers and conductors in the employ of the Corporation Tramways department, was held at Walton on July 27th, to protest against any outside interference in regard to the question of forming a trade union. A resolution was carried thanking Mr. Mallins (general manager) and the Tramways Committee for the concessions that had been made in the grant of merit pay to the great bulk of the drivers and conductors in the service. It was also stated that the employés wished to assure them of their continued loyalty to the department, but to say that they did not desire, and would not tolerate, any interference from outside which would tend to disturb the relations that had so long existed between the Committee and its employés.

London.—L.C.C.—The annual accounts and report of the chief officer for 1910-11 have now been prepared. The street mileage of the tramways amounted to 126 (electric) and 17 (horse) miles, which, with the exception of about 3 miles, is worked entirely by the Council. The net capital debt on the undertaking at March, was £9,465,499. The surplus on the working of the electric lines amounted to £914,418, which was reduced to £895,048 by the deficiency on the horse lines. Interest and redemption charges absorbed £656,991, and after meeting other expenses, a surplus of £232,727 remained for disposal. From this the renewals fund benefitted to the extent of £129,228 (at the rate of ¾d. per car-mile), bringing that fund up to £527,264. The balance, a sum of £103,498, was transferred to the general reserve fund, which now amounts to £176,845. The total operating expenses for electric traction were £1,235,821, including £22,993 for special charges, or 6·48d. a car-mile run, as compared with 6·42d. a car-mile in 1909-10. The total working expenses in connection with horse traction amounted to £101,948, or 10·38d. a car-mile run. The passenger traffic receipts in respect of electric traction amounted to £2,096,913, or 11·00d. a car-mile run, as compared with 11·21d. for 1909-10. From lines operated by horse traction the traffic receipts amounted to £80,580, or 8·20d. a car-mile run, as compared with 8·14d. for 1909-10. The Committee adds that in connection with the decrease a car-mile, it must be borne in mind that the most remunerative routes were the first to be reconstructed. During the past year less remunerative lines have been electrified; moreover, the weather during the summer and autumn of 1910 was very wet and cold, while the increasing number of workmen carried each year contributes to the falling off in the receipts a car-mile run. Considerable loss was sustained during the reconstruction of horse lines for electric traction, as sections of some of the routes had to be closed, and this disorganised the traffic on several important routes. The total number of passengers carried and car-miles run during the year were as follows:—

	Electric Traction.	*Horse traction.*	*Total.*
No. of passengers	482,296,935	22,418,391	504,715,326
No. of car-miles run	45,744,066	2,357,504	48,101,570

As satisfactory terms could not be arranged for the purchase of the London portion of the London United Tramways by the L.C.C., the B. of T. has appointed Mr. R. Elliot Cooper as arbitrator in the case. The Board is also to nominate an arbitrator to determine the purchase price of the Metropolitan Electric Tramways in Seven Sisters Road between Stroud Green Road and Green Lanes.

A new agreement is to be entered into with the Leyton U.D.C. for through-running between Epping Forest and London tramway termini, *viâ* Lea Bridge Road and Mare Street.

A supplemental agreement is also to be entered into with West Ham Corporation and Leyton U.D.C. regarding the running of cars by the three authorities in Leytonstone Road.

Mirfield.—The U.D.C. has decided not to take any further action respecting a proposal to adopt the railless traction system for the town.

Oakworth (near Keighley).—Some time ago, a deputation from the Keighley Corporation came before the Council in reference to the proposal of that Corporation to apply for Parliamentary powers for the running of motor-omnibuses and rail-less trolley tramways. The U.D.C. has now received a communication from the town clerk of Keighley, stating that it is proposed to run along Slaymaker Lane, and asking for the formal consent of the authority. The Council has decided to oppose the application.

Oldham.—A mass meeting of the tramway drivers and conductors has been held, at which a number of grievances were stated, including the alleged importing of inspectors and officials into the town, when equally capable local men are refused such positions. The men have issued an ultimatum to the manager, calling upon him to dispense with the services of the imported officials within 14 days. The men also complain of having to lose their work when "warned for office," and having no notification of the nature of the complaint. They contend that no man ought to be discharged by letter, and that he ought to be confronted with the complainant, and be allowed time to secure evidence. A deputation is to wait upon the Tramways Committee at an early date.

South Africa.—The Johannesburg tramway receipts for last June amounted to £24,921 against £22,346 for June in the previous year. While for the whole 12 months the fares have yielded £312,539, compared with £282,731 for the preceding year. During the year 26,632,015 passengers were carried, or 5,305,000 in excess of the figure for the previous year.

TELEGRAPH and TELEPHONE NOTES

Municipal Telephony.—The National Chamber of Trade has been in correspondence with the Postmaster-General advocating municipal telephone services, and asking for a committee to discuss this question and the method of charging for telephones.

A Telegraph Trust in the United States.—The Postal Telegraph Co., which is the American landline system of the Commercial Cable Co., has written an open letter to the Attorney General of Texas, setting forth that a monopoly and combination in violation of the Anti-Trust Acts of that State, has been brought about by the Western Union Telegraph Co. and American Telephone and Telegraph Co. and their subsidiary companies, with the effect that 83 cities and towns in Texas and surrounding States, each having more than 1,000 population, have been cut off from telegraph competition, besides a much larger number of smaller towns the Postal Co. is building into that territory as fast as the lines can be constructed. This letter is in response to an inquiry by the Attorney-General, who is investigating the subject in accordance with a resolution of the Legislature of Texas. The letter states that "we can maintain offices in all of your chief cities and towns, and intend to do so, and you may rely upon it that when we open offices in those cities and towns they will stay open, and will not pass under the control of the Bell Co. or the Western Union. . . . The American Telephone and Telegraph Co. is apparently seeking an absolute monopoly in ocean cables, landline telegraph and telephone communication in the United States."

Telegraphs and the Hot Weather.—The extremely hot weather experienced this summer, accompanied by severe thunderstorms, has considerably affected the telegraph systems on the Continent, causing long delays and congestion of the wires that remain open.

Wireless Telegraphy.—A wireless station is being installed by the French at Fez in Morocco, and another at Taurirt; the former will be able to communicate with Paris by way of the latter, and on to Paris by wire, or direct to Oran and thence to Paris entirely by wireless.

A contract has been entered into by the Marconi Wireless Telegraph Co., Ltd., and the Italian Government for the erection by the company of a 60-KW. station in the vicinity of Rome. The building, masts and material are being supplied by Marconi's Wireless Telegraph Co., Ltd., the erection of the masts being carried out through the intermediary of the Italian Agency. Six towers in iron and wood of the Coltano type are being erected, two each being 75 m. high and the remaining four each of 45 m. in height. These will support a multiple-wire T acrial of a total length of 360 m. The surface occupied by the aerial will be about 14,000 sq. m. The Italian Government are erecting the building, which will contain engine, power, battery and operating rooms, stores, waiting and staff rooms and the necessary adjuncts. In the engine room, which will have a floor space of 32 ft. × 25 ft., there will be installed duplicate 50-B.H.P. Diesel oil engines, each driving by means of a belt, a 30-KW. continuous-current dynamo. Two 32-KW. low-frequency inductances will be provided for regulating the frequency of the discharge circuit to the value necessary for the number of sparks adopted, and, in addition, two 32-KW. high-pressure transformers will be installed to transform the alternating current by the group of generators to the required voltage for the condensers. The receiving apparatus will consist of a valve receiver adapted to receive all waves comprised between 2,650 and 6,500 m. A magnetic detector will also be furnished. The station is to test to Poldhu and will have a normal power of 32 KW. and overload up to 100 KW. —*The Marconigraph.*

Last week wireless messages were dispatched from an aeroplane at Rambouillet to the Eiffel Tower at Paris, a distance of 31 miles. The apparatus carried on the aeroplane weighed about 46 lb.

It is stated that negotiations are proceeding with a view to the formation of a Russo-French company for wireless telegraphy in St. Peterburg, the share capital being put at £160,000. At first wireless telegraphy in Russia, which is largely employed in the Russian navy, only concerned the Russian Siemens & Halske Co.

Subsequently a competitor was formed under the title of the Russian Wireless Telegraph and Telephone Co. Although supported by the Government, the latter concluded the first financial year with a large loss, and the year 1910 has also ended with a loss of £13,000 on a share capital of £120,000.

According to a Berlin newspaper, the shares in the C. Lorenz Telegraph Co. have recently attracted greater attention on the Berlin Stock Exchange. The cause of the advance in quotations was to be found in a rumour that the Marconi Co. proposed to acquire patents from the High-Frequency Machine Co., which is a subsidiary of the Lorenz Co., but which declined to give any information on the matter when asked to do so. On the other hand, the Berlin newspaper learns from circles having relations with the Marconi Co. that the latter has no intention of obtaining any kind of patents from the High-Frequency Co., but proposes to enter into keen competition with the latter. The Marconi Co., it is added, also contemplates placing on the market a machine based upon the same principles in the near future.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Tenders for four double-deck cars. Drawings and specifications from R. Stuart Pilcher, general manager.

Australia.—Victoria.—August 9th. 530 A.C. meters, 496 D.C. meters and 133 maximum-demand indicators, for the Melbourne City Council. See "Official Notices" July 28th.

September 5th.—(*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

South Australia.—August 23rd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" July 28th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

Blackburn.—August 12th. Steam coal for a year, for the Corporation electricity department. P. P. Wheelwright, engineer and manager, Jubilee Street Works.

Bolton.—The Electricity Committee of the T.C. desires tenders for 25,000 tons of coal.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local representation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

September 25th.—All electric lighting fittings, fans, lamps, insulated conductors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. Directoria Geral do Expediente, Ministerio da Viacão e Obras Publicas, Rio de Janeiro.—*Board of Trade Journal.*

Croydon.—The Board of Guardians has instructed the borough surveyor, with the assistance of the borough electrical engineer, to prepare a specification, upon which tenders could be invited, with a complete estimate of the cost in detail of electrifying the lifts at the Waingates Children's Homes. The borough electrical engineer puts the cost at £250 per lift.

Erdington (near Birmingham).—Construction of $1\frac{1}{4}$ miles of double-track tramway. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switchboard, for the Farnham Gas & Electricity Co. See "Official Notices" July 21st.

Frodingham.—August 11th. Poles, lamps, wires and switches for street lighting, for the Brumby and Frodingham U.D.C. See "Official Notices" July 21st.

New Zealand.—August 14th. Tenders are invited by the Post and Telegraph Department for the supply and delivery of 36 magneto switchboards. A copy of the specification, &c., may be seen by British makers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Roumania.—The municipal authorities of Slatina are inviting tenders until the 10th inst. for the concession for the electric lighting of the town.

Russia.—The T.C. of Stavropol (Caucasus) is open to receive tenders for the installation and working of an electric tramway service. The last day of submission is August 14th.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

Turkey.—Tenders are invited for concessions (1) to establish a public water service; and (2) an electric installation for lighting and traction purposes in the city of Jerusalem and its suburbs. Guarantees, 1,000 and 2,000 £T respectively.

Warrington.—August 9th. Motor-driven induced-draught fan, for the Corporation. See "Official Notices" July 28th.

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" to-day.

Whalley.—Electrical plant, &c., for the new asylum. The Lancs. Asylums Board will shortly invite tenders for the above from a selected number of firms. See "Official Notices" July 28th.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

The Corporation Electricity Committee invites tenders for a 400-KW. rotary converter and switchgear, at an estimated cost of £1,600, for the purposes of the supply of energy to the Knowles Oxygen Co., Ltd.

CLOSED.

Aberdeen.—Mr. John F. Anderson, Bridge Street, Aberdeen, has secured the contract for electrical work in connection with the temporary buildings to be erected at Robert Gordon's Technical College.

Australian Contracts.—New South Wales.—Postmaster General's Department.—Noyes Bros. (Sydney) Ltd., 46 tons steel stranded wires, at £16 4s. 3d. per ton.

Victoria.—Postmaster-General's Department.

British Insulated and Helsby Cables, Ltd.—366 strips of jacks, 160 coils, 160 relays, and 8 terminal blocks.
Richard Johnson, Clapham & Morris, Ltd.—13½ tons galvanised iron wire, £154 18s.
Australian Metal Co.—22 miles telegraph cable, in lengths of 440 yards, £5,946; 108 miles telephone cable, £17,630 10s. 6d.

Small Arms Factory, Lithgow (N.S.W.).—Supply and installation of electric light, wiring lamps, &c.—Lawrence & Hanson, £494; electric light cables, Noyes Bros., Ltd., £728.

Barnes.—The parish church of Barnes has decided to install the electric light, with dimming arrangements for use during the sermon, and Messrs. T. L. Hellyar & Sons have been entrusted with the carrying-out of the contract.

Bennis Stokers.—Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, have recently received the following orders from electricity works:—Coventry Corporation—One "Bennis" coal-gathering conveyor (duplicate of the existing barge conveyor); Dudley Corporation—Two "Bennis" stokers, self-cleaning compressed-air furnaces (repeat order); Pembroke (Ireland) U.D.C.—Two "Bennis" high-pressure compressed-air furnaces (repeat order); Barnsley Corporation—Two pairs of "Bennis" chain-grate stokers; Cleckheaton U.D.C.—Four "Bennis" stokers and self-cleaning compressed-air furnaces.

Bispham (near Blackpool).—The U.D.C. has accepted the following tenders:—

Engines and dynamos.—National Gas Engine Co., Ltd., Ashton-under-Lyne (with a Bruce-Peebles dynamo).
Switchboard, balancers and boosters.—Kelvin & James White, Ltd., Glasgow.
Storage battery.—Premier Accumulator Co., Ltd., Northampton.
Section mains.—British Insulated & Helsby Cables, Ltd., Prescot.

Burnley.—The contract for the electric lighting at the Victoria Hospital extension has been secured by Mr. R. B. Beattie, St. James' Street, Burnley.

Canada.—The British Electrical Plant Co. has received the contract for pumping plant in connection with the Montreal (Quebec) filtration plant, the price being $40,000.

Denmark.—Notwithstanding protection and keen competition on the part of local firms, Messrs. Wm. Geipel & Co. have secured a contract for 68 Geipel steam traps for the new Copenhagen Hospital.

Eccles.—The T.C. has accepted the tender of Messrs. Korting Bros., Ltd., for the supply and delivery of a motor-driven centrifugal pump, at £185, for the electricity works.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows:—La Société d'Electro-Métallurgique de Dives, 50 tons of bi-metallic wire 2 mm. dia., at 1,839 francs per ton; La Compagnie Française du Bimétal of Paris,

75 tons ditto, at 1,840 francs per ton, 75 tons ditto, at 1,837½ francs per ton, and 40 tons ditto, 3 mm. dia., at 1,895 francs per ton; and La Compagnie Française des Métaux, of Paris, 40 tons ditto, at 1,898 francs per ton.

Gloucester.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Drysdale & Co., Ltd., for a circulating pump for the condensing plant, at £135.

Hendon.—The D.C. has had under consideration estimates for the lighting of the hospital by electricity and gas, and has accepted that of Messrs. C. Suckling & Co., at £65, for electricity.

London.—L.C.C.—The Fire Brigade Committee has received the following (fresh) tenders for electric wiring and fittings for the North Kensington fire station:—

E. Lawrance & Sons, Ltd.	(accepted)	£157
G. Weston & Sons, Ltd.		160
Malcolm & Allan, Ltd.		168
E. Newhald & Co.		194
Tredegar & Co.		221
Chief Engineer's estimate		160

Apparatus is to be installed at four stations for charging the batteries of the electrically-driven escape vans, at an estimated cost of £200.

The Highways Committee recommends the acceptance of the tender of Messrs. Kirk & Randall (£18,110) for the road work and platelaying for the Brixton Road-Herne Hill trolley tramways, and of the tender of John Mowlem & Co., Ltd. (£66,646), for similar work in connection with conduit tramways in Seven Sisters Road and Green Lanes. In connection with the above and other tramways, the Committee recommends that arrangements be made with Hadfield's Steel Foundry Co., Ltd., for the supply of special trackwork at a cost not exceeding £16,700. The same firm are to supply special work for junctions at St. George's Circus and in Kennington Road.

The tender of the British Westinghouse Co., at £6,390, for the supply of standard type controllers, electrical interlocking gear and cables for 100 double-deck cars, is recommended for acceptance.

For the third section of the central car depôt, machine tools are to be obtained from Messrs. Buck & Hickman, £1,565; and Pollock and Macnab, £524.

The Highways Committee has considered tenders received for (*a*) 6,000 steel driving-wheel tires, and (*b*) 4,000 steel pony-wheel tires, and recommends acceptance of the tenders of Messrs. John Batt & Co. (London), Ltd., for driving-wheel tires at 15s. 8d. each, and Messrs. George Schultz & Co., for the pony-wheel tires at 10s. 8½d. each. John Batt & Co. will sublet to Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne, and Gutehoffnungshütte Aktienverein für Bergbau und Hüttenbetrieb, Oberhausen, Germany; and George Schultz & Co. will sublet to Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne, Germany. The four lowest tenders in each case were for German material; the fifth and lowest English tenders were, for driving-wheel tires, Cammell, Laird & Co., 22s. each, and for pony-wheel tires, Steel, Peech & Tozer, Ltd., 19s. 2d. each.

Luton.—The T.C. has accepted the tender of the Hudson Economiser (1907) Co., Ltd., 110, Bishopsgate, London, E.C., for a cooling tower of 125,000 gallons capacity per hour, at £637 10s.; and that of Messrs. Hayward, Tyler & Co., Ltd., for a motor-driven feed pump (8,000 gallons) at £120.

Peterborough.—The Borough Education Committee has accepted the tender of Messrs. G. Andrews & Co., for electric light fittings for the new Lincoln Road Schools.

Salford.—The tender of Messrs. Babcock & Wilcox, Ltd., has been accepted, at £2,025, by the T.C. for the supply and erection at the electricity works of a water-tube boiler, superheater and mechanical stokers.

Southampton.—The T.C. has received the following tenders:—

Surface Condenser.

Willans & Robinson, Ltd.	(accepted)	£730
The Mirrlees Watson Co., Ltd.		750
John Musgrave & Sons		775
Cole, Marchent & Morley, Ltd.		806
Richardsons, Westgarth & Co., Ltd.		860

One 200-kw. Two-Phase Synchronous Motor.

The Electric Construction Co., Ltd.	(accepted)	£655
The British Westinghouse Co., Ltd.		670
The British Thomson-Houston Co., Ltd.		714
Mawdsley's, Ltd.		760
The Lancashire Dynamo and Motor Co., Ltd.		847
Dick, Kerr & Co., Ltd.		988

Swindon.—The T.C. has accepted the following tenders:—

Tudor Accumulator Co., Ltd.—Battery, £1,482, and £119 per annum for maintenance. (Tenders ranged from £1,210 to £1,741, and from £84 to £130 respectively.)

Chloride Electrical Storage Co., Ltd.—Automatic reversible traction booster and switchgear, £1,029. (Tenders ranged from £964 to £1,109.)

Electric Construction Co., Ltd.—Three-wire hand-regulated booster, £275. (Tenders ranged from £275 to £423.)

Messrs. H. & C. Spackman, Swindon.—Battery station, &c., £403.

Rotherham.—The Education Committee has accepted the tender of Messrs. Smith Bros., Ltd., of Rotherham, for E.L. fittings for the South Grove School, at £23, and 1s. 9d. each for extra pendants.

Wednesbury.—The Corporation Electricity Committee has accepted the tenders of the Tudor Accumulator Co., Ltd., Messrs. Johnson & Phillips, Ltd., and Mr. H. J. Smith, for further extensions at the electricity works, at a cost of £2,902, this being an increase of £352 on the original estimate.

York.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for high-tension cable for the extension to Messrs. Rowntree's works, at £2,640.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leay.

The following Orders are issued for next week:—

Headquarters will be closed for instruction, but will be open for office work as under until further orders:—

Monday, 7th	10 a.m. to 4 p.m.
Tuesday, 8th	
Wednesday, 9th	
Thursday, 10th	
Friday, 11th	
Saturday, 12th	10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

A Tough Pope Lamp.—A municipal employé reports that he was recently sent to a private house to repair a pendant that had fallen, owing to the breaking of the flex; he found the lamp, lampholder, and shade lying on the floor, the shade broken to fragments. After rewiring the lampholder and putting on a new shade, he picked up the lamp, expecting to find it broken, but on putting it into the holder it lit up as well as ever. The lamp (which was a "Pope" with metallic filament) had not been injured in any way by a 7-ft. fall, a circumstance which speaks well for the quality of the lamp.

Mechanical Engineers or Artisans?—The following paragraph from the *Standard*, of July 28th, is too delicious to be overlooked:—"Two hundred British engineers and mechanics who have been attending lectures at Zurich left yesterday on a tour through Switzerland for the purpose of visiting the principal electro-technical establishments and also various engine works."

Oil Engine Fuel.—The contradictory reports once so rife in regard to suction producer plants appear to have ceased. Possibly this is because of those producers having been brought by experience into better shape. The oil engine is now passing through the same period of doubt and inquiry which was the lot of the gas producer. Sometimes it would appear that the makers of the oil engine do not themselves fully realise its limitations or its possibilities. Would-be purchasers who see oil engines at work can be assured that they will be perfectly satisfactory so long as they are supplied with a refined oil of the cheap lamp-oil variety.

For a long time the use of crude or heavy oils was not seriously attempted. Some oil engines to-day will, it is claimed, work as readily with crude oil as with refined, though they will not give the same power with the cheaper oil. Some makers claim that their oil engines will deal with oils having a heavy tar base, and will run long periods without showing any deposit in the cylinders. Others again declare concisely that no oil engine can satisfactorily use an oil with an asphaltic base, but that there will be very serious deposit within the cylinder, and that an engine run with such an oil will be found when cold with its piston glued fast in the cylinder. Such as hold this opinion uphold, therefore, the system of vaporising the oil in a vessel separate from the cylinder, heating this vaporiser only to such a temperature that the oil will not be "cracked" or partially decomposed, but will be strictly distilled fractionally, the temperature being sufficient only to evaporate the constituents of the oil which can safely be admitted to the cylinder, whilst the non-vaporised residue is allowed to gravitate out of the vaporising chamber. In such engines the oil vapour is swept into the cylinder with air on the suction stroke and burned like gas, the residue to the amount of about 20 per cent. becoming even solid when cold.

Oil with an asphaltic base is particularly condemned by some engineers; others do not seem to desire to reject such oils, but rather to gloze over inquiries with fair words. Others say distinctly that their engine will use any oil, for it will reject the bad portions, which are thus not even admitted into the cylinder.

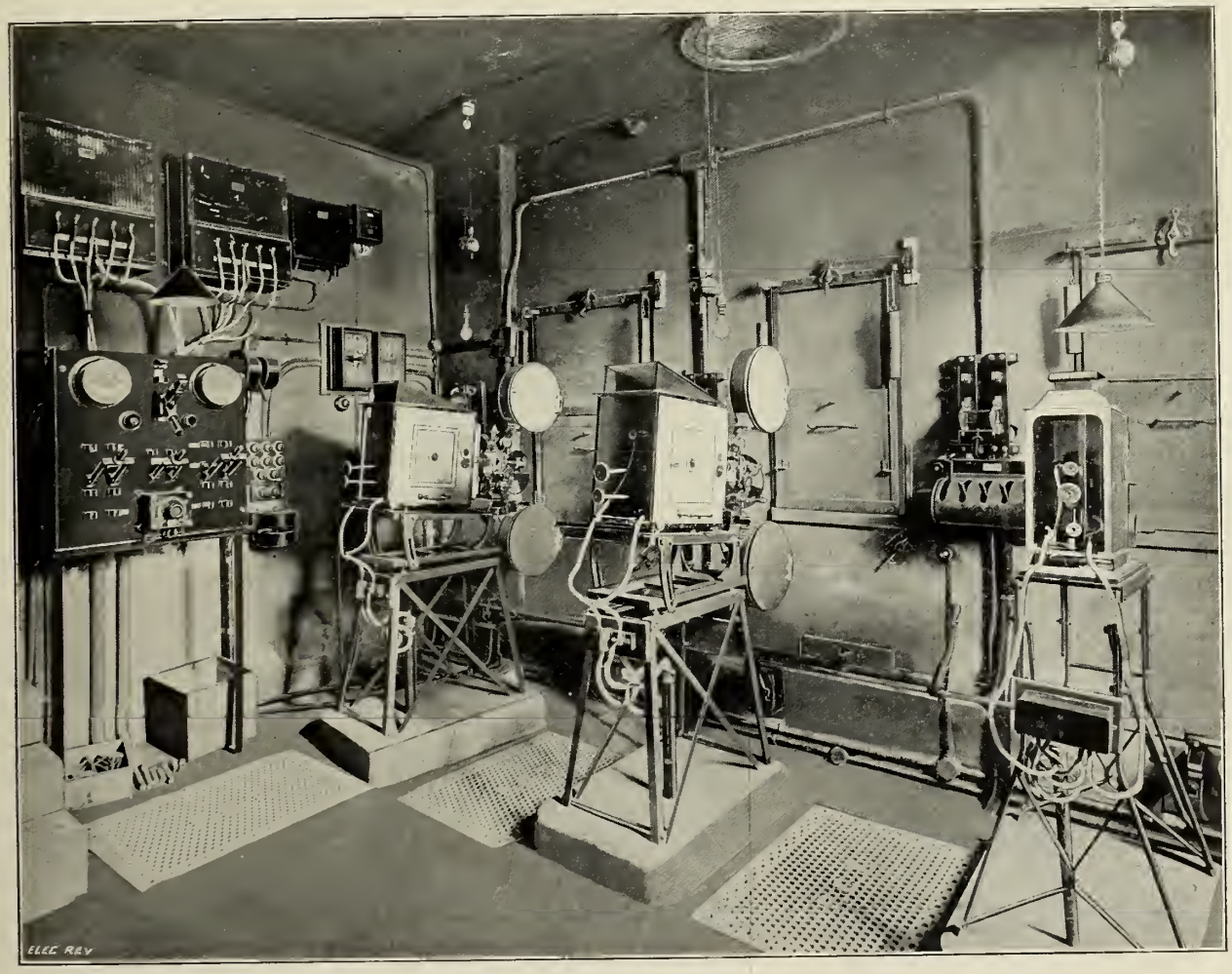
Given an assured supply of really cheap oil, the oil engine would very frequently put the producer gas engine out of court. The one engine will run with less stand-by attention than the other, drawing its own fuel from store if necessary; the other will run at most so long as a deep gas producer will permit, and it is never certain that a producer will not hang up, so that attention cannot be long absent.

(*Continued on page* 183.)

THE PICTURE HOUSE, BRIGGATE, LEEDS.

A prominent feature of the last 18 months has been the rapid rise in public favour of the electric theatre or picture palace. Every town in the British Isles now has its cinematograph entertainment, and in the majority of cases the supply of electrical energy is taken from the street mains. Although in some cases two performances are given each evening, the majority favour the continuous programme, and undoubtedly the latter is preferred by the central-station engineer, who is constantly endeavouring to improve his load factor.

The theatres vary greatly in size and style of decoration, but the old style of show, in which an empty shop in a back street, a few forms, one cinematograph machine, a questionably clean sheet, and a muscular attendant sufficed, is rapidly giving place to the large, luxuriously furnished, and perfectly ventilated "picture house," which one may enter at any time between 11 a.m. and 11 p.m., and where, for the modest sum of 1s., one may be sure of passing a pleasant hour, watching the reproduction of current events, or partaking of light refreshments in the lounges at will.



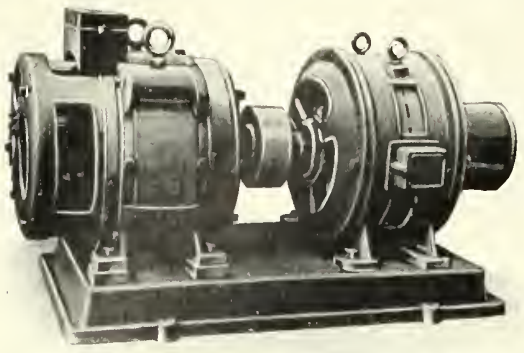
The Picture House, Leeds: Interior of Lantern Room, showing Switchboard, Dimmer Levers, &c.

In view of the importance of this feature of modern town life, we give below a description of one of the newest establishments of Provincial Cinematograph Theatres, Ltd., namely, The Picture House, Briggate, Leeds. This theatre, we understand, forms one of a large circuit, 12 being already open at Belfast, Bristol, Birmingham, Dublin, Edinburgh, Glasgow, Leeds, Leicester and Manchester, respectively, while others are in course of construction at Liverpool, Nottingham, Newcastle and Portsmouth.

The building, which is of fireproof construction throughout, includes vestibule, foyer, lounge and theatre on the ground floor, balcony and Wedgewood tea lounge on the first, and an oak panelled smoking room on the second floor. The lighting is, of course, by electricity in accordance with "Home Office Regulations, 1910," and so far as possible the inverted and concealed system has been adopted. Where the head room is limited, opal bowls mounted in inverted fittings, so arranged that part of the light is transmitted and part reflected, have been used, but where the height permits, hammered brass bowls are suspended about 4 ft. below the ceiling, with excellent effect. In the theatre proper, the height of the roof had to be curtailed, owing to the existence of ancient lights, and therefore reflecting bowls, cornice, and even direct lighting were unsuitable, as the line of sight from the balcony would have been obstructed. Arrangements were therefore made to utilise the space between the barrel vaulted ceiling and the roof proper, for combined lighting boxes and extract air ducts (in connection with the ventilating system mentioned later). The ceiling was designed with 12 cathedral glass lights, artistically enriched with fibrous plaster, and the result in the body of the hall, a 600-watt "Osram" lamp being placed above each light, is most effective.

As the programme is continuous, only 90-second intervals being allowed between each film, it is essential that there should always be sufficient light, even when the picture is on the screen, for the audience to find and leave their seats without inconvenience. Red-shaded lamps have been found most suitable for this purpose, and therefore two-light (17-watt lamp) candle brackets fitted with conical red silk candle shades have been fixed round the walls, and red lamps are also placed above the ceiling lights as noted above. Local lighting in the gangways and on the balcony steps is carried out by a very neat reflector, attached to the cast-

iron chair standard in such a manner that the light from the 2½-candle-power lamp is all thrown downwards on to the carpet, and only the reflected light from this reaches the eye.



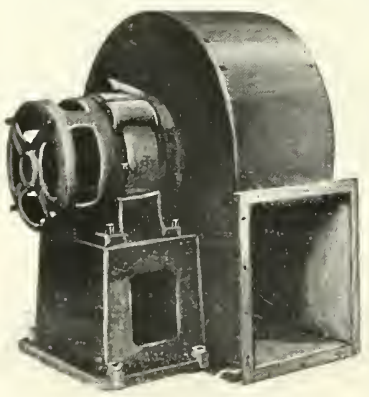
J.-L.-Churton 10-kw. Motor-Generator.

In order to obviate the frequent and instantaneous change from light to dark and *vice versa*, each time the lamps are switched on or off, dimmers are connected in the bus-bar circuit of both red and white lighting sub-distributing boards, so arranged that by a quarter turn of a handle, the whole of the white and red lamps are dimmed and brightened respectively, with a time limit of about 5 seconds.



Interior of Theatre, showing Ceiling Lights and Extract Vents combined, and Inlet Ducts above Radiators.

For the projector arcs a D.C. supply at 65 volts is, of course, required, and this is obtained from a Johnson-Lundell-Churton 10-kw. motor-generator set, the output being 100 amperes at 65 volts, with a guaranteed full-load overall efficiency of 70 per cent. The generator, which is compound wound, has the series winding reversed in order to limit the current on short-circuit to 100 amperes.



Davidson Exhaust Fan coupled to J.-L. 4-h.p. Motor.

As a stand-by to the generator set, a Morris & Lister auto-transformer, having an output of 130 amperes at 65 volts, has been installed, but this will only be used in cases of absolute emergency, the light emitted from an A.C. arc being, of course, very unsteady.

The ventilation of the building (which is open to the public 10 to 12 hours per day, smoking being permitted) forms a very important feature, and in practice it has been found necessary, in order to keep the atmosphere sufficiently clear for the perfect projection of pictures, to give 10-12 complete changes of the air per hour. For this purpose a 40-in. Keith centrifugal fan capable of delivering 20,000-25,000 cb. ft. per minute against 1 in. water gauge, and coupled by belt to a 6-B.H.P. Churton motor, is installed in the basement. The air is drawn in through a hair-cloth filter screen, maintained in a moist condition, and is then cooled by means of ice, or heated by passing through a battery of gilled pipes, capable of raising the full quantity of air from 32° F. to 60° F., 600,000 B.TH.U. per hour being required for this duty alone. In order to reduce cooling costs (10-15 cwt. of ice used per day in hot weather), a CO_2 refrigerating plant, capable of reducing the temperature of the full quantity of air 5° F., is shortly to be installed. This will, of course, ensure that the treated air is perfectly dry, as, in passing over the refrigerators, it will be cooled below the dew point and will, therefore, deposit its moisture before entering the theatre.

The vitiated air is extracted through the ceiling lights, which are specially arranged for this purpose, by means of a 60-in. motor-driven Blackman propeller fan capable of dealing with 20,000 cb. ft. per minute, against ⅛ in. water gauge. By this system (which was designed and carried out by the company's own staff) draughts in doorways and passages, which are so common in most of the big ventilating schemes, are entirely avoided. The supply of electricity required for the lighting and power installation is taken from the mains of the Leeds Corporation, on the single-phase



Meter Room at the Picture House, showing Main Distributing Board and Motor-Generator.

ystem at 200 volts, 50 cycles, by means of two 0·3 c.c. ervices, laid in earthenware ducts from Trinity Street, irectly under the concrete floor of the theatre, to a pecial meter room beneath the lounge.

In order to secure continuity of supply, the load is qually divided between the two services, one main lighting nd one main power distribution board being connected to



Lounge, showing Reflected Lighting by Metal Bowls.

ach. These boards are each fitted with two linked S.P. witches and two S.P. bridge fuses per way, and are themelves individually controlled by 100-ampere D.P. switches nd S.P. fuses of the ironclad type.

The two main lighting boards feed the local distribution oards (carrying approximately 25 amperes each) fixed in arious parts of the building convenient to the load, but ach of the motors and the stand-by transformer are fed direct rom the main boards, one way being allotted to each.

For the candle lamps, seat lights, signs and orchestra ghts, six 50-volt distribution boards are provided, and hese are fed from one way of the nearest 200-volt subistribution boards, through Morris & Lister 4 to 1 ratio uto-transformers, controlled by 5-ampere D.P. switches.

The D.C. supply from the generator is taken direct to one side of a D.P. throw-over switch on the lantern room switchboard, the other side being connected to the stand-by transformer, in order that the change over from D.C. to A.C. supply can be made without loss of time. In addition to the D.P.throw-over switch controlling the two cinematograph lantern circuits, a Morris & Lister auto-circuit-breaker of the thermal type is fitted to the board, and this is found to work well in practice, the heating time lag being sufficiently long to allow the arc to be struck without the breaker opening.

There are two cinematograph machines and one lantern slide projector, the former requiring 80-100 amperes (18 mm. solid and 25 mm. cored carbons), and the latter 20-25 amperes (12 mm. solid and 15 mm. cored carbons) through the arc when running on direct current, with an



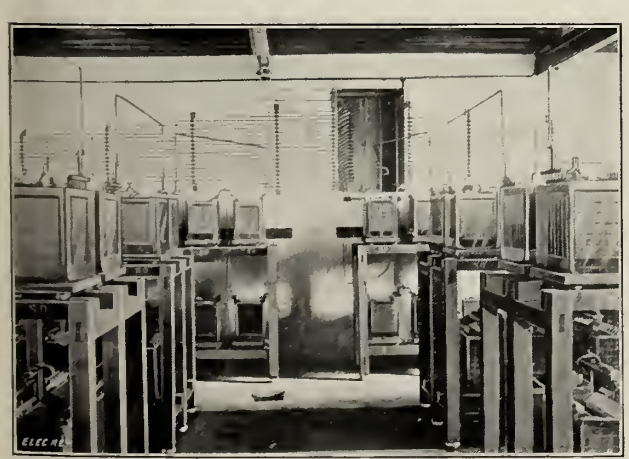
Wedgewood Lounge, showing Reflected Lighting from Candles and Glass Bowls.

increase of 25 per cent. on these figures when using alternating current.

The whole of the electrical installation has been carried out in Griffiths's solid-drawn screwed conduits by Messrs. W. J. Furse & Co., of Nottingham, to the designs and specification of the company's engineer, Mr. Ronald Grierson.

ELECTRICITY SUPPLY IN CARMARTHEN.

PROVISIONAL order for electric lighting at Carmarthen as first taken out by Messrs. J. B. Saunders & Co. in



Battery Room.

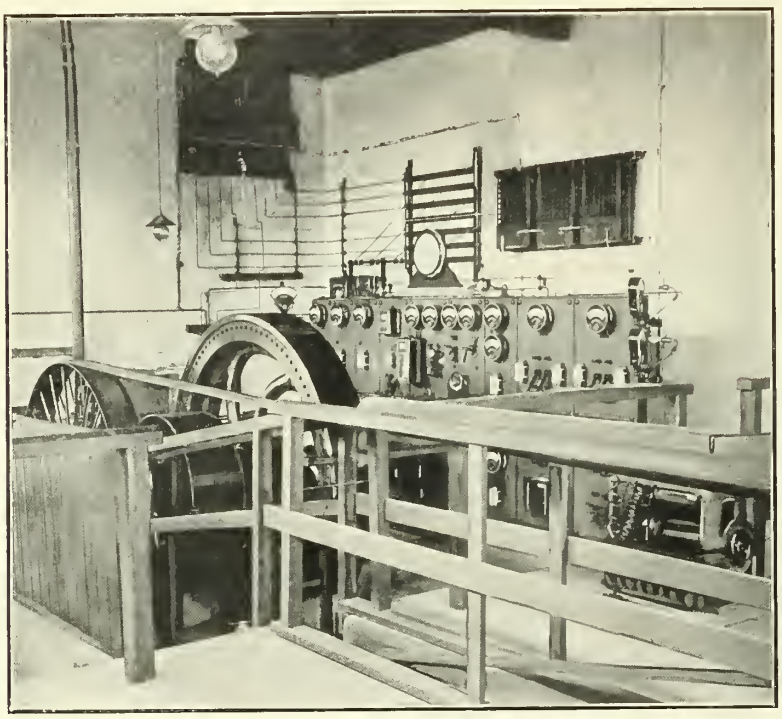


Producer Plant.

Carmarthen Electricity Works.

908; subsequently an agreement was entered into between e Borough Council and Messrs. Saunders for the lighting the street lamps by electricity, this agreement covering 232 lamps, for which the Council was to pay £680 per annum for a term of 14 years. Under this agreement the Borough Council gave its consent to the use of overhead mains throughout the borough.

Ultimately, as the result of negotiation, Messrs. Crompton



Interior of Engine Room showing Main Switchboard.

the engines could be started up electrica connections were made and switchgear vided, so that the armatures of the dyna which are separately excited, can be aeross the armatures of the boosters, booster sets, then being started up in ordinary way. This arrangement has found to be very reliable, and, moreover, not cause an excessive demand on the bat when the engines are started, and when battery is in a low state of charge.

A 3-machine booster set of Crom and Co.'s standard pattern was supp This set consists of a motor capabl driving two boosters at full load, and boosters each to give an outpnt of 60 amp at 0—115 volts. The motor is designe take current at 440—480 volts.

A C.M.B. automatic balancer is insta capable of dealing with 45 amperes ou balance voltage on either side of the t wire system, varying between 210 and volts. This machine takes up very little r and is found to be exceedingly efficient. switchboard consists of plain slate p carried on a wrought-iron framework, a equipped with all the necessary instrum and switchgear for controlling a mo three-wire installation. Besides contro



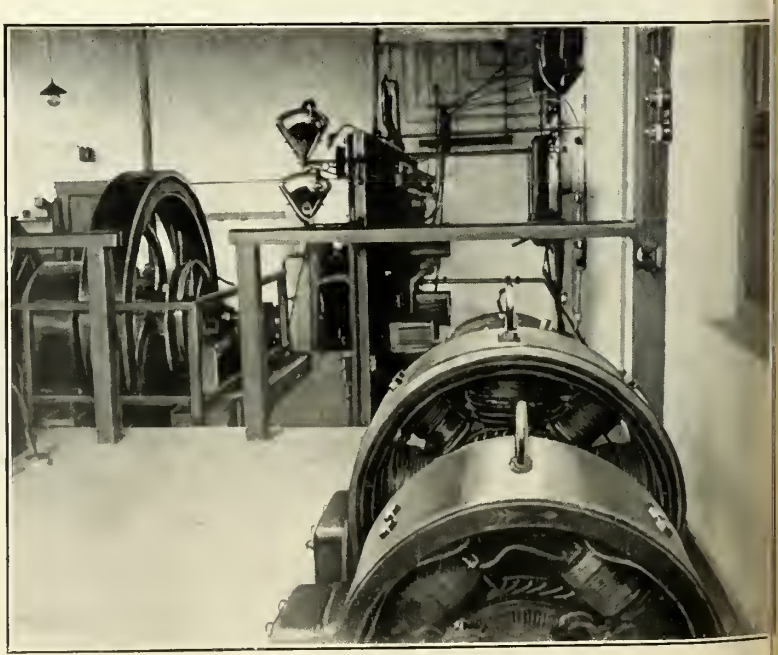
Typical Street Views, Carmarthen, showing the Overhead Wires and Street Lamps.

and Co. became interested in the scheme, and after investigating the possibility of the area, floated a local company, with Dr. J. A. Purves, of Exeter, as consulting engineer. Messrs. Crompton commenced to carry out the work in May, 1910, and the streets were electrically lighted on the August Bank Holiday following from a temporary plant, which was superseded by the permanent installation on November 1st.

This plant was designed to deal with connections equivalent to about 5,000 8-c.p. lamps, and consists of two single-cylinder horizontal type Crossley gas engines, each capable of giving 50-b.h.p. continuously, and working from gas producers using anthracite coal.

These engines drive, by means of belts, two Crompton multipolar open-type shunt-wound dynamos, each capable of giving 35 kw. at 440/480 volts. Each machine is fitted with a special pulley fly-wheel; this, combined with the fact that the engines are of Messrs. Crossley's electric lighting type, renders the supply exceedingly steady.

It may here be mentioned that arrangements were made on the switchboard, so that



The Engine Room, Carmarthen Electricity Works.

e plant above described, the board controls a battery and ree feeders.

Battery regulating switches are provided, but these are ounted away from the board on the battery room wall, so to keep the connections between the regulating cells and e regulating switch as short as possible.

All the usual recording instruments are fitted, the two cording voltmeters being installed in the engineer's office, th change-over switches, so that they can be used to gister the voltage of the 100 cells during the last hour or of charge.

The battery consists of 250 D.P. cells, having a capacity of 0 ampere-hours (10-hour rate.) The glass boxes were pplied sufficiently large to enable additional plates to be ded and the capacity is now being brought up to 540 pere-hours at the 10-hour rate.

The station lighting is carried out in steel tubing, with etallic-filament lamps throughout.

The mains are, of course, all overhead, with a pressure of 0 volts between the middle and outer wires of the three-re network.

Hard-drawn bare copper wire is used throughout, except a few narrow streets, where insulated wire is used.

There are three feeding points controlled by switch-fuses ounted in water-tight cast-iron boxes attached to the poles ich carry the overhead wires. The majority of the poles e of creosoted wood, but in the main streets steel poles e used.

Lightning arresters are provided at the station, with the cessary earth plate.

The street lighting is carried out by means of metallic-ment lamps of 50 and 100 c.p. Plain swan neck ckets with shades and well glasses are fixed to the poles, d the lamps are grouped as far as possible, each group ng controlled by a double-pole switch fuse.

In connection with this town, it is interesting to note that is one of the largest, if not the largest, town in Great itain to be equipped throughout with overhead mains, the ard of Trade having sanctioned this system after inquiry.

Another interesting point in connection with this town is t it was the first town under the Act (which came into ce in April, 1910) in which an inquiry was held as to the sition of the generating station. There was a good deal opposition from the residents to the site, chiefly through orance, but the Board of Trade finally sanctioned the e, and it has proved a very suitable one in every way.

Mr. T. D'Nassau was appointed engineer, and his efforts obtaining a load have proved very successful. There are less than 130 consumers already connected to the mains, total connections being equivalent to 82·3 kw. ere is likely to be a good demand for the supply of elec-city for power purposes, as there are several small indus-s in the town which it is hoped will install electric motors.

NOTES.

(*Continued from page* 178.)

Machine Tool and Engineering Association, Ltd.—The above Association, which was formed as the result of a meeting of machine tool makers and factors exhibiting at Olympia in 1910, is now in active operation and has a considerable and growing membership. The primary object of the Association was to exercise control over the organisation and frequency of exhibitions, which it was felt, were being overdone. One show will be held in 1912 in place of the two originally proposed; it will be under the direct control of a Committee of the Association, and run from the offices of the latter. Over £5,000 worth of space has been applied for and allotted to members of the Association, exclusive of space applied for by non-members. A strong board of directors has been appointed, with Mr. J. T. Peddie, of Vickers, Ltd., as chairman, and the offices have been transferred to 104, High Holborn, W.C. The policy of the Association with regard to exhibitions is to promote one in London every three years, and possibly one in the provinces alternately with those in London. It is probable that in the matter of exhibitions abroad, the Association will be asked by the Board of Trade to take a very important and responsible position in connection with the engineering section of such exhibitions. Now that the preliminary work has been completed, it is intended to initiate a progressive policy which will be of advantage to the trade generally. Information will be supplied to members from time to time dealing with trade openings abroad, and reports as to proposed legislation affecting the trade and other appropriate matters. It has been resolved by the directors that at all exhibitions organised by the Association, preference in the allotment of space shall be given to members. Each member is expected to take up 20 founders' shares of 5s. each.

Royal Agricultural Show, Norwich.—Referring to our report of the show above-mentioned, Messrs. Mann, Egerton and Co., Ltd., of Norwich, write to point out that our brief allusion to their stand gives quite a wrong impression of the nature of their exhibits. For the application of electricity to agricultural purposes they put down a 10-b.h.p. horizontal type oil engine, driving by belt a 6½-kw. dynamo; the current from the latter was carried to one of their standard switchboards and employed to drive a motor coupled to a standard pump for country house or estate water supply, and to another motor driving a corn grinding mill. In addition they had a high-speed two-cylinder oil engine direct coupled to a standard dynamo supplying current to eight flame arc lamps at the top of the stand; a 3-b.h.p. horizontal oil engine driving by belt a dynamo, illustrating the type of plant used for small country house installations, the current from the dynamo being used for various lamps, fans and heating appliances; also a high-speed oil engine, fitted with pulley, developing 3½ h.p., and used for estate work, such as pumping, grinding, &c. A brochure which they publish shows that they have carried out numerous installations in large country houses; the brochure is particularly well planned and well composed, points of considerable importance in dealing with customers of this class.

Railway Lighting.—Our contemporary, the *Railway Gazette*, in a recent issue, published an interesting article on railway lighting by a railway lighting officer, who, however, showed an unmistakable partiality for gas, and, in our opinion, spoiled an otherwise instructive article by introducing comparisons with electric lighting on an entirely superficial and misleading basis. Mr. Roger Smith, of the Great Western Railway, has since taken the matter up with a view to demonstrating that "candle-power-hours" is no real criterion of actual illumination. The following, which is a portion of one of Mr. Smith's letters in the above controversy, may interest electrical men:—

"A certain platform divided into two, longitudinally, by a brick wall, is lit on one side by electric tungsten lamps and on the other by inverted gas mantles, both installations being of the latest modern description. Each sort of lamp is equally spaced, and is an equal height above the platform, both being arranged to give as nearly as possible exactly the same minimum illumination midway between lamps. The minimum illumination as determined by a great number of measurements on a Trotter photometer is 0·022 for gas and 0·0235 for electricity. The candle-power of the gas lamp is 50 and of the electric glow lamp 40. During the time that the test lasted the candle-power-hours of the gas lighting were 90,000 and of the electric lighting 72,000. Both gave practically the same minimum illumination, but the maximum for electric light was 29 times the minimum, and the maximum for gas was 84 times the minimum. If costs had been taken out on the basis of candle-power-hours the gas gives better lighting than the electric light. The illumination photometer shows that while the minima are the same the contrast between maximum and minimum for gas is too great, the reason being that in that particular instance the shape of the mantle was such that far too much light was produced vertically downwards and not enough horizontally. . . . The short gas mantle does not give sufficient light in the horizontal direction and gives too much light in a vertical direction, so that the contrast between maxima and minima is much too great for good lighting. For platform lighting much better distribution can easily be obtained with the upright mantle than with the inverted mantle in small sizes, but as the candle-power increases and the inverted mantle grows longer, this defect is remedied. . . . As far as comparison between lighting by gas and lighting by electricity goes, the amount of illumination for a given sum of money depends partly on the cost of gas or of electricity, but where these are equal for the production of a maximum amount of candle-power in the same direction, their real value for most classes of railway lighting can only be judged by the shape of the distribution curve of candle-power in all directions in a vertical plane."

Power-Limiting Reactances.—At the Chicago Convention of the American Institute of Electrical Engineers last month, a paper was read by Messrs. R. F. Schuchardt and E. O. Schweitzer, on the use of reactances to limit the short-circuit current of large generators. Short-circuit tests were made on a 12,000-kw. 9,000-volt 25-cycle turbo-generator in the Fifth Street station of the Commonwealth Edison Co. of Chicago, without external reactance and with external reactances of 4 and 6 per cent., and the behaviour of the generator and other apparatus was observed. The instantaneous short-circuit current was not so high as had been expected, but, owing to its comparatively high-power factor, the current produced severe stresses on the generator and the oil switches. It was found that in the case of the generator tested, the use of an external reactance of about 6 per cent. was desirable, limiting the current to a value which could be safely interrupted by properly-designed oil switches, and keeping the torque on the generator at so low a value that even when feeding into the short-circuit on the bus-bars there was no appreciable lessening in the speed, nor was the unit subjected to severe strains. The authors claimed that the use of such coils was apparently the solution to one of the most serious problems in the operation of alternators of high voltage and large outputs.

Mr. E. B. Merriam gave an account of experiments carried on in connection with those described in the preceding paper.

During the tests it was noticed that the field current of the alternator increased when the armature was short-circuited, values as high as ten times normal field current being observed. This phenomenon was attributed to the interaction between the field and armature coils. The records obtained indicated that the voltage thus produced in the field coils under some conditions became as high as seven times normal. When a short-circuit was placed upon only one phase it was noticed that the voltage of the phase not short-circuited rose to a very high value, in some instances as high as two and one-half times normal. The current-limiting reactances consisted of 76 turns of 1-in. diameter copper cable wound on a cement core and supported by a wooden framework. The reactance consumed 6 per cent. of the generator voltage when carrying normal full-load current. With the introduction of this amount of reactance in each phase the maximum instantaneous short-circuit current was reduced to about one-half and the torque on the turbine shaft to about one-seventh of what it would have been without the reactance. When a short-circuit was thrown on the system beyond the reactance the terminal voltage of the alternator was maintained, and the alternator recovered its normal voltage after the short-circuit had been removed much more rapidly than would have been the case had the short-circuit been placed directly across its terminals. The oil circuit-breakers proved capable of opening all of the loads or short-circuits without producing any external disturbance or developing any undue pressures. —*Electrical World.*

Coal Prospects.—A recent Board of Trade White Book gives the following figures of mean cost of coal in the chief industrial countries :—

United Kingdom	8 to 9 shillings
Germany	9 ,, 10 ,,
France	12 ,, 13 ,,
Belgium	12 ,, 14 ,,
United States	about 6 ,,

These are prices at the pit-head. Thus, there is not far to seek for a prime cause of the prosperity of the United States, at least in such trades as require large amounts of fuel. The populations of the above countries who make their living out of coal mining are as follows :—

	Persons.	*Per worker.*
United Kingdom	966,300	250 to 290 tons
,, States	690,400	500 to 600 ,,
Germany	591,000	250 ,,
France	191,000	200 ,,
Belgium	145,000	170 ,,

The production per year per worker is given in the last column. The enormous output of the American may be compared with the 490 tons of Australia and the 425 tons per head in Canada. The minimum is that of Japan, 120 tons only. To what are the enormous differences to be attributed? Partly, no doubt, to the use of machinery. Partly, we may be sure, to the reckless way in which the more easily got seams are exploited. It was thus that so large a proportion of the coal in our British mines was left in the ground in scattered patches that are lost to knowledge, and even if known, could not now be made to pay. But a great cause of the small production per head is explicable by the long distances of the working faces from the shaft. There must come a time in every mine when the capital cost of idle walking time becomes greater than the cost of a new shaft or the provision of some means of rapid transit of the men between shaft and face.

This problem is becoming acute in many mines, and seems to invite electrical solution. It cannot conduce to the efficiency of a miner that he should walk miles below ground every working day on his way to and from work. It is but a few years ago that the best Yorkshire steam coal could be purchased for 5s. per ton, and, at the present rate of consumption, about 300 years will see the total exhaustion of known coal to 4,000 ft. in this country. And the output does not stand still.

The Walk to Brighton.—The Electrical Trades London-to-Brighton Walking Race took place on Saturday, July 29th ; six competitors out of an entry of nine started from Westminster Bridge at 5.1.25 a.m., the non-starters being C. S. Blake, A. J. Burbidge and A. Scott. The officials were :—Starter, Mr. C. E. May ; timekeepers, Mr. W. L. Woolveridge (chief) and Mr. A. Edwards ; judges, Mr. A. Edwards, Mr. C. E. May, and Mr. F. J. Worledge ; road marshals, stewards, &c., Messrs. H. S. Stockton, R. Robinson, Ralph Levy, D. Mickleson, C. P. Druitt, G. Cumine, C. A. Sewell, B. Smith, E. Marshall and H. Blackmore ; hon. secretary, S. C. Haynes. When the walkers set off there was a prospect of a cooler day, but as the morning wore on, and the sun shone forth, it became apparent that good times were out of the question. Mr. James Bateman, of Messrs. Bateman & Co., lent two motor-cars for the use of the officials, who were thus enabled to keep in close touch with the progress of the race, but the competitors soon got so spread out that it became difficult to take the desired intermediate times. At Cooper's Stores, Brixton (3 miles) the order was :—A. R. Edwards, Associated Fire Alarms, Ltd., 27 min. 22⅖ sec. ; Roland Farnhill, Callender's Cable and Construction Co., 29 min. 37⅕ sec. ; S. A. Hardstone, National Telephone Co., 33 min. 41⅗ sec. ; H. Tolley, General Electric Co., Ltd., 33 min. 55 sec. ; H. E. Purnell, General Electric Co., Ltd., 34 min. 11⅕ sec. ; A. J. Meakins, Wakelin Bros., Ltd., 35 min. 50⅕ sec. At Streatham Hill Station (5 miles 316 yards), Edwards passed in 46 min. 25⅗ sec. ; Farnhill second in 50 min. 30⅘ sec. ; Purnell third in 56 min. 24 sec. ; and Tolley fourth in 56 min. 38 sec. Edwards passed the Red Lion, Smitham Bottom (14 miles 68 yards) in 2 hours 14 min. 23⅖ sec., Farnhill being second 23 min. behind. At Merstham (18 miles 564 yards), Edwards was 3 miles in front of Farnhill, Purnell being third, Tolley fourth, and Hardstone fifth. Meakins had retired. Chief interest now centred in the competition for the Osram Cup for the first novice to finish.

Tolley retired at Redhill, 21 miles. At Horley, 24 miles 86 yards, Purnell led Farnhill by 15 minutes in 4 hours 57 minutes 55 seconds. Hardstone was now fourth, but after several stoppages retired for good at 36 miles, after passing Farnhill and leading him some distance. The positions were the same right to the finish, the result being : A. R. Edwards, Associated Fire Alarms Ltd., 9 hours 24 min. 1 sec., first ; H. E. Purnell, General Electric Co., Ltd., 12 hours 21 min. 53⅖ sec., second ; R. Farnhill, Callender's C. & C. Co., 13 hours 4 min. 56 sec., third. Owing to the fund falling short of the amount required to clear expenses, no scratch prizes were given, and Edwards's only reward will be the honour of finishing first ; Purnell receives the Osram Cup for the first novice and Farnhill a prize to the value of £3.

A movement is now on foot to organise another race at a shorter distance, and all who are in favour of this should communicate with the Hon. Sec., Mr. S. C. Haynes, as soon as possible.

Joint Committee on Mill Driving.—The *Manchester Daily Guardian* states that a meeting of representatives of the Textile Institute and of the Institution of Electrical Engineers was held at the Textile Institute, Manchester, on Friday last week to consider the question of conducting an investigation into the application of electricity in textile mills, both in the United Kingdom and abroad. It was decided to form a joint committee to be known as the "Textile Mill-driving Committee," to consist of 14 representatives of the Textile Institute and a similar number of representatives of the Institution of Electrical Engineers. Mr. Thomas Roberts, cotton manufacturer, Darwen, was unanimously elected chairman of the committee, and Mr. S. L. Pearce, Manchester city electrical engineer, vice-chairman. The members of the committee were elected as follows :—Textile Institute representatives : Messrs. J. R. Denison (Denison, Preusner & Co.), Bradford ; B. Pali Dobson (Dobson & Barlow), Bolton ; E. P. Fry, Shipley ; Oscar Ha (Robert Hall & Sons), Bury ; Frederick Leeves (Platt Bros. & Co. Oldham ; Frederick Lye (John Bright & Bros.), Rochdale ; J. Nasmith (Nasmith & Barraclough), Manchester ; W. J. Orr (Or and Sons), Castleton ; Thomas Roberts (Whipp Bros. & Co. Darwen ; Fletcher Robinson, Manchester ; George B. Storie, Rochdale ; F. W. Whittaker (Whittaker & Pendlebury), Bradford ; an T. Rowland Wallaston, Manchester. Electrical Engineers' representatives : Messrs. J. F. C. Snell, London ; R. K. Morcom (Bellis and Morcom) ; C. D. Taite (Lancs. Power Co.) ; S. J. Watson, Bury H. Wilson, Liverpool ; Prof. Schwartz, Manchester ; S. L. Pearce Manchester ; J. S. Peck (British Westinghouse Co.) ; H. Dickenson Leeds ; A. B. Mountain, Huddersfield ; W. B. Woodhouse (York Power Co.) ; W. N. Rogerson, Halifax ; Dr. Pohl (Phœnix Dynam Co.) ; and J. Schofield, Shipley. The investigation which the joint committee proposes will be thoroughly exhaustive in its character. It will not be a matter altogether of receiving evidence, but experiments will be carried out with the object of making the final report of real value to everybody concerned in the question of power supply. All the members of the committee are men of practical experience, and the fact that a cotton manufacturer has been appointed chairman indicates that the interests of power-users will have a paramount place in the work of the committee. A report will be published in due course under the direction of the joint committee.

Electricity in Agriculture.—Great developments in the use of the electric current in agricultural operations have taken place in various parts of Switzerland, and noteworthily in the Canton de Vaud. The very smallest communes of this canton are supplied with electricity, which is furnished by a company whose two stations, situated on the banks of the River Orbe, have a capacity of between 12,000 and 15,000 H.P. The primary distributing pressure is 13,500 volts. There are two networks—one with single-phase current for lighting and for small motors up to 1 H.P. and minor motive requirements, the other for power purposes generally, the current being three-phase. More than 40 communes in the canton have founded co-operative threshing societies, each of which possesses a threshing machine driven by an electric motor housed in a bought or hired building. The shareholders make use of the plant according to a fixed rotation, paying for the same according to either the weight or the number of sacks of grain obtained. The consumption of power is found to be 12 H.P. with an English thresher, and 8 H.P. with a German machine for 650 to 800 kg. production per hour. The simultaneous use of a straw vibrator requires an additional 1 H.P. ; of a straw elevator 1 H.P. and of a straw baling press 3·5 H.P. The current is supplied either by meter or at a rate per year.—*Revue Pratique de l'Electricité.*

Electrical Fatality.—Harold R. Fisher, 23, was killed at the British Thomson-Houston Co.'s works, Rugby, on July 26th. He was employed as an electrical tester, and was working underneath a motor-generator, when by some means the current was switched on at 2,100 volts. He was killed instantly.

Extension of Patent.—Notice is given in the *London Gazette* that November 20th has been appointed for the hearing of the petition of the Automatic Electric Co., of Chicago, for the extension of the term of Letters Patent No. 809, of 1898.

Inquiry.—A correspondent asks for the name of maker of "Velox" switchgear.

Appointments Vacant.—Mains assistant for the Dewsbury Corporation electricity department (37s. 6d.); chief assistant and electrical engineer for the Bournemouth Corporation Tramways (£300); assistant to the wireless telegraph expert in H.M.S. *Vernon*, Portsmouth (£300). See our advertisement pages in this issue.

The Radium Institute.—The Institute will be opened on August 14th, for the treatment of patients, both gratis and on a paying basis.

Bills Advanced.—In the House of Lords on Thursday last week, the Metropolitan Electric Tramways Bill, as amended, was read a third time and passed. On July 20th, the Bristol Tramways Bill was read the third time and passed.

In the House of Commons on July 28th, the Lords' amendments to the Nottinghamshire and Derbyshire Tramways Bill were considered and agreed to, and several provisional order Bills were advanced a stage. On August 1st, the Lords' amendments to the Gloucester Corporation Bill and the Metropolitan Electric Tramways Bill were considered and agreed to, and the Middlesbrough, Stockton-on-Tees, and Thornaby Tramways Bill was read a third time.

Erratum.—In the article on "Miscellaneous Lamp Characteristics," page 156, Table IV, the data for mercury arcs relate only to low-voltage arcs; for quartz lamps the usual C.P. is 800.

Educational Notes.—University College, London.—We have received from the Provost the handbook of the Engineering Faculty for the forthcoming session, which opens on Monday, October 2nd. Prof. J. A. Fleming is the Dean, and Prof. J. D. Cormack the Vice-Dean of the Faculty. Full particulars are given of the degree and diploma courses—applications to enter which must be lodged with the Provost not later than September 20th. Special courses can also be arranged, and post-graduate courses in certain subjects have been organised. In Electrical Engineering Prof. Fleming is aided by Assistant-Professor W. C. Clinton, and Mr. E. Kilburn Scott is Lecturer on Electrical Design. An entrance scholarship, value 120 guineas, will be awarded in September. Application must be made by September 5th to the Secretary. See our advertisement pages to-day.

City and Guilds (Engineering) College, Exhibition Road, S.W.—Particulars of courses in civil and mechanical engineering are given in our advertisement pages to-day.

Annual Outing.—For the second year in succession the employés of Electrical Installations, Ltd., over 40 in number, spent their annual outing on Saturday last at Clacton-on-Sea. Various amusements were indulged in, and after a substantial lunch at The Clarence, the party toured the beautiful surrounding country in brakes. The weather was all that could be desired, and a most enjoyable day was spent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—The Keighley T.C. has increased the salary of Mr. Webber, electrical engineer, from £250 to £300 per annum.

Mr. J. G. Ellis, secretary to the Newport (Mon.) Electricity Department, has resigned.

Mr. Ryecroft, assistant electrical engineer at Swindon, has resigned.

Mr. R. H. Campion, borough electrical engineer at Dewsbury, has been taken seriously ill whilst on his vacation. It is anticipated that he will be incapacitated from duty for six or eight weeks.

The Luton T.C. has decided to increase the salary of Mr. W. H. Cooke, electrical engineer, from £400 to £450 per annum, as from August, and that of Mr. H. A. Kell, chief assistant engineer, from £140 to £165.

The Southampton E.L. Committee recommends the appointment of Mr. H. Bennett (of the Westminster Electric Supply Co.) as head of the business development department, at a salary of £225, rising in a year to £250 per annum.

Mr. R. A. Stoker, chief draughtsman of the Durban Corporation electricity department, has been appointed electrical engineer to the Kroonstad Municipality (S. Africa).

The Dundalk U.D.C. has appointed Mr. Percy A. Spalding as resident engineer to its electricity supply undertaking. Mr. Spalding will act as clerk of works under the consulting engineers during the erection of plant, &c. There were 96 applications for this post.

Tramway Officials.—The Highways Committee of the L.C.C. recommends that the salary of Mr. J. Welling, permanent-way engineer, be increased from £550 to £575 per year; and that the salary of Mr. E. L. Pope, resident electrical engineer (southern section), be increased from £425 to £450 per year.

The Bolton T.C. has been recommended to increase the salary of Mr. C. Day, tramway overhead superintendent, from £143 to a maximum of £150 per annum.

The Bournemouth T.C. has appointed Mr. I. Bulfin, chief assistant and electrical engineer, to succeed Mr. C. W. Hill as general manager of the tramways at a salary of £500 per annum, rising by £50 per annum to a maximum of £700.

General.—Mr. B. M. Drake, of Messrs. Drake and Gorham, was severely injured in a motor-car collision last week, his face being cut by the glass screen. Fortunately his injuries were not of a grave nature.

Mr. G. H. Nelson has resigned his appointment as chief outside manager and constructional engineer to the Brush Electrical Engineering Co., Ltd., Loughborough, to take up an appointment with the British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester.

We have to congratulate Dr.-Ing. M. Kloss, of Messrs. Siemens Bros. Dynamo Works, Ltd., Stafford, on his being appointed Professor of Electrical Engineering at the Technical University, Berlin, Charlottenburg.

Obituary.—On July 27th, M. Ernest Mercadier died, in his 76th year. M. Mercadier, says the *Times*, entered the French telegraph service in 1859, and held the post of Director of Telegraphs during the siege of Paris, when he likewise organised the military telegraph service. After the war he became Professor of Physics at the Ecole Supérieure de Télégraphie, and in 1881 he was appointed director of studies at the Ecole Polytechnique, where he remained until the end of the year 1903. In addition to writing many technical works, he was the inventor of a number of technical appliances, including the multiple telegraph, and he was an honorary member of the Institution of Electrical Engineers.

CITY NOTES.

B.E.T. Capital Reorganisation.

The directors have issued the following proposals for re-arrangement of capital, as they do not consider that a reduction of capital is in the best interests of the shareholders, for the undermentioned reasons:—

The market quotations are not, in the opinion of the directors, a fair measure of the depreciation of assets, because these quotations are determined largely by the dividends paid, and not only by depreciation or appreciation of capital. Moreover, the quotations are very variable, the fluctuations between the highest and lowest prices of the company's share and debenture capital during the past year representing a difference of nearly £1,000,000.

It would be an unnecessary sacrifice to write down the capital of this company to meet the fall in market values; the profits of electrical undertakings have during latter years suffered serious reduction, but if the present indications of a recovery are fulfilled, the profits of the associated companies will increase, and the investments of this company will correspondingly improve in value.

It would be exceptionally difficult in the case of this company to make a true valuation of the assets as a basis for a reduction of capital, because many of the undertakings in which it is interested are subject to purchase by the local authorities; the tenures are of a very varied character, and the purchase prices to be paid by the local authorities upon eventual purchase are largely dependent upon the conditions obtaining at the dates when the options to purchase arise.

A valuation of the undertakings now might prove very prejudicial to the interests of the shareholders in negotiations and arbitrations which will take place when undertakings are purchased by local authorities.

With regard to depreciation of assets, the directors have already stated in the report for the year 1910, that "they propose for the immediate future to deal with the depreciation as and when its amount is ascertained, and so long as such depreciation continues to transfer to reserve any profits or losses (other than accrued dividends or interest) made by realisation of present investments," and this policy is being adhered to.

The proposals of the directors for a re-arrangement of capital, if adopted, would have the effect of giving the preference shareholders priority as to part of their capital in a distribution of assets as well as priority as to dividend, and of giving the ordinary shareholders a better position in regard to dividend on a part of their capital; or, stated reciprocally, the effect of the proposals would be that the preference shareholders would waive part of their rights as to future distribution of profits in favour of the ordinary shareholders, and the ordinary shareholders would waive part of their capital rights in favour of the preference shareholders. It is proposed that this should be done by converting the existing capital into—(*a*) first preference shares entitled to priority as to capital, and to a 6 per cent. cumulative preference dividend; (*b*) second preference shares entitled to priority as to capital over ordinary shares, and to 6 per cent. per annum (not cumulative), and further entitled, after the preferred ordinary shares have received 6 per cent. per annum out of the profits of each year, to the surplus profits until the arrears of dividend of £266,371 on the existing preference capital are paid off; (*c*) preferred ordinary shares entitled to 6 per cent. per annum after the first and second preference shares have received 6 per cent. per annum; (*d*) deferred

ordinary shares entitled to the remaining profits. The preferred ordinary shares and the deferred ordinary shares will rank *pari passu* as regards capital; and by converting (1) each existing £10 preference share into £2 10s. in cumulative first preference shares, £2 10s. in second preference shares, £5 in preferred ordinary shares; (2) each existing £10 ordinary share into £6 in preferred ordinary shares, £4 in deferred ordinary shares.

The present issued share capital is 161,437 6 per cent. cumulative preference shares of £10 each, and 133,301 ordinary shares of £10 each, or a total of £2,947,380. Both classes of shares rank alike as to capital. The full dividend on the preference shares has been paid up to September 30th, 1908. The first preference shares will rank for dividend as from April 1st, 1911, and on this basis the arrears of dividend on the existing cumulative preference shares at July 31st, 1911, will amount to £266,371. The nominal capital which is now £4,000,000 divided into £2,000,000 preference shares and £2,000,000 ordinary shares, all of £10 each, will be divided into £500,000 first preference shares, £500,000 second preference shares, £2,000,000 preferred ordinary shares, and £1,000,000 deferred ordinary shares, all of £1 each, but no shares will be issued, except as provided, without the approval in general meeting of the holders of the various classes of shares affected. Holders of the first and second preference shares, and of the deferred ordinary shares, will be entitled to one vote in respect of each share of either class, and holders of the preferred ordinary shares will be entitled to one vote in respect of every five shares.

Effect of the Proposals in regard to Capital.—The holders of the existing preference shares will hold all the first and second preference shares, which will have priority of capital over the ordinary shares. This represents priority in respect of £5 per £10 preference share, or £807,185 out of a total share capital of £2,947,380, and equality in regard to the remaining £5 per £10 preference share, which they will hold in preferred ordinary shares, while under the present constitution the preference shares rank equally, as regards the whole of the £10 share, with the ordinary shares in distribution of assets. The holders of the existing ordinary shares will hold £6 per £10 share, or £799,806 in preferred ordinary shares, and £4 per £10 share, or £533,204 in deferred ordinary shares. Both preferred ordinary shares and deferred ordinary shares will rank alike as regards capital, and will be entitled in a distribution of assets to any surplus after the first and second preference shares have received the return of their capital.

Effect of the Proposals in regard to Profits.—The dividend of 6 per cent. per annum on the cumulative first preference shares will amount to £24,215, which was the amount distributed on the existing cumulative preference shares in each of the last two years (viz., 1½ per cent., or 3s. per share on 161,437 shares of £10 each). The preference shareholders will thereupon be entitled to further profits up to a further £24,215 as holders of the second preference shares. The holders of the present preference shares will therefore be entitled, preferentially as holders of the first and second preference shares, to all the first profits up to an amount equal to double the profits distributed in each of the last two years. A dividend of 6 per cent. on the preferred ordinary shares will amount to £96,419, and of this the holders of the present preference shares will be entitled to £48,431, and the holders of the present ordinary shares to £47,988. The holders of the present preference shares will be entitled to all further profits until the arrears of dividend of £266,371 are paid off. Thereafter all surplus profits will go to the holders of the deferred ordinary shares, all of which will be held by the holders of the present ordinary shares. Under the present constitution the holders of the ordinary shares are not entitled to any profits until the existing preference shares have received a cumulative 6 per cent., equal to £96,862 per annum, and until sufficient profits have been made to pay the arrears of dividend for the time being on the existing preference shares.

Extraordinary general meetings are to be held in October to consider these proposals.

National Telephone Co., Ltd.

The forty-eighth ordinary general meeting of the National Telephone Co., Ltd., was held on Thursday last week, at Hamilton House, Victoria Embankment. Mr. George Franklin presided.

The Chairman, in moving the adoption of the report (see Electrical Review, page 104), said that during the past half-year there had been added to the system 15,675 stations, as compared with 16,286 stations in the corresponding period of 1910. When they remembered that they were shortly approaching the termination of their licence, and that there were consequently many cessations, it must be gratifying to them to see that they were still able to attach to their system such a large number of stations, making the grand total remaining on June 30th last, 549,928. The income accrued in respect of the business of the half-year, £1,807,871, showed an increase of £129,559. The Post Office royalties amounted to £173,424, or £11,543 more than in the corresponding six months of 1910, and the total amount which they had paid to the Government under this head was £3,645,820. After deducting the Post Office royalties, the net income stood at £1,634,447, being an increase of £118,016. The working expenses, £1,058,169, were larger by £86,255, and left a net profit of £576,277, as compared with £544,516, an increase of £31,761. That sum had been disposed of by an additional transfer of £25,000 to the reserve, making £200,000 for the half-year, and the remainder had been absorbed in the payment of debenture interest and dividends. The percentage of working expenses to net income was 64·74 per cent., as compared with 64·09 per cent. That appeared to show an increase in working expenses, but it was not really so, because the increase was more than due to a sum of £50,000, which had been charged against the profits of the half-year under the title of inventory and arbitration suspense account. He had been asked why the company continued to expend such a large sum as £211,121 on construction, seeing that they were so near to the end of their licence. The answer was, first, that in a telephone business the capital account never closed, and he thought the shareholders might be reassured that the whole policy of the board was so to direct the capital expenditure as to make it reproductive in income within the period of the licence. But even that would not be sufficient unless it could be shown that when the winding-up came, and the property was transferred to the Postmaster-General, their purchase money would be larger by reason of this expenditure, which they were now making. The view of the board was that no capital should be spent except such as would produce an added sum at the time when the arbitration came on, and their system was over. During the past year the board had deemed it wise to ask for offers of the 3½ per cent. debenture stock up to a sum of £500,000, and in view of the opinion of counsel as to the amount at which such stock might ultimately be repayable, a limit of par value was placed upon it. For this they had in various quarters been subjected to adverse criticism on the ground that in certain events this stock was redeemable at 103. The company had been advised by eminent counsel that the events referred to in the certificate, and the instruments creating the stock, had not and never could arise, and that any payment of the premium mentioned, that was 103, would only result in depriving the holders of the junior securities of moneys which were properly theirs. In March last when the board made the offer, the price of the debenture stock in the market was only 98½, and it was felt that in fixing the limit at par for those who desired to offer stock, a fair and a reasonable attitude was adopted, having regard to the opinion of counsel, which they could not afford to disregard. As to the policy of such repayment, he thought it would be obvious to shareholders that there could be no better investment for the company's spare funds than in paying off their debenture obligations. With regard to their credit balance shown in the balance-sheet, £436,886—as shown in the appropriation account, dividends had absorbed £218,750, and reserve fund account £200,000, leaving £18,136 to be carried forward. The reserve fund totalled £4,059,123. Shareholders were constantly asking him where this £4,000,000 odd was to be found. The answer was that, to the extent of £1,839,800, it was represented by solid cash and by freehold and leasehold properties. As to the balance, he could say with some confidence that it would be found in the assets of the company when these came to be distributed. In other words, the difference had been used by the company in carrying on the business instead of the shareholders being asked to supply more capital for the purpose. He thought that this account had now reached a sum which should be ample to protect the shareholders' capital from any possible diminution in value. The work upon the enumeration and checking of the inventory commenced in October last. It was occupying the constant time and attention of a staff of about 500 persons, and was, of course, a great expense alike to the Postmaster-General and to the company. But the directors believed that no other course was open to them than to face this task, which was, no doubt, a great burden upon the officers engaged upon it. The cost of this work was being charged to the inventory and arbitration account. Last half-year £25,000 was placed to that account, and in the half-year under review £50,000 had been placed to it. Referring to the objections to certain of the company's plant received from the Postmaster-General, and the subsequent legal proceedings, an arrangement had been effected between the Postmaster-General and the company, by which practically the whole of the plant objected to was to be taken over and purchased by the Postmaster-General, certain deductions from the ultimate purchase price of portions of the plant objected to having been agreed to be made by the company. He did not want to say too much about that settlement, but it was one which the directors had cordially approved. There had recently been introduced into the House of Commons a measure entitled the Telephone Transfer Bill, the object of which was to facilitate the arrangements necessary to be made by the Postmaster-General in relation to such transfer. In response to representations made to the Postmaster-General by the company certain alterations had been approved which, while preserving to the Postmaster-General the necessary powers required, would at the same time remove the company's objections to the Bill as first presented. The Bill also made provision for the company's staff, and it was due to the Postmaster-General to express satisfaction at the fair and reasonable provision which he offered to make in this regard.

Mr. S. H. Sands seconded the resolution.

The Chairman, in reply to Mr. Collins, a shareholder, said that the purchase agreement provided in certain events for the transfer either on December 31st next or some day or days to be fixed by the Postmaster-General during 1912. A great deal would depend upon the decisions of the next few months. The all-important question they had to think about was that of price—how best could the company be fairly compensated for the money it had put into this business. That was obviously the question which was still under consideration, and upon its solution depended in a large measure the date of the actual transfer of the business to the Postmaster-General.

The report was adopted.

Kaministiquia Power Co., Ltd. — The directors announce the usual quarterly dividend at the rate of 3 per cent. per annum.

Metropolitan Railway Co.

THE half-yearly meeting of the shareholders of the above company was held on Wednesday at the Great Eastern Hotel, Liverpool Street, Lord Aberconway presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 142), said there had been an increase of £1,019 in the maintenance of way, works and stations; an increase of £2,533 in locomotive and generating expenses, due partly to the increased mileage run, and partly to a slight increase in the price of coal; and an increase of £858 in carriage and wagon repairs. There had been a saving of £2,264 in traffic expenses due to economies effected in various directions. Law and Parliamentary expenses were up about £618, in consequence of their having had to oppose several Bills in the present session of Parliament. Rates and taxes showed a decrease of £5,060. The passenger traffic on the Metropolitan line proper, apart from the joint lines in which they were interested, showed an increase of £5,610; parcels showed an increase of £1,264, and merchandise and minerals an increase of £2,135. Their loss on the Hammersmith and City line was about £2,343 less than in the corresponding period, and they were charging £5,000 to the electrical renewal and depreciation fund, as against £10,000 in the corresponding period. It had been stated that they were unduly reducing that fund, but that was not so. He would remind them that £5,000 was the amount they usually placed to this fund each half-year, and which they considered sufficient under normal conditions. Last year they were about to enter into a contract for the renewal of their generating plant at Neasden, and they thought it wise to take advantage of the fact that they had received some moneys which were not strictly applicable to the revenue of that year, to make a special provision for the strengthening of the electrical renewal fund. He might say that this fund now stood at £87,697, and that when they had paid for that portion of the work now proceeding at Neasden which was chargeable to revenue, they would still have £37,000 left to the credit of the fund, which, in view of the fact that they would have an entirely new generating plant, they considered would be amply sufficient. They intended gradually to add to the fund out of revenue. Their proportion of the profits on the working of the Metropolitan and Great Central joint line north of Harrow was more by £2,342, which he considered very satisfactory, especially as regarded its promise for the future. A short time ago they introduced some new compartment stock trains into this service for the purpose of running through to the City. These trains were exceedingly comfortable, and had been so greatly appreciated that they had decided to purchase four more similar trains for the same line to be in readiness for the further improved service which they intended to bring into operation as soon as the alterations at Baker Street were completed. During the half-year there had been a small increase in both the electrical and the steam mileage. It was necessary in these days of quick and frequent train services to keep their line well to the front, and that could only be done by increasing their train services judiciously to meet the public demand. After providing for the debenture and preference stocks, they had a balance of £61,425 available, for the dividend on the ordinary stock, as compared with £41,869 12 months ago. That would admit of their paying a dividend at the rate of 2 per cent. per annum, and carrying forward £4,104. That was an increase of ½ per cent. in the dividend, and he thought they were justified in regarding the result of the half-year's working as very satisfactory. The percentage of expenditure to gross receipts during the half-year was 48·83, as compared with 49·56 in the corresponding period, and the percentage of expenditure to traffic receipts alone was 53·9, as against 54·9. The number of passengers carried during the half-year was more by 562,420. Their season-ticket traffic showed a very satisfactory increase, which was evidence of the growing popularity of the line and of the appreciation by the public of their increased train services. On the subject of rates and taxes he was glad to be able to report that as the result of the revaluation of the line for the new quinquennium, which commenced last April, and of very lengthy negotiations with the various authorities in London, they had succeeded in effecting a reduction of £26,852 in their rateable value, which meant, on the present poundage, a saving in cash to them of about £10,000 per annum. They had had the advantage of this saving for three months in the accounts under notice, and, in addition, some refunded money which they had received as the result of the new assessment. The importance of these reductions to them was very great, and they justified the view he had always expressed there, that railway property was unfairly treated by local authorities in matters of rating. He wished to say that their contract with the Westinghouse Co. was proceeding quite satisfactorily, and the first of the new machines had been running some little time, and had been of the greatest service to them. They could not afford to suffer the slightest risk of a suspension of the services by any of their generators failing to perform their work.

COL. PROBYN seconded the motion, and the report was adopted.

Anglo-American Telegraph Co., Ltd.

THE half-yearly meeting of the shareholders of the above company was held on Friday last at Winchester House, Old Broad Street, Mr. A. Bevan in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 143), said that the Western Union had come to the conclusion that the pooling agreement of 1882, by which the two companies shared the receipts in certain proportions, was invalid under the Sherman Trust Act, and they gave them notice that, having made that discovery, they would as from March 1st cease to carry out its terms. Since then they had no longer handed over to them the American traffic, the result of which was that they had earned £37,000 less. He wished to emphasise that that showed the immense importance of keeping on the best of terms with the Western Union, as a good deal more than half their traffic arose on the other side of the Atlantic. It was in the power of the Western Union with their enormous ramifications throughout the whole Continent to dispose of that traffic as they pleased. So long as there was a pooling agreement it did not matter which line it came by, but directly the pooling agreement ceased to take effect the Western Union, having, in the meantime, laid a third cable, which enabled them to carry the traffic which hitherto they had been unable to carry, took the larger portion for themselves. For some months before that occurred, they had been negotiating with the Western Union for a new agreement, and he was very hopeful that in a very short time they might be enabled to say that the agreement had been exchanged. The agreement provided that the Western Union were to take a lease of their cables for 99 years, and when he said their cables, that involved the purchase by the Anglo-American Telegraph Co. of the new cable that was laid down by the Western Union Co. That would absorb the greater part of their renewal fund—certainly, at least £700,000, or perhaps a little more. The Western Union were to give them a guarantee of 3¾ per cent. on their ordinary stock, which amounted to £262,500 a year, payable quarterly, and as the preferred stockholders took 6 per cent., that would leave 1½ per cent. on the deferred stock. That was exactly the amount of dividend that they were able to pay their stockholders last year; and on one occasion only had they paid more. The agreement meant that, whatever happened in the future, for 99 years the Western Union, so long as they had a cent in their exchequer—and they had an enormous capital and a large reserve—were bound to keep up this payment of £262,500 a year. They were to maintain the Anglo-American Co.'s renewal fund, just in the same way as they had maintained it—by setting aside £20,000 a year, and the interest upon the securities in which the fund was invested. The management would be in the hands of the Western Union; a small board would be retained who would act really as trustees for the Anglo-American shareholders. The Western Union also were to maintain the cables and all of the property, so that in the very unlikely event of the agreement having to be broken through *force majeure*, their property would be restored to them in the same position, as far as possible, as it was in when it was handed over. When the Western Union first proposed the agreement they stated that they wished to make certain alterations or improvements with regard to the traffic arrangements—they wanted, for instance, to have deferred messages at a cheaper rate, and they (the Anglo-American Co.) saw that very possibly they might suffer loss through those arrangements. Now, of course, the Western Union could make what changes they pleased; they could put on a lower tariff for certain messages, but whatever they did it would be at their own risk—whatever the tariff was, they were bound to pay them this £262,500 a year. Then it must be borne in mind that the larger portion of their business originated in the United States, and not on this side, and therefore, if they were to continue to have their fair proportion of that business, it must be by entering into some sort of arrangement such as that proposed. As to the security, he believed it was as good as they could possibly have, and instead of having a stock which was constantly fluctuating according to the prospects of the traffic, they would have what he might call a gilt-edged security—an absolute fixed rate of interest guaranteed by one of the most powerful companies in the United States.

SIR GERALD FITZGERALD, K.C.M.G., seconded the motion.

MR. FRY said he believed he was voicing the opinion of all the shareholders when he said that there was a general feeling of satisfaction at the way in which the chairman and the board had carried out these negotiations with the Western Union.

The report was then adopted.

Electric and General Investment Co., Ltd.

THE directors report for the year ended May 31st, 1911, a gross profit on the transactions of £11,848. After deducting all general charges and the interim dividend already paid on the preference shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, 1911, there remains a balance of £4,176. As a further reserve to meet the depreciation in the company's investments, £2,976 of this amount has been carried to the contingencies fund, raising it to £78,924 as at May 31st, 1911, leaving a balance of £1,200. The directors recommend that the £1,200 be distributed by the payment of a dividend at the rate of 6 per cent. per annum on the capital paid up on the ordinary shares for the year ended May 31st, 1911. The warrants for the dividend on the ordinary shares, as stated above and subject to the deduction of income-tax, were to be posted on July 27th.

In June, 1907, a scheme for the reconstruction of the company, in order to extinguish the founders' shares, was submitted to the shareholders, which had to be adjourned *sine die* owing to its being found impossible at the time to obtain the necessary majority of the holders of the founders' shares to vote in favour thereof. The main objection to that scheme was that it put a new liability for uncalled capital upon the founders' shares. Since then the directors have had the matter before them continuously, and now submit an amended scheme, which they have every reason to hope will meet with the approval of all classes of the company's shareholders. Briefly, the proposals are:—That the existing 100 fully-

paid founders' shares of £5 each he converted into 10,000 fully-paid deferred shares of 1s. each. That the investments deposited many years ago with trustees, on behalf of the holders of the ordinary and founders' shares respectively, be capitalised by the creation and issue of £22,500 5 per cent. redeemable debenture stock and of 30,000 fully-paid deferred shares of 1s. each, making in all 40,000 deferred shares of 1s. each. That there be issued to the holder of each founders' share £125 in 5 per cent. debenture stock, 200 deferred shares of 1s. each fully paid (of which 100 shares will represent the converted founders' share), and a cash distribution of £7; and that there be issued to the holder of each ordinary share 10s. in 5 per cent. debenture stock and one deferred share of 1s. fully paid, and a cash distribution of 6d. The holders of the present founders' shares will receive 20,000 of the deferred shares, and the holders of the ordinary shares will receive the remaining 20,000 deferred shares, thus preserving the existing equities and rights of the two classes of shares. A fuller explanation of the proposed scheme is appended to the report.

Extraordinary general meetings will be held immediately after the close of the business of the ordinary general meeting to carry this scheme into effect, and the directors think it desirable to take the opportunity of bringing the articles of association of the company more into accord with modern practice. Mr. J. B. Braithwaite retires from his office as a director, and offers himself for re-election.

The twenty-second ordinary general meeting of the shareholders of the company was held on Thursday last week at Winchester House, Old Broad Street, Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report, said the year had been an uneventful one from the company's point of view. The net result was that they had earned £11,848, as compared with £13,086 in the previous year, or about £1,300 less. That enabled them to pay the dividend on the preference shares, to pay the same dividend as last year—6 per cent.—on the ordinary shares, and to add a further £2,975 to the contingencies fund, which would raise that fund to close on £79,000. Their investments had increased during the year from £244,619 to £250,154. He was pleased to say that the process which was commenced last year in regard to the recovery of their securities was still going on. Last year he told them that there was an improvement of about £7,000 in the depreciation. This year he was glad to say the improvement had amounted to £13,652, so that in the two years there had been an improvement of over £20,000. As he pointed out last year, they had a considerable interest in the British Electric Traction Co., and they would no doubt have noted with satisfaction the improved position of that company as disclosed in the recent report, and also the continued increase in the traffic receipts of the associated companies which had been steadily going on for a considerable period, and which had recently assumed very considerable dimensions. The other companies in which they were interested were the City of London and the County of London Companies, both of which were making excellent progress.

Mr. E. Garcke, in seconding the motion, said he was pleased to be able to confirm the statement of the chairman with regard to the progress which was being made by the British Electric Traction Co. The traffic receipts had undoubtedly been very much better this past year, and the company had in view some new business abroad which might still further improve their profits.

The report was adopted.

The Chairman next proposed a resolution for the rearrangement of the company's capital. He said it would be remembered that one or two attempts had been made to reorganise the capital, but hitherto they had failed to obtain the necessary consent of the holders of the founders' shares. This time, however, they had obtained the support of the holders of those shares, and, he believed, the scheme which the board now recommended was one which was greatly in the interests of the company, and of all classes of shareholders. Briefly, the scheme might be thus summarised. They had at the present time certain securities which were invested under trustees on behalf of the holders of the ordinary and the founders' shares. It had long been felt that it was rather an anomaly to have those securities in a separate basket, while the holders of the ordinary and founders' shares were entitled to their distribution in some form or other. They therefore proposed to distribute those reserve funds, and, at the same time, to simplify the share issues of the company by issuing shares to represent the rights which the founders' and the ordinary shares at present possessed. At the present time the ordinary shares were entitled to a non-cumulative 10 per cent. dividend for each year, and any profits over and above 10 per cent. on the ordinary shares were divided equally between the ordinary and the founders' shares, there being 100 of the latter, of £5 each. They now proposed to convert the founders' shares into deferred shares of 1s. each, giving every founder £5 of capital in the form of 100 deferred shares. They then proposed to create a further 30,000 deferred shares of 1s. each and give 10,000 of them to the founders and the other 20,000 to the ordinary shareholders. Thus, share for share, the effect of this would be that out of the 40,000 deferred shares, the ordinary shareholders would hold half and the founders half, thus exactly preserving their present equities. The deferred shares would be entitled to the whole of the profits after 10 per cent., non-cumulative, had been paid on the ordinary shares. The fund which they proposed to realise would be distributed in the form of 5 per cent. debenture stock. They proposed to give to the holder of every ordinary share 10s. in that stock, 1s. in a deferred share, fully paid, and 6d. in cash. The founders would receive £125 in 5 per cent. debenture stock, £5 in deferred shares, and £7 in cash. The result of that would be that the capital of the company would be very much simplified, as they would only have the 10 per cent. non-cumulative ordinary shares and the deferred shares. As to the preference shares, of course they never had any interest in either of these reserve funds, and obviously they could not have anything out of them. But their position was in no way prejudiced under the rearrangement. The board already had power to issue debenture stock up to £200,000 if they chose. They did not propose to exercise that power except to the extent of the £22,500 contemplated under the scheme, and for that assets of the full value were brought into the company, so that the preference shares would be left exactly where they were now. He was pleased to say that the amount of support which they had received from all classes of shareholders indicated that the general opinion was that the scheme was a just and equitable one.

Mr. E. Garcke seconded the resolution, which was carried unanimously.

Subsequently, extraordinary meetings of the various classes of shareholders were held, when resolutions were adopted for increasing the capital in order to carry the scheme into effect.

Crompton & Co., Ltd.

The annual general meeting of the shareholders of the above company was held on Monday at Salisbury House, London Wall, Mr. John Trotter presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 143), said that all he could say regarding the year's working was that the final result, after paying all charges and providing for the usual depreciation, was a loss of £14,000 instead of £20,000 last year. Prices had remained low, and it required a large turnover to make a satisfactory profit. The condition of the electrical manufacturing industry during the year under review made it far from easy to obtain large sales, but he was glad to say that in this respect there was now a very distinct improvement. In the past they had made large profits out of contracting, but great care had to be exercised in a business of that description: he regretted to say there were two contracts which were the subject of dispute, although they did not anticipate anything but a favourable termination in both cases. The policy of the board at the moment was to do everything to fill the works where so much capital was employed, and while doing this to steer clear of business likely to unduly lock up money. That involved the rejection of a certain amount of contract business, but they would still require an expensive staff in this side of the business, although not so large or so expensive as in the past, and it was under those circumstances that their general manager had tendered his resignation. He (Mr. Trotter) would like to recognise the long and valuable services that the general manager had given them. Referring to the balance-sheet, they would note considerable changes. Sundry creditors and loans from bankers were reduced by £27,000, and cash at bankers showed an increase of over £5,000. Their stock was reduced by £22,000, and trade debtors by over £26,000. There was another item he would like to see reduced, although it remained at practically the same figure as last year, and that was their investments in the Electric Supply Corporation and other companies. The combined value of those investments was too large a one, in spite of the reserve of nearly £21,000 which they held, mainly against the Electric Supply Corporation shares. That company, he was glad to say, was making steady progress, and the chairman had said that a dividend might be expected during the coming year. Nevertheless he was afraid they would still have to exercise some patience before they could advantageously dispose of, at any rate, some part of their holding in that company. The reduction of plant and tools was due to the usual writing down. The final adverse balance was now the large one of £48,000. In the profit and loss account there was a satisfactory reduction of £1,227 in trading expenses, although that item included a considerable sum for renewals of plant and tools and experimental work. Administration expenses showed a small increase of £200. They had hoped that that item would have shown a considerable saving due to economies in salaries, rent, &c., but unfortunately that saving had been more than counterbalanced by special expenses incurred owing to troubles in India and Turkey, and to extra legal expenses. The gross profit was £32,455, against £31,826, and the revenue account showed a final figure of £48,271 against them as a result of the last two years' trading. There was a reduction in fees from £2,007 to £1,440, due to Colonel Crompton having given up his fee as technical adviser. With regard to the coming year, as he had told them, there would be a change in the management. He could only add that during the year the staff had worked zealously, and had done their best to improve the company's manufactures and keep pace with the times.

Colonel J. Clibborn, in seconding the motion, said that since he had been connected with the company, he had devoted himself in the main to looking into its past working, to see under the circumstances what prospects he could find as regarded its future prosperity. One of the first points to determine, he considered, was the efficiency of the works, and he was very glad to be able to tell them that, in his opinion, in the works they had a truly powerful aid to prosperity. He had an opportunity, some time ago, of seeing how the branches in India were working. They appeared now to have got over all the difficulties which were inseparable from branches starting in a new country, and it seemed to him that if their output could be increased they might also look to large profits in the future from that country.

Mr. Gordon remarked that, according to the report, all that

was needed to give them good profits was an increase in the turnover. He communicated with the secretary some months ago, and that gentleman told him that there was not a technical man on the board who knew anything whatever about the industry except Col. Crompton. He (the speaker) quite endorsed that, and he felt sure that, unless something was done in that direction, an increased turnover would make no difference at all. The efficiency of the works had been mentioned. His experience was that their cost charges were so high that they could not possibly compete with a number of other British manufacturers—they had not the ghost of a chance. With regard to their investments in companies, apart from the Electric Supply Corporation, amounting to £34,000 odd, he supposed there was no market valuation for them, but he would like to know, supposing there was a forced realisation, whether they would fetch 10 per cent. of their value.

The Chairman said it was difficult to say what those investments were worth, but they would certainly fetch more than 10 per cent. of their face value. Some of the investments were repayable in full, but they would have to wait some time before they could get the money.

Mr. Gordon asked whether the chairman could enlighten them as to who was to succeed the late general manager.

The Chairman said he could not say anything upon that subject then.

Mr. Gordon said he hoped that in the appointment the company would go outside its staff, and get somebody of reputation in the electrical world who would improve the status which the company held. He was afraid that their name had gone down considerably in India, and he did not think there was much likelihood of their getting a big business there. In Canada their name was unknown.

The Chairman: We don't do business in Canada.

Mr. Gordon remarked that Canada, in his opinion, offered a good field for business.

Mr. Weston said that in default of being able to forecast a decided improvement in the business, he expected that the chairman would have put before them the advisability of winding up the company. The last dividend which the shareholders received was 1908. The policy of filling the works with work was no good the work did not pay—the more work they did, the more they lost. They had got a debit balance of nearly £20,000, and supposing they succeeded well enough to make 5 per cent., it would be four years before that debt was wiped out, so that they would at the least have to wait another five years before they could even get a precarious dividend of 5 per cent. Allowing a handsome sum for loss in realisation, he should say that the assets would come out at about £1 per share, and he thought most of the shareholders would rather have that £1 than wait another five years for a precarious 5 per cent. upon their money.

Mr. Andrews said that in view of the very unsatisfactory state of affairs, it seemed to him that it was no use going on unless the directors had very satisfactory grounds for supposing that the future would yield better results than the past. He thought it would be well if the board faced the situation, and considered whether it would not be well to cut down the shares to £1.

The Chairman said he could assure the shareholders that the board were fully alive to the serious difficulties under which they had been and were still working at the present moment. The increase in output would have a very remarkable effect, for in a manufacturing business of this sort they very soon ran into big losses, and, on the other hand, they very soon ran into big profits. He agreed with the speaker who said that they ought to have more technical men on the board. Speaking for himself, he would be only too glad if some skilled electrical engineer could be found to take his position. As regarded writing down the shares, that, he thought, would be a necessity if they could secure a good profit, because they would not be able to declare any dividend unless they did cut down the value of the shares. With regard to winding up, there were other ways of dealing with the concern which were having their attention very carefully, and which would be much more advantageous to the shareholders than endeavouring to realise.

The report was adopted.

The Chairman formally proposed the confirmation of the election of Col. Clibborn to a seat on the board.

Col. Crompton, in seconding the motion, said he held an unusually large proportion of the shares of the company, and he appealed to the shareholders to have patience with the board, who had worked very hard under extraordinarily difficult conditions which he could not explain then for many reasons. The main asset of Crompton's was its works and its staff, and they were in a perfectly healthy condition. It was absolutely untrue to say that they could not manufacture at present prices and realise a large profit on the orders. The crux of the whole difficulty was the present lock up of capital, and if that could be surmounted they could earn sufficient to pay a good dividend.

The motion was carried.

The auditors having been re-elected, the proceedings terminated with a vote of thanks to the chairman for presiding.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax (as last year), for the three months ended July 30th last.

Stock Exchange Notice.—The Committee has been asked to allow the following security to be quoted in the Official List:—Chili Telephone Co., Ltd.—Further issue of 22,000 shares of £1 each, fully-paid.

Mersey Railway Co.

The half-yearly ordinary general meeting of the shareholders of the above company was held on Friday at Worcester House, Wallbrook, Mr. James Falconer, M.P., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 145), said he was pleased to say that the progress of the company had been steadily maintained. If they compared the condition of affairs now with that which prevailed before the railway was converted to electric traction, it would be seen that the number of ordinary passengers carried had more than doubled, while the number of season ticket-holders had been trebled. The past half-year showed an increase in the net revenue of £4,115 as compared with the corresponding period in 1910. After payment of all expenses there remained a balance of £8,061 available for payment of interest on the contingent debenture stock. They were not, however, in a position to make any distribution at that meeting, as the payment of interest was contingent on the revenue available in each separate year ending December 31st; and therefore increased by the balance from the current half year, the amount would be available for distribution at the next meeting. They would thus be in the happy position of being able, for the first time in the company's history, to pay some interest to debenture-holders who had waited so long and so patiently for a return on their capital.

Mr. Robert Cooper seconded the motion.

Mr. G. Williams said he had to congratulate the directors upon the satisfactory report which they had been able to present to the shareholders. He thought, however, that in the interests of the company, it would be well if the board were to forego their fees for the present.

Mr. W. Dunstall congratulated the directors on having reduced the working expenses from £36,000 in 1908 to £30,000 last half-year.

The Chairman, in reply, said he could not agree that it would be any advantage to the company if the directors gave up their fees. He would remind the shareholders that for many years he and his colleagues took their fees in "D" debenture stock, so that during the troublous and anxious times through which the company had passed they had no fees, and they had practically written them off. The reduction in the expenses was due in a great measure to the work of the engineer and the general manager, and he did not believe they had yet come to the end of economies which would be effected in working.

The report was adopted.

Continental.—France.—The report of the French Westinghouse Co. (Société Anonyme Westinghouse) for 1910, states that in spite of the progressive development of the business and satisfactory results shown by the establishments at Freinville, the year 1910 closed with a debit balance of 131,540 fr., this result being due to the poor financial return made by the electrical department. Orders for electric material have come in well from the railways and the general trade, and compensate for the loss of Italian orders, consequent on the commencement of business by the Societa Italiana Westinghouse. This subsidiary has had a depressed year in consequence of the Italian Government interrupting the execution of its programme of electrification of the State Railways. The Hungarian Westinghouse Co. has commenced to build chassis for motor-cars, and has made a small profit, which it has applied to amortisation. The Leblanc-Westinghouse Co. continued its prosperous career, and distributed a 125 per cent. dividend for 1910, which, however, only enters into the accounts of the parent company for 1911. The Heintz Railway Heating Co. distributed a dividend of 15 per cent. for 1910. The directors propose, in view of the necessity of making certain allowances for depreciation referred to in the preceding year's report and not provided during the past year for want of funds, to reduce the capital from 20,000,000 fr. to 14,000,000 fr.—*Financial Times.*

La Société Electrique Edison, of St. Etienne, reports a profit of £10,859 for the last financial year, as compared with £8,125 in the preceding 12 months.

La Société Havraise d'Energie Electrique, of Havre, has decided to increase its capital from £250,000 to £290,000.

New General Traction Co.—The revenue in the year ended March 31st amounted to £22,656, as against £19,482 in the previous year. A profit of £3,674 is shown, reducing the balance of loss previously shown to £21,631. The Coventry Corporation have given notice of their intention to acquire the Coventry Electric Tramways.—*Financial News.*

National Gas Engine Co., Ltd.—A dividend at the rate of 5½ per cent. per annum (less income-tax) on the preference shares and 20 per cent. per annum (less income-tax) on the ordinary shares for the half-year ended June 30th, 1911, has been declared.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have decided to pay an interim dividend at the rate of 5 per cent. per annum (as last year) on the ordinary shares of the West End undertaking.

Metropolitan Electric Supply Co., Ltd.—An interim dividend for the half-year ended June 30th last at the rate of 4 per cent. per annum has been declared, being the same as last year.

MARKET QUOTATIONS.

Wednesday, August 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£12 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b „ Wire, in ton lots ..	„	£102	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6⅝d.	⅛d. dec.
c „ Tube (brazed)	„	8⅛d.	..
c „ „ (solid drawn) ..	„	7d.	..
c „ Wire, basis	„	6⅜d.	⅛d. inc.
c Copper Tubes (brazed)	„	9⅜d.	¼d. inc.
c „ „ (solid drawn	„	8⅜d.	¼d. inc.
g „ Bars (best selected) ..	per ton	£71	..
g „ Sheet	„	£71	..
g „ Rod	„	£71	..
e „ (Electrolytic) Bars ..	„	£58 5	15/- dec.
e „ „ Sheets ..	„	£74	15/- dec.
e „ „ Rod ..	„	£61 10	15/- dec.
c „ „ H.C. Wire	per lb.	7¾d.	⅛d. dec.
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
b Gutta-percha, fine	„	8/6	..
h India-rubber, Para fine	„	4/8	4d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	46/9	2½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£14 5	10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	..
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8⅝d.	⅛d. inc.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£193 to £194	£4 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/1	2d. dec.
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£30	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, L
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Coronation Fires.—The British Fire Prevention Committee has issued a report on the special fire preventive work undertaken in connection with the Coronation celebrations in the metropolis. About 4,000 occupiers and householders were communicated with by letter, large numbers of inspections were made, 14,000 posters were put up, and 13,000 circulars distributed. Particulars were also issued to the Press, which accorded them considerable space. The result of the precautionary measures was that there was only one fire on the processional route when cleared for the King and Queen, and only 11 other fires attributable to the celebrations during June 22nd and 23rd.—*Morning Post.*

Turbine-Driven Vessel with Electrical Speed Reduction.—An opportunity for comparing the performance of recent improvements in speed-reducing gears with generator-motor systems of connection between steam turbines and propellers will be offered in the construction of two sister-ship colliers now building for the U.S. Navy. The new collier *Neptune* is to be equipped with Milville-MacAlpine reducing gears, while the turbines of the new coal-carrier *Jupiter* will drive generators which in turn supply energy for operating the motors on the propeller shafts.—*Electrical World.*

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have been reassured by the clearer atmosphere which seems to prevail in respect of Morocco. Last week's depression has worn off already to a great extent. Recovery in Consols led to improvement in Home Railway stocks. Financial troubles caused by weak-kneed speculation have been surmounted and now we come to the holiday season—when, of course, there is nothing much doing, and the inevitable tendency is to let prices sag.

The Home Railway Market is at last feeling the beneficial effects of a batch of good dividends, which, when they were announced, were completely obscured by other considerations. It is pointed out, for instance, that the Brighton Company, thanks largely to its electrification scheme, will probably be able to pay a dividend of 5 per cent. at least upon the Deferred stock, which now stands at 104, and carries six months' dividend. The distribution for the full year will be made next January. Other steam stocks enjoyed improvements, part of which was afterwards lost, and Metropolitans and Metropolitan Districts have moved in sympathy with these, Districts showing ¼ rise on balance. City and South London has been moving actively, so little stock being required to change the quotation one way or the other. On the week, the price shows a drop, allowing for the dividend deduction. Central London Deferred fell 5, and is amongst the very few stocks to show a bad fall since last week. The report showed no new favourable points, and people who have been holding in the hope of good news sold their stock. Other electrical issues are steady, but it is something to be able to report that, at all events, the tone of the market is fairly firm, with the exception of Central London stocks.

The Canadian-Mexican group is principally noticeable for further improvement in the prices of Mexican Light and Power Bonds. The 5 per cent. 1st Mortgage Bonds have risen practically to par, being up to 97½ *ex* dividend, and the Preferred and Common shares have advanced. Mexico Tramways are also better, but Sao Paulo shares have gone back 2. United Electric Trams of Monte Video shares continue to drop. British Columbia Electric Preferred, allowing for the dividend, is rather harder, and the inquiry for good prior-charge stocks is still a feature.

Babcock & Wilcox shares have dwindled a little amongst the manufacturing issues, and India-Rubber Preference fell ⅞. Callender's Ordinary hardened to the extent of 5s., and this market generally, while showing firmness, is very quiet. There is not much doing in rubber, but the strength of the raw material imparts steadiness to the market in the shares, which has been helped by good results obtained at the Antwerp sales last week.

The movements in Home Electricity Supply shares are mainly due to the marking of prices *ex* dividend. Here we may repeat that in such cases as those in which a fall in price is represented practically by the amount of the dividend, no drop is registered in our lists overleaf as having occurred, because the actual alteration in value is more nominal than real.

South Londons have been weak, losing $\frac{3}{16}$, but Edmundson's Preference are ¼ higher, and Folkestones have been in demand. The improvement in Edmundson's Preference serves to draw attention to the fact that the Edmundson's guarantee of dividend to the Urban Company ran out at the end of last year.

Anglo-American Telegraph stocks hardened up after the meeting, the chairman's speech being considered so strong an argument in favour of agreement with the Western Union Company that little reasonable opposition could now be expected. The sticking point we take it, for those who are against the agreement is the necessity which the latter will entail for parting with the painfully acquired million pounds fund which the Anglo-American Company saved for cable renewals, but the chairman dealt with the subject in a way that should resolve the fears raised on this score.

American Telephone and Telegraph capital stock has fallen points and MacKay Companies Common went down 4. West Indian and Panama Preference have been moving in opposite direction, the seconds gaining at the expense of the firsts. Western Union Telegraph bonds of both classes have hardened.

Prominent features of strength have been provided by National Telephone stocks and shares. The latter recovered their dividend deductions in all three cases, and the Deferred stock did the same, so there is really a rise of £3. These advances are due to the satisfaction felt with the statements made at the meeting the other day, while the forced selling of the Deferred stock has come to an end. Chili Telephones and United River Plates are also a firm market.

For Sale.—The Rugby School Electric Lighting C have for sale a quantity of electrical generating plant. Tende are invited for the purchase of the undertaking of F. A. Glov and Co., electrical engineers, carried on in London and branche See our advertisement pages in this issue.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91⅓	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅞ xd	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½ xd	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	9/16 — 13/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2¼ — 2⅝	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5⅞	6	4½ — 4⅝	+ ⅛	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Hove	5	8½	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7⅞ xd	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞ — 4⅜	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3⅜ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜ — 3⅝ xd	..	5 3 3
Do. 5 % Pref., Non. Cum.	5	5	5	3⅞ — 4⅜	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7¼	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅞ — 9¼ xd	..	5 8 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛ xd	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	— 3/16	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101⅓	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7¾ — 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7½	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	111 —116	..	6 0 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	2	3	⅜ — 7/16	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86 — 88	— ½	5 13 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	19/32 — 23/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4	88 — 90	+1	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	110 —112	+1	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98 xd	+1½	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	6	7	171 —175 xd	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	44 — 46	..	10 17 4
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	119½ —121½	..	3 5 10
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108½ —110½	..	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	139 —141	—3	5 13 6
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅜	3⅜	67 — 69 xd	— ¼	5 8 8
Do. 6 % Pref.	Do.	6	6	111½ —112½	+ ½	5 6 8
Do. Def.	Do.	25/-	30/-	25⅞ — 26⅛	+ ¼	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6⅞ — 7⅛ xd	+ 1/16	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10½ — 11	+ ¼	5 9 1
Do. 10 % Pref.	10	10	10	17¼ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4¼	4½	7⅝ — 8¾	..	5 7 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101½ —103½	+ ½	3 17 4
Eastern Extension	10	7	7	13¾ — 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100 —102 xd	+1	3 18 5
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞ — 11⅛	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	88 — 90	—4	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2⅛ — 2¼ xd	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	102½ —104½ xd	..	5 14 10
Do. Def.	Do.	6	6	119 —122 xd	+3	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜ xd	+ ¼	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜ xd	+ ¼	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝ xd	+ ⅛	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102¼ —103¼	— ¼	4 7 2
Oriental Telep. and Elec.	1	8	8	1 1/16 — 1 1/8	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅞ — 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98½ —100½	..	4 9 7
United River Plate Telephone	5	8	8	7¼ — 7½ xd	+ 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	3/4	2⅜ — 2⅝	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10⅝	+ ⅛	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¼ — 10¼	+ ¼	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜ — 14⅝	..	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	+1	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	+ ½	4 7 5

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	.	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/16 — 1/2	..	Nil
Do. 6 % Pref.	10	1½	1½	3½ — 4	— 1/8	3 15 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	76 — 80	—1	5 12 6
Central London Railway, Ord.	100	3	3	68 — 70	—1	4 5 9
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	50 — 52	—5	3 17 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	31½— 32½ xd	— 1/8	4 12 6
Do. 5 % Pref., 1891	100	5	5	108 —110 xd	..	4 11 0
Do. Do. 1896	100	5	5	104 —106 xd	..	4 14 4
Do. Do. 1901	100	5	5	103 —105 xd	..	4 15 3
Do. Do. 1903	100	5	5	102 —104 xd	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½— 13½	..	4 10 7
Great Nortbern & City, Pr'f. Ord	10	Nil	Nil	7/8— 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼ — 2¾	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancasbire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3½ — 4	— 1/8	Nil
Do. 4 % Deb.	100	4	4	74 — 77	..	5 3 11
Metropolitan Railway Consol.	100	1	1⅜	47¼— 47¾ xd	— ½	2 17 7
Do. Surplus Lands	100	2⅜	2⅜	66 — 68 xd	+ ½	4 0 11
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14 6
Do. 3½ % Pref.	100	3½	3½	87 — 89 xd	—1¼	3 18 ×
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89 xd	— ¼	3 18 ×
Metropolitan District Ord.	100	Nil	Nil	27½— 28	+ ¼	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3½	90 — 92	+1	3 19 8
Do. 3½ % Gtd.	100	3½	3½	71 — 76	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	25/32— 1 1/32	..	5 6 8
Do. Def.	1	Nil	Nil	1/16— 1/16	..	Nil
Do. 5 % Pref.	1	5	5	25/32— 1 1/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15 8
Potteries, Ord.	1	2	2	7/32— 11/32	..	..
Do. 5 % Pref.	1	5	5	15/16— 1 1/16	+ 1/32	7 5 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	1/32— 1/32	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	1	64 — 66	..	1 10 4
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/32— 3/32	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜— 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16— 5 1/8	..	4 16 5
Do. 2nd Pref.	5	5	5	4 13/16— 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11¼ xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96⅜— 98⅝	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	96⅜— 98⅝	..	5 1 6
Brisbane Trams Inv't., Ord.	5	8	8	6½— 7	+ ⅛	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	118 —122 xd	+1	4 18 4
Do. 5 % Pref.	100	5	5	106 —119	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	6	5⅜— 6½	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/32— 1/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 5/8— 5 3/4	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	7/32— 9/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf.	1	6	6	1 5/16— 1 1/8	..	5 13 0
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	— ½	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	+ ⅛	4 18 0
Mexico Trams Com.	$100	7	7	121 —123	+1	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	98½— 99½	+ ½	5 0 6
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5¼— 5¾	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	3/32— 5/32	..	..
Do. 5 % 1st. Deb.	100	5	5	101¼—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜— 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10 0
Rio de Janeiro Trams	$100	1	4½	116¾—117¾	+ ¼	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	97½— 98¼	+ ½	5 1 6
Sao Paulo Tram, Lt. and P.	$100	10	10	181 —184	—2	5 8 8
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15 3
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video	5	5	6	5⅛— 6	— ⅛	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	5/32— 3/32	..	8 0 0
Do. 6 % Pref.	1	10	9	1 1/16— 1 3/32	..	7 7 8
Babcock & Wilcox	1	24	26	5 7/16— 5 29/32	— 1/16	6 1 0
Do. Pref.	1	6	6	1 5/32— 1 3/16	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 5/32— 7 3/32	..	6 15 7
Do. Pref.	5	6	6	5 3/4— 6 1/4 xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	+1	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32— 1/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/16— 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8— 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	—1	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9⅛	+ ¼	7 18 0
Do. Pref.	5	5	5	4 7/8— 5 1/8	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 1/16— 3 1/32	..	4 17 4
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	1/8— 3/8	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2
Dick, Kerr	1	6	5	13/16— 15/16	..	5 6 8
Do. Pref.	1	6	6	31/32— 1 1/32	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	3/32— 1/8	..	Nil
Do. fully paid	5	Nil	Nil	1/8— 2 3/8	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	11/16— 13/16 xd	..	Nil
Do. Pref.	2	7	7	1 1/16— 1 1/16 xd	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7½— 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8½— 9	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12½— 12¾	..	5 16 6
Do. Pref.	5	4½	4½	4 7/8— 5 1/8	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3 4
India-Rubber, G. & T.	10	10	10	11½— 13½	..	7 8
Do. Pref.	10	5	5	10 — 10⅝	— ⅛	4 16 5
Telegraph Construction	12	17½	20	35 — 37 xd	..	6 7 2
Do. Deb.	100	4	4	99 —101	..	3 19 3
Willans & Robinson	1	Nil	Nil	1/32— 3/32	..	Nil
Do. Pref.	5	1½	Nil	3/32— 1/8	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

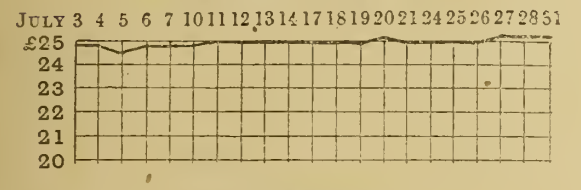
* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

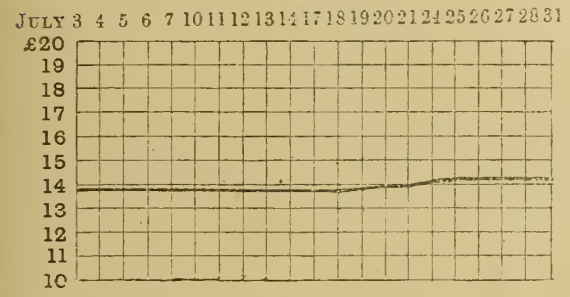
METAL MARKET.

Fluctuations in July.

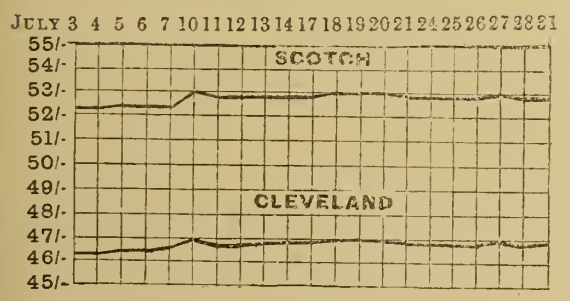
SPELTER (G.O.B's.).



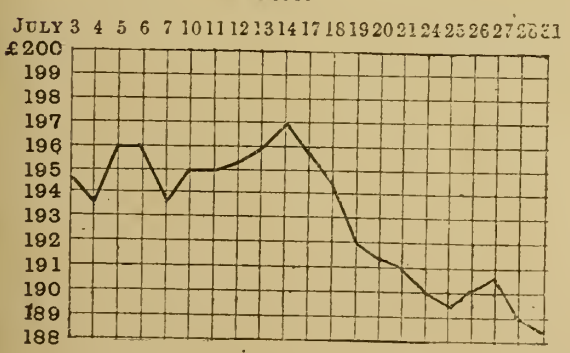
LEAD (ENGLISH).



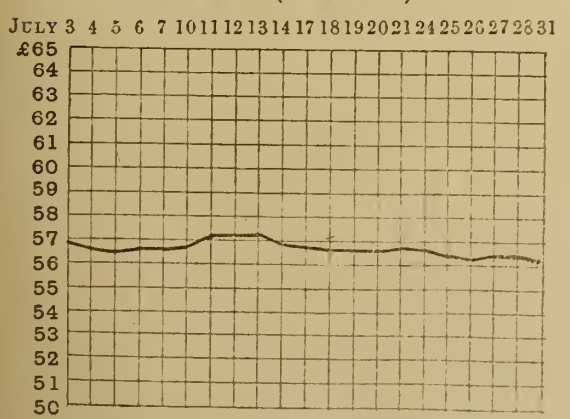
IRON.



TIN.



COPPER (G.M.B's.).



London Electric Railway Co.—A dividend at the rate of 1 per cent. per annum on the ordinary stock is announced, £7,500 being placed to renewals and £14,500 carried forward.

THE ELECTRICAL WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1910.

By EDWARD S. HODGSON.

The following notes are compiled from the annual report of the Reichsanstalt for last year, kindly supplied to the writer by the authorities of the institution :—

One of the most important subjects dealt with was the determination of the E.M.F. of the Weston normal cell during some work carried out at the Bureau of Standards, Washington, by representatives of the standardising laboratories of Germany, England, France and America. The value for the E.M.F. at 20° C. was found to be 1·0183 international volts within limits of 1 part in 10,000, agreement being secured between the countries named. This value has, therefore, been adopted in Germany as from January 1st last.

A number of tests were undertaken on the energy loss in dielectrics. An experimental condenser was built up of 10 plates of solid insulating material interleaved with copper-foil sheets, the capacity being from 0·004 to 0·01 mfd. Some particulars of the method of testing are given, and the results up to now show that over a range of frequency 9 to 2,000 cycles the phase variation in the case of some substances is only to a slight extent dependent on the frequency, while in the case of others this variation is considerable. Sometimes it was also noticed that the phase difference depended on the voltage applied.

In the course of the ordinary conductivity tests on copper instituted during the past few years, it has been ascertained that with great approximation there is proportionality between temperature coefficient and electrical conductivity, *i.e.*, a very approximate formula was $\alpha_{15} \cdot c_{15} = \text{const.}$ (α_{15} temperature coefficient, c_{15} specific resistance in ohms m/mm² at 15° C.). The mean value (for all types of copper tested at the Reichsanstalt since 1905), for the constant, is $6{\cdot}7_8 \cdot 10^{-3}$. The same relation seems to apply for aluminium and iron, with, of course, other values for the constants.

The experiments on the variation of wire resistances with atmospheric humidity were continued and further tests made on coils hermetrically sealed according to the suggestion of the Bureau of Standards. Two coils were filled with petroleum and two with paraffin oil, and sealed up, measurements being taken before and after sealing. The coils filled with paraffin oil showed great constancy, while those filled with petroleum were not so constant.

In connection with the research dealing with the influence of the chemical composition and thermal treatment on the magnetic and electrical properties of iron alloys, measurements were carried out on 15 different carbon alloys, both after slow annealing and after sudden quenching at 750°, 800° and 850° C. The measurements dealing with saturation values, initial permeability, electrical conductivity, &c., are not yet concluded, but will have particular reference to the influence of carbon in permanent magnets, the best hardening temperature and durability against shock, &c.

Experiments were carried out to determine the best arrangement for testing transformer oils. The electrodes used were sometimes spheres of 10 and 15 mm. diameter, and at other times conical points and pin-points. In the case of very dry and pure oils, the breakdown voltage between pointed electrodes was somewhat lower than between spherical electrodes. The difference was scarcely appreciable, however, when the distance between electrodes was small, only becoming more noticeable at greater distances. In the case of damp oils, a higher breakdown voltage was sometimes observed between pointed electrodes than between spheres ; with pointed electrodes very irregular values in particular were often obtained for the breakdown voltage. Obviously this is partly accounted for by the strong electric field at the ends of the spheres.

Certain difficulties are experienced in the arrangements for testing the breakdown voltage on substances used for

embedding cables. If the mass is poured on to a smooth metal surface, considerable sparking takes place on the surface of the mass, resulting in the latter heating and premature breakdown occurring. In order to imitate the conditions existing in the case of cable sockets, in which filling is employed, the Reichsanstalt made iron tubes 15 mm. wide and 10 cm. long, thickened cylindrically at the ends. A 40-cm. long cardboard tube was slipped over so that the iron tube was at the middle of the cardboard tube. A 9-mm. thick brass rod was fixed concentrically in the cardboard tube by means of two corks. The pipe was then placed upright, and the filling material inserted hot, through an opening in the upper cork. After setting, the mass formed an insulating layer of approximately 3 mm. thick between the brass rod and the iron tube. The cardboard attachments filled with the mass prevented sparking from the iron pipe through the air to the brass rod when testing. About four such test pieces were prepared for each test. The breakdown voltages determined on the individual test pieces generally agreed well among themselves, which shows that the rods and tubes were sufficiently concentric.

Some experiments on the ageing of fuses, mentioned in last year's report, were supplemented by experiments on the influence of high voltage and of the filling material. Silver wires, 0·1 mm. thick and 150 mm. long, were stretched in glass tubes 15 mm. wide and 200 mm. long, the tubes being filled with dry sand. The normal current density was 4 amperes. With this current the mean of the temperatures along the wire was approximately 230° C. A number of these fuses were loaded with 4 amperes, and others with 2 amperes A.C. at 50 cycles. Tinfoil was pasted round the glass tubes, and an alternating potential difference in some cases of 4,800 volts applied between tinfoil and fuse wire; in other cases the potential difference was 600 volts, and in a third group no voltage at all was applied. The resistance of the fuses was measured from time to time in the cold state. The fuses loaded with 4,800 volts and 4 amperes showed a rapid increase of resistance to twice the amount and fused within 10 days. In the fuses loaded with 2 amperes and 4,800 volts, resistance increase and fusion proceeded less rapidly. This increase of resistance is attributed to powdering of the wire. In the case of the fuses loaded with 4 amperes and 600 volts the resistance increased about 10 to 20 per cent. in the course of eight months, and fusion did not occur. No perceptible increase of resistance occurred in the remainder of the fuses. It appears that overloading fuse-wires in enclosed tubes causes less corrosion of the wires than when they are stretched in the free atmosphere. In the latter case the circulation of the air caused by the ascending heat produces oxidation.

In connection with the tests on glow lamps, mention may be made of a series of nine 25-C.P. 116-volt metal-filament lamps which were run on D.C., the useful life of these being 7,500 hours.

Some experiments were made to determine the amount of water absorbed by certain insulating oils, and in the course of these it was found that the product termed commercially "transformer oil" absorbs but slightly more water than petroleum. Absorption of water at 18° C.; paraffin oil, 0·003 per cent.; petroleum, 0·005 per cent.; benzol, 0·05 per cent.

A PORTABLE CURRENT TRANSFORMER.

For some years the Dietze "Anleger," or portable current transformer, has been recognised as a useful addition to many test room equipments for both alternate current and direct-current work, and some particulars of its present form, as made by Messrs. Hartmann and Braun, will be of interest. It is made up in three or four sizes, of which the smallest is shown in figs. 1, 2 and 3. This pattern is intended for low voltage circuits, and is capable of embracing a conductor not exceeding 38 × 20 mm. in dimensions.

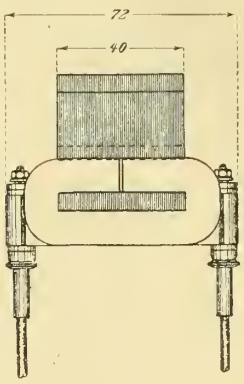


Fig. 1.

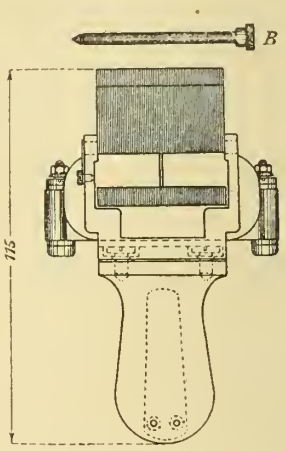


Fig. 2.

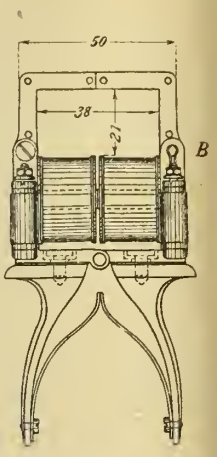


Fig. 3.

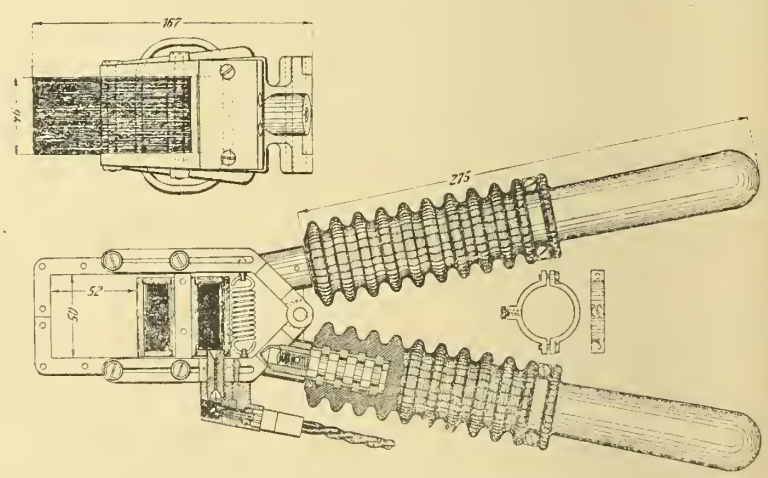


Fig. 4.

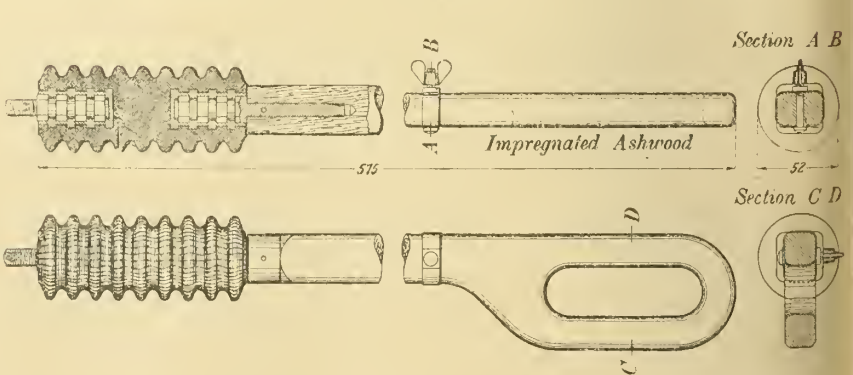


Fig. 5.

The method of using the instrument consists in opening the jaws of the laminated iron-core by pressing the handles together and then slipping the cable or conductor through the opening thus formed, and re-closing the jaws. An ammeter of the hot wire or moving iron type is connected by flexible leads to the coil of the instrument, and the whole arrangement is then identical with an ordinary current transformer with its ammeter, and enables the amount of an alternating current flowing in the cable to be obtained without opening or interrupting the circuit in any way.

When desired, the bolt B (figs. 2 and 3) can be withdrawn and one-half of the transformer can then be used alone as a fault tester with a telephone receiver in place of the ammeter.

A larger form of the apparatus is shown in fig. 4. This can

embrace conductors up to 50 × 50 mm. section, and at the same time can be fitted with long insulating handles which enable H.T. circuits up to 10,000 volts to be dealt with safely. As an additional safegnard earthing clips are provided halfway up the handles. Insulating extension pieces, as shown in fig. 5, can also be fitted when desired, so that the person reading the instrument can keep well away from the H.T. circuits.

A still larger type of the apparatus is also made which can embrace condnctors as large as 70 × 70 mm.

Ordinary instruments can be used in connection with the transformers, though, for accuracy, they should be calibrated together with the transformer at the working frequency. A special small type of portable ammeter is sometimes supplied which can be plngged direct to the coil without the use of flexible leads, and forms an integral part of the transformer.

The smallest type of transformer (figs. 1, 2 and 3) is suitable for nse with hot-wire ammeters having maximum scale readings between 50 and 200 amperes or moving-iron instruments with scales between 100 and 200 amperes. The larger types have about the same lower limits, but can be used for maximum currents of from 500 to 1,000 amperes.

When using these transformers, care has, of course, to be taken that the core joint closes np completely and that no grit, &c., introdnces an air-gap into the magnetic circuit.

Amongst the useful applications to which this instrument lends itself may be mentioned the adjustment of the current of A.C. arc lamps. Without interrupting the circuits or extinguishing the lamps, a number of such lamps can be quickly tested by this means. Another common use is the determination of the equality or otherwise of the currents in the three lines of a three-phase supply where, perhaps, only one phase has an ammeter permanently connected. Again, where several transformers are connected in parallel, it is often important to know how they divide up the load and the introduction of an ammeter may considerably disturb the balance. The use of the portable transformer, however, besides being simpler, introduces practically no such disturbing effect.

Of individual occasions on which the instrument has proved its utility, some examples are given below :—

In one case a particular consumer, whose contract only permitted him to run his motors during the day, was suspected of running also at times of peak load. Without opening any connections or otherwise raising suspicion, one of these tranformers connected to registering meter was clipped round the supply mains at a convenient point and left for one week, when an examination of the record showed occasional night consumption, and so justified the suspicion.

In another case a sudden earth fault occurred on a large H.T. distribution network. One of these transformers connected to a telephone receiver was taken to the chief feeding point and applied in turn to each incoming and outgoing cable. The cables leading in one particular direction gave a much louder indication in the telephone than the rest. This was not due to the normal working currents in the cables, because the lead and return being embedded in the same core, the main currents cancel out as regards the telephone. The charging currents, however, flowing towards the fault are unequal, and these produce the sound in the receiver.

Without interrupting the general supply, one or two fuses were removed on those cables showing the strongest charging current, thus opening the meshes of the network, so as finally to leave only one cable supplying the charging current to the fault. This cable was fonnd to lead to a particular feeding box, and on testing here again in the same way, the direction of the fault was again localised, and finally a blown fuse was reached, and close to it the faulty cable was found. The whole process, using this instrument, took only about half an hour. In cases where, owing to low voltage or smallness of the network, the charging current is too small to give reliable results, a similar unbalancing can generally be introduced artificially by earthing one of the sound mains. In direct-current networks a small pulsating or alternating current must be superposed on the main current before the test can be carried out.

In many cases of breakdown, delay is introduced by the difficulty of seeing just which fuses have blown. In this case the transformer and telephone placed around each fuse-holder or cable in turn qnickly pick out those carrying no current.

The instrument has also often proved useful in tracing out cables before making complicated connections, such as are involved in large junction boxes, or in theatre lighting regulation, car controllers, &c. A small pulsating or alternating current is applied, and the cable carrying this current is then quickly picked out by means of the transformer and telephone.

The instrument is also useful in many cases of machine breakdowns. For instance, the short-circuited rotor of an induction motor developed an extra connection. The winding was opened at one point, and an alternating-current sent from one end of the winding through the fault. Half the transformer (obtained by removing bolt B in figs. 2 and 3), with a telephone receiver connected to it was then moved round the armature periphery, and the slot containing the fault was discovered in a few minutes.

The slip of an induction motor can also be readily obtained by simply clipping the transformer round one of the connecting cables between the starting resistance and the slip-rings. The rising and falling rotor current of low frequency can then be readily heard in the telephone and its frequency determined. In the case of squirrel-cage rotors the same result can be obtained by clipping one of the stator supply cables, when it will generally be possible to distinguish the slow rotor pulsations by their reaction on the stator currents.

Nnmerous other applications could be described, but the above indicate the scope of the work that has been done by this simple instrument.

LIGHTNING PHENOMENA.

In a paper on "Some Unexplored Fields in Electrical Enginecring," recently presented at a joint meeting of the Franklin Institute and the American Institute of Electrical Engineers, Dr. C. P. Steinmetz said that lightning was one of the most important uninvestigated phenomena of electricity. In the early days lightning was explained as a discharge from the clouds. The clouds being positively, and the ground negatively charged, a spark jumped from the clouds to the ground.

Speculations were made as to how the clouds became charged, and as then the only method of producing electricity was by friction, it was said it might be the friction of the vapour through the air, or the rain-drops through the air, or some other form of friction. That explanation used to appear satisfactory, but with our present knowledge of dielectric phenomena, it was not any more satisfactory.

It was thought that lightning was the discharge from the cloud to the ground. That meant that the electric field between the cloud and the ground must be beyond the breakdown strength of air. In a uniform field the breakdown strength of air was about 75,000 volts per inch, or nearly 1,000,000 volts per foot. Even if the cloud were only 1,000 ft. above ground, this would require 1,000,000,000 volts. If there were an electrostatic field between the cloud and the ground of 1,000,000,000 volts extending over the whole area of the thunder cloud, this would represent such an immense amount of electric energy that it was inconceivable how any reasonable source of energy could produce it ; or how it could exist without having a destructive effect far beyond anything known of lightning. Furthermore, a uniform field could not well exist between clouds and ground on account of the unevenness of the ground surface.

Another conception was not a uniform electrostatic field, but an ununiform field, like that of the discharge between points. With long striking distances between points the average gradient was about 170,000 volts per foot. This would require only 170,000,000 volts between a cloud 1,000 ft. high and the ground. This would be more reasonable. It would not require such an unreasonably vast amount of stored electric energy. But they knew that in such an ununiform field the spark was preceded by a brush discharge covering more than half the distance. Thus, lightning should be preceded by a brush reaching down from the cloud and up from the ground for several hundred feet. Now, such an enormous brush had never been observed, and was inconceivable ; the brush discharges occasionally observed at points during storms were only a few inches long. Furthermore, a 300-ft. brush was inconceivable, because the resistance of the ground was not low enough to conduct the energy necessary to maintain such a brush discharge.

Furthermore, most of the lightning discharges were not between the cloud and the ground, but were internally in the clouds, frequently reaching the length of several miles. So one saw that the explanation of the lightning as a spark discharge similar to the discharge of the friction machine appeared plausible in the early days, but with our present knowledge it was not tenable any more.

The lightning discharge could not be considered as a simple electric rupture, in the same way that an overloaded beam might break mechanically, but as an equalisation of internal stresses, much as a piece of hot glass that was rapidly chilled, and thereby full of internal compression and tension strains, might suddenly break all over by the internal stresses. So, with their present knowledge, they must consider as the most probable explanation—although not certain by any means—that the lightning discharge was the phenomenon of the equalisation of internal electric stresses in the cloud, and was analogous to the splintering or breaking of an unevenly stressed brittle material like glass.

The question then was how did those uneven electrostatic stresses originate in the cloud, and how did they reach such values as to cause internal equalisation by rupture ? If there had been produced a very highly unequal distribution of voltage in the electrostatic field of the cloud, it was easy to see how a discharge could pass along miles of cloud without such unreasonably great potential differences as would be required for a direct discharge across space, just as from a scratch in a poorly-annealed glass plate cracks might run all over the plate, splintering it in all directions. Let them assume that the potential distribution in the cloud became very uneven. If then at some point the potential gradient became higher than the disruptive strength of air at this point, a local disruptive discharge occurred, perhaps only a few inches in length. This discharge equalised the potential gradient within its path, and thereby increased the gradient at the end of the discharge. If this gradient was already fairly high, it rose beyond the disruptive strength of air, and thereby the discharge extended farther along the discharge path, but the voltage equalisation resulting therefrom still further increased the potential gradient ahead of the discharge, and in this manner the equalising discharge extended further and further, possibly for miles, side discharges issued from it, or ran into it, until finally cloud regions were reached where the initial potential gradient was very low and the discharge gradually tapered down.

But where did the initial voltage come from, and how did it become uneven ?

It was not so difficult at least to make a preliminary estimate of the building up to very high and uneven voltage distribution in the clouds as soon as they had assumed some initial voltage. They did not know where the initial voltage came from, but they must accept the fact that there was normally a voltage gradient in the air, a potential difference between different altitudes which

might amount to 100 volts or more per foot. In the air 100 ft. above the ground there might be a potential difference against ground amounting to thousands of volts. If they brought a wire up to there they did not carry a current down, they merely carried the ground potential up, but by a carefully insulated electrostatic voltmeter they could measure these potential differences. Possibly this potential gradient in the atmosphere might even be of cosmic origin, the earth having a high negative potential against our solar system, against the universe. which would mean that there must be a positive voltage gradient from the surface of the ground into space.

If condensation took place in the higher regions of the atmosphere, rain drops formed, minute drops at first, which necessarily must be at the potential of the air in which they formed. That meant they had a potential difference against the ground, and therefore an electrostatic charge against the ground corresponding to this potential difference. Assuming now that many of these minute rain drops conglomerated to larger drops, it meant that many small condensers conglomerated to one condenser, which was somewhat larger in capacity than each component, but very much smaller in capacity than the sum of the capacities of its components. But it contained all the electrostatic charges of the rain drops, and at the much smaller capacity the same charge gave a higher potential difference. Suppose 1,000 small rain drops conglomerated into one large one. This had 10 times the capacity but 1,000 times the charge, hence 100 times the voltage. Conglomeration of minute drops into larger ones thus must give a great increase of potential differance against ground.

The clouds were by no means uniform in density, and where the density was greatest, conglomeration of condensed drops took place to a much greater extent, building up to a much higher voltage, and thereby between the parts of the cloud of different density, the light and the dark portions, potential differences must appear and increase with increasing condensation, until somewhere the disruptive gradient was passed, equilisation occurred by a lightning discharge, and then the same play was repeated again and again.

Lightning discharges then were the result of the voltage unequalities produced in the clouds by the unequal rate of conglomeration of rain particles due to the unequal cloud density.

In agreement with this was the fact that heavy lightning strokes were usually followed by a heavy downpour of rain ; in reality they were preceded and caused by it, but it took time for the rain-drops to come down.

Let them assume now that the process was reversed, and after conglomerating to high voltages the rain-drops evaporated again. Since gases apparently did not carry electrostatic charges, the rapidly dwindling rain-drop retained its entire charge. hence must rise in potential, and finally must discharge, and this progressive evaporation of the rain-drops must also result in the building up of potential differences and therefore the formation of lightning, and this might explain the two forms of lightning, that accompanying rainstorms and thunderstorms, and the so-called "heat" lightning.

The former was the result of condensation and conglomeration, the latter the result of evaporation of rain-drops.

One saw then that in this field, which was not merely of theoretical interest, but of high industrial and general importance, their knowledge was still very limited ; it was a fairly unexplored field of electrical engineering and electrical science. It was a branch of electrostatics, of the phenomena of the dielectric field. The phenomena of the dielectric field they could not very well call unexplored, because there had been a great deal of investigation in the early days, and volumes had been written on it. Many of them might still remember the early days when the text-books of electrical engineering started with the theory of the distribution of the electric charge, investigated the electric density on an ellipsoid and all that sort of thing. All this had now pretty well vanished from electrical engineering text-books. With the development of electrical engineering, electrostatics became of less interest and were thus neglected. Only in recent years, when they had in transformers and transmission lines reached voltages higher than in almost any electrostatic machine, and those not of a negligible power, but of a very large power, the field of electrostatics had become a very important one and had to be studied again.

It was seen that in the study of electrostatics the conceptions of the work of former days were untenable, from their present point of view ; they could not conceive of the dielectric phenomena as a charge on the conductor surface, they knew there was not an electric charge on the conductor, the dielectric energy resided not on the conductor surface, but in the space around the conductor, in the dielectric field, and the so-called "charge" was nothing but the termination at the conductor surface of the electrostatic field in space. It was the electrostatic or dielectric field which they must consider as representing the phenomena of electrostatics, in the same way as Faraday had shown them with the magnetic field.

The old conception of the electrostatic charge on the conductor had been the cause of the far greater difficulty which they found in dealing with even simple phenomena of electrostatics, compared with the simplicity with which even apparently complex phenomena were treated by the conception of the lines of magnetic force.

One must then abandon the conception of the theory of electrostatics of the early days—which was still largely used in theoretical text-books—as incorrect and useless. Capacity then was not the capability of the conductor to store electric quantity, but was the ratio of the number of lines of dielectric force to the E.M.F. which produced them, just as permanence was the ratio of the number of lines of magnetic force to the M.M.F. which produced them : the "charging current" was no more a current charging the conductor with electricity than the "inductance voltage" was a voltage charging the conductor with magnetism. The former as "capacity current" supplied the energy stored in the dielectric field, just as the inductance voltage supplied the energy stored in the magnetic field, and dielectric and magnetic phenomena were very largely analogous and treated in the same manner and with the same simplicity.

This was not possible with the conception of electrostatic charges, and even simple problems such as the calculation of the capacity and the mutual capacity of parallel conductors, became so complicated that the most satisfactory method of their calculation was not to calculate the capacity at all, but to calculate the corresponding inductance and derive the capacity by the relation, that capacity × inductance equalled the square of the velocity of propagation, which, in space, was the velocity of light (3×10^{10}).

It would thus be seen that in this field, which was of the highest industrial importance now, where they had, in transmission lines, reached voltages which approached those of lightning, they were only just in the beginning of an intelligent understanding, an insight into the phenomena.

SOME NOTES ON INSULATING OIL.

Prof. Hughes was one of the earliest investigators of the properties of oil as an insulator, and the results of his experiments were given in his paper before the Institution of Electrical Engineers (1892, Vol. XXI, page 224). Steinmetz also, about the same time, carried out important experiments in this field. At that time, oil was not used to any great extent for insulating purposes ; in fact, it is within comparatively recent years that its adoption has become universal.

It is in even more recent years that this material has received from engineers some of that notice which it demands : but even now, it would appear, its properties are not so familiar as they should be. This would apply rather to the users of, than to the designers of, gear in which oil plays so important a part.

It is the purpose of the following notes to point out the necessary qualifications for good oil, the methods adopted for testing these, and the means for their being retained.

These notes will refer to oil in its two chief uses—that is, in transformers and oil switches.

All common oils, so far as insulating properties and dielectric strength are concerned, would fulfil the requirements called for in transformer and oil-switch work ; but other considerations physical and chemical have eliminated the oils formerly used, and it is now agreed that mineral oils best meet practical conditions. Formerly animal and vegetable oils, especially resin oil, were used, but these oils have a great affinity for oxygen, and this combination produces fatty acids in the oil, while at the same time the oil congeals and becomes sticky. For these reasons the use of animal and vegetable oils has been discontinued, and mineral oil, the best grades of which do not exhibit these properties, is now used exclusively.

The two most important properties of oil, and those which make its use possible, are resistance and dielectric strength. These properties are allied but distinct, as Fessenden says : "A thing insulates because it is possessed of two distinct properties, first, the ability to stand the mechanical and electrical stresses due to voltages used ; secondly, because it is such a poor conductor that a negligibly small current can flow through it and leak away. In other words, it will neither allow current to break through it nor steal through it. The first property is called by Maxwell the 'dielectric strength of the insulator,' the other is called its ohmic resistance. The two together form its insulating power." Oil for use in transformers and oil switches should have high dielectric strength, and to ensure the use of an oil possessing this quality a test should be made on a sample.

The test is carried out by the immersion in the oil of two electrodes and applying to these an increasing voltage until breakdown occurs.

Several precautions are necessary in making the test. The electrodes should be bright, smooth spheres about $\frac{1}{2}$ in. in diameter. Points and plates seem to give varying results. The spheres should be kept bright and clean, so that no foreign particle can reduce the gap and give false results. The spheres should be kept submerged the same depth in all comparative tests, as the height of oil above the gap influ-

nces the breakdown voltage. The time during which the oltage is applied should be the same in all tests, and the emperature of the oil should also be the same in all cases. Bubbles of air in the oil must be excluded, and care should e exercised to keep the oil vessel clean, as a piece of dust r hair lining up with the spheres will give an apparently ow breakdown voltage, as has already been mentioned. Duc

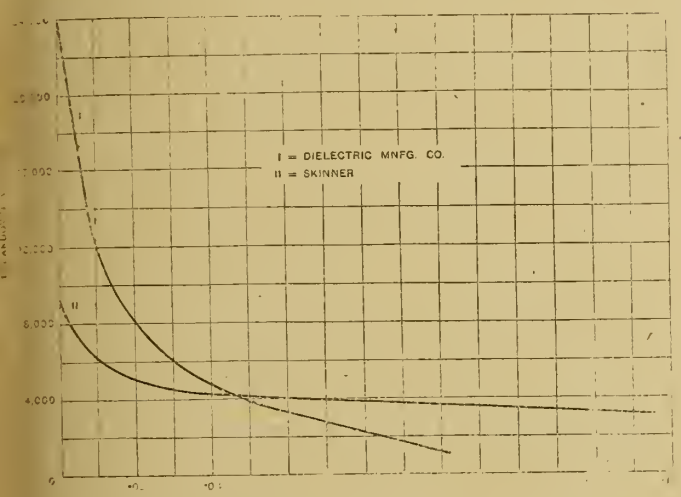


Fig. 1.—Effect of Moisture on Dielectric Strength.

o small amounts of moisture being present in some oils, a lischarge is got at comparatively low voltages, but the oil is hereby dried out, and the real dielectric strength can then e ascertained. This feature is not so much in evidence with he best oils.

Carbon is formed at each rupture, and if this is allowed o concentrate at the electrode, low readings will be got ; in ny case, when the oil becomes much discoloured, due to nuch carbon being present, the dielectric strength will drop apidly, and a new sample of oil must be used. As nearly s possible, a sine wave form of E.M.F. should be used for esting, which necessitates field regulation on the generator or varying the voltage instead of the use of resistance in ircuit. Of course, a peaked wave would break down the nsulation at a lower virtual voltage than a sine wave with qual R.M.S value. Elihu Thomson first showed that oil s not as good an insulator at low frequencies as at high nes, but throughout the range of commercial frequencies he factor is negligible.

Oil tested in the manner described should not break own at less than 20,000 volts with 2 mm. gap.

Moisture present in insulating oils reduces the dielectric trength alarmingly. Fig. 1 gives curves showing the fall i dielectric strength due to the presence of moisture in arying quantities, and it will be noticed that it is the mall percentages that make the great differences in dielectric trength.

In testing oil samples, one cannot well estimate the ercentage of water present (in getting the results from hich the curves in fig. 1 were constructed, dry oil was rst tested, and then known quantities of water were dded), nor is this necessary, since if there were present nore than the slightest trace (such as would dry out uickly), the oil would be useless.

These oils evaporate slightly at 100° C., so that one cannot iscover the moisture present by condensing the water vaporated.

Dehydrated copper sulphate put in with the oil and well aken up with it shows a bluish tinge on becoming hydrated hrough the presence of moisture.

A rough method of testing for moisture is to plunge a ed-hot wire into the oil, when, if moisture is present, a rackling sound will be heard. This will only detect comratively large quantities of water.

Acids and alkalis should be guarded against, and to test or these, a small quantity of oil should be taken in a test ube and shaken up with a little distilled water. Any acid or kali present will be taken up by the water and can be tested or by litmus paper.

Insulating oils should have a high flash point and burning point. This is obvious, as an oil having a low flash point would be dangerous to use. Heavy oils are not so inflammable as is often supposed ; good transformer oil will readily quench a lighted torch, if this is pushed beneath the surface. It is possible, however, that the lighter oils may be present in small percentages in the heavy oil, and these small quantities reduce the flash point abnormally. For this reason it is

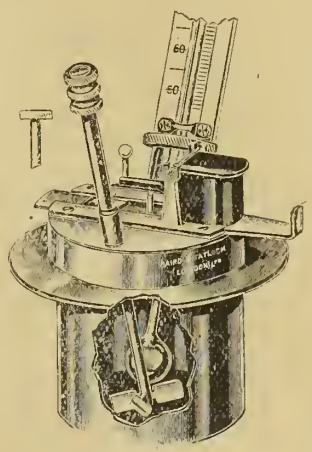
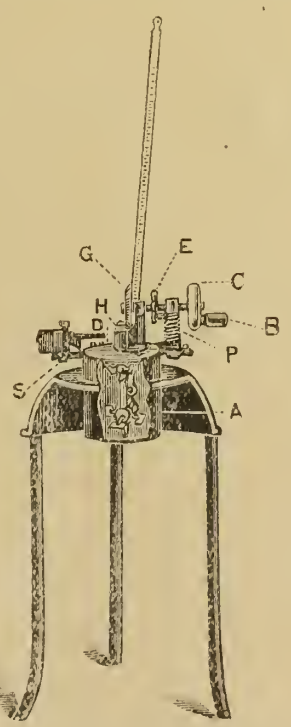


Fig. 2.—Abel's Flash-Point Apparatus.

preferable to use the closed-cup rather than the open-cup method when testing for flash point. Normally, the temperature of the oil in use would not exceed 60° C., but it is possible, in case of faulty winding in a transformer or poor contact in a switch blade, to have this limit far exceeded. An insulating oil should not flash at less than 180° C. or burn at less than 200° C.

The flash point of an oil is that temperature at which gases are given off at such a rate as to form an explosive



A, Brass oil cup; B, C, Hand-wheel for operating stirrers; D, Test flame; E, Mechanism for moving sliding cover and depressing test flame; G, H, Gears for driving stirrers; P, Spring for replacing sliding cover; S, Sliding cover.

Fig. 3.—Gray's Flash-Point Apparatus.

mixture with the surrounding air. The burning point is that temperature to which the oil must be raised so that the liquid oil takes fire and continues to burn on the application of a flame to the surface.

There are several types of apparatus for making these tests on oil. The earliest type of flash-point apparatus had an open cup in which the oil was heated. This was succeeded

by Abel's apparatus, in which the cup was closed, and the operation of uncovering the cup also depressed the flame of a small lamp for the purpose of flashing. This form (fig. 2) is the one recommended by the Board of Trade in the Petroleum Act, 1879. A modification of this instrument is the Abel-Pensky, in which a clock-work arrangement is fitted to uncover the cup and apply the flame. The Pensky-Marten apparatus has a smaller water bath and differs from the Abel form in the arrangement for moving the flame. Gray's apparatus, fig. 3, is somewhat similar to the Pensky-Marten.

To obtain good results in testing the flash point of oils it is necessary to take several precautions.

The oil must not be heated too quickly, or the vapour being driven off rapidly will give a low flash point. This is taken care of to a great extent by the water bath.

The quantity of oil used must be the same in all tests. The more oil used, the more vapour is driven off, and hence

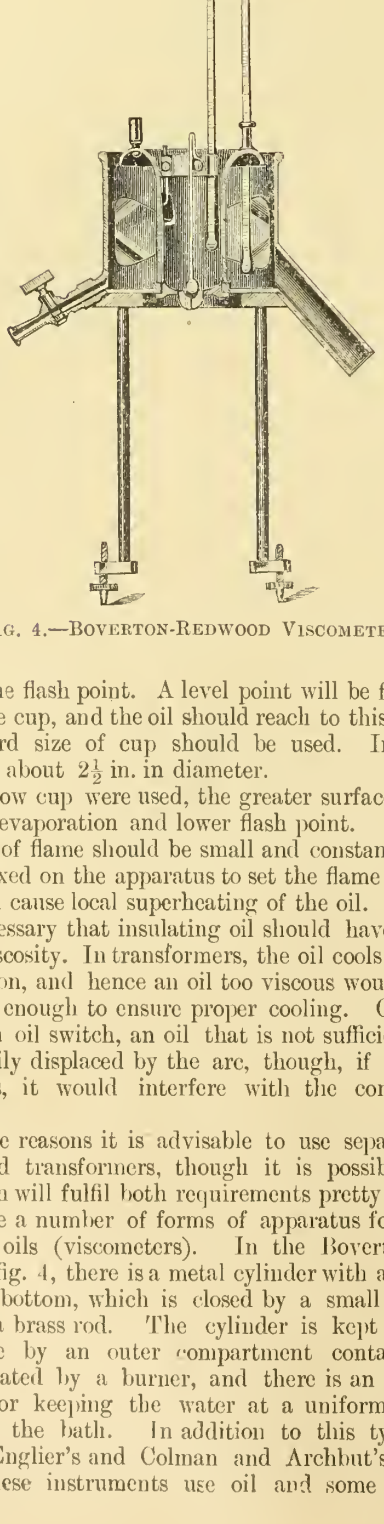


Fig. 4.—Boverton-Redwood Viscometer.

the lower the flash point. A level point will be found on the inside of the cup, and the oil should reach to this level.

A standard size of cup should be used. In the testers named it is about 2½ in. in diameter.

If a shallow cup were used, the greater surface would give more rapid evaporation and lower flash point.

The size of flame should be small and constant. A gauge is usually fixed on the apparatus to set the flame to. A large flame would cause local superheating of the oil.

It is necessary that insulating oil should have a more or less fixed viscosity. In transformers, the oil cools the winding by convection, and hence an oil too viscous would not circulate rapidly enough to ensure proper cooling. On the other hand, in an oil switch, an oil that is not sufficiently viscous is too readily displaced by the arc, though, if the oil were too viscous, it would interfere with the contact of the brushes.

For these reasons it is advisable to use separate oils for switches and transformers, though it is possible to obtain an oil which will fulfil both requirements pretty well.

There are a number of forms of apparatus for testing the viscosity of oils (viscometers). In the Boverton-Redwood apparatus, fig. 4, there is a metal cylinder with a small agate jet at the bottom, which is closed by a small brass sphere carried on a brass rod. The cylinder is kept at a proper temperature by an outer compartment containing water, which is heated by a burner, and there is an arrangement of vanes for keeping the water at a uniform temperature throughout the bath. In addition to this type there are Saybolt's, Englier's and Colman and Archbut's viscometers. Some of these instruments use oil and some water as the standard of viscosity, and the viscosity of the sample is proportional to the time taken to run a definite quantity of oil or water through the meter.

The viscosity of transformer oil should be between 8 and 12, and for oil-switch work between 12 and 16 at 20° C. using water as the standard.

An evaporation test on insulating oil is not so important as flash-point and dielectric tests, but it is advisable to test occasionally for evaporation on oil intended for use in transformer work. This can be done by heating about 3 gramme for about 10 hours at 100° C. and calculating the percentage loss of weight. This should not exceed 2 per cent.

A cold test should be made on oil for use in oil switches, as, owing to the exposed position sometimes allotted to this type of apparatus, it is possible for the oil to freeze and so put the switch out of action. A sample of the oil when placed in a freezing mixture should readily form drops.

Considerable care should be exercised in the handling of insulating oil. The oil is practically non-hygroscopic, but if open cans are left lying about exposing a large surface of oil to the atmosphere, as the writer has seen in some shops, moisture will condense on the surface of the oil and be carried down, thus reducing the dielectric strength. Oil should be stored in steel drums so as to be perfectly dry, which might not be the case when stored in wooden casks, especially if these are left outside with rain water standing on the heads.

When it is necessary to dry out the oil, this should be done in a vacuum oven and at 80° to 90° C. If the oil is heated above this temperature for any length of time, it begins to deteriorate.—W.L.

PACKING FOR EXPORT.

[CONTRIBUTED.]

The system of packing goods for export must always be based on the nature of the goods, and on the conditions involved. Crockery, for example, can, without damage, be wrapped in paper and packed in hay, in any case that is strong enough to carry the weight.

Machinery which is heavy, and much of which is machined bright, presents peculiar difficulties. It must not be packed with hay, for a band of hay round a bright shaft will produce rust, as hay is naturally damp, and may produce acid which will bite into a polished surface.

Some men in charge of machinery we have seen, who will have no bright parts exposed. They paint everything. English locomotives have coupling rods polished on both sides, after the manner of some of the work of the masons of the middle ages, who carved stonework where it has ever since been invisible. American coupling rods are black on the rear side. Most men still prefer to have many parts got up bright, and in many machines there must of necessity be a good deal of bright work, as, for example, in a machine tool.

Let us suppose that such an article has to be packed. How should it be done? Probably the machine will have a standard rising from a large wide-spreading base plate.

The normal packer stands this machine flat on the floor of a stout packing case, and thinks he has done well. Now had that man been at some foreign port where the labour was rough—rougher even than usual—and where the sun was baking everything within an oven of high eneirelin mountains, and the lifting gear was not of the best, he would picture to himself that case of machinery coming down to heavily on one corner, and he would hear a corner break on that machine base plate, and perhaps, if he thought about it, he would change his ways. Such a bed plate should not be stood on a flat case bottom. On the bottom of the case should be a circle or a square of wood standing above the general level and serving to support the middle part only of the bed plate, leaving the outer part, and particularly the corners raised well above the timber floor, so that a blow on the case corner cannot reach the machine base corner.

It is a common practice to lower a machine into its case at

hen to add supports and struts to hold the machine from oving, such struts being nailed casually to the outer walls f the case by a man who cannot get down into the case, nd probably fails to do his work at all perfectly.

Now properly to pack a machine, it is best built up inside stout framing of timber—a sort of crate of outer bars arrying struts or cross-bars to steady the machine. Inside his crate or frame there is sure to be some vacant space, nd into this space is built a boarded enclosure in which are acked the small loose parts of the machine.

To avoid undue size of packing it is often usual to remove ome far-projecting piece, and pack this in a different osition. The crate system lends itself well to this, and nables such loose pieces to be safely secured. Every part ies within the planes bounding the crate's exterior planes. hen all is complete, the crated machine is lifted bodily nto a packing case, and slides into it a fit. The cover is astened down and the case is ready.

When building up the crate the intention is that the nachine will stand upon the middle of its base, especially hen this is of the flate plate order, and not a deep box ection, which is less liable to be broken than a thin base-late, such as the base of a shaping machine.

But the business of packing in the skeleton crate-frame nust also be regarded from the view-point of the case being urned roughly over upon any one of its four sides or ven upon its head. Support must, therefore, be given to ake the lateral stress of any of the tumbles-over sideways. his can usually be arranged by strut pieces from the crate raming, and between the strut and the machine there may e interposed a pad of felt to soften the jar; a strut piece nay also carry the upside-down weight of the machine.

A long accurate piece of machined work for the tropics, ike a lathe bed, should, in the writer's opinion, be painted n its finished surfaces and protected by stout boarding and acked with well dried wood-wool all round in order to pre-ent shock. The paint can be removed by suitable solvents, nd should be worth this trouble for the protection it affords, or a rusted lathe bed may destroy the whole machine as an nstrument of precision. Large machines are not usually acked whole, but are pulled down and packed in sections.

If not painted with ordinary paint, small bright parts and inished holes may be well coated with vaseline. Wrapping ith jute cloth is sometimes resorted to for protection; this hould follow a wrapping of vaseline paper. All small parts, uch as are promiscuously heaped into cases with the pattern hop sweepings, should be wrapped first in greasy and in lain papers.

It has been suggested that particular small parts might irst be packed in tin canisters or boxes. As to this, ex-orters must satisfy themselves that the whole of the ontents of a case will not have to pay duty on the scale of he most heavily rated article. Thus in Mexico there is a ery heavy duty on glass, and this practically prohibits the mportation of food stuffs in glass bottles, for the bottles are eighed with their contents, and duty at glass rates is levied n the full combined weight. Exporters must always watch or these snags when packing goods or when sending compound rticles—such as steel cum brass, silk cum wool—for duty on he full weight is always charged as if the higher-rated ngredient formed the whole.

When packed, a line may be painted round the case, and narked "Sling here," in the languages of the ports and ailways on which the case will travel. One often sees 'Sling here" on a case in a foreign port. Doubtless in ime the significance of the words becomes known, but it ould be as well to put it in other languages also. Weights lso should be in the right system, tons, tonnes or kilo-rammes, so as to give warning not to use chains too small.

It is always to be remembered that packing cases are egarded as protectors of what is inside them, and so long as he case is not broken it is assumed the contents will not be armed. Articles which are apt to be very much damaged, owever carefully packed, will sometimes travel safely in pen crates fully visible to the eye and plainly showing heir delicate construction.

Packing is an art with a good deal of science in it. The cience consists in providing against cross breaking stresses ue to shock by suitable supports and some elasticity. here is nothing better than hay packed tight; hay will pack tight where straw will not, yet it will give elasticity. It is a pity hay has faults which render its use inadvisable for many things; but for clay goods it is excellent and cannot damage them. Tightness in all packing is essential. Goods must not settle into less space as they travel, or they may chance to tumble about in the free space of the case.

Our readers being engineers, many of them will be going abroad or coming home, and may have pictures and other impedimenta to pack. Pictures should go in shallow cases, say 9 in. deep, lined with tar paper, and packed between each layer of pictures with blanket, and with tight rolls of paper between pictures in the same layer. The case should only be large enough for the largest picture. Gaps in the layers may be filled with thin books, and the whole stuffed tight, to prevent movement, with dry wood wool. The hanging rings should be removed, or they will do serious damage.

In the tropics it is often impossible to keep things dry, and anything with iron about it will be apt to rust, such as buttons, clips, buckles, &c., of clothing, ties, &c.

Before going abroad, clothing should be cleaned free from grease or any traces of perspiration.

Mildew or other parasitic growth will fasten on clothing that has been worn; for example, if a speck of food has touched a coat, there will form white mildew. Starched articles may mildew also. Woollen clothes should be packed with a few wrapped-up naphthalene balls, to keep out moth and similar insects.

Holborn Street Lighting.—At the meeting of the Borough Council last week, the report of the Special Committee of the whole Council, dated May 24th last, with regard to street lighting, again came up for consideration. The Works and General Purposes Committee, to which had been submitted the report and recommendations of the Committee of the whole Council, put forward the following observations and recommendations:—(*a*) Capital expenditure: The companies in their tender undertake for payment of a lump sum per annum to make all the improvements, supply all the new lamps, fittings and columns, and maintain a light of a certain gross candle-power, as required by the specification. The sum which the company will spend in providing the new fittings (which will become the property of the Council) is not stated, but we are informed that it will amount to about £9,000, payment of which will be spread over a period of 10 years as part of the contract amount. The estimate has been carefully examined with the specification, and it has been ascertained that it represents the reasonable cost of supplying the new lanterns, fittings and columns required to be provided, and of the work in altering and adapting part of the existing system to electric lighting. During the past year the lighting of the borough by the present system cost £6,975, whereas if the improved lighting were in force it would have cost only £6,745, after deducting £900, the proportion of this estimated capital charge. For the year 1901-2, the first complete year of the Council's existence, and before the adoption of incandescent gas lighting, the expenditure amounted to £7,537, and the amount for the past year is the lowest figure that it has since reached. (*b*) Amount of light and distribution: The difference in the amount of light proposed by the companies, which is some 20,000 C.P. in excess of that required by the specification, is accounted for by the increase proposed in the power of the lamps in certain main thoroughfares, which are partly in adjoining boroughs. This is considered desirable for the purpose of uniformity. If it were decided to retain the lamps in the side streets at the present candle-power, *i.e.*, 60 C.P., instead of the proposed 90 C.P., this would mean a reduction in the total candle-power in such streets, which comprise 1,390 lamps, from 125,100 to 83,400. It should be borne in mind, however, that this latter figure represents the minimum to which the mantles are allowed to run down, and a truer comparison would be made between 80 C.P. (the original power of the mantles when first installed), and the proposed 90 C.P. The difference in that case would amount to only 13,900 C.P. In conclusion, the Committee recommends: "That subject to the consent of the London County Council being first obtained to the form and principle of the contract, the joint and several tender of the Gas Light and Coke Co., and the Metropolitan Electric Supply Co., Ltd., dated April 11th, 1911, for lighting the streets of the borough for 10 years for the sum of £7,645 per annum, subject to the deletion of Clause 35 of the specification, and the amendment of the schedule of lighting as proposed by them, be accepted, and that the seal of the Council be affixed to the necessary contract to be prepared by the town clerk." This was passed.

Magnetic Variation.—In the annual report of Admiralty surveys for 1910 it is stated (says the naval correspondent of the *Western Morning News*) that a systematic determination of the magnetic variation in the North Sea was carried out in March by the officers of four cruisers. The results afford good values of the variation at 62 positions, enabling isogonals to be drawn with considerable accuracy.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CUBA.—With reference to the notice which appeared in the ELECTRICAL REVIEW of June 30th last, regarding a Bill before the Cuban Legislature, in which it was proposed to increase by 50 per cent. the Cuban Customs duties on goods from countries which have not concluded, or which have not within six months of the promulgation of the Bill as Law concluded, reciprocity treaties with Cuba.

The Board of Trade are now informed that the Bill in question has been reported from the Committee of the House of Representatives to which it was referred, and was read in the House for the first time on June 9th. The principal amendments are the alteration of the proposed rate of surtax from 50 to 30 per cent.

SOUTH AFRICA.—The South African Customs Authorities have published a decision to the effect that paper tape imported in rolls for use with telegraph machines, shall be admitted free of duty if imported from the United Kingdom and shall pay 3 per cent. *ad valorem* if of foreign origin.

BAHAMAS.—A new tariff of the Bahamas, which came into force on March 28th of this year, provides that goods not separately mentioned in the Tariff and not free of duty shall be raised from 20 per cent. *ad valorem* to 25 per cent. *ad. valorem*. For further details as to the effect of this revision readers should consult the information as to the tariff rates in Bahamas published in the ELECTRICAL REVIEW of January 1st, 1909. Pumps which were formerly free of duty now pay 20 per cent. *ad valorem*.

NETHERLANDS.—The Customs Authorities have issued a decision to the effect that apparatus for separating air from the feed water for boilers is to be admitted free of duty.

PANAMA.—The Panama Government have now issued a decree to the effect that from September 1st next all articles included in the second of the General Classes of the Tariff of Panama shall be dutiable at the rate of 15 per cent. *ad valorem* instead of 10 per cent. as formerly. The Second Class of the Tariff comprises all goods except those which are free of duty, and includes electrical goods except such as might be imported under special circumstances for the Canal Commission, the Panama Railroad Co. or for irrigation.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,426. "Process for the electrolytic production of ammonium nitrate from hydrated nitric acid." ELEKTROCHEMISCHE WERKE G.M.B.H. (Convention date, July 16th, 1910, Germany.) July 17th. (Complete.)

16,437. "Spark plugs." J. W. MACKENZIE. (Champion Ignition Co., U.S.) July 17th. (Complete.)

16,438. "Spark plugs." J. W. MACKENZIE. (Champion Ignition Co., U.S.) July 17th. (Complete.)

16,440. "Electrical contacts." ANSCHUTZ & Co. (Convention date, November 26th, 1910, Germany.) July 17th. (Complete.)

16,456. "Electrical driving devices for sound-reproducing machines." M. KAISER. July 17th. (Complete.)

16,458. "Electrically-operated apparatus for locking railway carriages and other doors." C. LEGRAND and A. ARMEL (trading as Soc. Ch. Legrand et Cie). (Convention date, date July 27th, 1910, France.) July 17th. (Complete.)

16,468. "Electrical measuring instruments." F. STROUDE and E. JOSEPHS. July 17th.

16,488. "Terminal and like boxes for use with conduits or casings for electric conductors." A. E. WOODHOUSE. July 18th.

16,489. "Conduits or casings for electric conductors." A. E. WOODHOUSE. July 18th.

16,498. "Electrical conducting cables and the like." M. D. DAVIS. July 18th.

16,514. "Electrical terminals." A. P. LUNDBERG, G. C. LUNDBERG and P. A. LUNDBERG. July 18th. (Complete.)

16,523. "Portable field telephoning apparatus." C. M. M. DARE. July 18th.

16,532. "Electric lifts." W. H. SCOTT. July 18th.

16,542. "Covering of electric conductors with plastic material and apparatus therefor." W. S. SMITH and A. D. SHUTER. July 18th. (Complete.)

16,547. "Electric fuses or cut-outs." C. W. DENNY. July 18th.

16,553. "Apparatus for recording telephone calls." C. C. CHAPMAN and A. GRIMSLEY. July 18th.

16,554. "Manufacture of electrical condensers and similar apparatus." J. A. L. DEARLOVE and S. G. BROWN. July 18th.

16,584. "Electrical combined switch and fuses." R. ADAMS. July 19th.

16,602. "Device for heating running water or other liquid by electricity." H. LOFQUIST. July 19th. (Complete.)

16,636. "Production of long stable electric arcs for the treatment of gases." J. Y. JOHNSON. (Badische Anilin and Soda Fabrik, Germany.) July 19th.

16,641. "Electro-mechanical change-speed and reversing device." P. GASNIER. (Convention date, July 19th, 1910, France.) July 19th. (Complete.)

16,667. "Method of controlling and operating electric locomotives, electric trains, electric tramcars and other electric traction machinery." A. MARTIN and A. J. CAMPBELL. July 20th.

16,678. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. July 20th.

16,679. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. DOWDELL. July 20th.

16,694. "Insulating supports for electric conductors." J. J. KINLEYSIDE. July 20th.

16,707. "Telephone and other suitable sound receivers." C. KAHN (trading as E. C. Rein & Son). July 29th.

16,721. "Transmitting telegraph keys." E. E. MOORE. July 20th.

16,737. "Compensation of polyphase commutating dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Elektricitäts Ges., Germany.) July 20th.

16,738. "Regulating devices for the driving motors of spinning machines." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine ElectricitätsGes., Germany.) July 20th.

16,796. "Means for connecting electric cables to junction, bifurcating, trifurcating terminal boxes and the like." G. W. HUMPHREYS. July 21st.

16,828. "Terminals for ignition plugs." G. H. LONGFORD and W. R. CLARK (trading as Sphinx Manufacturing Co.). July 22nd.

16,841. "Regulators for dynamo-electric machines." A. H. RAILING and A. J. D. KRAUSE. July 22nd.

16,859. "Electrical secondary or storage batteries." C. BAYEA and HUBBARD. July 22nd.

16,867. "Automatic telephone exchange selector." F. R. MCBEATY. (Convention date, July 23rd, 1910, United States.) July 22nd. (Complete.)

16,868. "Wiring contacts of telephone switches." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) July 22nd. (Complete.)

16,869. "Semi-automatic telephone systems." F. R. MCBERTY. (Convention date, July 23rd, 1910, United States.) July 22nd. (Complete.)

16,870. "Drum type controllers for the shunt control of electric motors." A. WEST & Co., LTD., and W. J. MOGGRIDGE. July 22nd. (Complete.)

16,871. "Liquid electric controllers." A. WEST & Co., LTD., and W. MOGGRIDGE. July 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

VOLTAGE REGULATION OF DYNAMO-ELECTRIC ALTERNATING CURRENT MACHINES. Akt.-Ges. Brown, Boveri et Cie. 15,415. June 27th. (July 10th, 1909.)

AUTOMATIC ELECTRIC RECORDING DEVICES. A. Lambot. 15,619. June 29th.

ELECTRICALLY CONTROLLED EJECTOR VACUUM CLEANING APPARATUS. T. White. 15,695. June 30th.

COUPLINGS FOR ELECTRIC ARC LAMPS. J. E. F. C. Pechin. 15,789. July 1st.

ELECTRIC TRANSMISSION MEANS FOR USE AS OR IN HELM INDICATORS OR TELEMOTOR ARRANGEMENTS FOR STEERING GEAR AND THE LIKE. Clark, Chapman & Co. and H. J. Moysey. 16,559. July 11th.

STRETCHER OR GAUGE BARS FOR RAILWAY SWITCHES. A. H. Johnson and L. Williams. 16,800. July 14th.

ELECTRICAL SWITCHES. Electric and Ordnance Accessories Co. and N. Collis. 19,182. August 16th. (Addition to 24,373/1909.)

ELECTRIC CONTACT BREAKERS FOR USE IN CONNECTION WITH THE IGNITION SYSTEM OF INTERNAL COMBUSTION ENGINES. B. Brooks and F. H. Alston. 19,2[illegible] August 20st.

ELECTRIC FURNACES AND THE MANUFACTURE OF STEEL. G. Massip. 22,[illegible] October 1st. (October 2nd, 1909.)

ELECTRIC HEATING APPARATUS. H. Hirst and C. H. Archer. 24,238. October 19

MAGNETO ELECTRIC CURRENT GENERATORS. P. A. Juston and R. Bunzli. 28,1[illegible] December 3rd. (March 10th, 1910.)

ELECTRIC LIGHTING. I. Frankenburg & Sons, Ltd., and E. Fleming. 28,7[illegible] December 10th.

TUNGSTEN AND THE MANUFACTURE THEREOF. British Thomson-Houston Co. (General Electric Co.) 8,031. April 2nd.

ELECTRICAL TIME SWITCHES. W. Hamilton and Ferranti, Ltd. 13,704. June 6

WIRELESS OPERATED ELECTRICAL SIGNALLING, INDICATING OR LIKE MEANS. L. Cerebotani. 16,360. July 8th.

TROLLEY POLES FOR ELECTRIC TRAMWAYS. R. Ashworth. 17,690. July 6th.

ELECTRICAL HEATERS OR STOVES OF THE RADIATOR KIND. Veritys, Ltd., and W. G. Pipkin. 18,136. July 30th.

AUTOMATIC MEANS FOR RAISING AND LOWERING ARC LAMPS OR OTHER FITTINGS SUSPENDED IN CENTRAL CARRIER FRAMES. J. Stevenson and O. R. William[illegible] 18,217. August 2nd.

SPEED REGULATION OF INDUCTION MOTORS. Milch. 22,717. (October 1st, 19[illegible] Addition to 12,326/08.)

DEVICE FOR PROTECTING THE EARS AND TROLLEY WIRE ON ELECTRIC RAILWAYS AND TRAMWAYS. H. M. P. Dudgeon. 23,536. October 11th. (Cognate application No. 26,462/10.)

SELF-REGULATING ARC LAMPS FOR PROJECTION. A. Schmidt. 25,634. November 4th.

ELECTRIC HEATERS. M. B. Field and Ferranti, Ltd. 26,836. November 18th.

1911.

REFLUX CONDENSERS. C. Still. 3,269. February 8th.

ENCLOSED ARC LAMPS. Korting and Mathiesen Akt.-Ges. 3,891. February 16th. (February 21st, 1910.)

ELECTRICITY MOTOR METERS. Chamberlain & Hookham, Ltd., and S. James. 10,816. May 4th.

Barcelona Electrical Trade.—According to the French Consul at Barcelona, the import trade in electric apparatus in this city and the adjacent districts is mainly in the hands of German firms, the imports from Germany in 1909 attaining a total of 1,351,541 kg. as against France's contribution of 2,146 kg. The Allgemeine Elektricitäts Gesellschaft, of Berlin, is the principal importer. The Compania Barcelonesa de Electricidad is only an independent offshoot of this firm. The Spanish manufacturing company recently started, called La Industria Electrica, which turned out dynamos, cables and a lamp styled the Z lamp, is likely to be absorbed shortly by the German company, negotiations to this end being already afoot.—*Revue Pratique de l'Electricité.*

THE
ELECTRICAL REVIEW.

VOL. LXIX. AUGUST 11, 1911. No. 1,759.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1911 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE SPHERE OF GOVERNMENT INFLUENCE.

THE thoughtful person who endeavours to foretell the effect of proposed legislation by studying the undoubted results of statutes now in force has much food for reflection at the present time. During the last decade, the list of effective Acts of Parliament has increased in an amazing degree. Within the last five years we have seen an enormous number of measures passed in the interest of the working classes. What is the result of it all? What other legislative efforts will be made when the skid which, according to the view of some minds, now clogs the wheel of the State chariot is finally and completely removed?

In former centuries trial was made of a number of sumptuary laws. By these means attempts were made to restrict the output of certain manufactured articles, and to control the liberty of the person. Each and every one of those strange Acts of Parliament now lies in the limbo of forgotten things, "unwept, unhonoured, and unsung." It has remained for twentieth-century Governments to revive at least one of the objectionable features of the old sumptuary laws—namely, interference with freedom of contract.

However attractive for the nonce interference with freedom of contract may be, it is bound in the long run to injure the man whom it is designed to protect; and in so far as it does that, it is an extension of Governmental control beyond its legitimate sphere. John Stuart Mill, at any rate, took this view. He wrote: "When a Government provides means for fulfilling a certain end, leaving individuals free to avail themselves of different means if in their opinion preferable, there is no infringement of liberty, no irksome or degrading restraint."

So long as the Government enforces the fulfilment of contracts, they provide the means for attaining the end. They regulate the dealings of employers with employed, and it is in those relations that readers of this journal take the deepest interest. Those relations—at one time free, or practically free, from Government control—are now hedged about with all kinds of restrictions. The parties are not free to contract one with the other. A may not run a factory unless it is open to the view of a Government inspector. B may not employ able-bodied pitmen for nine hours at a stretch in his coal mine. C may not agree with D, for whom he works, that he will take no advantage of the Compensation Act if he meet with an accident in the course of his employment. Are not all these "infringements of liberty" or "degrading restraint"? *Et cui bono?*

Take the Workmen's Compensation Act. Compare the position of the workman employed by a humane employer 15 years ago and the position of a similar workman to-day. Suppose him injured and placed on the sick list. On pay day the employer would most likely say, "We had better send Tom his wages. Poor chap, he has a wife and

family to keep"! And the result? Realising that he was being kindly treated, Tom would try to get back to work as soon as possible. If unable to do his regular job, he would clean out the yard or assist as best he could. But now, if Tom goes under, it is the hard-hearted insurance company that he has to deal with. He gets half his wages; is encouraged to believe that he will continue to get half wages so long as he is ill, and, getting to like an idle life, he hangs about and becomes a worthless malingerer. If he loses his job, he never gets another if it is rumoured abroad that he has once claimed compensation. If he is past middle age he has nothing in front of him but the workhouse or an old-age pension.

These, save the mark, are some of the results of beneficent, up-to-date legislation! If these are the consequences of workmen's compensation, what shall be the result of industrial insurance? Here, again, we see the negation of freedom of contract. Employer and employed must insure. There is no option. Would the employer who was kind to Tom in the manner above suggested continue to be quite so kind after paying 6d. a week to the State in respect of Tom for 10 years? Would he not be more inclined to leave Tom to get some of his own back in the shape of disablement allowance from the State, which had intervened to modify his relations with his own servant?

This interference with freedom of contract is amongst the most illusory of the devices which are adopted to try and demonstrate that one can make the poor richer by legislation. So long as an employer is not bound to employ, and not bound to employ at a particular wage, so long can he obtain workmen at the market rate. That market rate is fixed by an inexorable law. The tendency of such a measure as the Workmen's Compensation Act must be to lower it. The actual result of the Act may be that wages have not risen as fast as they otherwise would have risen—but the result is there. As surely as this will the National Insurance Bill now before Parliament have no real and ultimate effect upon the relative wealth of employers and employed. Its only result may be to enable the employer to save that which he would otherwise spend.

Publicity and Business Getting.

At the recent Canadian Electrical Convention at Niagara Falls, some discussion took place on the advantages of publicity to the central station and on the subject of new business getting.

The author of a paper on the former subject dealt more particularly with newspaper publicity, but the remarks of subsequent speakers showed that there was a considerable diversity of opinion as to its value, more especially in small towns.

Local poster advertising found some supporters, and one speaker drew attention to the value of cartoons, which tell their story at a glance. In any case, haphazard advertising or publicity is of little real worth as compared with an intelligent methodical scheme for directing attention along the lines which pay best.

The paper on new business getting, by Mr. Kemble, sales agent of the Toronto Electric Light Co., was of considerable interest, following on the ideas we have frequently advocated in these columns.

He pointed out the great necessity for discrimination in canvassing for entering new business in order to ensure that it should be profitable. The salesman should have a thorough inside knowledge of his district and its needs—even a personal knowledge of the business men's associations and of local affairs, so that he might scent coming business and determine its prospective value.

The discussion turned largely on the payment of canvassers—a matter which has exercised the central-station engineer at home.

In the ordinary way a man will take the business which comes easiest, without regard to the electric supplier—if paid a straight commission. The author preferred to put a man on his honour and pay him a fixed salary—that was the ideal method. In the States a number of stations were trying mixed methods of paying canvassers, but as they were modifying their systems, he judged that they had not found a satisfactory one. Another system mentioned as in use in Canada was the payment of a salary and a commission varying with the class of service.

This question of the canvasser and his remuneration bristles with difficulties, as on the judgment of the "business getter" depends largely the successful progress of the year.

While he deals with the present, he must keep an eye on the future; and his efficiency will not be high unless he has some knowledge of station economics, and the lay of the mains in his district. Obviously this points to a good man who should be good enough to receive a fixed salary; and indeed, a logical bonus system dependent on the value of the load taken on, and such as to place a premium on the valuable consumer, seems to be almost beyond reach in practice.

Relays.

The rapidly growing use of relays—mechanical watchmen, whose function is not to perform the operation with which they are associated but to act as sentinels and to give the order for more powerful but less intelligent mechanisms to carry it out—is a marked feature of the present time.

While it apparently introduces greater complication, it in reality makes for simplicity, for though the electrical connections necessitated become more numerous and involved the apparatus controlled becomes less elaborate and expensive than it would be if it had to combine the whole of the watching and operating mechanism within itself. Moreover, the use of relays, far from diminishing the reliability of operation, greatly increases it, for relays nowadays are so well designed and constructed that they can be set within well-defined limits and confidently depended upon to act when called upon, whereas it is impossible to combine with the heavy operating parts of a large circuit-breaker, for example, the delicacy of adjustment necessary to ensure reliable and accurate operation under the prescribed conditions.

With the improvement of the relay itself, the ingenuity of inventors has kept pace in devising new systems of connections which confer upon the instrument powers which do not fall far short of animal intelligence—so that while it ignores all those phenomena, no matter how powerful, which it is meant to ignore, it unerringly picks out that particular combination of circumstances under which it is its duty to act.

The little relay has established itself as the ever-wakeful watchman controlling the operation of the most powerful generating and transmitting systems, and must be regarded as a factor of the first importance to their successful operation. The article, therefore, which we conclude in this issue—contributed by Mr. Kenelm Edgcumbe, an expert in the subject—should prove interesting and helpful to our readers, and we cordially commend it to their notice.

HE SWISS TOUR OF THE INSTITUTION OF MECHANICAL ENGINEERS.

By OUR SPECIAL COMMISSIONER.

s the object of this tour was to visit the great water-power eetricity generating stations in the North of Switzerland, has been of quite as much interest to electrical as to echanical engineers. In fact, hydraulic and electric works e no longer considered as other than two special branches mechanical engineering. They have much in common in eir theoretical purely scientific development ; and in these viss generating plants they are found close hand in hand, ch essentially dependent upon the other.

On Saturday, July 22nd, we started from London in heerful mood, because a temperature of 62° had been moured to exist in Switzerland. On reaching Basle, how-er, it almost seemed as if some confusion had arisen tween 62° F. and 62° C. ; and one portion of the Insti-tion took refuge in the waters of the Rhine, swimming wn stream attended by rescue boats, while another party ught fresh air by tram-riding to the foot-hills beyond the ty, and climbing to the top of Chrieshone, where a splendid noramic view of distant mountain and forest, along with ol breezes and clear atmosphere, rewarded their enterprise. hose who reached Basle early were enabled to visit the ity electricity works. The old water works of Basle are scribed in the issues of October 3rd and 10th, 1896, of e *Schweizerische Bauzeitung*. In fig. 1 we give an illus-ation of the most recent addition to the steam-power plant, mely, a turbo-generator of 2,000 KW. at 1,500 R.P.M., Sulzer Bros. Great extensions of the water-power ectric plant are now nearly complete. Ten kilometres ove Basle, between the towns of Augst and Wyhlen on e south and north side of the Rhine, the river is com-etely dammed, giving a gross fall of from 5 to 8½ m., with ean 6·7 m., to 10 Francis turbines of 15,000 H.P. total on e south or Swiss side, and to other 10 turbines on the erman side yielding about the same total horse-power. The rbines are direct couped to three-phase 1,600-K.V.A. nerators on horizontal shafts with periodicity 50, and speed 7 R.P.M. From the south side the energy is taken to asle at 7,000 volts, that is, without transformation. On e north side part of it is raised to 45,000 volts, and ansmitted over six aerial lines, while other four nes transmit the rest without transformation. This is e most thoroughly modern plant in this immediate strict, and it seems a pity that it should have been left t of the regular programme of the Institution tour and rele-ted to a back page as an extra to be taken by those who uld find the time for it by hook or by crook. Some of the rty visiting Rheinfelden on Monday, however, were clever ough to double back upon Wyhlen, and thus to visit one-lf of this double station. One special feature of the total sign is that the switchboard is placed in a separate build-g communicating with the power house by a bridge over e supply canal, across which bridge are carried the main bles.

The orthodox programme was commenced on Monday orning under a still blazing sun, and through dense hosts big horse-flies, which drew blood from many a wounded d irate member of the Institution. One party drove to e Rheinfelden works, some 17 km. above Basle, while nother reached the same point by train. We were received d conducted over these works and the Laufenburg works,) km. further up the river, by the very courteous vice-irector, Herr Otto Albrecht. The Rheinfelden dam has veral sluice-gates in the river part, while the head of the pply canal is without gates, but is protected by an ob-quely-set grating to keep back flotsam and ice. Next to e supply canal, whose breadth is 50 metres, is a ide walled canal for the down-passage of timber fts, and several fish ladders are provided. At the rbine house the entrance to the 20 wheel pits is protected a fine-mesh screen, for the periodical cleaning of which a ecially designed machine is erected which travels on rails ong the whole length of the power house. Here also e provided sluice-gates, one between the canal and each wheel pit. We were unable to see anything of the turbines, which are vertical-shaft Francis machines, each of four runners, because they were all wholly submerged in water. The generators, direct-coupled on the vertical shafts, run at 55 R.P.M., and yield a total of nearly 17,000 H.P. The governing is effected by the usual servo-motors with oil at 25 kg/cm² pressure as working fluid. Twelve of the machines give continuous current at from 50 to 155 volts to various aluminium and other chemical works ; and the other eight supply three-phase current at 6,800 volts for power purposes. In a separate house on the opposite side of the supply canal is placed a steam power reserve with two Brown-Boveri-Parsons turbo-generators of 1,400 and 2,400-KW. power, with condensing plant, so that only the make-up for the boilers requires to be taken direct from the river. Although the Rhine water is rather hard, no water-softening plant is used here for this make-up ; but in the more modern plant at Wyhlen above-mentioned, it is interesting to note that it has been found advisable to add a water softener. The hardness of the Rhine water is from 7 to 8 per 1,000.

This station is connected to the works at Beznau, from which it has for some years taken a supply of about 5,000 H.P., as well as taking a considerable quantity from the other generating station at Wangen ; both of these stations will be referred to later.

After luncheon, the party proceeded to visit the Laufenberg works, 21 km. further up the river. Here 50,000 H.P. are developed from 10 Francis turbines running at 107 R.P.M., each direct-coupled to a 5,200-KW. three-phase generator. There are here no modern features demanding description in these pages.

One party of the members devoted Monday afternoon to inspection of the Brown-Boveri works at Baden and to listening to an exposition, illustrated by lantern slides, of the general method and organisation of work adopted in these famous works by Mr. Eric Brown, who is as familiar with the English language as with German. These Baden works employ over 3,000 workmen, besides a staff 700 strong, and the capital invested is 28 million francs. Affiliated works, each with its own independent capital and financial responsibility, have in recent years been established at Mannheim, Paris, Milan, Christiania, London, Vienna, Budapest and Rotterdam. Of these the first-mentioned was the earliest offshoot, and is at present the most important as regards bulk of manufacture turned out. In all these works the total employment aggregates over 10,000 hands. Besides steam turbines, dynamos, motors and transformers, the firm does a large business in air compressors, mine ventilators electrically driven, and in electrical plant for metallurgical works and for the textile and paper industries. One of the two systems adopted for driving the extraction ventilating plant has special electric interest. A steam turbine drives a shaft on which are mounted in tandem an alternator and a D.C. generator, which is connected to a D.C. motor according to the Leonard system. Rapid variations of load are thrown back upon the boilers, which really act as the fly-wheel reserve of the system, and the result is a reduction of the number of machines needed for a given mine, and of capital and maintenance costs, as well as a valuable clearance of space occupied. In the Brown, Boveri works at Baden, one notices that the driving of machine tools each by its own motor is not carried so far as in some other modern Continental works, one motor usually driving a countershaft which serves a whole line of machines. This is probably because the great bulk of the machine tools are of comparatively small size, a large lathe and a large boring machine for the rotors and cylinders of steam turbines being the most noteworthy tools of extra size. These and other of the larger size of tool have each its own separate motor. From the scientific engineering point of view the world owes most to the firm in respect of its development of the combined impulse and Parsons type of turbine, of which it is needless to say anything here, and in respect of its perfecting of the Déri single-phase motor. This seemed rather a hopeless machine for some years after the date of its birth in the brain of the inventor, but in the hands of Brown, Boveri it has finally become a thoroughly practical motor of great utility. It excels all others in

simplicity of construction, and therefore in low costs of manufacture and of maintenance. It is extremely compact in outside form, and although its weight per H.P. is greater, the extra weight is in dead material, the quantity of copper being less. It is made in two forms, single and double. The objection sometimes raised to the single machine is that at times it draws power very unequally from the collectors on a three-phase system feeding it. In the double machine a compensation acts so as always to equalise the draft from the three collectors. The rotors of the two single-phase motors are mounted on the same shaft, while the two stators, although built together mechanically, are not magnetically connected. The special advantages of the Déri motor are

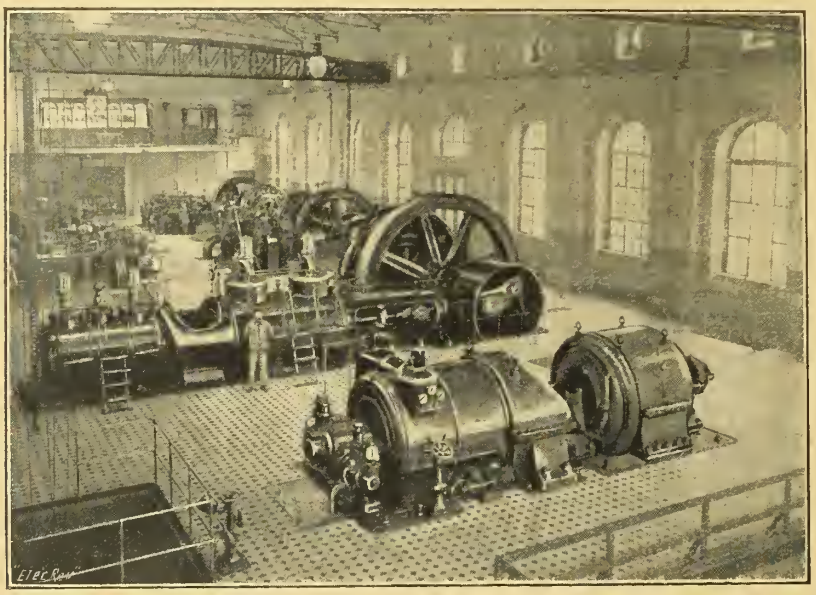


Fig. 1.—Sulzer 2,000-kw. Turbo-Generator at Basle Electricity Works.



Fig. 3.—Rotor of 1,000-h.p. Francis Turbine, Showing Corrosion of Blades.

well known; large initial torque in starting, with rapid decrease as the speed rises from zero, large overload capacity, extra low pressure in the rotor, recuperation of energy in braking, and, above all, quick and powerful regulation, as

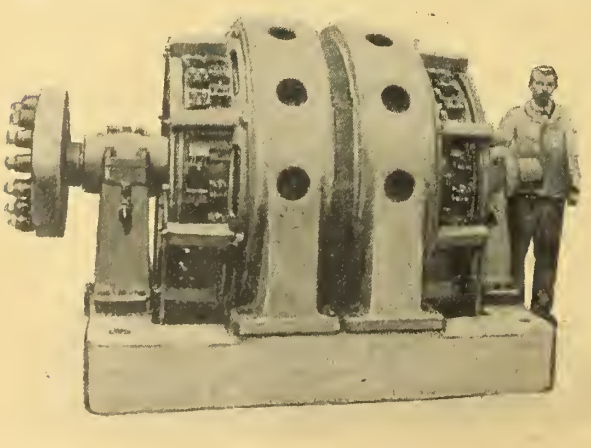


Fig. 2.—Duplex Deri Three-Phase Motor.

well as reversal, by simple shifting of the brushes. Fig. 2 represents one of these duplex balanced Déri motors as now being made. Several hundreds of these are now at work, and the manufacture in several standard sizes is proceeding briskly.

On Monday evening President Ellington entertained a large number of English and Swiss engineers to dinner at the Baur au Lac Hotel in Zurich. This was perhaps the most delightful and interesting episode in the whole week's programme. Here we were given the opportunity of making personal acquaintance in free and easy style with the great intellects which have in so short a period of years raised Switzerland to the first rank of mechanical and electrical engineering skill and efficiency, and of vigorous, perfectly organised commercial prosperity. It was a most exhilarating and educative contact, and one which those privileged to take part in it will not soon forget.

On Tuesday morning at 10 o'clock, the Institution meetings for the reading of papers were begun by a short address of welcome by Herr Sulzer-Ziegler, Vice-President of the Verein Schweizerischer Maschinen-Industrieller, to which President E. B. Ellington replied in brief and graceful terms. Papers upon "Swiss Electric Traction," by Herr Huber-Stockar, of Zürich, and upon "Rack-Railway Locomotives on Swiss Mountain Railways," by Herren T. Weber and S. Abt, of Winterthur, were first read. These were discussed by Dr. E. Hopkinson, in English, and by Prof. Wyssling, in German. Dr. Hopkinson attributed the recent extensions of electric traction (1) to the greatly reduced cost of generators and motors; (2) to the use of transformers; and (3) to the use of three-phase power. Prof. Wyssling emphasised the importance of commercial economy, of traffic conditions, and of the cost of coal. At present all Swiss electric traction on railways is privately owned. No State railway has yet been electrified, but a Government Commission is studying the question whether electrification backed by water-power is not cheaper than the present steam locomotive traction. The answer will be—Yes, until England sends coal to Switzerland at lower prices. The Lötschberg marks the beginning of the extension of electrification of long lines. Mr. Patchell then spoke, in English, illustrating by the figures 25·9 and 58 watt-hours per ton-mile the influence of stops, the former figure being for a certain line without intermediate stops and the latter for the same with four stops. He also asked for further information as regards construction costs in Switzerland, contrasting the high costs of water-power plants with those of steam and Diesel engines. The discussion was finished by Dr. T. Weber in German, who pointed out the necessity for high-grade workmanship throughout, and especially for more than ample braking power upon rack railways.

Herr Huber-Stockar's paper is a long one, profusely illustrated by photographs and drawings, and contains seven lengthy tables giving very full details of all the Swiss lines, including the total and analysed costs of construction, total operating expenses, and total traffic receipts. It includes also a map showing the total railway system of the country and the small part of it now electrified.

Herr F. Schubeler's paper on "Modern Diesel Oil Engines" was the next read. Herr Sulzer-Ziegler took part in the discussion of this paper, speaking in German; pointed out that 2,000 H.P. in four-cylinder engines had now been reached, and that a two-stroke cycle with 80 per

cent. efficiency was now possible, as compared with the four-stroke cycle with 95 per cent. efficiency. Experimental engines were now at work on steamers on Lake Zürich and on the Adriatic ; and engines of 1,000 and even 2,000 H.P. per cylinder were quite probable in the near future. Prof. Constam, director of the Fuel Laboratory of the Polytechnikum, speaking also in German, mentioned that experiments were now proceeding on the use of tar-oils in Diesel engines. Tuesday's forenoon meeting finished with a demonstration of Dr. Amsler's two new forms of transmission dynamometer. One of these is based on the optical measurement of the small angle of twist of a square transmitting shaft ; in the other the central boss and the outside pulley of a transmitting gear transmit the torque from one to the other through four small oil cylinder-and-plunger couplings laid circumferentially, the oil pressure being measured and recorded upon a clock-driven drum. The workmanship of the dynamometers exhibited was of a specially high grade.

It may be convenient here to continue our report of the meetings at the Polytechnikum, which were renewed on Wednesday morning at 9.30. The first paper read was upon "High-Pressure Water-Power Works," by Mr. Zodel, the managing director of Escher, Wyss & Co. This was illustrated by a great many lantern pictures upon a large-sized screen. The most remarkable plants yet erected are those in Mexico, and to English eyes and ears, the descriptions of these are indeed astonishing. The paper also supplies descriptions and particulars of the Tyssedalen 33,600-H.P. station in Norway, the net head being 1,260 ft., and the turbines Escher, Wyss Pelton wheels ; and of the Brusio power station on the Swiss-Italian frontier, where the total available head is 3,280 ft., which is utilised in two stages of 1,970 and 1,375 ft., as well as of several other European plants. Interesting particulars and photographic illustrations of the failure of an ill-laid-out pipe line near Cannes were given. This paper is a valuable contribution to our knowledge of water-power works, and should be referred to by engineers who wish to have the latest information on this subject.

The last remark applies equally to the next paper read, although it is a very short one—namely, that on "Results of Experiments with Francis Turbines and Tangential (Pelton) Turbines," by Prof. Dr. Franz Prásil, who is recognised as the leading Swiss expert in hydraulic measurement. The diagrams and tables of this paper show to how high a grade of efficiency these machines have now attained, and especially how this high-grade efficiency of over 80 per cent. is maintained throughout a long range of load—namely, from quarter or one-third load up to 25 per cent. overload.

The last paper was read by Herr Zoelly upon "Steam Turbines." This paper is partly theoretical, but mainly a description of the Zoelly turbine as now made by Escher, Wyss & Co. At 3,000 R.P.M. eight stages are used ; at 1,500 R.P.M. 12 stages are used ; and as many as 16 stages at 1,000 R.P.M. In the discussion of this paper, Prof. Stodola spoke for the first time during the meetings. His opinion is that the principles on which steam-turbine calculations are to be made are now well established, and that many of the earlier troubles were due to wrong choice of materials of construction, such as nickel-steel. He admits, however, that while the action of the steam in the stationary nozzles is quite certainly known, its action in the running blades is almost entirely unknown ; and this seems hardly consistent with the proposition that the basic principles of steam-turbine action are now fully established. The knowledge vacuum comes in when it is attempted to evaluate all the effects of centrifugal forces on the concave and convex sides of the blades. Prof. Stodola also spoke of the critical speed, and of the damping of the amplitude of vibration of a shaft running in water at or over critical speed. He said that the most recent experiments confirm theoretical calculations as to the elastic yield of disks at very high rotary speeds, and also referred to an important new Sulzer steam-turbine governor in the form of a small centrifugal pump. He predicted that gas turbines would become practicable when a material was found which would permanently retain its elastic qualities at 800° C. temperature. He concluded with a complimentary reference to the Humphrey gas-explosion pump, and a very handsome acknowledgment that the steam turbine would not have existed to-day had it not been for the energy and enterprise of Parsons. Several other gentlemen took part in this discussion, which closed the Zürich meetings so far as the reading of papers was concerned.

On Tuesday afternoon two parties made visits respectively to Messrs. Escher, Wyss & Co.'s works, on the outskirts of the town of Zürich, and to the Oerlikon works, three miles north of Zürich. The limits of this article will not permit any description of these works in it, but we will in a future issue give notes upon the recent modern developments that have taken place in them. Messrs. Zodel and Zoelly themselves conducted the party to their works in very kind and



FIGS. 4 AND 5.—BREAKAGES IN A GIRARD TURBINE DUE TO A CURIOUS ACCIDENT.

courteous fashion, and put a fine finish to their hospitality by entertaining the whole company to afternoon tea in the gardens of the Ton-Halle, on the borders of Lake Zürich, whence we enjoyed the magnificent view of the wooded hills bordering each side of the valley and of the grand distant snow-clad mountain ranges, at the same time listening, as far as engineering conversation permitted, to the excellent music of the Ton-Halle orchestra. The reception at the Oerlikon Works was equally friendly and hospitable, this party taking tea in the works restaurant itself.



FIG. 6.—CORRODED BLADE OF TURBINE.

We may here mention an interesting item of information obtained during these evening relaxations. We are indebted to Dr. Franz Prásil for the illustrations, figs. 3 to 7. Fig. 3 shows a phenomenon difficult to appreciate except by actual seeing of the parts. This is the rapid corrosion of the blades of water turbines. The life of these does not often exceed from two to three years. This applies equally to Francis and to Pelton wheels. It is proved not to be due in any degree to the scour of the rush of water, but to be entirely chemical and to consist of an oxidation

of the iron. In some manner not yet clearly known, the oxygen of the air in the water is separated and perhaps changed in chemical form so as to facilitate more vigorous attack on the iron. Many attempts have been made to find a remedy for this corrosion, but up to now turbine users have had to resign themselves to the necessity of renewing the runners every three years, this renewal, however, bearing an extremely minute proportion to the initial cost of the whole plant.

Figs. 4 to 7 illustrate the results of an extremely curious accident, a description of which we will reserve to our next published article.

On Monday afternoon the many ladies of the Institution party, and a good few of their male companions, spent their time in a steamboat excursion on the lake. On Wednesday afternoon the like section of our membership spent their time in viewing the very beautiful and grand Falls of the Rhine at Neuhausen, just below Schaffhausen ; while we, more devoted to the acquisition of technical information, spent most time in a fatiguing inspection of the Schaffhausen Water-Power Electricity Works, which we will describe as to its newer details in a future special illustrated article. Our genial guide throughout the day was Herr Amsler, son of the inventor of the planimeter so widely known, and himself designer of the transmission dynamometers mentioned above ; and at the works itself Herr Director Geiser kindly gave us full explanations. Frau Amsler showed true Swiss kindliness and courtesy in taking charge of the ladies' party. The engineers made a hurried late afternoon rush to the Schloss Laufen on the south side of the river, there imbibing unphysiological quantities of tea and lemonade, and eventually crossing by boat to the north side through the spray of the Rhine Falls. We all-combined in a specially agreeable attack upon dinner at the exquisitely situated Schweizerhof Hotel, and were a merry party on our late return by train to Zürich.

Thursday's excursion was much more arduous, at least for those seriously bent upon engineering investigation, and commenced by a start at half-past eight in the morning from the Zürich main station. Everyone kept to the train as far as Netsal, a few kilometres lower down than Glarus, in the valley of the Linth.

Here the engineers left the railway, while those on pleasure bound, along with their ladies, went further up and spent the day in the Braunwald, a picturesque partly snowclad neighbourhood reached by a mountain rack railway. The others made a thorough examination of the Löntsch water-power electricity station. This is the most modern, the boldest and the most finely executed of these works yet accomplished in Switzerland. They are electrically united with the Beznau central station, and their main purpose is to support the supply going out from Beznau. Throughout the day we had the great advantage of the guidance and companionship of Herr Schenker, the chief manager of the united plants at Beznau and Löntsch. These works are so important that a special article will be devoted to describing them. Herr Schenker first took us up by the service rope railway to the Wasser Schloss, where the long water tunnel from the lake issues to the surface of the rocky mountain and effects a junction with the three great pipe lines or flumes which descend the almost precipitous cliffs, the maximum gradient being 1 in 1, or 45°. This face forms one of the lower slopes of the rugged Wiggis Mountain, and the whole scenery surrounding this bold engineering enterprise is wild and grand in the extreme. On the opposite side of the valley—the Klönthal—we look across to the precipices and the glaciers of snow beds of the Glärnisch range ; and the narrow valley between these two is filled and partly blocked by the gorgeously-wooded underhills produced some 1,300 years ago by enormous landslips from both mountains. The rocky gorge down which the river Löntsch dashes is thus a very narrow one, constantly changing its direction by sudden bends, and producing the best imitation of the Scotch Highlands that Switzerland is capable of. The power house at the bottom of this valley is a model of simplicity and perfect regulation. Carriages took most of us from here (after a good lunch at the St. Fridolin Hof at Netsal) up to the Klöntaler See, a lake whose depth and water storage capacity have been enormously increased by the building of a great dam across its lower end. Here, under the shadows of the Glärnisch Gletscher, which prevented us imagining we were in the wild west of Scotland, we visited the intake to the long supply tunnel bored through 2·1 km. of solid rock ; and also the overflow or spill-way tower, where, owing to the level of the lake standing only less than half a metre above the circular intake edge of the tower, one of the most beautiful water-shower effects was seen. The heat, although not so intense as down below, was still great enough to transfer very quickly the whole stock of beer, mineral waters, "most" and lemonade from the store houses of the little mountain restaurant into British interiors. We took a slightly varied route in driving down again to Glarus, where we met the Braunwald party in trying to consume a wonderfully badly-prepared dinner. Then back to Zürich by train in the evening glow.

The excursion to Beznau water-power and electricity station had been originally planned for Wednesday, but had to be abandoned for that day owing to our secretary's too generous efforts to provide an over-liberal programme ; but it was too interesting a thing to miss altogether, so that a small party was made to carry it out on Friday forenoon. We made an early morning start from Zürich, and reached

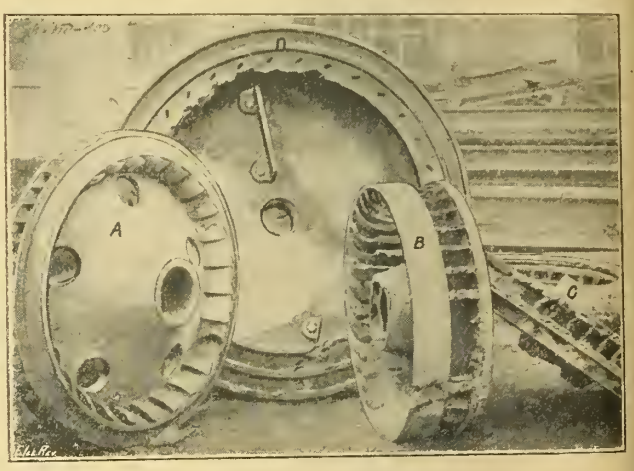


Fig. 7.—Group of Damaged Turbine Rotors.

Turgi before the sun was high. On this day, again, we were favoured by the company and explanations of Herr Schenker, and also by those of Mr. Eborall, who is well known in London. We drove from Turgi to the Beznau canal and works, and, although our time was short, we were well able to inspect the cleverly arranged power house and the specially fine switchboard, as well as the river dam, the canal intake and the tail races. We drove smartly back to Baden to enable the majority of the party, who wished to spend the afternoon in Zürich, to catch an express train ; but a few of us remained in Baden to visit the Brown, Boveri works, which we could not do on Monday owing to the electro-mechanical impossibility of existing at the same moment in two widely-separated geographical positions.

The Beznau works are also so important that they require separate description in a special article.

On Friday evening those who were not dead tired with the week's proceedings attended a Cinderella dance, at the invitation of President Ellington, in the Baur-au-Lac Hotel.

By Saturday evening the whole party was widely scattered over Switzerland on long-distance excursions, to visit various interesting power works and electric and steam rack railways.

A Municipal Bowling Match.—In a bowling match in connection with Blackpool Municipal Officers' Guild, on August 3rd, the cleansing and electricity departments were in the final. The latter won by 21 to 15, and secured the first prize—a handsome rose bowl. This, and the league championship shield, have been presented by Mr. Charles Furness, electrical engineer and tramways manager, during the course of the week.

THE COMING ELECTRICAL EXHIBITION.

By A. HUGH SEABROOK.

I suppose all electrical men sincerely wish to see this Exhibition a big success.

Undoubtedly an unparalleled opportunity will be afforded of showing the electricity and gas using public what electricity can do for it, and the effect should be to make those who use a little electricity, use more, and to make those who are still using the agents of the 19th century really unhappy until they are using *the agent* of the 20th century.

I will only touch upon one direction in which the use of electricity can be greatly and profitably extended by means of the Exhibition, to the advantage of electrical manufacturers, electricity suppliers, and the general public; that is, cooking by electricity. The field for cooking is infinitely greater than that for power, vast as that is.

Viewed from the point of public health and hygiene, I do not regard the advent of the gas cooker as any advance on the old coal fire method, in fact, it is a retrogression.

The advantages of the gas cooker or boiling ring are mainly in the direction of saving time and trouble (at the expense of good health conditions) and the reduction in the public nuisance caused by the domestic coal fire chimney.

Now let us look seriously into the matter.

Are the living conditions of the *family* improved by the boiling of kettles, &c., on an unventilated open gas ring as compared with the older method of boiling on the open coal fire or closed range?

Are not the products of the combustion of gas—permeating as they do the whole house and poisoning its inmates—far more harmful than a little more smoke coming from the domestic chimney?

Can anyone claim that food cooked in *burning gas*, as in a gas cooker, is as wholesome as food cooked in a coal range?

In spite of the claims made by the gas people that gas cookers are perfectly ventilated, can you not, immediately on stepping into a house detect whether a gas cooker is in use? Even if it has been turned out for sometime there is a permanent unpleasent odour in that part of the house where gas is used.

I suppose most of us have used gas for cooking at some time or other, and it is common knowledge that my statement is correct. When we get to gas fires for warming, the position is far worse as regards impure air in rooms.

Now, what do we offer the public? A cooker which will cook as cheaply, better, and more quickly than gas, and which will not taint the food cooked or poison the air of the place where cooking is carried on; which will actually save on the butcher's bill as regards wastage and shrinkage (see Mr. Berry's conclusive evidence on this point, and I also have further confirmatory evidence), which cannot possibly cause explosions (so common with gas cookers), and which can be controlled and regulated in a more perfect manner than any other cooker—coal or gas.

Although the kitchen is cooler with gas cooking than with a coal fire, the electric cooker is by far the coolest in use if any. We know now that electricity can equal, and sometimes beat gas in cost of cooking, but is not the health point of view far more important than mere cost?

In towns there is too much impurity in the outside air, and the use of gas vitiates the inside air of our houses as well.

As I sometimes tell my consumers, when advocating electricity for everything, "it is barbarous to permit a crude chemical operation, such as combustion, to be carried on in your house; such things should be done under proper supervision and control, in properly constructed apparatus, as in an electric power house. We give you a pure and finished article, ready for immediate use, not a crude chemical product, which you have got to do a lot to before it is of any use to you. You are not a chemist, and unless you are you cannot use gas without injury to your health and that of your family."

But is not every direction in which we electricians endeavour to push our wares greatly to the public advantage? Is there any other commodity so absolutely pure, harmless, and, at the same time, universally useful and cheap as electricity? Should not our very business infuse into us a little more enthusiasm?

I admit that up to the present the public have had a larger slice of the advantages of electricity than electricians, but is it not largely due to insufficient individual enthusiasm that our increase in business turnover and profit have not been as great as they would have been had we enthusiastically and energetically marketed our commodity?

Well, let us make up for lost time, and combine to made the Exhibition the greatest success in the history of electricity.

If the manufacturer paid more attention to standardisation of his apparatus instead of quarrelling over patents, and the electric supply man were to let his costs per unit take care of themselves, and devote extra time to increasing sales, more money would be made by both. (I am so frequently taken to task myself, that I take an almost fiendish delight in getting one in on my own account.)

The most pitiable object (he would be humorous, if he were not so dangerous to the industry) is the candid *(sic)* electrical engineer, who, out of sheer lack of personal experience and knowledge, and, in spite of Dr. Fleming's statements, says that electric cooking is hopless, and can never compete with gas. I could give him any amount of proof to the contrary—*e.g.*, consumers who have had it rammed into them, often, to my knowledge, by electrical engineers—that electric cooking is costly (and, in spite of this, have adopted it), have actually queried the accuracy of the meter owing to the cost having come out so low.

The following letter came to me quite unexpectedly the other morning:—

Maida Vale, W.

The Manager,
Marylebone Electric Light Supply Co.,
York Place, Baker Street, W.

Dear Sir,—It gives me much pleasure to inform you that the electric cooker put in at my place gives me every satisfaction. It is very much cleaner than gas, and I consider that meat cooked by electricity retains its juices and flavour better than if cooked by any other method.

I have not had the cooker in long enough to let you know how the cost compares with gas, but so far as I can see there is no very great difference between electricity and gas.

I am sending this testimonial entirely unsolicited.

Yours truly.

(I enclose a copy of the original letter.)

Then we have the timorous person who writes to the technical papers and wonders what on earth he is going to do if a consumer wants a cooker at a house on the end of a small distributor. The same precious specimen would probably welcome a dozen 5-H.P. motors on the same distributor, in fact, would worry to get them, supply them at a lower price then he would a dozen cookers (a seven days' a week load—not $5\frac{1}{2}$), and happily proceed to increase his mains.

On reading the foregoing, I am afraid I have gone somewhat from the subject of the Exhibition, but what I have tried to point out is that electric cooking is reliable, cheap, and gives better results than other methods of cooking; that it is a class of load to be strenuously cultivated by supply managers, and it should be made a special feature of the Exhibition.

I have no doubt that all these points will be well emphasised at the "Tricity" stall, but it is necessary constantly to repeat and reiterate statements if they are to have any effect on the public.

I do hope that cooking will be one of the main features of the Exhibition, and I am profoundly disgusted that arrangements have not been made for the Exhibition caterers to use electricity for all their cooking during the show.

Tantalum Lamp Competition.—Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, inform us that owing to the enormous number of designs received in their competition, some delay in making the final selection is unavoidable. The work is being carried on with all possible speed. The number of designs received surpassed the firm's most sanguine expectations.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Plumbed Joint and Bonding.

In the ELECTRICAL REVIEW of July 21st, 1911, there was published an article by me under the above title. At the time the above article was written I had not had any extended experience with Mr. Harden's system of plumbing, hence I purposely avoided any reference to the patents exploited by the Metal Jointing Co., of Adelphi House.

Recently, however, I have come upon such use of the Amalgaline joint—to wit, upon the cable system of the Metropolitan Borough of Fulham—as to cause me to modify my views very considerably, and to make me seriously consider that some of my brother mainsmen may like to know what is being adopted elsewhere. To begin with, in the Amalgaline joint, lead, and lead only, is used in the cast form.

I have seen joints at Fulham which, I am told, have been installed for upwards of five years, and all are in such a condition to-day as to make one think that finality has been reached in so far as bonding and encasing the electric portion of a joint on lead-sheathed cables is concerned. Without going into technical details of the process, which has already been described in the technical Press, suffice it to say that the quantity of metal used only approaches one-third of that required for what is generally known as the plumbed joint, whereas the time necessary to complete a joint is so small as to beggar comparison. Need I say more to demonstrate the disparity where financial reasons predominate? In conclusion, I wish to say that any mainsman interested will be well repaid by visiting Adelphi House and investigating the wonders of Adelphi Arches. I have not the smallest atom of interest either financially or otherwise in the Metal Jointing Co., Ltd.

Walter E. Rogers, A.M.I.E.E.

[The Amalgaline system was described in our issue of February 25th, 1910, when we inspected it and commented favourably upon it.—EDS. E.R.]

Battery Maintenance.

With reference to Mr. Rycroft's letter in reply to mine on the above subject, the case which drew forth my letter was not that of a new station, or even a new battery in an old one. The place has had a battery for some time, and is now enlarging it by paralleling the existing cells and putting in half the number of new ones of double the capacity. Possibly Mr. Rycroft will not think his remarks apply to such a case as this. In the case of a new station, however (and, by the way, neither of the other two cases I mentioned were new stations), I do not agree that it is right to postpone the payment of fixed charges till the future, except, perhaps, in special cases, where the future payments need be only slightly increased for a lengthy period. In the case of a battery it means comparatively large arrears paid off in a few years, and various things might happen, such as the need for a larger battery, before the agreement expires (which has actually just happened, and the original makers have got the order for the new battery, although, unless I am much mistaken, they were not the lowest tenderers, the payments to be made under the old agreement having settled the matter). This is, perhaps, a fundamental question, and not open to much argument on either side. I do not mean by this that Mr. Rycroft's letter contains no arguments, but only that it seems impossible for a continuous argument to take place, as can be the case with, say, tariff reform.

As to the shoulders upon which the expenditure falls, it is, of course, the case that, at any rate with a new station, theoretically they belong to the consumers: but in practice it is any odds that what will be affected is the amount allocated to the relief of the rates or the debit which has to be met therefrom.

With the places to which I referred, I venture (tremblingly) to be dogmatic, as it is inconceivable that the price of current would be decided by the matter under discussion. I might also mention that I take the liberty of objecting to a matter of this sort being dealt with unknown to our grandmother the L.G.B., as I think it fairly certain that the auditors do not know anything about it, and would probably object to it if they did.

With regard to the case mentioned of a new battery being required before the expiration of the maintenance on the old one, I do not mean that the maintenance to which I object was responsible for the order going to the original makers, but only that a station may be let in for unforeseen expense in connection with storage, and therefore it is not right to postpone the payment of fixed charges. At the same time it is obvious that the greater the amount of the last maintenance payments, the greater will be the pull the maker has over his competitors.

J. S.

Ventilation and Ozone.

I read with great interest the article by Mr. Kershaw, on "Day Loads for City Power Stations," especially that portion relating to ventilation and the use of ozone.

Unfortunately, he makes no reference to the highly important subject of the impurities formed when ozone is produced by high-tension apparatus.

When using large spark coils, either for Röntgen ray photography, wireless telegraphy or connected to high-frequency apparatus for "Tesla" experiments, I have always found that not only ozone but nitric oxides are also formed, and these appear to irritate the mucous membrane, causing catarrhal affection.

Mr. Kershaw states that under the Rosenberg system, ozone is produced by a silent (sparkless?) discharge, the potential used being as low as 4,500 volts, and it would therefore be interesting to learn whether chemical analysis indicates that oxides of nitrogen are entirely absent when this process is used, and, if such is the case, whether pure ozone, when mixed with fresh air, affects the mucous membrane or produces any other ill-effect.

Ronald Grierson,
Engineer, P.C.T., Ltd.

London, W., *August 5th*, 1911.

REVIEWS.

History of the Theories of the Aether and Electricity. By E. T. WHITTAKER, Hon. Sc.D., F.R.S., &c. London: Longmans, Green & Co. 1910. Price 12s. 6d. net.

The above title, limited by the addition "from the age of Descartes to the close of the Nineteenth Century," sufficiently indicates the scope of this volume, but does not do justice to the fascinating subject matter. There is one very noticeable omission in the book, namely, the lack of a preface, the author contenting himself with an acknowledgment of assistance rendered in proof reading and suggestion and criticism by Mr. W. W. Rouse Ball and Prof. Orr, F.R.S. He also tenders thanks "to the Board of Trinity College, Dublin, for the financial assistance which made possible the publication of the work." Many readers will undoubtedly unite with the author in this expression of gratitude.

The volume gives a concise and connected account of the various theories which have been from time to time advanced to account for the diverse phenomena of nature in the Universe all around us, and the struggles of the human race to formulate a logical basis on which all these phenomena may be agglomerated into a homogeneous system.

The Ethnological historian can point to the rise and fall of empires and the evolution of racial characteristics in the human family, and paint an interesting and impressive picture of success and failure, but the historian who deals with the theories of cosmic action and universal phenomena has a much more impressive theme.

We see man—but a tiny molecule of the matter which goes to form the gigantic whole—casting the lead of reason into the unfathomable depths of space in an attempt to prob

its secrets: pushing his intellect outwards along the rays from a new-born sun—so far away that the figures which denote the distance pass comprehension—and bringing back evidence to confirm or refute a theory; or perchance, studying the interaction of some magnetised bodies and deducing results as far-reaching as the confines of space itself.

Such is the theme this volume deals with in a most satisfactory manner. There are 12 chapters in all, each dealing with a particular period or a particular state of theory. Thus we have the 17th century theory of the æther treated in Chapter I. In opening this chapter, the author predicates the existence of the æther and propounds the problem awaiting solution.

Then follows a general idea of the Cartesian philosophy, from whose ruins it was "that later philosophers constructed those more valid theories which have endured to our own time." Notice is given to the work of Petrus Peregrinus and Gilbert in magnetism, and of Fermat, Hooke, Newton, Galileo and Roemer in light, and to the conflicting deductions made from the various experiments.

Chapter II deals with "Electric and Magnetic Science prior to the Introduction of the Potentials," and treats of the one- and two-fluid theories and the doctrine of effluvia.

In the following chapter the rise and progress of "Galvanism from Galvani to Ohm" is considered. "The Luminiferous Medium, from Bradley to Fresnel," occupies Chapter IV, and this leads up in the following chapter to a consideration of the Aether as an Elastic Solid, bringing up the discussion of the various theories to that of Joseph Boussines (b. 1842).

Here the author halts and turns back to devote a chapter to the researches of Michael Faraday. "Among experimental philosophers," says the author, "Faraday holds by universal consent the foremost place. The memoirs in which his discoveries are enshrined will never cease to be read with admiration and delight; and future generations will preserve with an affection not less enduring the personal records and familiar letters, which recall the memory of his humble and unselfish spirit."

Chapter VII is filled with the mathematical deductions of the "Mathematical Electricians of the Middle of the Nineteenth Century," and Chapter VIII is devoted to "Maxwell," the works of his followers being dealt with in the eleventh chapter. "Conduction in Solution and Gases from Faraday to J. J. Thomson," and the "Theory of Æther and Electrons in the Closing Years of the Nineteenth Century," conclude this most interesting volume.

Throughout the book the various theories which have been propounded are given mathematically. To some the domination of mathematical formulæ will detract from the interest of the volume, while to others it will add materially to its value.

To review—in the ordinary sense of the term—such a volume as this is manifestly difficult, and the writer cannot do better than give the conclusion in the author's own words, with the remark that the volume well repays perusal:—

"By the investigations which have been recorded, the hypothesis of atomic electric charges has been, to all appearances, decisively established. But all the parts of the theory of electrons do not enjoy an equal degree of security; and in particular it is possible that the future may bring important changes in the conception of the æther.....Let this record close with the anticipation that fellowship in the pursuit of knowledge will increase in the nations the spirit of generous emulation and mutual respect."—J. D. M.

Factory Accounts. (Sixth edition.) By Garcke & Fells. London: Crosby Lockwood & Son. Price 6s. net.

This subject may either be dealt with *generally* so as to cover the procedure in all kinds of factories in which labour forms a prominent feature, or *specially* in connection with one particular industry. Furthermore, the author or authors who deal with manufacturing accounts may either be trained accountants or experts in the control of men and equipment engaged in actual production.

The book under review appears to consist of a general survey of the methods employed for controlling and keeping records in every industry mainly dependent upon labour, and the subject is dealt with from the accountant's rather than the expert's point of view.

The accounts relating to the cost of production in engineering factories—with which we are mainly concerned—have become highly specialised, and although the independent accountant must necessarily study the methods used in every manufacturing industry, the attention of those responsible for the control of engineering works may well be confined to their own special line.

As might be expected in a general survey of factory accounts, Messrs. Garcke and Fells give a number of alternative methods without any guidance as to the best procedure, whilst certain of the practice referred to without adverse comment would not be contemplated in any up-to-date machine shop. For instance, one sheet upon which a workman enters his weekly time for both day and piecework is described, apparently as a serviceable method of obtaining labour records. This plan has long since been discarded in modern establishments as being hopelessly incorrect. Again, the foreman is saddled with the custody and serving out of valuable loose tools—a system which we do not think will now be found in vogue, excepting in the smallest undertakings.

Apart from the points above-mentioned, a great deal of information is contained in "Factory Accounts," which should prove very useful to general managers of manufacturing concerns and independent accountants, but the work is lengthened and somewhat marred by the unnecessary use of long words and complex construction throughout.

Whittaker's Electrical Engineer's Pocket-Book. Edited by Kenelm Edgcumbe, M.I.E.E. London: Whittaker and Co. Price 5s. net.

This is the third edition of a pocket-book which professes "not merely to give a number of formulæ, rules and data, collected from various sources, and often of a contradictory nature, but a kind of synopsis on each subject brought thoroughly up to date."

The same lines have been followed as regards general arrangement, as in the previous editions, but advantage has been taken of the opportunity afforded by the issue of a new edition to rewrite a very large part of the whole book.

The first 100 pages deal with useful numbers, mathematics and physics, practical mechanics, and various electrical tables. The value of a collection of formulæ, &c., relating to mathematics, physics and mechanics is somewhat doubtful since such information is part of the mental equipment of men who have had a scientific training, and it is only a very exceptional man who can actually apply such formulæ to practical work without this training, and the confidence it brings. Further, the values of the power given to drive various machines on pages 64, 65 and 66, are practically useless, owing to the fact that particulars relating to depth and width of cut, and cutting speeds are not given. An error occurs at the bottom of page 64; the name of the author of the I.E.E. paper should be A. B. Chatwood. The wire tables are complete and well arranged.

The next 50 pages are devoted to the principles of magnetism and electricity. The matter given is decidedly good and concise.

Electrical measuring instruments and electric clocks, which occupy the next 50 pages, are well described, and the illustrative diagrams are clear.

Following these we have sections on lighting, secondary batteries and heavy-current resistances. The latter two articles are exceptionally good and complete, while the former is very short, a defect being that "wire" lamps are treated too briefly.

The next three sections deal with direct-current dynamos and motors, alternating-current machines and testing generators, motors and transformers. In the outline method given for designing machines the d^2l = constant × watts per rev. is recommended for finding the diameter and length of core, and the electric loading method is recommended as a check. The writer prefers the converse way, but in these days of standardisation it is really only a question of taste.

Some of the flux densities on page 247 could be materially raised without risk. The information and data given in the alternating-current section are remarkably good and correct.

Electrical transmission of power, which is treated in the next section, is very well written indeed, and, as far as we have tested, thoroughly accurate. Accuracy of formulæ is, of course, always important, but it is impossible to be too careful with those relating to transmission lines, since a serious error in the magnitude of a numerical result expressed in henries or microfarads is not at all easily detected by inspection or common sense, as, of course, it may be in other types of calculation.

The subject of Electric Traction occupies the following 40 pages. It is, of course, an enormous subject, and a line must be drawn somewhere, but the information given on single-phase work appears to be comparatively meagre. Also the majority of footnote references are rather of the ancient history type, *i.e.*, 8 or 10 years old. No reference is made to the highly important paper recently read before the Institution of Civil Engineers on "Single-phase Electric Traction." This is a pity, since the said paper is of the nature of an authoritative treatise on the subject. Possibly, however, this section was printed before Mr. Dawson's paper was announced. The direct-current section of the article and also the part relating to the power required for driving are quite good.

The next three sections deal with the subjects of switches and switchgear, electro-metallurgy and electro-chemistry, and electric power stations and mains. The first two are brief but good. The last is necessarily more lengthy and is also good.

The book concludes with a chapter on general legal information, and a good index.

A book of this kind is a difficult one to review in a really genuine manner, and is a very difficult one to write or rather edit, since the trouble is not what to put in but what to leave out. The amount of information—good, bad and indifferent—at a technical man's command nowadays through the multiplicity of "Proceedings," &c., is almost appalling.

The book is well bound and got up, and is well worth its price, since it strikes a mean between the cheap varieties and the elaborate volumes—largely of American origin or association—which are published at a much higher price.—H.G.S.

Engineering Estimates, Costs and Accounts. (Third Edition.) By A General Manager. London: Crosby Lockwood and Son. Price 7s. 6d. net.

This work was originally published more than 20 years ago, and although the present edition has been revised to suit modern practice, some of the procedure advocated would now be considered old-fashioned. On the other hand, the principles laid down are sound and quite applicable to existing manufacturing conditions. The author appears to have had jobbing business in view throughout, as all orders are assumed to be put in hand for customers instead of for stocks.

For training the young engineer in commercial practice, this feature has some advantages, as the man who has mastered the art of estimating for jobbing and repair work will find the costing of standard products comparatively simple.

In spite of revision, the prices given for materials and finished parts are higher than obtain at the present time, whilst the charges of 50 to 70 per cent. recommended for factoring files and certain finished materials appear to be unreasonable.

In connection with methods of calculating weights some reference to the slide rule might well have been introduced, as the use of this appliance has now become almost universal for estimating purposes. Excepting as regards repairs, it is doubtful whether young engineers of the present day will ever have any use for the steam engine and boiler estimates given in Chapters XX and XXI.

The final chapter on "Costs Book-Keeping" is of a very useful character, and describes practice which should still give good results. The old-fashioned plan of allowing the men to record their own time will, however, be condemned by most up-to-date authorities.

Apart from the points mentioned above, this book is of a thoroughly practical nature, and contains matter in a readable form with which every manufacturing engineer should be familiar.

PARLIAMENTARY.

Brighton, Hove and District Railless Traction Bill.

This Bill came before a Select Committee of the House of Commons on Tuesday and Wednesday of last week, presided over by Sir Luke White.

The promoters are the Brighton, Hove and Preston United Omnibus Co., who seek powers to work their omnibuses between Kemp Town and Rottingdean by means of the railless system of electric traction. Originally, it was intended to extend the system to Worthing, but that portion of the Bill has been dropped. After hearing evidence in support of the Bill by various local representatives, Mr. Hutchinson, K.C., addressed the Committee in opposition to the proposal which, he contended, had only been introduced as a "blocking" Bill in opposition to the Hove and District Tramways Bill, which died by reason of not receiving the necessary consents. He argued that it could not be in the interests of the public that in this growing district they should for ever be saddled with a system of trackless trolleys 2½ miles long. He admitted that at present the the Brighton Corporation tramways did not run up to Kemp Town, but Brighton was extending in that direction, and there could be no doubt that in course of time the electric tramways would be taken to Kemp Town. If the present Bill were passed it would absolutely prevent the expansion of any tramway system towards Rottingdean, as the Corporation would find when they got to their boundary that the road was occupied. He contended that the railless traction system was never intended to be used permanently, but only as an adjunct to existing tramways.

After deliberating in private the Chairman announced that the Committee found the preamble of the Bill proved, subject to the work being carried out in two years instead of three as originally proposed.

Mr. Wedderburn, K.C., who appeared for the promoters, said he was quite willing to accept that clause, for it was the intention of the company to carry out the work within two years.

On Tuesday last the Bill was read a third time.

Telegraphs across Railways.—The Telegraph (Construction) Bill, which authorises the P.M.G. to carry telegraph wires across railways without payment, was reported to the House of Commons without amendment in favour of the railway companies which opposed the Bill.

Bills Advanced.—In the House of Commons, on Monday last week, the East Kent Electric Power Bill was read a second time.

In the House of Lords, on August 1st, the London County Council (Tramways and Improvements) was read a third time and passed.

In the House of Commons on Monday the Lords' amendments to the London County Council (Tramways and Improvements) Bill, were considered and agreed to. The following Bill was considered and read a third time:—London, Tilbury and Southend Railway Bill.

Electric Lamps in Mines.—At an inquest recently on the death of two men at Bryncethin Colliery, who were suffocated by an outrush of gas, some remarkable views were expressed. On the first warning of the presence of gas the workmen retired; as the work they were doing was urgently necessary, to restore ventilation which had been interrupted, they were then provided with electric lamps, and the manager, who was present, left his safety lamp 35 yards away. The mines inspector, Col. Pearson, who was present at the inquest, pointed out that the presence of men where there was gas was contrary to the regulations, and suggested that it was wrong to use electric lamps, because if they had had a safety lamp, it would have indicated danger. The Coroner, however, elicited the opinion from a witness that if they had had safety lamps there might have been an explosion. Before the accident occurred, the manager sent a man to extinguish his safety lamp, clearly showing that he was aware not only of the presence of gas, but also of the danger of using a safety lamp anywhere in the vicinity; what more could he have learnt if those so-called "safety" lamps had been used instead of the really safe electric lamps? Yet the jury said that if safety lamps had been used the deaths would not have occurred. Seeing that the object of the work was to restore ventilation, that the use of "safety" lamps would have imperilled the lives of everyone in the mine, and that the presence of gas was fully known, the rider is to us inexplicable.

TRADE STATISTICS OF JAPAN, 1910.

The following statement, showing the imports into and exports from Japan of electrical and similar goods during the year 1910, is taken from the recently issued official trade statistics; the figures for 1909 are given for purposes of comparison, and notes of any increases or decreases are added :—

	1909.	1910.	Increase or decrease.
	Yen.	Yen.	Yen.
Galvanised iron wire.—			
From Great Britain ...	61,000	59,000	— 2,000
,, Germany	1,149,000	1,979,000	+830,000
,, Belgium	24,000	75,000	+ 51,000
,, Austria	27,000	15,000	— 12,000
,, United States ...	54,000	150,000	+ 96,000
,, Other countries ...	19,000	3,000	— 16,000
Total ...	1,334,000	2,281,000	+947,000
Rails.—			
From Great Britain ...	447,000	53,000	—394,000
,, Germany	409,000	782,000	+373,000
,, Belgium	121,000	161,000	+ 40,000
,, United States ...	560,000	599,000	+ 39,000
,, Other countries ...	5,000	1,000	— 4,000
Total ...	1,542,000	1,596,000	+ 54,000
Posts for electric wire, materials for building, &c.—			
From Great Britain ...	540,000	365,000	—175,000
,, Germany	6,000	34,000	+ 28,000
,, United States ...	368,000	332,000	— 36,000
,, Other countries ...	27,000	20,000	— 7,000
Total ...	941,000	751,000	—190,000
Submarine and underground cables.—			
From Great Britain ...	199,000	1,045,000	+846,000
,, Germany	160,000	438,000	+278,000
,, United States ...	—	109,000	+109,000
,, Other countries ...	—	3,000	+ 3,000
Total ...	359,000	1,595,000	+1,236,000
Insulated electric wire.—			
From Great Britain ...	1,070,000	825,000	—245,000
,, France	40,000	35,000	— 5,000
,, Germany	210,000	403,000	+193,000
,, Italy	19,000	22,000	+ 3,000
,, United States ...	174,000	343,000	+169,000
,, Other countries ...	4,000	9,000	+ 5,000
Total ...	1,517,000	1,637,000	+120,000
Parts of electric cars.—			
From Great Britain ...	348,000	247,000	—101,000
,, Germany	86,000	113,000	+ 27,000
,, Norway	9,000	—	— 9,000
,, United States ...	685,000	464,000	—221,000
Total ...	1,128,000	824,000	—304,000
Steam engines.—			
From Great Britain ...	580,000	397,000	—183,000
,, Germany	47,000	14,000	— 33,000
,, Belgium	1,000	—	— 1,000
,, United States ...	77,000	194,000	+117,000
Total ...	705,000	605,000	—100,000
Gas engines, petroleum engines and hot-air engines.—			
From Great Britain ...	297,000	448,000	+151,000
,, Germany	55,000	23,000	— 32,000
,, Belgium	1,000	7,000	+ 6,000
,, Sweden	1,000	19,000	+ 18,000
,, United States ...	29,000	19,000	— 10,000
,, France	—	5,000	+ 5,000
Total ...	383,000	521,000	+138,000
Steam turbines.—			
From Great Britain ...	38,000	62,000	+ 24,000
,, Germany	130,000	27,000	—103,000
,, Switzerland ...	—	7,000	+ 7,000
,, United States ...	64,000	50,000	— 14,000
,, Other countries ...	—	3,000	+ 3,000
Total ...	232,000	149,000	— 83,000
Steam boilers.—			
From Great Britain ...	841,000	462,000	—379,000
,, Germany	10,000	4,000	— 6,000
,, United States ...	62,000	18,000	— 44,000
Total ...	913,000	484,000	—429,000
Electrical machinery.—			
From Great Britain ...	826,000	611,000	—215,000
,, Germany	916,000	634,000	—282,000
,, Belgium	—	1,000	+ 1,000
,, Italy	8,000	26,000	+ 18,000
,, United States ...	1,249,000	902,000	—347,000
,, Other countries ...	1,000	18,000	+ 17,000
Total ...	3,000,000	2,192,000	—808,000
Caoutchouc and gutta-percha, crude.—			
From British India ...	71,000	91,000	+ 20,000
,, Straits Settlements	427,000	1,246,000	+819,000
,, Dutch India ...	318,000	142,000	—176,000
,, Great Britain ...	426,000	959,000	+533,000
,, Germany	7,000	42,000	+ 35,000
,, United States ...	154,000	246,000	+ 92,000
,, Other countries ...	62,000	316,000	+254,000
Total ...	1,465,000	3,042,000	+1,577,000

The exports of electric dynamos and electric motors from Japan in the years 1909 and 1910 were as follows :—

To China	23,000	52,000	+ 29,000
,, Kwantung Province	196,000	151,000	— 45,000
,, Corea	75,000	104,000	+ 29,000
,, Asiatic Russia ...	8,000	2,000	— 6,000
,, Philippine Islands ...	11,000	3,000	— 8,000
,, Siam	4,000	7,000	+ 3,000
,, Australia	1,000	5,000	+ 4,000
,, Other countries ...	4,000	3,000	— 1,000
Total ...	322,000	327,000	+ 5,000

Yen = 2s. 0⅛d.

OVERHEAD WIRES.

[FROM A LEGAL CONTRIBUTOR.]

In the course of discussions on overhead line construction it has been frequently pointed out that in erecting such wires the only thing to do is to err on the safe side as a factor of safety. On the face of it this is sound advice, but it is sounder still when one comes to consider the matter in its legal aspect; and a few notes on the subject from this point of view may not be out of place.

The "common law" on the subject may be stated to be that anyone who stretches a wire across the land of another without leave or licence, is guilty of a technical trespass. Hence again, if wires are stretched across or along a street or highway, the person who puts them in that position does so at his peril, inasmuch as the public who are using the street are entitled to be protected against falling wires. But there may be circumstances in which a man who owns land on either side of a highway has the right to stretch wires across it. In such a case he owns the surface of the "hard high road," and so long as the right of the public to pass and repass along it is not interfered with, he cannot (at common law) be prevented even by the highway authority from placing his wires, whether they be for the purposes of telephone, telegraph, or the transmission of energy.

The Legislature, however, has stepped in to prevent the use of overhead wires in such a way as to endanger the safety of the public. They can only be used in compliance with regulations made by the Board of Trade—the only exception being the case in which a man, for his own purposes, stretches wires on his own land. If, however, A wants to stretch a wire for the supply of energy across B's field, he must comply with the regulations of the Board of Trade.

Our knowledge of the liability of those whose wires fall about and injure people must, of necessity, be largely derived from a study of the law relating to tramway companies, and it may be convenient if we review some of the cases in which the liability of these bodies has been considered.

In the first place, it may be stated that by the Tramways Act, 1870, Sec. 55, which applies to every tramway company, it is provided that the promoters or lessees of a tramway (as

the case may be) shall be answerable for all accidents, damages and injuries happening through their act or default, or through the act or default of any person in their employment by reason or in consequence of any of their works or carriages, and shall save harmless all road and other authorities, companies or bodies, collectively and individually, and their officers and servants from all damages and costs in respect of such accidents, damages and injuries.

The above provision prevents a tramway company, when sued by a person who has been injured by a falling trolley wire, from raising the defence that they are protected from actions for negligence owing to the fact that they work under statutory powers. This was made clear in a number of accident cases. For instance, in Sadler *v.* South Staffordshire, &c., Steam Tramways Co., 1889 (23 Q.B.D. 17), it appeared that an accident was caused by the company's car, which ran off the line at a point where that line joined the line of another system, over which the company had running powers. It ran off the line owing to a defect in the points at the junction, but it was not clear whose duty it was to repair the points. It was held that in any event the owners of the car were liable, because their statutory powers did not authorise their running along the highway on a track which was in a defective condition. Again, in an Irish case, a tramway company was held liable for injuries caused by the worn and slippery condition of their track.

Most of the cases in the books which illustrate the liability of tramway companies were decided in relation to cars drawn by horses, but the same principles apply in the case of electric traction. Indeed, it may also be said that an electric tramway company have a greater burden imposed upon them, as the weight and speed of the cars which they use are so much greater than the weight and speed of the old-fashioned car.

It is first important to consider the position of a tramway company with regard to the highway. Under the Act of 1870 and the provisional order which has been granted to them, they obtain leave to use that portion of the road which lies between the rails and which extends to a distance of 18 in. beyond the rails at either side. This part of the road they have to keep in repair. They also obtain leave to erect posts for the support of the overhead wire which is to be suspended at such a distance above the road metal that it will not interfere with the ordinary traffic in the streets. Regulations have been issued from time to time by the Board of Trade with regard to the use of these trolley wires. It is now proposed to consider some of the more important of these regulations.

Clause XV of the Form of Regulations made by the Board of Trade and applied to overhead wires is as follows :—"The overhead conductors used in connection with the working of the tramways shall be securely attached to supports, the intervals between which shall not, except with the approval of the Board of Trade, exceed 120 ft., and they shall be in no part at a less height from the surface of the street than 17 ft., except where they pass under railway bridges." Clause XXI of these regulations provides that "efficient guard wires shall be erected and maintained at all places where telegraph or telephone wires cross above the overhead conductors of the tramways." In September, 1902, however, the Board of Trade issued the following egulation to be used in substitution for No. XXI : "If, and whenever, telegraph or telephone wires, unprotected by any permanent insulating covering, cross above, or are liable to fall upon, or to be blown on to, the electric conductors of the tramways, efficient guard-wires shall be erected and maintained at all such places." In an explanatory memorandum which is sent with this proposed clause, the Board indicate the position in which the guard-wire should be placed.

Where there is no guard wire above trolley wires, the breaking of a telephone wire may result in contact between the wires. The result may be that serious injury is caused by electric shock. In these circumstances it appears, upon the authority of a County Court judge, that responsibility does not rest with the tramway company. In Bedworth & Son *v.* The National Telephone Co., an action was brought against the company for the price of a horse killed by an electric shock. It appeared that a broken telephone wire, which fell on the horse, had short-circuited a trolley wire belonging to the South Staffordshire Tramway Co., who were joined as defendants. The judge held that the telephone company were liable, as they had been guilty of a trespass in allowing their wire to touch that of the tramway company, and he made them responsible in damages.

Owing to a number of accidents which took place at Liverpool from the entanglement of broken telephone wires with trolley wires, the National Telephone Co. brought forward a clause excluding them from liability in such cases unless it was proved that the escape of electricity was due to the fault of the telephone company. A clause of this kind appeared in the Tyneside Bill of 1901, and a number of others. (See the Electrical Review, August 23rd, 1901, page 330).

In America it was held that where one defendant's wire carrying a dangerous current crossed the other defendant's wire carrying a harmless current, and there was no guard between them, both defendants might be found guilty of negligence, where an accident occurred owing to a contact of the wires (Rowe *v.* N.Y. and N.J. Telegraph Co. (1901) N.J. 48 At. 1 Rep. 523) ; but it was otherwise where the contact was caused by the fault of the owners of the dangerous wire, or where it was due to the fault of the owners of the harmless wire in suffering it to get out of repair (Western Union Telegraph Co. *v.* Thorn, 1894, 64 Fed. Rep. 287).

The question whether the person who sustains injury can be guilty of contributory negligence which will relieve the tramway company, does not appear to have been decided in the English Courts. It is submitted that if a passenger on the roof of a double-decker were to deliberately grasp a naked trolley wire, or otherwise expose himself to danger in contravention of the notices and by-laws of the company, and he could be found guilty of such contributory negligence, then the tramway company could be relieved. At any rate, the decisions of American Courts could be cited in support of such an argument. In Freeman *v.* Brooklyn Heights Railroad Co., 1900 (66 N.Y.S., 1,052), a company was held not to be liable when its guard wire had become charged, and injured a boy who was walking on the girder of a bridge, where he had no business to be, although it was the custom of boys so to walk. There is no contributory negligence, however, if the injured person is under duty to be where he is at the time of the accident, or where a wire is dangerously near a public passage, although the injury is caused by an unusual act on the part of a passer-by.

In addition to the liabilities which they incur to members of the public who may be injured, the company are subject to penalties if they fail to observe the by-laws already considered. It is provided that the promoters or any person or company using electrical power on the tramway contrary to any of the above regulations are, for every such offence, subject to a penalty not exceeding £10, and also, in the case of a continuing offence, to a further penalty not exceeding £5 for every day during which such offence continues after conviction thereof.

Electricity in a Textile Mill.—The electrical equipment of the works of Messrs. Mark Fletcher & Sons, Ltd., Pendleton, bleachers, dyers and finishers, has recently been completed. Electricity is purchased from the Salford Corporation, the supply being direct current at 440 volts. Approximately 165 h.p. of motors have been installed, varying in size from 10 h.p. to 50 h.p. The motors were manufactured by the Lancashire Dynamo Co., and the starters by Messrs. Royce, Ltd. The contract was carried out by Mr. Bertram Thomas to the specification of Messrs. Lacey & Sillar.

Trade with Brazil.—The Brazilian sub-section of the London Chamber of Commerce has presented a petition to the Brazilian Minister, pointing out that there is a growing practice of undervaluing and misdescribing, by means of fictitious invoices, merchandise and machinery shipped to Brazilian ports, to the detriment of honest traders and of the Brazilian revenues, and urging that steps be taken to repress the practice complained of.

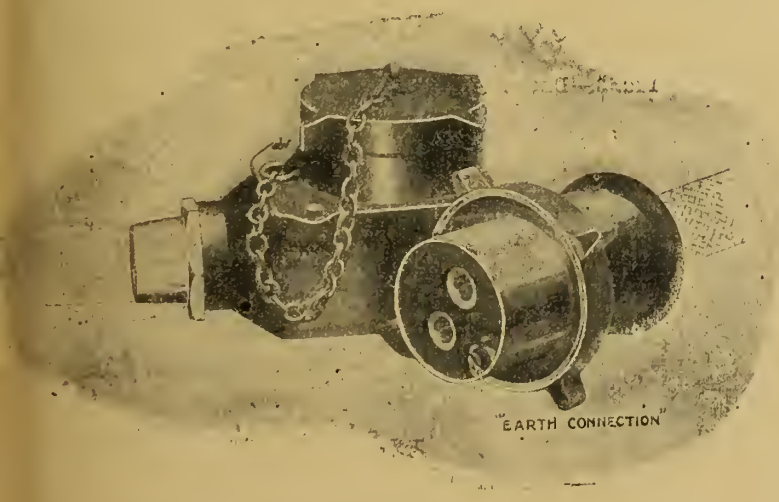
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Large Electric Sign.

The Franco-British Electrical Co., Ltd., of 50, Oxford reet, W., have recently completed a large electric sign with their tent Franco letters at the premises of the Viennese Syndicate, d., in Oxford Street. The sign consists of several lines of words ; the top two sets there are 306 4-c.p. lamps, the letters being in. high, and 24 in number. The rest of the sign consists of , 15, 10, and 8-in. letters, illuminated with 986 2-c.p. lamps, each nsuming six watts, and the size of all the bulbs being 35 mm. ie whole sign works in connection with a 4-way motor-flasher, d when the whole is alight the total consumption is 8,400 watts. ie holders are of a special type, consisting of porcelain threaded take S.E.S. lamps, the connections to the lamps being made with simple spring and middle contact ; the connection is perfectly eather-proof without rubber washers. The makers state that is is the largest sign in London of its kind.

Watertight Wall Plug.

Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, are aking a strong wall plug to carry 50 amperes, for use in con- ction with cranes and other heavy portable machines in docks d shipyards ; the plug is watertight, and is provided with an



Reyrolle Wall Plug.

xtra pin for the earth connection, which makes contact before the irrent-carrying pins, and breaks after them ; the design is there- ore in accordance with the Home Office regulations for the earthing ' portable apparatus.

AP AND WAVE WINDINGS FOR DIRECT-CURRENT ARMATURES.

By Robert Rankin, B.Sc.

The subject of armature windings is ever a puzzling one to nyone first tackling it, so much so, in fact, that it may afely be said that the majority of electrical engineers never eally master the elements of the theory of windings. Many have often applied the well-known rules for the rdinary lap and wave types of winding, although they ould have some difficulty in proving, without an actual rial, that those rules will give a practical result. Very ttle assistance will be obtained by a reference to most text- ooks, as the most puzzling part is usually passed over with remark that from the nature of the winding the following ules hold, or something to that effect.

The following notes show how the properties of lap and ave windings may be demonstrated, and how it may be roved, without reference to anything other than a simple iagram exhibiting the conductors arranged and numbered onsecutively, that the usual formulæ for simple windings of he kind mentioned are correct. The notes may prove of assistance to some who have experienced a difficulty in grasping the fundamental ideas involved in he theory of drum windings.

In the connecting-up of an armature as a lap-wound or as a wave-wound one, it is essential that any given bar should be connected to another bar which has induced in it an electromotive force which, relatively to the armature, is opposite in direction to the electromotive force induced in the given bar. That is to say, if the given bar is under the influence of a North Pole, the one it is connected to must be under the influence of a South Pole. It will, therefore, be convenient to connect together bars similarly situated under dissimilar poles, that is, bars distant about a pole pitch from each other. In a lap winding a forward step is taken in one direction round the armature, and then a backward step, and in order that the winding may be closed and all the bars included in it, the last backward step must return to the bar from which a start was made, so that in one complete journey round the armature all the conductors have been picked up.

In the case of a wave winding all the steps are in one direction, and a journey round the armature must end approximately at the bar from which a start was made, in order to fulfil the condition that the electromotive forces in bars connected together shall be in opposite directions relatively to the armature.

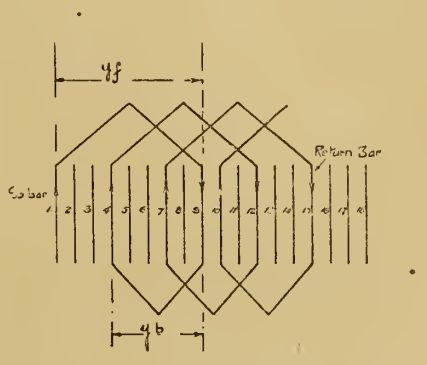


Fig. 1.—Lap Winding.

The winding rules are that, in a lap winding, the number of conductors must be even, and the back and front pitches must be odd and differ by two ; and, in a wave winding, the number of conductors must be even, and the pitches must both be odd, although they may be equal. In symbols :—

$$Lap\ Y_1 = \frac{z \pm b}{2p} + 1\ ;\ Y_2 = \frac{z \pm b}{2p} - 1.$$

$$Wave\ Y_1 + Y_2 = Y = \frac{z \pm 2}{p}.$$

Where p = number of pairs of poles,
z = total number of bars on the armature.
Y_1 and Y_2 are back and front pitches.

Denoting the pitches by Y_f and Y_b, where Y_f denotes front pitch, and Y_b denotes back pitch, the reasons for the foregoing rules will be evident from the following discussion, in which bars running from back to front are called go-bars, and those running from front to back are called return-bars. The figures have been drawn with impossible pitches in order to exhibit the errors which are caused thereby.

Case of Lap Winding :—

The number of bars between two consecutive go-bars = $Y_f - Y_b - 1$, and similarly the number of bars between two consecutive return-bars = $Y_f - Y_b - 1$.

Since the steps are chosen unequal in order that continual progress may be made round the armature, and since after every pair of steps an advance is made, it is evident that there can only be one return bar between any two consecutive go-bars. Hence, as may be seen by referring to fig. 1, the number of *unconnected* bars between two consecutive go-bars is $Y_f - Y_b - 2$. As all the bars must be embraced in the winding this must be equal to zero, and therefore $Y_f - Y_b = 2$, that is, the pitches must differ by 2. Hence

the pitches must either be both even or both odd. If they are both even the go-bar will coincide with a return bar, when $Y_f/2$ back steps have been made, and the winding will be prematurely closed. This means that the pitches cannot both be even, and, since they must differ by 2, they must both be odd. The forward pitch being odd goes to an even number; the back pitch being odd returns to an odd number, and this goes on all round the armature, so that the forward pitch *always* goes to an even number and the back pitch *always* goes to an odd number, that is, if the starting bar is called No. 1. Hence the go-bars are all numbered odd, and the return bars are all numbered even, so that go

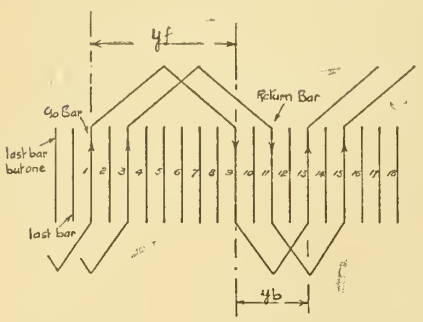


Fig. 2.—Wave Winding.

would be connected to one already used when $Y_b/2$ journeys had been made. Hence Y_b cannot be even. If Y_f were even, connection would be made in a similar manner when $Y_f/2$ journeys had been made. Hence Y_f cannot be even. Both pitches must therefore be odd. Similar reasoning would hold if connection were made to the last bar but one instead of to No. 3.

A start being made at bar No. 1, and a return being made to No. 3, the pitches Y_f and Y_b both being odd, it is clear that all go-bars will be odd, and all return bars even. Also, the last return-bar of the first journey is to be connected to bar No. 3, the span between them being Y_f, which is odd.

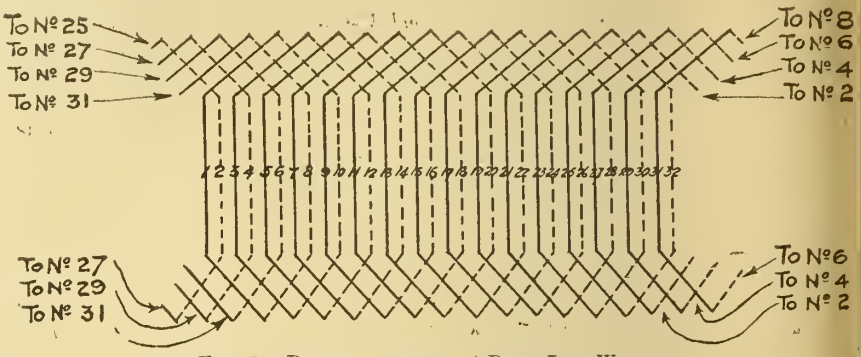


Fig. 3.—Development of 4-Pole Lap Winding.

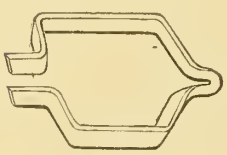


Fig. 4.

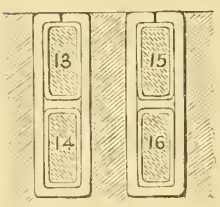


Fig. 5.

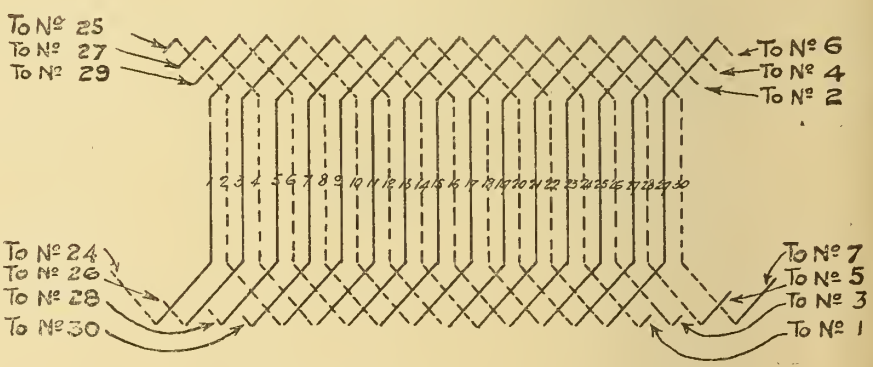


Fig. 6.—Development of 4-Pole Wave Winding.

and return bars occur alternately round the armature. Since the winding must be closed the last return bar must be connected to No. 1, which is a go-bar, and, since go and return bars alternate round the armature, and return bars are all numbered even, the bar adjacent to No. 1 must be even, that is, the total number of bars in the armature must be even. As already mentioned the pitches Y_f and Y_b should be approximately equal to the pole pitch, and therefore Y_f and $Y_b = \frac{z}{2p}$ approximately. $\frac{z}{2p}$ may not be a whole number, and therefore an even number must be added to or subtracted from the numerator z to make the numerator an even multiple of $2p$, and Y_f and Y_b are made equal to $\frac{z \pm b}{2p} + 1$ and $\frac{z \pm b}{2p} - 1$ respectively.

Case of Wave Winding:—

In this case a complete journey must finish up approximately at bar No. 1, the starting point. If a return were made to No. 1 the winding would be closed in one journey. From the following it will be seen that, if a return were made to No. 2, or to the last bar, that is the one adjacent to No. 1, the winding would also be prematurely closed. Consider the return to 2. Whatever the value of Y_b, the winding would be closed to an already used bar when Y_b (or Y_f, if Y_f is less than Y_b) journeys had been made, a go or return-bar being connected in opposition to a go or return-bar already used. A similar remark would apply in the case of a return being made to the last bar. The next most favourably situated bar is No. 3, or the last bar but one.

Consider connection to No. 3. If Y_b were even, a go-bar

The number of bars between the last return-bar of the first journey round the armature and bar No. 1 is obtained by deducting 3 from Y_f, and this number must be even, since Y_f is odd. Hence, since the last return-bar must be numbered even, it follows that the bar next to bar No. 1 is also even—that is, the total number of bars on the armature is even.

Evidently Y_b and Y_f may be equal without violating any of the conditions of winding. Hence Y_f and Y_b must both be odd, and z must be even.

Let $Y_f + Y_b = y$.

Then $p \times Y = z + 2$, since a return should be made to bar No. 3, or the last bar but one.

And therefore $Y = \frac{z + 2}{p} = Y_f + Y_b$.

Fig. 3 shows a proper development of a four-pole lap winding with 32 conductors. The pitches are $9 = \frac{32}{4} + 1$ and $7 = \frac{32}{4} - 1$.

Obviously the arrangement of bars shown in the figure is not a satisfactory one, as it simply consists in laying the bars side by side on the surface of the armature. In practice, of course, the bars are let into slots cut in the armature. To enable this to be done the bars forming the sides of a coil are bent into different planes.

Consider bars 13 and 22 in fig. 3. If the end connections are properly bent, a coil of the shape shown in fig. 4 is the result. All the pairs being arranged in this way, the bars shown full in the figure will be further from the centre o

the armature than those shown dotted, and the slots being made in the armature slightly greater in depth than two bars on edge together, the top or full bar of each pair may be put in a slot with the bottom or dotted bar of another pair. This is equivalent to moving the full bars in fig. 3 relatively to the dotted bars by the pitch of the bars, and the resulting arrangement in the slots is as shown in fig. 5, top bars being numbered odd and bottom bars even. Fig. 6 shows the development of a four-pole wave winding with 30 bars. The pitches here are Y_f and Y_b, where $Y_f + Y_b = \frac{30 - 2}{2} = 14$, and $Y_f = Y_b = 7$.

They are thus equal, and a return is made to the last bar but one. Remarks similar to those made in connection with the lap winding obviously apply, in this case, with reference to the actual formation of the coils and the arrangement of the bars in the slots.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, S.E.—Catalogue No. 811 of automatic time switches for A.C. or D.C.; the "Arbiter" type for switching on by hand and off automatically, as in restricted-hour supply, and the "Opus" type for performing both operations automatically, as in street lighting, &c. The clocks run for 35 or 16 days, and the currents controlled range up to 100 amperes.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets about aluminium bus-bars and standard forms.

The London Electrical Trading Co., Ltd., 21, Broad Street House, E.C.—List No. 4, describing the "Quartzalite" electric heating and cooking apparatus, on the Bastian patents, which work with red-hot heaters, guaranteed for four years.

The Genest-Stossel Insulating Co., 47, Victoria Street, S.W.—Brochure describing the "Korfund" system of impregnated cork foundation plates for absorbing the vibration of machinery.

Messrs. T. W. Broadbent, Ltd., Victoria Electrical Works, Huddersfield.—Leaflet No. 10, describing the N-type A.C. motors for one, two or three-phase circuits, from ¾ to 100 B.H.P. These motors are robustly built to withstand high temperatures, with improved rotor connections.

Messrs. Mavor & Coulson, Ltd., 47, King Street, Mile End, Glasgow.—Card for August, showing three-phase Pick-Quick coal-cutter.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.—List No. B56, relating to the "Supra" carbon brush-holder, a simple and efficient type which is already well known, and brushes for the same; other types of brush-holder are also listed.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 19, describing lever type motor starters, with the firm's patent resistance.

Simplex Conduits, Ltd., 116, Charing Cross Road, W.C.—Preliminary List F3 of electric light fittings in the various period styles, including some specially designed for Holophane glassware. A much more comprehensive catalogue will be issued later.

Messrs. Haslam & Schontheil, Ltd., 11, Windsor Place, Cardiff.—Leaflet illustrating magneto and battery call telephones, particularly suitable for mines, steel works and shop work. They are ironclad and water-tight, and can be worked with one hand, being automatic in action.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, E.C.—Leaflet of Armorduct - "Therma" indestructible laundry and domestic irons, with testimonials from station engineers to their durability.

Consular Notes.—Russia.—The British Consul at Moscow reports that during 1910 there was a very considerable increase in Russia in the use of electrical energy, and as a consequence, of the manufacture of electrical machinery. The greatest increase in the machinery produced was shown in the output of Diesel motors, of which as many were turned out last year as during all the preceding five years. Owing to the increasing needs of municipalities, factories turning out cables, tramway and telegraph fittings, &c., extended their business, and in this connection one may refer to the signs of activity which are apparent in provincial towns such as Orel, Tamboff, Kaluga, Smolensk, Minsk, Tula and Moghileff, all of which have important municipal projects (both electrical and other) in anticipation or in progress.

In this connection, the following subsequent remarks made by the British Consul regarding British enterprise in Russia are of considerable interest:—

Hints to British Traders.—During the autumn of 1910, the British Vice-Consul at Moscow visited various important towns in the west and south of the Moscow Consular district. His tour indicated that British commercial enterprise was conspicuously lacking in the different centres where he stayed, in regard to both municipal schemes and private business. German commercial travellers were well-known visitors in the provincial towns. German price lists (drawn up in Russian) were widely distributed and this resulted in mutual knowledge between the traders of both countries, which greatly facilitated the development of German trade. Even in those districts where the strong Polish element (*e.g.*, Minsk, Moghileff) would gladly boycott goods made in Germany, it has been found impossible to exclude certain classes of German manufactures (*e.g.*, some kinds of agricultural machinery) as there is nothing to take their place. Polish agricultural syndicates would gladly purchase British-made machinery, &c., if British firms produced the goods they require or made any effort to advertise their manufactures and to get into touch with possible purchasers in those centres.

The same thing applies to British lack of enterprise in this district in general, with the exception, perhaps, of Moscow and a few other important centres. The obvious way to develop our trade relations with this country is to be found in closer intercourse between our manufacturers and possible Russian purchasers. Representatives of British firms should come out equipped with a good knowledge of Russian, with price lists drawn up in that language, and, where possible, with samples of their goods. They should personally study local conditions and requirements, ascertain how to surmount possible hindrances due to Customs and other relations, and, in general, make themselves thoroughly acquainted with the methods of business in vogue in those districts which they desire to conquer. This is what certain German firms already do, with marked success. It would probably be found very advantageous if the prices contained in catalogues, &c., were quoted for delivery at a port in Russia—say, St. Petersburg, Riga, or Libau.

Another suggestion which I would offer for the consideration of British manufacturers would be for several non-competing firms to combine for opening depôts in likely centres, by which the individual expenditure would be considerably reduced and British goods would become known and appreciated, while the firms acting in co-operation would be in a position to acquire much better and more complete information than would be available for a single firm acting alone.

The question of credit, as is well known, is another great stumbling block in the way of the success of British commerce. The long credit given by our German competitors may be impossible for British firms in the same position, but the inability of the latter to give such favourable terms must tell heavily against them.

Madeira.—The British Consul at Madeira reports that the Madeira Electric Light Co., Ltd., extended its supply in many directions during 1910. The company is substituting Diesel oil engines for its present steam plant, and the distribution will be gradually changed to the three-wire system. When this is finished the company will supply current day and night for lighting, heating and power purposes. The project for the installation of a telephone service appears to have been abandoned. The Consul feels sure that a telephone service would be a great boon in Madeira, if the charges were not too high.

China.—The British Consul at Nanking reports that the Electric Light Co., a semi-official concern formed in 1909 with native capital, commenced operations during 1910, and is now supplying light to all who desire it. The machinery, which was obtained from the United Kingdom, has proved very satisfactory, in spite of some hard usage. In this connection the Consul remarks that it may be well to mention here that it is not always advisable, when dealing with what purport to be official or semi-official concerns in China, to relax ordinary commercial precautions. The keen competition for such orders no doubt makes it necessary to allow considerably more latitude than would be granted to a private concern, but the results are rarely satisfactory.

Bankruptcy Proceedings.—William Henry Ridpath (trading as Ridpath & Wells), electrical engineer, 20, Bath Street, Ilkeston, Derby.—The public examination of the above debtor took place on Wednesday last week at the Court House, 20, St. Peter's Churchyard, Derby, on accounts showing a deficiency of £1,308. In reply to questions, debtor stated that he had traded at the above address for four years, and had been aware of his position for two years. Debtor admitted that during the five weeks prior to the filing of the petition he had spent about £40 in getting about, drinking, &c. Ultimately Mr. Registrar Woodforde ordered the case to be concluded.

Liquidation.—The Helptophone Co., Ltd.—At a meeting on July 12th, it was resolved that the company be wound up voluntarily, and that Mr. R. E. Smith, of 53, New Broad Street, E.C., be appointed liquidator. A meeting of creditors was to be held yesterday.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 47, No. 208. London: E. and F. N. Spon, Ltd.—The issue for July, 1911, contains the following papers:—"Electricity Meters and Meter Testing," by H. A. Ratcliff and A. E. Moore; "Wireless Telegraphy in Relation to Interference and Perturbation," by J. E. Taylor; "Long-distance Transmission of Electrical Energy (Reply to Discussion)," by W. T. Taylor; "The Electrical Undertaking of the Tame and Rea Drainage Board," by L. F. Mountfort; "Electric Cooking Apparatus," by Harold Gray; and "Parallel Working of Alternators," by J. R. Barr.

Les Lampes Électriques. By H. Pécheux. Paris: Gauthier-Villars.—This little book forms a part of the Encyclopédie scientifique des Aide-Mémoire, and gives a concise account of the manufacture, testing and characteristic properties of the various kinds of electric lamps. The treatment is rather scientific than popular, and occasionally academic; the illustrations in particular must be regarded as diagrammatic sketches, by no means affording

a guide to good modern practice. The matter, however, is well up to date, and brings together in convenient form a great mass of information on the subject named.

Elektrochemische Umformer (*Galvanische Elemente*). By J. Zacharias. Vienna: A. Hartleben. Price M. 4.—In this work the author first discusses the nature and development of primary cells, and proceeds to describe many of the commercial forms now in common use for various purposes, with special attention, of course, to the "dry" cell. The setting-up, testing, and connections of primary batteries, both for small current apparatus and for the more weighty applications, are fully dealt with, so recent a cell as the Benkö bein g included. The author appears unduly optimistic as to the results to be got from "earth cells," but has collected in this volume a quantity of data which should render it a valuable work of reference.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXVIII, No. 3. July, 1911. Philadelphia: The Club.

"The Ten Republics." By Robert P. Porter. 1911. London: George Routledge & Sons. Price 1s. net.

"Atti della Associazione Elettrotecnica Italiana." July, 1911. Milan: Stucchi, Ceretti & Co.

"Il Nuovo Cimento." July, 1911. Pisa: Tipografico Toscano.

"Corrections for the Effects of Atmospheric Conditions on Photometric Flame Standards." By W. J. A. Butterfield, J. S. Haldane and A. P. Trotter. Paper read at the meeting of the International Photometric Commission at Zürich, July, 1911. From the authors.

"Revue d'Electricité (*Bulletin* of the Société Belge d'Electriciens). Vol. XXVIII, No. 6. June, 1911. Brussels: E. Bruylant.

Trade Announcements.—General Electric Co., Ltd.—Owing to increasing trade, the Dublin branch has removed to more commodious premises at 13, Trinity Street, the new telephone number being 3300 Dublin (two lines).

Arthur Jopling & Co., 10, Westmoreland Buildings, Aldersgate Street, E.C.—This business will in future be known as "The English Electrical Co.," under new proprietorship. The firm will continue to manufacture arc lamps and act as wholesalers of electrical accessories of every description.

Messrs. Andre Citroen & Co. opened new works at Paris on the 22nd ult., equipped with the latest gear-cutting machines, made by the firm themselves.

Messrs. Galsworthy, Ltd., 15 and 16, Newman Street, Oxford Street, W., announce that owing to increasing business they have just completed very considerable extensions to their showrooms, which have also been redecorated and rearranged. The firm claim that they form one of the finest suites of showrooms for electrical fittings, containing a very complete all-round selection of models.

For Sale.—The business of Messrs. Wenham & Waters, Ltd., electrical and sanitary engineers, &c., Paragon Works, Croydon, is offered for sale by private tender. See our advertisement pages to-day.

LIGHTING and POWER NOTES.

Aldershot.—The U.D.C. has received the sanction of the L.G.B. to a loan of £2,500 for E.L. plant.

Altrincham.—The Bowdon, Hale and Timperley Councils have agreed to be represented at a conference to be held about September next, for the purpose of discussing the proposal of the Altrincham Electric Supply, Ltd., to apply for a prov. order authorising an extension of the area of its supply.

Bacup.—The Corporation has decided to apply for sanction to the borrowing of £1,250 for electricity purposes.

It has also decided to supply current for public lighting at 2d. per unit, or 18s. per 50-c.p. lamp for 2,000 hours.

Biddulph.—Mr. Robert Heath has placed before the U.D.C. particulars of the cost of the proposed E.L. scheme for the town. With overhead mains the cost will be £2,700, and the annual expenditure, with repayment of capital and interest, £607. A canvass of the town has shown 230 probable consumers, and the probable consumption is 37,800 units per annum. At a charge of 1½d. per unit this would cost £236, and retailed at 4d. or 4½d. per unit, the income, with meter rents, would give a prospective surplus of £84 per annum. The whole matter is being considered in Committee.

Clayton.—With reference to the E.L. scheme for the district, the U.D.C. has asked the Electrical Distribution of Yorkshire, Ltd., whether it is able to supply current at ¾d. to 2d. per unit for power, and not exceeding 4d. per unit for lighting, and whether current can be supplied within a year from the date of the receipt of the order.

Clevedon.—The U.D.C., on August 2nd, decided to assent to Messrs. Christy Bros. applying to the B. of T. for an extension of three months for completing the E.L. scheme.

County Durham.—The County of Durham Electric Power Supply Co. has applied to the B. of T. for consent to the use of extra high-tension transmission above ground, for the purpose of supplying energy at a pressure of 20,000 volts between the sub-station at Pease's West, Crook, to Windlestone Colliery, and from South Hetton to New Hesledon. The lines will be in the area of the Crook and Willington U.D.C.'s, and the Auckland, Sedgefield and Easington R.D.C.'s, all of which bodies have given their consent.

Crook.—The U.D.C. has accepted the tender of Messrs. Pease & Partners for installing 20 25-c.p. lamps at Sunniside, at £213, and supplying current at 35s. per lamp per annum.

Ealing.—The profits of the electricity undertaking for the past year amounted to £1,700. Freehold property in Bond Street is to be purchased for outside offices for the electricity undertaking, at a cost of £1,200. Alterations, &c., are to be carried out at an estimated amount of £500.

Egham.—The B. of T. has granted the application of the E.L. Co., which was the subject of a recent inquiry for permission to erect a generating station on the Causeway at Egham.

Epsom.—After partly considering a suggestion made by its engineer, Mr. A. C. Gilling, as to the expenditure of £3,500 upon additional power plant for the electric lighting works, the U.D.C. has deferred the matter until after the summer vacation. Mr. Gilling advocated the purchase of a Diesel engine and generator, whereby the total cost of production would be reduced and the Council would be able to supply cheap power to customers where necessary. It was estimated that the net economy effected by the Diesel installation would be £639 15s., and repayment of capital and interest would further reduce this sum to £289 15s. The Lighting Committee complimented Mr. Gilling upon the financial and technical results of the undertaking since his appointment as resident engineer.

Finchley.—At the last meeting of the Electricity Committee it was decided to instruct Mr. Ryde to appear on behalf of the Council in the appeal pending in regard to the assessment of the electricity undertaking. The appeal had been lodged owing to the assessment having been increased from £400 to £1,800, which, in the opinion of the Electricity Committee, after making comparison with the assessments of other electrical undertakings, was very high. Councillor Fry stated that the £1,800 was the sum put before the overseers by an expert valuer.

Gellygaer.—The U.D.C. has decided to substitute electricity for gas for lighting the main road from Glanymant, Pengam, to Bargoed Station.

Herne Bay.—Both the gas company and Messrs. A. E. Hunt & Sons, a local firm, have submitted terms to the U.D.C. for taking over the E.L. order. The Council has deferred discussion on the matter.

Hornsey.—The sanction of the L.G.B. has been received to a proposed loan of £9,000 for electric lighting. A strip of land at the rear of the generating station is to be purchased from the Great Northern Railway Co. for £500. The feeder cable in the Broadway is to be extended at a cost of £400.

Horwich.—A correspondent says it was announced on Tuesday, in connection with the strike of 4,000 employés at the L. & Y. Railway Co.'s locomotive works at Horwich, near Bolton, that the electric lighting of the works, institute, villas, cottage hospital, offices, and other places supplied from the works, will be stopped. The men who have worked the plant, it was stated, were to be brought out. An agreement was made with the company last Saturday to the effect that certain men should be allowed to work at the plant on condition that they should do no other work. The men alleged that that agreement had been broken, and they decided to withdraw the men.

Hull.—The trawler owners and merchants engaged in the Hull fishing district are anxious to obtain a supply of electric current for lighting and power, and have forwarded an application to the Hull Corporation to supply them. A deputation has also waited upon the Corporation Electric Light Committee, and impressed its claims upon the Committee. The North-Eastern Railway Co. has, however, to be taken into consideration as the owners of the fish dock and as the landlords of many of the applicants. The Committee hopes to arrive at an agreement satisfactory to all the parties.

Ilkley.—The U.D.C. on August 2nd decided not to entertain a proposal to take current in bulk from the proposed Wharfedale Electric Light Co.

King's Norton.—The work of providing a supply of electricity to the district has been commenced, and the order for laying mains has been given to Callender's Cable and Construction Co., Ltd. The work will be carried out under the supervision of the Birmingham authorities, under whose control the district will pass shortly.

London.—Islington.—The Lighting Committee has decided to reduce the price paid by the Council for electricity supplied for public lighting from £12,100 to £11,000. It has further decided to place £1,000 out of the surplus fund of the undertaking to the relief of the general rate.

Loughborough.—In our last issue we referred to the June statistics of the electricity undertaking, and it is only fair to state that the apparently adverse figures are explainable as to output, because there were two general holidays in the month, when, of course, the power load fell to nothing, and, as to costs, because it was necessary to run non-condensing for a week, owing to the

canal being emptied. In the prsceding 12 months the monthly increased outputs, compared with the previous year, ranged from 97 per cent. to 30 per cent., and similarly a reduced cost per unit delivered was shown. It will be seen, therefore, that June was an exception to the rule.

Lytham.—Through Mr. Butterworth, a London solicitor, a private concern has informed the U.D.C. that it intends applying to the B. of T. for a prov. order for E.L.

Mansfield Woodhouse. — The Mansfield T.C. has informed the U.D.C. that it is desirous of carrying out the E.L. order which it holds for the district, and asked whether, in view of the increased population, the Council would be prepared to pay £150 a year for public lighting. The U.D.C. refused to vary the terms of the agreement already entered into.

Nelson.—At the T.C. meeting, on August 3rd, the chairman reported that the B. of T. had decided to make an order authorising the supply of electricity in bulk to Brierfield, subject to a provision that such supply should not be used for traction purposes in connection with tramways worked by the Burnley Corporation.

Newcastle-on-Tyne. — Power Supply Progress.— The Newcastle-upon-Tyne Electric Supply Co. reports a considerable increase of electric power in its area to June last. Taking the whole of the North-East Coast power systems into consideration, including the Newcastle, Durham and Cleveland companies, about 150,000 KW. was connected up to June 30th, the greater part of which is supplied by the Newcastle Co. Of this total, 66,000 KW. is used in collieries and ironstone mines in the Northumberland, Durham and Cleveland districts. Among the more important extensions lately carried out are supplies in connection with the shipyard of Messrs. Swan, Hunter and Wigham-Richardson, Ltd., which now contains a sub-station of 2,700 H.P. The sub-station has recently been extended and contains four 700-H.P. transformers, with a ratio of 5,500 to 440 volts, the low-tension switchgear being of the Reyrolle pattern. The additions are to cope with the steadily increasing demand, and there is a duplicate low-tension supply given from the Carville generating station. An important installation of electric power is being made in connection with Messrs. Armstrong, Whitworth & Co.'s new naval equipment works at Walker-on-Tyne. Here four large electrically equipped cranes are being employed, each with two 25-H.P. and one 10-H.P. motors. These cranes are situated on the river side, and are being used to swing wagons of excavated material over lighters which take "the spoil" out to sea. The contractor is also using electric power for various other operations. At the engineering works of Messrs. Donkin & Co., Walker Gate, some 200 H.P. of electrical machinery is in use, an addition having recently been made to the lathes in the heavy machine shop and telegraph shop, driven at 440 volts, three-phase. At the St. Lawrence ropery of Messrs. T. & W. Smith, Ltd., of Newcastle, 350 H.P. of electrical plant is now installed, including four rope machines of 20, 15, 12½ and 6½ H.P., and for other purposes; 75 H.P. of three-phase squirrel-cage motors running at 480 R.P.M. and 440 volts has been installed at Messrs. Carr's Saw Mills, Newcastle-upon-Tyne, to replace steam plant using saw mill refuse, previously considered one of the most economical ways of obtaining power. An installation of electric power has been made at the Ouseburn Sailcloth Factory, belonging to Messrs. Stokoe & Co., where over 50 H.P. is being used for the looms and spinning frames. In connection with the lighting in the Monkseaton district a new sub-station is being built with special architectural features to suit the surrounding residential property, which will have a capacity of 140 H.P., and will transform power from 5,500 down to 440 volts. In this connection a new cable has been laid from the Cullercoats sub-station to the Monkseaton sub-station. A new sub-station is also being built for the purpose of supplying the Burradon and Coxlodge Coal Co. at Burradon Colliery, which will have a total capacity of 1,200 H.P., containing two transformers of 600 H.P., with a ratio of 20,000 to 3,000 volts. High and low-tension switchgear of the Reyrolle ironclad pattern is being used. In connection with this and the other 20,000-volt sub-stations on the system, 12 sets of 20,000-volt electrolytic lightning arresters are being installed on the main step-up and junction switchboards of the system. These various extensions have been carried out under Messrs. Merz & McLellan, of Newcastle-upon-Tyne and Westminster, the consulting engineers to the power companies, who are also responsible for various other private, colliery and shipyard supplies.

Northallerton.—At a meeting of the Urban Council on the 3rd inst., it was decided to accept the tender of the Northallerton Electric Power Co. for street lighting for five years. It was the only tender received, and it was stated that the company offered a discount of 5 per cent. if the tender were accepted for five years. The motion that the tender should be for five years was only carried by the chairman's casting vote.

Oulton Broad.—The U.D.C. has applied to the B. of T. for permission to use overhead mains for the purpose of carrying out the E.L. order.

Peterborough.—For the year ended March 31st last, the electricity undertaking shows a net surplus of £534. Of this amount £350 is being set aside to form the nucleus of a reserve fund.

Rishton.—The directors of the Victoria Mill, Rishton, have decided to work their machinery by electricity. This will be the first mill in the district to adopt this method. There will be a separate motor for each loom.

Rochdale.—The Electricity Committee has recommended the T.C. to reduce the charge for current for private lighting from 4½d. to 4d. per unit, as from July 1st.

St. Helens.—The T.C. has decided, subject to the consent of the B. of T. and the local authority concerned, to extend the H.T. feeders from the power station to St. Helens Junction, and thence along the permanent way of the London and North-Western Railway to Earlestown, in order to supply current to the Railway Co.'s works. The company will guarantee a minimum annual consumption equal to 500 KW. for 21 years, with option to discontinue at the end of seven and 14 years, on payment of compensation to the Corporation in respect of the mains laid on the company's property. The new feeders will be available for the supply of current to the works of Messrs. Bolton & Sons, Ltd., and the Parr side of the borough.

Stockport.—For the past year the Electricity Department's income totalled £21,513, and the gross profit amounted to £10,235. A sum of £3,539 was contributed to the local rates. The tramways made a profit of £28,449 out of an income of £56,642, and contributed £7,050 in aid of local rates.

Wadebridge.—The public lighting on the Egloshayle side of the river by electricity was inaugurated on August 1st, and has given great satisfaction.

Wakefield.—At the City Council meeting held on August 1st, Councillor England, chairman of the electricity department, in referring to the previous year's work, briefly dealt with the financial position of the undertaking, which last year showed a smaller deficit than in the previous years, viz., £213. He pointed out that the total capital expenditure had been £88,863, and that since 1898 plant valued at £11,566 had been scrapped, and that the total dead capital was £15,318, against which £6,562 had been repaid, leaving £8,756 as non-revenue producing at the present time. Between the years 1905 and 1908, nearly £3,000 was withdrawn from the undertaking for the rates, which should have been available in a reserve fund. However, the prospects of the undertaking were now better, partly in view of the increased efficiency which the plant would have when the new exhaust turbines were working. He concluded by urging that the electricity department should have a fair share of the street lighting. The Wakefield electricity department is fortunate in its chairman, Mr. Harry England—the well-known manager of the local tramways undertaking.

Wath (near Barnsley).—The U.D.C. has decided to discuss in committee an application from the Electrical Distribution of Yorkshire, Ltd., for the consent of the authority to distribute electricity in its area. At a meeting of the Council it was explained that if the B. of T. granted the order the company would have power to supply the district for 42 years, at the end of which time the Council would have the right to take over the supply.

Wellingborough.—The R.D.C. has consented to the parishes of Newton Bromshold and Higham Park being deleted from the prov. order for E.L. which is being applied for by a Northampton company, but to insist on the other parishes in the district being included.

Wimbledon.—Mr. T. C. Ekin, Inspector to the L.G.B., has held an inquiry in connection with an application made by the B.C. for powers to borrow £7,459 for the extension of the Corporation's electrical undertaking to supply energy to the Maldens and Coombe districts.

Wrexham.—The L.G.B. has sanctioned the borrowing by the Council of £3,587 for electrical extensions, the majority of the loans being for terms of 10 or 15 years. The short period items are a traction battery (seven years) and meters (four years). For the reversible booster, switchgear and cables in connection with the battery 15 years are allowed. It will be recollected that the L.G.B. inquiry produced strong opposition from the local gas company, which naively suggested that the electricity concern "was going ahead too fast." Electric street lighting, for which a loan of £500 has now been sanctioned, was also strongly contested. That inquiry brought out other matters as well, for according to the newspaper reports, Mr. Ekin, the L.G.B. inspector, criticised the Council for placing its balance of net profit to reserve, rather than paying off its arrears of rate aid. As the Town Clerk explained, this revolutionary doctrine is diametrically opposed to the views of one of Mr. Ekin's more energetic colleagues, who had previously urged the Council on the course it has taken. Anyway, it is satisfactory to the Council and Mr. Pickvance, the engineer, to know that they have successfully established their case before the L.G.B.

Yarmouth.—At a recent meeting of the T.C. a report was received from the Lamps Sub-Committee as to a visit paid to Southtown Road to inspect a system of electric lighting from the tramway standards which had been installed. The Council decided to adopt the system of lighting, the lamps to be hung in anti-vibration holders. At present the road is lighted by gas

TRAMWAY and RAILWAY NOTES.

Accrington.—At the T.C. meeting last week, Ald. Higham referred to the recent tramways arbitration question, and suggested that a further letter be sent to the Haslingden Assessment Committee, pointing out that the Corporation did not disagree with the terms of the award as binding and final, but it asked that it should be amplified, and enough data given to enable it to arrive at the amount the umpire had settled. If the Committee refused, he did not know what would happen, but he had some reason to believe it would consider a letter in such terms and arrive at something like a fair understanding. The Council would see that the town clerk had submitted a case for the opinion of Mr. Ryde, K.C., one of the highest authorities on rating, as to whether the tramways assessment award complied with the terms of reference. Mr. Ryde had given his opinion that the umpire had not duly complied with the terms of reference.

Barrow-in-Furness.—The new electric tramway across Walney Island was formally opened last Friday, and during the holidays in the early part of this week it was extensively patronised and proved a boon to thousands. It links up the town with the Irish Sea, and for a mile stretches from the one side of the island to the other, the cost has been only £7,000. Alderman Smith, the chairman of the T.C. Electricity Committee, at the official opening, said the plans and scheme were got out in five or six weeks' time, and in one day short of two months from the signing of the contract the work had been accomplished.

B. of T. Railway Statistics.—A recent B. of T. Blue Book records the fact that at the end of 1910 there were 229¾ miles of railway worked partly by electricity, and 205 miles worked solely by electricity, the figures being similar to those of the preceding year. During 1910 the energy used actually for train working amounted to 236 million units, an increase of about 16 million units on the previous year. In that year the tube railways of London carried 173 million passengers, and during 1909 the total railway passengers amounted to 1,204,870,000, as compared with 2,743,189,000 tramway passengers. The corresponding 1910 results are not given.

Burnley.—The B. of T. recently recommended the trial of speed indicators on the Burnley tramcars. After the tramways manager had reported on the matter to the Tramways Committee, it was resolved that "the Board be informed that when a speed indicator is made satisfactory for bogie cars, the Corporation will consider the advisability of adopting it."

Continental Notes.—Italy.—The Italian Public Works Department has officially approved of the project of the Commune of Vicenza, to construct an electric tramway from the Porta Castello to Loggetta, and for extensions of the existing lines running to the station of the Vicenza-Schio ailway. Official sanction has likewise been accorded to the scheme for establishing an electric tramway between Napoli and Acerra.—*Giornale dei Lavori Pubblici.*

The beautiful district around Lake Maggiore in Lombardy has been made accessible by the opening on the 12th ult. of the eleotric rack railway from Stresa to Mottarone. This line has some important features. It starts from the bridge on the lake at Stresa, at an altitude of 97 m., and rises to Mattarone at a level of 1,379 m., thus bridging a difference of level of 1,182 m. The line is 9·86 km. long, 6·96 m. of which are on the rack system. The least radius of the curves in the natural adhesion portion of the line is 25 m. urban and 60 m. extra-urban. In the rack portion it is 70 m. The lines are equipped with 35-kg. Phœnix rails in the city portion, and 23-kg. Vignole beyond. The teeth are of Strub pattern. The system of traction adopted is continuous current at 750 volts, the return being made by the rails. The train is composed of an automotor and attached coach, capable of accommodating 110 passengers. The speed is 20 km. an hour in the natural adhesion portion of the track, and 12 km. on the rack portion.—*Ingegneria Ferroviaria.*

Russia.—It is stated that the Warsaw-Vienna Railway Co. owns a concession for the construction of an elevated electric railway between Warsaw and Grodzisk, which would be carried over the track of the railway. It is not definitely known when the directors will make use of the concession, although it is believed that the matter will be settled in October, by which time they hope that the Russian Government will give a binding declaration in regard to the continuance of the railway as a private undertaking. Should the latter question be regulated in the desired way, the company will make use of the electric railway concession by granting a sub-concession to an American firm.

A scheme for the construction of an electric railway between Krestowski-Tor (Moscow) and Sscrgijew, a distance of about 45 miles, is at present under consideration.

Germany.—An electric cable railway between Erdmannsdorf and Augustusburg, Saxony, has lately been completed and opened for traffic.

France.—A new company has recently been formed in Paris, with a capital of £32,000, and the title La Compagnie des Tramways Electriques d'Eu a Ault et du Littoral, to construct and work an electric tramway between Eu and Ault, in Normandy.

Erdington (near Birmingham).—At the meeting of the U.D.C. it was reported that the time provided by the notices for receiving objections to the proposed construction of a double tramway track had now elapsed. It was decided to hold a special meeting of the Council on the 21st inst. for the purpose of accepting a tender or tenders for the work.

Haughton-le-Skerne.—The Darlington T.C. has applied to the B. of T. for a further extension of time from October 24th next for extending the electric tramways to Haughton. The order, obtained in 1902, was due to expire on July 24th, but the B. of T. extended the time to October 24th. The extension has not been carried out for financial reasons.

Lanarkshire.—The extension of the Lanarkshire Tramways from Motherwell to New Stevenston has now been officially inspected, on behalf of the B. of T., by Col. Yorke, and is open to traffic. The new line is about 1½ miles in length, and has been constructed within three months.

Leeds.—The Corporation Tramways drivers and conductors, numbering 1,000, struck work on August 3rd, and the tramway service in the city was consequently suspended. An agreement was, however, reached the next day as the result of a conference organised by Mr. G. R. Askwith, of the B. of T. In the agreement special attention has been paid to the "spread over" system of hours, which was the chief cause of dissatisfaction on the part of the men, who said that working practically 78 hours a week for 54 hours' pay was unendurable, allowing time for neither rest nor recreation. It is now agreed in the case of drivers that on all duties when the "spread" does not exceed 12 hours, there shall be a margin of three hours (a compromise between four and two), with no deduction for meal time. On all duties exceeding a 12-hour "spread" and up to 15 hours, a margin of two hours is to be allowed. On all duties exceeding a 15-hour "spread" a margin of one hour is to be allowed. When a duty exceeds 12 hours a half-hour is to be deducted for meal time. The Corporation guarantees that the percentage of "spread overs" shall not increase in future, but, so far as possible, decrease.

Leigh.—The Corporation has approached the South Lancashire Tramways Co., with a view to obtaining a 10-minutes' service between Leigh and Lowton—the company's terminus. The matter is under the consideration of the tramway authorities.

Liverpool.—Mr. C. W. Mallins has had one of the Corporation cars fitted with a modification of the present form of lifeguard affording further protection, and he has also designed a form of lifeguard for the motor-omnibuses in the Corporation's service, which are at present unprotected. The Corporation has decided, in consideration of Mr. Mallins permitting it to have the restrieted right for all time of manufacturing, acquiring and using the improved tramway lifeguard and the lifeguard for the 'buses without payment of any royalty or other charges, to pay the patent fees, together with the general manager's out-of-pocket expenses in connection with designing and patenting the inventions. Two different types of lifeguard are to be fitted to two cars each.

London Suburban Railway Electrification.—At the half-yearly meeting of the Brighton Co., the chairman remarked that they had now nearly regained the whole of the traffic they lost from the advent of electric tramways in the suburban districts. The Victoria-Crystal Palace electric service had only been running since May 12th, but the results were equally satisfactory: at the end of the year when the London Bridge-Crystal Palace service was working they expected to attain even better results. The additional receipts derived from these services represented nearly 30 per cent. of the total increase in passenger receipts.

In conjunction with the above, it is worth noting that the chairman, speaking at the South-Eastern and Chatham Railway Co.'s joint meeting, said that the competition of the Brighton Co.'s electrical trains had cost them an infinitesimal sum. He did not think that the electrification of the North Kent loop lines would pay, unless as an alternative to extending Cannon Street and Charing Cross Stations. As the S.E. and Chatham directorate has relinquished its short-distance passengers to the tramways, and the outer "suburban" passengers, which it is supposed to cultivate, are fewer in number, the prospects of terminal station enlargement or electrification seem somewhat remote.

The report of the North-Western Co. refers to the progress being made with the Euston and Watford Railway, in which the laying of the permanent way and construction of stations is being taken in hand.

Malvern.—The B. of T. has confirmed the Malvern (Funicular) Light Railway Order, 1911, made by the Light Railway Commissioners.

Manchester.—A resolution not to work with non-unionists after the 31st inst. was adopted at a mass meeting of the Manchester municipal employés, at the Downing Street Co-operative Hall on Sunday. It was urged by the chairman, Councillor W. Phillips, that there was great unrest among the tramway employés of the city, and something would have to be done to remove it. Colonel J. T. Jones, the organising secretary of the Municipal Employés' Association, said they wanted a minimum wage of 26s. per week, and an eight-hours day.

Newcastle-on-Tyne.—On the 2nd inst., at a meeting of the City Council, Councillor Rodgers moved the sealing of two agreements—one between the Corporation and the Newcastle Electric Supply Co., Ltd., and the other between the Corporation and the Newcastle and District Electric Lighting Co., Ltd. He said the first had reference to the supply of electricity in Walker. The Council were under an obligation in Walker to take their electric supply from the Electric Supply Co., although they thought that when the Electric Supply Co.'s (1903) Act was before Parliament the Corporation had got powers which exempted them after August, 1910. An injunction was obtained, however, against the

Corporation in 1910 by the Supply Co., and, the reading of the clause being faulty, left the Corporation in the position of having to take their electricity from the company. To correct this error was the principal reason why the Corporation's Parliamentary Bill was promoted, so that they might set aside the clause which compelled them to take their electricity from that source. For eight years they had been paying £1,350 per year compensation under the old agreement, but since January this year they had been taking electricity from the company. This had cost them at the rate of £2,400 per year. During the progress of the Corporation's Bill they entered into negotiations with the Supply Co., and the result was embodied in the present agreement, which was that they should pay the Supply Co., £12,250 for compensation or expenses, and the Corporation were to have the right to supply their own current in Walker. By this means they would save about £2,000 per annum. The second agreement was for the supply of current to the trams at Newburn. Originally it had been decided to take current for this section from the Newcastle Electric Supply Co. at a cost of ·55d. per unit, but this would have necessitated the Corporation spending £10,500 on a sub-station. As a result of negotiations between the Corporation and the Newcastle and District Co., the latter had made an arrangement with the Supply Co., under which the District Co. would supply the Corporation tramways in Newburn at a cost of 1·1d. per unit, and the Corporation would cease altogether to take current from the Newcastle Electric Supply Co. The sub-station under this arrangement would not be needed. The agreements were ordered to be sealed.

Oldham.—At the T.C. meeting on the 3rd inst., discussion took place as to the desirability of running railless trams on the new route which is to be opened from Moorside to Grains Bar. Councillor Isherwood, chairman of the Tramways Committee, stated that the railless system would cost about £1,400 or £1,500 per mile, instead of £10,000 or £12,000 per mile, which was the cost of the present system.

On Saturday evening in Manchester Street, Oldham, an Oldham electric car going in the direction of Manchester, suddenly burst into flames. There were a number of passengers inside the car, and as the flames shot up they made a rush for the door. All got out safely, and the inside of the car was quickly enveloped in flames, which were extinguished by sand, but not before much damage was done. The seats were badly burnt, and the windows broken. The car had to be removed to the depôt.

Richmond.—No arrangement has yet been come to with regard to the electrification of the Kew Road Tramway. At the last meeting of the T.C. a proposal that permission be given to the company to put up specimen standards was defeated.

U.S.A.—According to the *Electrical World*, much favourable comment has been created by the successful operation of an automatic emergency brake on a New York subway train when motorman Stone died while the train was running at full speed on July 15th. It is believed that the motorman was killed by striking a post while leaning from the side of the cab. The push-button safety switch on the controller handle acted immediately to set the brakes and bring the train to rest within several hundred feet.

Wallasey.—The annual statement of accounts with reference to the municipal undertaking, includes an encouraging report *re* the working of the tramways for the first three months, which discloses a surplus equal to half of the estimated surplus for the whole year. The Poulton and Wallasey Village route showed the most encouraging results.

West Africa.—It is proposed to improve the Congo line from Matadi to Leopoldville by electrification, and also to lay a new line between the two termini for supplying the steamers on the upper river with crude petroleum to take the place of wood fuel.—*British South African Export Gazette.*

TELEGRAPH and TELEPHONE NOTES.

Anglo-Belgian Telephony.—A double-loaded cable is to be laid between La Panne, in Belgium, and St. Margaret's Bay.

France.—Although the hour at mid-day is daily signalled throughout France from the Eiffel Tower by wireless telegraphy, a recent decree of the Administration of Posts and Telegraphs forbids French clock-makers to set up receivers to regulate their clocks and watches. The reason for this is that the Administration claims the monopoly of working the system of wireless telegraphy. *L'Industrie Electrique* waxes scornful over this latest exhibition of obstruction to private enterprise, and points out that watchmakers of Chaux de Fonds, in Switzerland, are allowed to make use of the Eiffel Tower signals, while their use is denied to the French watchmaking industry. A curious feature is that, according to our contemporary, among the eminent persons forming the staff of the Posts and Telegraph Administration, there is no one competent to make use of the system. *L'Industrie Electrique* adds caustically: "Its telegraph service leaves much to be desired; its telephone service is—what we know; and its wireless service—nil."

International Telephony.—A Bill sanctioning the provision of telephonic communication between Milan, Zürich, Basle, Frankfort and Berlin, has been passed by the Italian Parliament. The installation of the line will be a very important undertaking.

New Cable.—The Northern Telegraph Co. has laid a new direct cable between Nystad, in Russia, and Grisslehaum, in Sweden. This is the third cable between these points, and is 198¼ km. in length.

New Pacific Cable.—The Bill referred to under this heading recently provides for the extension of the Pacific Cable from Australia to New Zealand, as asked for by the representatives of those Dominions at the Imperial Conference.

Wireless Telegraphy.—Under an agreement entered into by Marconi's Wireless Telegraph Co., Ltd., the Marconi Wireless Telegraph Co. of Canada, Ltd., and the Marconi International Marine Communication Co., Ltd., on the one hand, and the Canadian Government on the other, says the *Marconigraph*, the Marconi companies undertake to transmit general messages between stations on the Atlantic coast of Canada and corresponding stations on the coast of Great Britain and Ireland, at not more than 10 cents per word for such messages, which is 60 per cent. less than the rates now charged for cablegrams across the Atlantic the rate for the latter being 25 cents per word. Press messages will be transmitted at a shore-to-shore rate not exceeding 5 cents per word, and messages in connection with weather conditions and forecasts, tide conditions, ice, and reports on aids to navigation, will also be transmitted at that rate. The Montreal and Three Rivers stations pass into the possession of the Government for a substantial consideration, and the Marconi companies undertake to maintain and operate the Government-owned wireless stations in Newfoundland, Quebec, Nova Scotia and New Brunswick. This contract remains in force for 20 years.

The Postmaster-General has agreed that Press messages sent through the station in Sydney shall be charged at the rate of 25 words for 2s. 6d.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Tenders for four double-deck cars. Drawings and specifications from R. Stuart Pilcher, general manager.

Australia.—Victoria.—September 5th. (*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

South Australia.—August 23rd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" July 28th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

Belgium.—October 3rd. La Société Nationale des Chemins de Fer Vicinaux, of Brussels, (14, Rue de la Science) is inviting tenders for the electrification of the light railway between Brussels and Haecht. The contract includes the overhead equipment, the transformer sub-station, and the supply and erection of the electrical plant for the cars.

October 6th.—The city of Mons invites tenders for the supply of electricity for lighting and power. Particulars, Secrétaire, Hôtel de Ville.

Tenders will shortly be called for at the Bourse at Brussels for electric lighting apparatus for the Belgian State Railways.—*La Lumière Electrique.*

Blackburn.—August 12th. Steam coal for a year, for the Corporation electricity department. P. P. Wheelwright, engineer and manager, Jubilee Street Works.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local representation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

Tenders, returnable by August 25th, are also invited for a floating steel crane, capable of lifting up to 120 tons; likewise for two auxiliary cranes, 50 and 25 tons capacity respectively. Deposit 400 francs. Particulars as above.

September 25th.—All electric lighting fittings, fans, lamps, insulated conductors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. Directoria General do Expediente, Ministerio da Viacão e Obras Publicas, Rio de Janeiro.—*Board of Trade Journal.*

Cleethorpes-with-Thurnscoe.—September 2nd. Vulcanised bitumen distribution and feeder cables, for the U.D.C. See "Official Notices" to-day.

Croydon.—The Board of Guardians has instructed the borough surveyor to prepare a specification, with the assistance of the borough electrical engineer, upon which tenders could be invited, for electrifying the lifts at the Waingates Children's Homes. The borough electrical engineer puts the cost at £250 per lift.

Erdington (near Birmingham).—Construction of 1¼ miles of double-track tramway. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switch board, for the Farnham Gas & Electricity Co. See "Official Notices" July 21st.

Hungary.—September 30th. The T.C. of Bestzerce invites tenders for the erection of a hydro-electric station to supply light and power. Particulars from the Burgermeisteramt der Stadt Bestzerce, Ungarn.

Ipswich.—August 24th. Paper-insulated cables for a year for the Corporation. See "Official Notices" to-day.

Penang.—September 5th. One 500-KW. steam dynamo (engine or turbine), with ejector, condensing plant and switchgear, for the Municipality of George Town, Penang. See "Official Notices" to-day.

Russia.—The municipal authorities of Kamenz-Podolsk have just invited tenders for the concession for the electric lighting of the town.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

South Africa.—According to the *British & South African Export Gazette*, purchases will shortly be made by the Administration of Southern Rhodesia of copper telegraph wire for installation along the railway from Salisbury to Bulawayo, and thence to the border of the Cape Province at Ramathlabama, the cost being estimated at £20,000; also considerable quantities of material will be required for the installation of a double-wire telephone system at Bulawayo in place of the existing single lines, a scheme for which is under consideration.

Swinton and Pendlebury (near Manchester).—August 22nd. Electric lighting of new Cromwell Road School, Pendlebury. Particulars from J. T. Bushell, John Dalton Street, Manchester.

Switzerland.—A concession has been granted to Messrs. Masson, Gilliéron & Chenaux for the construction of an electric railway from Glion to Sonchaux, with a branch to Caux, the line having a length of about 5 km., and the estimated cost being 600,000 francs.—*La Lumière Electrique.*

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" August 4th.

Wigan.—August 14th. Best firing slack and (or) washed peas, for the Corporation electricity works for a year (12,000 tons). Harold Jevons, town clerk.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

The Corporation Electricity Committee invites tenders for a 400-KW. rotary converter and switchgear, at an estimated cost of £1,600, for the purposes of the supply of energy to the Knowles Oxygen Co., Ltd.

CLOSED.

Blackburn.—The T.C. has accepted the tender of Messrs McPhail & Simpson, Ltd., for the supply of a superheater and fittings to the electricity works.

The Council has concluded a contract with Messrs. Joseph Wrigl and Co. for water softening plant for the electricity works.

Bolton.—The Corporation has placed a contract fo continuous current electricity meters with the Electrical Apparatu Co., Ltd.

Canterbury.—The T.C. has accepted the tender of Messrs Wm. Cory & Sons, for coal for the electricity works for a year the following prices:—Nixon's Navigation large steam, 13s. per to Rochester house screenings, 14s. 10d. per ton.

Coventry.—The B. of G. has accepted the tender Mr. H. J. Tett, for the E.L. installation at the Nurses' Home, at £6

Dundalk.—The U.D.C. has accepted tenders for th electric lighting scheme of the town amounting, in all, to £16,1 as follows:—

Oil engines and generators.—Messrs. Mirrlees, Bickerton & Day, Ltd.
Mains.—Messrs. Siemens Bros. & Co., Ltd.
Switchboard, &c.—Messrs. Brook, Hirst & Co.
Battery (Tudor Accumulator Co.'s plates).—Sandycroft Foundry Co.
Booster.—British Westinghouse Co., Ltd.

Erith.—The U.D.C. has accepted the tender of Mess Beadle Bros. for 7,000 tons of Kingsley small coal for the electric works, at 10s. 2d. per ton, or alternatively Longhurst small coal, 10s. 6d. per ton.

France.—The French Post and Telegraph Authorit have just placed contracts with Messrs. Geoffroy et Delore of Clic and the Société Industrielle des Téléphones, of Paris, for the supp by each, of 125 km. of telephone cable.

Gillingham (Kent).—The T.C. has accepted the ten of Messrs. Wm. Cory & Son, Ltd., for Hillhouse washed nuts for electricity works, at 13s. 7d. per ton.

Hastings.—The T.C. on Friday accepted the follow tenders:—

Oliver Arc Lamp, Ltd.—200,000 pairs of carbons for Oriflamme arc la 30s. per 1,000.
Main Colliery Co., Ltd.—Welsh steam coal 18s. 11½d. per ton.
A. H. Wood, Hastings.—Installing the electric light at Clive Schools, £62.
Bruce & Co., Hastings.—Installing the electric light at Tower Road Technical Schools, £100.

Liverpool.—The Mersey Docks and Harbour Board h accepted the following tenders for electric cables: Edison Swan Co., Ltd., and India-Rubber, Gutta-Percha and Telegr Works Co., Ltd.

Manchester.—The City Corporation has accepted tender of the Union Cable Co., Ltd., at £1,185, for service ca required during the year ending June 30th next.

Shanghai.—A large order has just been placed by Municipal Commissioners of Shanghai for Osram lamps, w includes the following: 1,000 of the 100-C.P. size, 500 of the 200 size, and 200 of the 400-C.P. size.

Shrewsbury.—The T.C. has accepted the tender Messrs. Danks & Co., Ltd., of Oldbury, for a boiler for the electr works, at £422 10s., and that of Mr. Henry Price, of Shrewsb for boiler house extensions.

Stockport.—The T.C. has accepted the follo tenders:—

Messrs. Walter Scott, Ltd., Leeds.—Tram rails, £6 15s. per ton, an plates, £9 15s. per ton.
Walker's Road and Destination Indicators, Ltd, Bradford.—36 desti indicators, £18.
Bell Punch and Printing Co., Ltd.—Tramway tickets, 1¾d. per 1,000.
Morgan Crucible Co., Ltd., London.—Carbon brushes.
British Insulated & Helsby Cables, Ltd.—Overhead line material.

Tunbridge Wells.—The T.C. has accepted the tend the Western Electric Co. for cables for a year, and that of M Harris, Hardman & Co., Ltd., for Yorkshire nuts for the elect works, at 15s. 6d. per ton.

Watford.—The Council has accepted the tende Ferranti, Ltd., at £175, for switchgear.

NOTES.

Electrolytic Disinfecting Fluid.—The annual report of Dr. F. W. Alexander, Medical Officer of Health to the Poplar Borough Council, on the manufacture and use of the electrolytic disinfecting fluid made under his supervision shows, as usual, very satisfactory results. The electrolytic fluid was in great demand by the public. The cost of material in manufacturing 50,726 gallons of the electrolytic fluid was as follows.—

	tons.	cwt.	lb.		£	s.	d.
Electricity, 8,084 units at 1½d. per unit				...	50	10	6
Chloride of magnesium	5	3	38	...	21	6	4
Salt, 9 tons					15	8	0
Caustic soda					9	7	6
Water					1	10	0
Total cost of materials to produce 50,726 gals.					£98	2	4
Electric motor for stirring : 98 units				...	0	12	3
Bottles and Corks.							
Bottles					£30	15	1
Corks					6	17	6
					£37	12	7

Since the plant has been installed, a period now reaching five years, 140,000 gallons have been manufactured, at a cost for electricity and materials of under £271. The two plants can deliver in eight hours 400 gallons of electrolytic fluid at a strength of 4·5 to 6·1 grammes of chlorine per litre. The first plant was erected at the end of 1905 at a total cost of £583 ; the second was installed at the beginning of the year 1910, and with alterations to the first plant cost in round figures £501. After working for nearly five years and not having been cleaned for a period of over 12 months, the apparatus was taken to pieces, over-hauled and thoroughly cleaned. The platinum wire and slates upon which it is wound were found in perfect condition—these are the positive electrodes, and are the costly portion of the plant. The tanks are made of earthenware (which if well glazed will never wear out). Tanks made of slate contain iron, and were being constantly destroyed by the action of the electric current and had to be often replaced.

Rubber Trees.—In discussing the question of the most suitable variety of rubber for the contemplated development of Costa Rican plantations, Senor J. E. van der Laat, editor of the *Boletin de Fomento* (organ of the Costa Rican Ministry of Commerce) has grouped in concise tabular form the principal concrete facts available with regard to Hevea, Castilloa and Ceara. These three classes of rubber tree are, he considers, the only varieties deserving consideration. As he remarks, each of them has a natural zone, where conditions are specially favourable and where the attempt to introduce any of the other classes would be a short-sighted policy.—*The India-Rubber World.*

Comparative Results.

	Hevea.	Castilloa.	Ceara.
Under the most favourable conditions the first tapping can take place at the age of	3½ years	7 years	In 4th year
Product in latex is, at—			
4 years	7-11 oz.	None	Trifling
6 years	11-28 oz.	None	18 oz.
9 years	35 oz.	14 oz.	28 oz.
12 years	53 oz.	21 oz.	35 oz.
Complete development ..	106-140 oz.	70 oz.	53-90 oz.
Product of one acre (in full development) in dry rubber	610 lb.	305 lb.	395 lb.
Market value by latest advices ..	$1.44 lb.	$1.17-1.26 lb.	81-99 cents lb.
Analysis of the rubber—			
Pure rubber	94·60 %	89·19 %	76·25 %
Resin	2·66 %	12·42 %	10·04 %
Protein	1·75 %	0·87 %	8·05 %
Water	0·15 %	0·32 %	3·20 %
Ash	0·14 %	0·20 %	2·46 %
Proportion of pure rubber in latex ..	40-60 %	25-40 %	15-30 %
The tree thrives and can be successfully cultivated in the tropics up to the height of about	3,300 ft.	1,300 ft.	5,000 ft.
Ideal zone—			
Altitude up to	1,300 ft.	500 ft.	2,000 ft.
Average temperature	74-81° F.	77-85° F.	63-86° F.
Annual rainfall	60-80 in.	80-120 in.	30-80 in.
Exigencies of soil	Great fertility not required, but depth.	Fertility and depth required.	No great exigencies.

The Artificial Lighting of Hospitals.—In the course of a paper on "The Artificial Lighting of Hospitals," read before the Engineering Section of the Royal Sanitary Institute Congress held at Belfast on July 27th, Mr. J. Darch said that in visiting the principal London and other hospitals, he had been keenly struck with the universal want of discrimination in lighting. There was a kind of trade orthodoxy which cherished certain forms and fittings, and decided their use often in defiance of common sense. They had to avoid, on the one hand, the evils of glare, and, on the other hand, the risk of eye strain consequent upon insufficient light. In the hospital ward direct lighting lamps might be used if provided with proper shades, but everything depended on the word "proper." Glass shades and all transparencies were inadmissible, nor should any partial translucency exceed the limits of 0·1 c.p. per sq. in. If bracket lights were used for general lighting, a half-circle shade should be used so as to illuminate the wall. The practical result was a soft all-over illumination which was very pleasing. Indirect lighting by means of the inverted electric arc was deservedly gaining favour, but he did not recommend it for the ward, as the ceiling would be too dazzling for those who had to lie on their backs. A happy effect might, however, be obtained from indirect lighting with tungsten or other metalic-filament lamps placed inside a shallow metal bowl, white on the inside. To obtain the best effect they should be hung as low as convenient, and the lamp should not be set too low in the bowl. In electric lighting, several expedients for night-lights had been adopted, but a 2-c.p. shaded lamp was the most economical. An excellent arrangement was indirect lighting from a 8-c.p. lamp in a small bowl which was employed for night purposes only at Tooting Bec Asylum. The operating theatre needed good artificial light, and plenty of it. Electric arc lamps were employed in some Continental theatres. Direct lighting with ordinary arc lamps was out of the question on account of the unavoidable shadows, excepting, perhaps, for general lighting, but where there was a large skylight a splendid direct illumination might be obtained from white flame arc lamps, which had a remarkably high efficiency, and threw most of their light downwards. Four of these might be suspended over, but not too close to, the ceiling light, which should be of clear fluted glass, to spread the light. Indirect arc lighting, particularly where there was no skylight, was eminently suitable. Four 10-ampere open arcs, properly placed, and reflecting directly against a white ceiling, would give a brilliant illumination with all the advantages of daylight. Mr. Leon Gaster (Society of Illuminating Engineers), stated that the French Government had recently appointed a committee, composed of physiologists, architects, engineers and others, to report on different illuminants, their hygienic aspects, and so on, and it was greatly to be hoped that the Home Office of this country would do something of the same kind. Major Morgan said they had lately installed electricity in the large military hospital at the Curragh. Major Blackman said he thought the lighting of barrack rooms was a matter the Government might well take up. Mr. E. T. Hale, F.R.I.B.A., said his own preference was for a light about 2 ft. from the wall, but suspended from the ceiling. Mr. Darch briefly replied, and said the majority of hospitals had perfectly inefficient methods of lighting.

Accidents in Electric Lifts.—Replying in the Parliamentary papers to a question, the Home Secretary said that some years ago the Factory Department instituted inquiries with a view to ascertaining how far accidents arising in connection with the use of hoists or lifts might be preventible by means of automatic or other appliances attached thereto. As a result, a full report was issued in 1904 dealing with the construction and arrangement of lifts and the means of preventing accidents. Further inquiries were now proceeding with regard to hoists which were worked electrically. Mr. Churchill added that he had no power to take any action with regard to hoists used elsewhere than in places to which the Factory or the Mines Acts apply.

An Electrical Discharge (?)—A correspondent provides what appears to be an adequate explanation for the curious effects shown in the photograph reproduced on page 100 of our issue of July 21st. In tank or "stand" development the negatives are for long periods immersed in the developer in a vertical position, and as the fluid slowly circulates, those portions of it which pass over parts little affected by light (as the dark sail and mast of the boat) are less impoverished than other portions, with the result that they develop the adjoining areas with undue vigour, and produce an excess of density. Assuming the negatives to be upside down in a bath of this type, this explanation amply suffices to account for the light streamers above the masts and sails.

Smoke Abatement Exhibitions and Conferences.—The great success which attended the Exhibition of Smoke Abatement Apparatus and Appliances, held at Glasgow in the autumn of 1910, has led to the organisation of two other Exhibitions on similar lines, the first being planned for Manchester in November of the present year, while the second, which will be international in character, is to be held in London in May, 1912. In each case a conference of public authorities, manufacturers and sanitary officers interested in the problem of smoke abatement, will be held during the Exhibition, and at these conferences papers will be read and discussed. The following details will be of interest to many of our readers.

Arrangements are now well advanced for the Smoke Abatement Exhibition, which is to be held in the City Exhibition Hall, Manchester, from November 10th to 25th next. The Exhibition is being organised by the Manchester and District Smoke Abatement Society, with the support of the Smoke Abatement League of Great Britain and the Coal Smoke Abatement Society. The general manager is Mr. Walter Cawood, and the Special Advisory Committee, which has Alderman Robert Gibson as chairman, consists of the Chairmen of the Gas, Electricity and Sanitary Committees of the Manchester and Salford Corporations, together with the technical heads of several gas and electricity undertakings, and other gentlemen interested in the Smoke-abatement movement. The scope of the Exhibition is to be very extensive, and it is expected that it will embrace a very complete range of gas and electrical appliances for lighting, heating, cooking, ventilating, &c. Everything that experience can suggest will be done to secure that the Exhibition shall attract the attention of the public. The Conference of the Smoke Abatement League of Great Britain will be held in Manchester, while the Exhibition is in progress.

The Manchester Corporation has agreed to fix or wire free of charge all electric heating appliances sold at the Exhibition. The space in the gas, electrical and mechanical sections of the Exhibition is being rapidly taken up (see *Chem. Trade Journal*, July 15th and 22nd).

The London Coal Smoke Abatement Society has undertaken the

organisation of the London Exhibition and Conference, which is to be international in character, and is designed to cover all the best recognised means for diminishing or abolishing factory and domestic smoke. The last International Exhibition of this kind was held in the Royal Albert Hall in 1881, and it is felt that after the lapse of 30 years, the time has arrived when another International Exhibition is called for. The 1912 Exhibition will be held from May 6th to 18th in the Royal Agricultural Hall, Islington.

Much support has been already accorded to the undertaking as the result of the preliminary announcement of the Exhibition. This has amply justified the expectation that an International Exhibition of this character will be heartily welcomed, and there is every indication that the undertaking will prove the largest and most representative display of smoke preventing appliances and apparatus, and of smokeless fuels ever held.

An influential Council has consented to serve, and the scope of the Exhibition is sufficiently wide to cover all appliances directly or indirectly concerned in the abolition or diminution of smoke or dust from chimneys, and in the more perfect combustion of fuel.

Particulars of the Exhibition and of the tariff for floor space can be obtained from the Organising Manager and Secretary at the Exhibition Offices, Balfour House, Finsbury Pavement, London, E.C.

Ozonisers as a Day Load.—Referring to the article by Mr. J. B. C. Kershaw in our last issue, Messrs. Ozonair, Ltd., point out that the author states at the foot of page 166 that "The ozoniser is of the plate type, no dielectric of glass or other material separates the two discharging surfaces, and sparking is avoided by employing copper gauze as the electrode material"; but they have not used copper gauze for their electrodes for over five years, it having been their practice to use an alloy of aluminium exclusively. They suggest also that the statement is somewhat contradictory, as it is first said that they use no dielectric, and then (lower down) that each complete element of the ozoniser is composed of a thin sheet of micanite with gauze on either side.

Educational Notes.—Glasgow and West of Scotland Technical College.—The new session begins on September 26th (evening classes September 21st). Very large extensions to the engineering laboratories have recently been completed. Some particulars of the courses are given in our advertisement pages to-day.

Appointments Vacant.—Instructor in telegraphy and telephony for the evening classes at the East Ham Technical College (10s. 6d. per evening); junior drawing office assistant in the mechanical engineering department (£100), and assistant junior demonstrator in the electrical engineering and applied physics department (£80), at the Northampton Polytechnic Institute; clerk for the Swindon Corporation electricity and tramways departments (£70). See our advertisement pages to-day.

Machine Man Fined.—George Ferguson, machine man, pleaded guilty in Falkirk Sheriff Court on Monday, to having, while in charge of an electric coal-cutting machine in Craigend Colliery, failed to have the earth wire of the machine connected with the gate-end box. The machine, as a result, became charged with electricity and dangerous. Accused himself received a shock, and was off work for three weeks as a result. He was fined 5s. for the offence.

Annual Outing.—On Saturday, August 5th, the employés of Ozonair, Ltd., visited Hastings on the occasion of their first staff outing. The weather was excellent, and the catering and travelling arrangements were ideal. There was unanimous appreciation of a thoroughly enjoyable day, which everyone hoped was but the precursor of an annual event.

Institution and Lecture Notes.—The Institute of Metals.—The annual autumn meeting of the Institute will be held at Newcastle-on-Tyne on September 20th, 21st and 22nd. The Hon. Sir Charles A. Parsons is acting as chairman of the Local Committee, and Dr. J. T. Dunn as honorary secretary. Applications for membership should be sent to the secretary, Mr. G. Shaw Scott, M.Sc., of Caxton House, Westminster, S.W., before August 15th, to be in time to take part in the Newcastle meeting.

Institution of Municipal Engineers.—On July 29th a meeting was held at Edinburgh, and the "Scottish District" of the Institution was formed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The marriage took place at Fulham, S.W., on August 2nd, of Mr. Ernest M. Pearson, of the staff of the York Corporation Electricity Works, and Miss Annie Josephine Taylor, eldest daughter of Mr. Taylor, of Fulham.

The salary of Mr. Calvert, the Finchley Council's electrical engineer, is to be increased from £525 to £575 per annum, as from July 1st, 1911.

The Epsom U.D.C. has decided to increase the salary of the resident electrical engineer, Mr. A. C. Gilling, from £210, by £20 as from August 15th, and by £10 a year until a maximum of £250 is reached.

Mr. H. N. Warburton, late manager and secretary to the Winchester E.L. Co., has commenced practice as a consulting engineer at 4, Upper High Street, Winchester, and 31, Great James Street, Bedford Row, London, W.C.

Mr. K. N. Saye, senior station supervisor of the Electrical Department at Portsmouth Dockyard, has been presented by the staff with a gold lever watch and travelling case on his departure for the Straits Settlements.

The Winchester T.C. has appointed Mr. R. Ayton as resident engineer of the electricity works.

Mr. C. W. Rycroft, chief assistant engineer at Swindon, has withdrawn his resignation.

Tramway Officials.—Inspector Cole, in the employ of the South Lancashire Tramways Co., has been presented with a gold watch on his departure for New Zealand.

General.—The *Board of Trade Journal* states that Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Australia, who recently revisited this country under instructions, is now on his way back to Australia. Any inquiries which British firms may desire to address to him should be sent to his office at Equitable Building, Melbourne. During his stay Mr. Wickes visited 24 Chambers of Commerce, and interviewed over 400 firms.

The staff and foremen of Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford, have presented a canteen of cutlery to Mr. M. E. Sizer on his marriage.

The Postmaster-General has appointed Sir Alexander King, K.C.B., to be Secretary to the Post Office, in place of Sir Matthew Nathan, G.C.M.G.

Mr. Edison arrived at Liverpool on Tuesday last, on his first holiday for 25 years; he intends to visit various places in this country, including his cinephonograph works at Willesden, and will later proceed to Germany. He is accompanied by his wife and son.

Mr. Thos. Scharffetter, of 81, Peter Street, Manchester, has resigned his position with the Lahmeyer Electrical Co., Ltd., and has been appointed outside representative of the Electrical Engineering and Agency Co., Ltd., 109-111, New Oxford Sereet, London, W.C.

Mr. Henry V. Browne, after 32 years' service as superintendent of the Direct Spanish Co.'s station at Barcelona, has taken charge of the Marseilles station of the same company. To mark the esteem of the French colony of Barcelona, the honorary distinction of "Officier de l'Instruction Publique" was conferred upon him by the French Government on his leaving Barcelona, at the unanimous request of the colony. Mr. Browne was also founder and President of the British Chamber of Commerce for Spain.

Mr. Balsillie has been appointed Director of Wireless Telegraphy for the Commonwealth of Australia, at a salary of £600 a year, and has left for that country.

Obituary.—The death occurred on August 1st of Mr. John A. Surtees, the newly-appointed manager of the Cromer station of the Urban Electricity Supply Co., a position he was just about to take up. Mr. Surtees, who died from Bright's disease at the age of 33 years, had been at Grantham for eight years, latterly as local manager for the Urban Electricity Supply Co., and formerly as accountant for the Grantham and Stamford stations.

Mr. C. W. Pearson, a member of the firm of Pearson Bros., electrical engineers, Nottingham, who was recovering from a breakdown through overwork in connection with the Coronation celebrations, leapt from an express train on Monday night, and received terrible injuries, from which he died in a few hours.

NEW COMPANIES REGISTERED.

Anglo-French Wireless Co., Ltd. (117,056).—This company was registered on July 29th, with a capital of £50,000 in £1 shares, to carry on the business of electrical and mechanical engineers and contractors, suppliers of electricity, manufacturers of and dealers in railway, tramway, electric, magnetic, galvanic and other apparatus, &c., to acquire certain inventions, patents, rights, privileges and other property relating to wireless telegraphy and telephony, and to adopt an agreement with Compagnie Generale Radio-telegraphique. The subscribers (with one share each) are:—H. Mesnil, II, New Court, Carey Street, W.C., French advocate; F. P. Winterhotham, 1, New Court, Carey Street, W.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are M. Sins and M. Trouchon; no qualification necessary; remuneration as fixed by the company. Registered by Waterhouse & Co., 1, New Court, Carey Street, W.C.

Provincial Electrical Co., Ltd. (116,972).—This company was registered on July 24th, with a capital of £250 in £1 shares, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in apparatus and plant for electric lighting, telephones, telegraphs, or for producing power by means of gas, electricity, hydraulic, steam and other means, &c. The subscribers (with one share each) are:—W. H. Buxton, Easy Row, Birmingham, manager; W. E. Richardson, 41, Church Street, Birmingham, solicitor; H. H. Butler, Drayton Road, Edghaston, Birmingham, traveller; W. H. Bagley, 52, Great Hampton Street, Birmingham, manufacturer. Private company. The number of directors is not to be less than three or more than five; the first are W. H. Buxton, W. H. Bagley and F. E. Butler; qualification, 15 ordinary shares; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Compania de Electricidad de la Provincia de Buenos ·es, Ltd. (117,118).—This company was registered on August 3rd, with a pital of £1,000,000 in £1 shares, to carry on the business of electricians, ctrical, water, gas and mechanical engineers, suppliers of electricity, lvanism, magnetism and gas for light, heat, traction, motive power, trans- ssion of sound and otherwise, manufacturers of and dealers in cables, res, lines, connections, lamps, dynamos, generators, accumulators, gaso- ters, pipes and mains, railway, tramway, omnibus, carriage, motor car and n proprietors, transmitters of telephonic and telegraphic communications tside the United Kingdom, &c., and to adopt an agreement with Alex. L. cretan & Co., Ltd. The subscribers (with one share each) are:—W. Stewart ne, 5, Galpins Road, Thornton Heath, secretary; J. Heattie, 51, Christ- urch Street, Chelsea, clerk; A. J. Culley, Friars House, New Broad Street, C., secretary; A. E. Rowland, 5A, Hamfrith Road, Romford Road, Stratford, rk; R. C. Howley, 11, St. Anne's Road, Leytonstone, clerk; F. C. mpfield, 564, Salisbury House, E.C., director; R. W. Worsley, 564, Salisbury use, E.C., secretary. Minimum cash subscription, seven shares. The mber of directors is not to be less than two or more than 12: the subscribers to appoint the first directors. The directors shall establish an advisory ard in Buenos Aires for the supervision of the company's affairs in the gentine Republic, and such board shall not incur liabilities exceeding £500 any one time; qualification, £200; remuneration of directors and mbers of advisory board £120 each per annum (chairman, £160) and 2 per nt. of the available net profits, devisible. Registered by Ashurst, Morris, sp & Co., 17, Throgmorton Avenue, E.C.

Magic Appliances, Ltd. (117,110).—This company was istered on August 2nd, with a capital of £5,100 in 5,000 ordinary shares of each and 2,000 deferred shares of 1s. each, to carry on the business of ctrical and general engineers and contractors, manufacturers of and lers in electrical and mechanical appliances, &c. The subscribers (with share each) are:—W. Schmahl, Creek House, Broom Water, Teddington, ctrical manufacturer; S. J. Atkinson, 11, Farringdon Avenue, E.C., ctrical engineer. Private company; the number of directors is not to be than two or more than five; the first are W. Schmahl (managing director), J. Atkinson, A. Stolberg and O. Rouff; qualification, 10 ordinary shares; nuneration (except managing director), one guinea each per meeting ended. Registered office, 6, Farringdon Avenue, E.C.

Ohio Power Syndicate, Ltd. (117,111).—This company was istered on August 2nd, with a capital of £2,000 in £1 shares, to carry on the iness of electricians, suppliers of electricity for light and power, &c. The scribers (with one share each) are:—M. Ross, 43, Deronda Road, Herne l, S.E., clerk; H. G. Rushen, Cromwell Lodge, East Finchley, N., clerk; Postlethwaite, 119, Mildmay Road, Mildmay Park, N., secretary; W. B. irt, 12, Donovan Avenue, Muswell Hill, N., accountant. Private company. number of directors is not he less than three or more than five; the sub- bers are to appoint the first. Registered office, 123, Cannon Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bridgwater and District Electric Supply and Traction Ltd. (76,429).—Return dated May 4th, filed May 11th, 1911. Capital 000 in £1 shares (5,000 preference); 12,899 ordinary and 525 preference res taken up; £4,552 paid on 4,017 ordinary and 525 preference, including on 100 forfeited shares; £8,882 considered as paid on 8,882 ordinary shares. tgages and charges: £12,000.

Bournemouth and Poole Electricity Supply Co., Ltd. 89).—Return dated March 30th, filed May 5th, 1911; capital £500,000 in 00 ordinary, 7,500 4½ per cent. preference and 17,500 6 per cent. second erence shares of £10 each; 15,000 ordinary, 7,500 4½ per cent. preference and 00 6 per cent. second preference shares taken up; £375,000 paid. Mortgages charges: £187,500.

Carnbica Quarry and Lighting Co., Ltd.—Particulars of £200 entures, created June 16th, 1911, filed pursuant to Sec. 93 (3) of the Com- es (Consolidation) Act, 1908, the amount of the present issue being £100. perty charged: The company's undertaking and property, present and re, including uncalled capital. No trustees.

Burford Electric Light and Power Co., Ltd.—Particulars of 00 debentures, created June 10th, 1911, filed pursuant to Sec. 93 (3) of the panies (Consolidation) Act, 1908, the whole amount being now issued. perty charged: The company's undertaking and property, present and re, including uncalled capital. No trustees.

Billingham Electric and Steam Laundry Co., Ltd. 194).—Further charge, dated July 1st, 1911, to secure £60", supplemental ortgage dated November 25th, 1909, charged on the property comprised in original mortgage. Holder: E. D. Goodwin, 207, Canterbury Street, ngham.

Codge-Muirhead Wireless and General Telegraphy ·icate, Ltd. (70,681).—Issue on July 14th of £2,000 debentures, part of a s of which particulars have already been filed.

British Westinghouse Electric and Manufacturing Co., Ltd. 19).—Return dated May 15th, filed July 13th, 1911; capital, £1,875,000 in 00 preference shares of £3 each, and 75,000 ordinary shares of £5 each. inal capital: £1,500,000 in 200,000 preference shares of £5 each, and 0 ordinary shares of £10 each.) All shares taken up; £3 per share called n 500,000; £1,500,000 paid; £375,000 considered as paid on 75,000 shares. gages and charges: £1,474,953.

Eastern Telegraph Co., Ltd. (6,338).—Return dated May 31st, July 7th, 1911. Capital £6,000,000 in £4,000,000 ordinary stock and 00,000 pref. stock. All stock taken up; £6,000,000 paid. Mortgages and ges: £1,896,706.

Feedes Electric Traction, Ltd. (109,698).—Return dated 11th, filed July 15th, 1911. Capital £20,000 in £1 shares; 3,000 shares n up; £3,000 paid. Mortgages and charges: Nil.

Frompton and Kensington Electricity Supply Co., Ltd. 13).—Return dated March 30th, filed April 28th, 1911. Capital, £300,000 in hares (9,551 preference). 9,551 preference and 30,449 ordinary shares n up. £5 per share called up on 9,551 preference and 29,449 ordinary. 1,000 paid. £5,000 considered as paid on 1,000 ordinary shares. Mortgages charges: Nil.

Gamborne Electricity Supply Co., Ltd. (57,950).—Return d June 14th, filed July 3rd, 1911. Capital, £10,000 in £1 shares. 607 shares up. £1 per share called up. £605 paid, leaving £2 in arrears. Mortgages charges. Nil.

Calcutta Tramways Co., Ltd. (14,764).—Return dated May filed June 17th, 1911. Capital £1,400,000 in 140,000 ordinary and 140,000 rence shares of £5 each. 137,610 ordinary and 47,295 preference shares taken £2 per share called up on 4,400 ordinary, £2 10s. per share on 8,000 ordinary, s. per share on 22,000 ordinary, £5 per share on 79,430 ordinary and £5 per on 47,295 preference. 23,780 ordinary considered as fully paid; £3 per considered as paid on 4,400 ordinary, £2 10s. per share on 8,000 ordinary £1 15s. per share on 22,000 ordinary. Mortgages and charges, £350,000.

Lamplough & Son, Ltd. (99,688).—An agreement, and a debenture issued pursuant thereto, both dated June 29th, 1911, to secure £3,000, charged on Lamplough Works, 2, Albany Works, Willesden; benefit of a licence, and the company's undertaking and property, present and future, including uncalled capital. Holders: London Steel Castings Co., Ltd., 56, Moorgate Street, E.C.

Rio de Janeiro Suburban Tramways, Ltd. (110,272)—Issue on July 13th, 1911, of £25,000 debentures, part of a series of which particulars have already been filed.

Waltons & Co., Ltd. (87,797)—Issue on June 20th, 1911, of £50 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

The B.E.T. Capital Reorganisation Scheme.

The somewhat complicated scheme proposed by Mr. Garcke, the Chairman of the B.E.T., for the reorganisation of the capital account of that company, in consequence of the inadequacy of the revenue account to yield a surplus which will satisfy dividend requirements, and owing to the increasing arrears of preference dividend, cannot be said to possess any distinctive merit, and its adoption is not unlikely to meet with the usual reward of the application of an ineffective remedy. To those shareholders of the B.E.T. who may not be practically conversant with the affairs of companies, the interpretation of the scheme may prove to some extent a stumbling-block, and they may be unable to analyse the subject of the memorandum to the best advantage without the disinterested aid of an independent expert.

Instead of a reduction of capital, which seems to have been of general expectation, the proposition consists merely of a re-arrangement of the existing capital, which, in the circumstances, is not generally regarded as being characteristic of financial wisdom, though it is not doubted that the scheme has been conceived in the interests of the shareholders. All such proposals are usually so constructed; but it is possible that they may be born of failure (by a few at the expense of the many) to appreciate the true requirements of the situation or to the possession of undue optimism of the resources and prospects of the undertaking, which, in this case, has been described as an unhappy one, as the loss sustained by investors has been undoubtedly great.

The present issued and fully paid share capital of the company is:—

161,437 6 per cent. cumulative preference shares of £10 each	£1,614,370
133,301 ordinary shares of £10 each	1,333,010
Total	£2,947,380

If the scheme submitted be carried out, this share capital will become as under:—

(A) 403,592½	cumulative first preference shares of £1 each entitled to 6 per cent. ...	£403,592 10 0
(B) 403,592½	non-cumulative preference shares of £1 each entitled to 6 per cent. ...	403,592 10 0
807,185		£807,185 0 0
(C) 1,606,991	preferred ordinary shares of £1 each entitled to 6 per cent. ...	£1,606,991 0 0
(D) 533,204	deferred ordinary shares of £1 each	533,204 0 0
2,947,380	Total	£2,947,380 0 0

This, it will be observed, is the same in total as the existing issue share capital. There will thus be four classes of shares of the new denomination of £1, as against the present two classes of shares of the denomination of £10.

As regards priority of capital, the shares (A) will rank first, (B) second, and (C) and (D) will rank *pari passu*.

As regards priority of dividend the following represents the order:—

(A) 6 per cent. on 403,592½ cumulative preference shares of £1 each will require per annum ...	£24,215 11 0
(B) 6 per cent. on 403,592½ non-cumulative preference shares of £1 each will require per annum	24,215 11 0
(C) 6 per cent. on 1,606,991 preferred ordinary shares of £1 each will require per annum ...	96,419 9 2
(Here apparently follows the payment of the present arrears of preference dividend, viz., £266,370 1s.)	
(D) The 533,204 deferred shares of £1 each may be considered as so much waste paper, and in present circumstances the probability of any adequate return on the preferred ordinaries would appear to be dim and distant.	
Total required per annum ... ... (excluding arrears and D)	£144,850 11 2

It may be remarked here that at present the debenture stocks of the company impose an annual charge for interest of £92,994.

Each existing cumulative preference shareholder will receive in exchange for his £10 share the following :—

Existing cumulative preference share of				£10
will be exchanged for—				
£2½ first preference shares of £1 ...	£2	10	0	
£2½ second preference shares of £1 ...	2	10	0	
£5 preferred ordinary shares of £1 ...	5	0	0	
				£10

Each existing ordinary shareholder will receive in exchange for his £10 share the following :—

Existing ordinary share of		£10
Will be exchanged for—		
6 preferred ordinary shares of £1	£6	
4 deferred ordinary shares of £1...	4	£10

It will thus be seen (1) that although the preference shareholders will get 6 per cent. if earned, the cumulative preference dividend is reduced from 6 per cent. to 1½ per cent. ; (2) that the proposed cumulative preference share capital of £403,592 10s. will rank in any distribution of assets in priority of other classes of shares (at present the preference and ordinaries rank *pari passu*) ; and (3) that the present ordinary shareholders, if they surrender their *paripassu* rights, receive certain preferred ordinary shares, as shown, on which (the best that can be said at present) a dividend may be impossible for some considerable time, whilst they lose £533,204 in the shape of the deferred ordinaries.

The net result, therefore, is that the preference shareholders waive in favour of the ordinary holders part of their dividend rights for part priority of capital rights, and that the ordinary holders waive a portion of their capital rights to the preference holders for a return remote, though anticipated, on the preferred ordinary shares, whilst the £533,204 referred to, may be treated apparently as a negligible quantity.

The scheme would appear to possess all the elements of an ineffective solution of the difficulty, and does not impress us, having regard (*inter alia*) to the fact that there are, according to the last published balance-sheet, £1,679,007 of securities, yielding no return ; that there is a large depreciation of B.E.T. securities ; and that the creation of deferred shares is objectionable.

With regard to the question of the influence of the local authorities in B.E.T. finance, it would seem that the position is that the B.E.T. is determined to get all that it can out of them upon the sale of undertakings, and that the local authorities are resolved upon giving the B.E.T. as little as possible—two extremes—which may or may not be due to the B.E.T.

North Metropolitan Tramways Co.

The directors' report for the half-year ended June 30th, states that the gross revenue amounted to £368 and the total expenditure to £296, leaving as net profit £72. This balance of £72, together with £759 from last account, make up a sum of £831, which is carried forward to next account. The London County Council gave up possession of the Leytonstone Car Works on March 31st last, and the various tools and machines have been catalogued with a view to their disposal. What is not sold by private treaty will be put up for public auction next October, when the car works and frechold land are to be offered for sale.

The eighty-third half-yearly general meeting of the shareholders of the above company was held on Wednesday, at Electrical Federation Offices, Kingsway, Mr. George Richardson presiding.

The Chairman, in moving the adoption of the report, said the gross revenue for the half-year had amounted to £368 13s., and the total expenditure to £296 5s. That left a net profit of £72 8s., which, together with £759 2s. 7d. from the last account, they proposed to carry forward. Since the issue of the report they had entered into negotiations for the sale of their Roman Road depôt, and if they could dispose of the Barking Road depôt they would be able to go into liquidation in October.

Mr. J. W. Greig seconded the motion, and the report was adopted.

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ending June 30th, 1911, states that the surplus of receipts over expenses is £4,288, which, with the balance brought forward of £456, makes a total to the credit of profit and loss account of £4,744, and after deducting interest on debentures, loans, &c., amounting to £989, there remains an available balance of £3,755. This profit the directors propose to appropriate in the payment of dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601 ; in the payment of dividend on the ordinary shares at the rate 1½ per cent. per annum (less income-tax), £1,004 ; in placing to the credit of reserve for renewals, depreciation and other contingencies, thus increasing the amount to £10,100, the sum of £1,000 ; and in setting aside for the reduction of registration and formation expenses, &c., £530 ; leaving to be carried forward to next half-year £619. The traffic receipts show an increase of £832 as compared with the corresponding period of last year, due largely to the improved trade of the district.

The half-yearly meeting of the company was held in Newcastle-on-Tyne on the 8th inst., Dr. J. T. Merz presiding.

The Chairman, in moving the adoption of the report, said the receipts per car-mile had increased to 8·87d, against 8·273d. for the corresponding period of last year. These were the largest receipts per car-mile they had recorded, the nearest being 8·8d in 190[illegible]. They had carried 276,600 more passengers than in the corresponding period of last year. They had increased the dividend from 1 per cent. to 1½ per cent., and had increased the reserve fund by £1,00[illegible]. Referring to the Newcastle Corporation's Bill, he said the cost of the litigation to the company was £405, and although their differences could easily have been settled by a meeting in Newcastle, they had been forced to go before the Parliamentary Committee in London.

The report was adopted and dividends approved.

Great Northern and City Railway Co.

The report for the half-year ending June 30th last, shows a total revenue of £41,844, and working expenses amounting to £20,1[illegible], or at the rate of 48·17 per cent. The net revenue amounting to £21,687 was insufficient to meet the company's fixed charges for the six months by £1,110, which, as in previous years, was provided from outside sources. The number of passengers carried during the half-year was 6,323,045, as compared with 5,966,114 in the corresponding period last year.

The half-yearly meeting of the company was held on August 2nd at the Westminster Palace Hotel, Lord Lauderdale presiding.

The Chairman, in moving the adoption of the report, briefly dealt with the figures in it, pointing out that the company's business was slowly improving, a satisfactory feature being the comparatively small sum required from outside sources to meet the deficiency on fixed charges (a year ago the amount was £3,163). He believed the day was not far distant when they would be quite independent.

Mr. Chas. Steel seconded the motion, which was adopted.

Chatham and District Light Railways Co.—The twenty-first ordinary meeting of the shareholders of this company was held on Thursday last week at the offices, 83, Cannon Street, E.C., Mr. A. R. Monks presiding. On the motion of the Chairman, seconded by Mr. W. B. H. Martindale, the report and accounts were adopted.

Lanarkshire Tramways Co. — The twenty-first ordinary general meeting of the shareholders of this company was held on Thursday last week at the London offices, 83, Cannon Street, under the presidency of Mr. A. R. Monks. The Chairman formally proposed the adoption of the report, which was seconded by Mr. W. H. Whaite and agreed to.

Mather & Platt, Ltd.—The directors have declared an interim dividend on the ordinary shares of 5 per cent., free of income tax, for the half-year ended June 30th, 1911, being at the rate of 10 per cent. per annum.

Oldham, Ashton and Hyde Electric Tramways, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (5s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

Edgware and Hampstead Railway Co.—The statutory meeting of the shareholders of the above company was held on Wednesday at Electric Railway House, Broadway, Westminster.

Blackpool and Fleetwood Electric Tramways.—The half-yearly meeting of this company will be held at Fleetwood on August 24th. The report shows that the number of passengers carried was 1,041,121, and the receipts were £11,801, compared with £11,341. Maintenance of ways and works cost £837, compared with £1,006 ; engine power, £1,767, compared with £1,[illegible] and traffic expenses, £2,452, as against £2,411. The car-mileage run was 227,118½ miles compared with 221,356½ miles.

Continental.—La Société Nationale d'Eléctricité is the name of a new company which has recently been formed in Paris with a capital of £40,000.

La Société des Tramways et Eléctricité, of Brussels, is increasing its capital to £120,000.

London Electric Railway Co.

HE directors in their report for the half-year ending June 30th oint out that the comparative figures for the corresponding half last year are those of the Great Northern, Piccadilly and rompton, Baker Street and Waterloo, and the Charing Cross, uston and Hampstead Railways, consolidated. The capital ex-nditure during the half-year amounted to £47,222. The gross ceipts on revenue account amounted to £392,817, being an increase £27,193 on the receipts for the corresponding half of last year. he working expenses amounted to £174,919, being an increase of 7,699. After providing for interest and rents, and reserving 7,500 for contingencies and renewals, there remains a balance of 124,156 available for dividends, and the directors recommend that dividend at the rate of 4 per cent. per annum be declared on the per cent. preference stock, and that a dividend at the rate of per cent per annum be declared on the ordinary shares, leaving balance of £14,516 to be carried forward to the next half-year. he directors recommend that these dividends shall be payable on ugust 15th. The number of passengers carried in the last ro years is as follows :—

Half-year ending—	Number, inc. est. journeys by season-ticket holders.	Receipts £
ec. 31st, 1909, Bakerloo, Piccadilly and Hampstead Railways	46,783,143	328,566
ne 30th, 1910, Bakerloo, Piccadilly and Hampstead Railway	50,045,140	343,604
ec. 31st, 1910, London Electric Railway	*46,665,279	332,563
ne 30th, 1911, London Electric Railway	*52,548,384	369,326

* Prior to July 1st, 1910, a through passenger was counted as one passenger each of the company's lines used, whereas since that date a through ssenger is counted as one passenger only.

The London Electric Railway Act, 1911, the Bill for which was proved by the proprietors at a special meeting held on February h last, received royal assent on June 2nd last. The company oposes to proceed with the construction of the Charing Cross and ddington extensions at an early date. The Metropolitan District ilway Act, 1911, the Bill for which was approved by the oprietors at a special meeting held on February 9th last, received e royal assent on June 2nd last. The powers conferred by this Act, hereby the Lot's Road power house undertaking is to be purchased a Joint Committee of the London Electric and Metropolitan strict Railway Companies and leased to the two railway com-nies, were fully explained in the circular issued to the share-olders on June 10th last. It is proposed that the power house be ansferred to the Joint Committee and leased to the two railway mpanies as from January 1st, 1912.

South American Light and Power Co., Ltd.

N abstract of the directors' report for the year ending March 31st 11, appeared on page 145. The following table showing the ogress of the company's business is of interest :—

	1907.	1908.	1909.	1910.	1911.
Arc lamps connected ..	126	336	469	511	587
4-c.p. inc. lamps connected	13,096	21,022	29,728	39,084	44,544
Fans connected	47	124	206	200	219
Motors	3	14	38	52	75
Customers	316	462	715	900	1,106

The eighth annual general meeting of the shareholders of the mpany was held on Wednesday, last week, at the offices, Laurence Pountney Hill, Cannon Street, the Right Hon. H. Jackson presiding.

The Chairman, in proposing the adoption of the report, said it as satisfactory to be able to report a further improvement in the ceipts of the company as compared with the previous year ; the sult being that they were able to carry a balance of £9,478 to e balance-sheet, against £8,453. Turning to the balance-sheet, the debit side it would be seen that the whole of the share pital—£150,000—had now been issued ; the remaining unissued ares—£21,500—having in accordance with the decision come to st year, been allocated to the Bahia-Blanca and North-Western ilway Co. in repayment of the moneys expended by them on eir behalf on capital account. They had also issued the remain-g £6,500 5 per cent. mortgage debentures, and the cash proceeds ere applied towards meeting the remainder of the company's ligations to the Bahia-Blanca Railway. The debentures were ld at a premium of £194, which sum had been transferred to the serve account. On the other side of the balance-sheet it would seen that the capital expenditure during the past year had been ry heavy—£79,363, which had been expended in building three ansformer sub-stations and an elaborate network of under-ound cables, which it had been necessary to install for present id future requirements. On the other hand, there was a reduction £3,023 from that item in respect of meters and the whole amount respect of meters—£4,962—disappeared from the balance-sheet. hey had made an arrangement with the Bahia-Blanca Railway p. by which the item for meters and motors should be placed to a parate account, to which would be put the rentals which the com-ny received for those things, and after the whole of the item was ped out by renewals, then the balance would accrue to the com-ny. That was a slight modification of the original agreement, t they thought it mutually advantageous to make the arrange-ent. He wished to say a few words upon the question of the contract which they had with the municipality. As most of the shareholders were aware, that contract was entered into in 1900, and it expired at the end of last year. The Bahia-Blanca Railway had been in negotiation with the municipality on behalf of the company for a renewal of the contract for a further period of 10 years, which he understood was the limit of time for which such a contract could be given by Argentine law. A provisional agreement had been entered into, and it was probable that the final contract would conform in all material matters with that provisional agreement. They had been obliged to make certain minor concessions, but the most serious alteration in the contract was that while in the previous one it was provided that no other company could lay lines in the City of Bahia-Blanca in any street within two metres of their lines, the new contract provided that in the event of any new lines being placed in competition with theirs, they were to be compensated for any damage done to their lines. It was found by practical experience that the previous clause was a sufficient deterrent to any competition, while the new clause raised the possibility of a competitor coming on the scene. On the other hand, they must bear in mind that they were so firmly installed that it was extremely unlikely that any competitor would be able to make much headway, and, therefore, competition was not very probable. At the same time, it could not be denied that the result of the alteration of the contract must be that the security for the debentures was weakened, as competition was now more possible than it was, even if it was still improbable. The other matter he wished to refer to was that they owed the Bahia-Blanca Co. the large sum of £71,377, which, of course, they would have to meet in due course. The whole of the authorised capital of the company had now been issued, and they had an issue of £50,000 of debentures outstanding which, under the existing trust deed, could not be increased, but it was always possible for them to pay back those debentures and issue a new series of debentures for £150,000. That was practically what they proposed to do, and, in conjunction with the Bahia-Blanca Railway Co., they had formulated a scheme for that purpose, but after consultation with the railway company they had decided to defer taking any action in the matter until later on in the year. He believed the debentures would form a very attractive investment. With regard to the earnings of the company during the past year, as he had told them, their profits had somewhat increased, and, taking into consideration the suffering which had been inflicted upon the town owing to the failure of the crops, he thought they had done very well. If, as they hoped and expected, the country this year had a plentiful harvest, the prosperity of the town should materially improve, and that was sure to bring an increased demand for light and power.

Mr. T. Penn Gaskell seconded the motion.

The Chairman, in reply to questions, said it could hardly be expected that their capital expenditure would be closed for some time to come, if, as they hoped, the country continued to make progress. The mains system was laid out, and any further extensions would only be in connecting branches, which, of course, was not so costly as laying main cables.

The report was adopted.

Liverpool Overhead Railway Co.

The report of the directors to June 30th, 1911, states that the gross revenue amounted to £38,154, and the working expenses to £27,229. The number of passengers carried during the last two years is as follows :—

	Half-year ending			
	Dec. 31, 1909.	June 30, 1910.	Dec. 31, 1910.	June 30, 1911.
First-class	553,409	546,742	567,911	579,328
Third-class (including tramways)	3,184,636	3,013,785	3,260,261	3,113,073
Workmen (special return tickets)	1,477,506	1,529,553	1,563,128	1,701,196
Total	5,215,551	5,090,080	5,391,300	5,393,597

Compared with the corresponding period of last year there has been an increase in the number of passengers carried during the half-year of 303,517, producing an increase in the receipts of £1,968. The rolling stock and permanent way have been fully maintained. The company's Bill for the consolidation of its borrowing powers and for authorising the Mersey Docks and Harbour Board to guarantee the payment of interest on debenture stock, which was approved by the proprietors on February 14th last, has passed both Houses of Parliament, and now only awaits the royal assent.

The balance after meeting working expenses was £10,924, from which is deducted interest on mortgage debentures, and on calls paid in advance £4,329, leaving £6,595. With the balance brought forward, £4,246, the sum available is £10,841, and the directors recommend the declaration of dividends at the rate of 5 per cent. per annum on the preference shares, and 1 per cent. per annum on the ordinary shares, payable on and after August 17th next, leaving a balance of £4,665 to be carried forward to next half-year.

Westminster Electric Supply Corporation, Ltd.—The directors have declared an interim dividend for the half-year to June 30th at the rate of 10 per cent. per annum, less income-tax.

Metropolitan District Railway Co.

The report of the directors for the half-year ended June 30th, 1911, states that the expenditure on capital account during the half-year has been £88,669, including £10,686 in part payment of arrears of dividend on guaranteed stock. The gross receipts on revenue account have amounted to £327,170, being an increase of £27,124 on the receipts for the corresponding half of last year; the working expenses have amounted to £152,741, being an increase of £9,410. After providing for interest and other charges, and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £82,992, and the directors recommend that a dividend at the rate of £4 per cent. per annum be declared on the 4 per cent. guaranteed stock, and that a dividend at the rate of £4 10s. per cent. per annum be declared on the 4½ per cent. first preference stock. The directors recommend that these dividends shall be payable on August 15th. The following table gives a summary of comparative figures for the first halves of the years 1911 and 1910:—

	Half-year ended June 30, 1911.	Half-year ended June 30, 1910.	Increase per cent.
Gross revenue	£327,170	£300,046	9·04
Working expenditure	£152,741	£143,331	6·57
No. of passengers, including workmen and season ticket-holders' journeys	40,539,464	36,180,308	12·05
No. of passengers carried at workmen's fares	7,050,800	6,646,532	6·08
Passenger receipts	£306,428	£280,483	9·25
Average receipt per passenger ..	1·81d.	1·86d.	2·69
Train-mileage on District Railway	1,743,068	1,666,350	4·60
Car-mileage on District Railway..	7,107,134	6,646,998	6·92

The company's passenger traffic continues to show satisfactory increases, and has justified the improved train service. The widening works between Studland Road and Acton Lane Junction will be completed by next autumn, and will afford additional facilities for further improvements in the train service. The increase in working expenses is due to the increased train service, extra expenses incurred during the Coronation period, including an extra day's pay to nearly the whole of the staff, and for extensive improvements to the rolling stock. Thirty-one new carriages have been put in service during the half-year; 20 carriages remain to be delivered by the builders, and an order has been placed for 14 additional carriages. The Metropolitan District Railway Act, 1911, received the Royal Assent on June 2nd, 1911; the powers conferred by this Act were fully explained in the circular issued to all of the shareholders on June 10th last. It is proposed that the Lot's Road power house undertaking be transferred to a Joint Committee and leased to the Metropolitan District and London Electric Railway companies as from January 1st, 1912. Clauses for the protection of this company have been inserted in the London Electric Railway Bill.

Yorkshire Electric Power Co.

The directors' report for the last half-year states that the gross profit on the revenue account for the last three corresponding half-yearly periods ending June 30th is as follows:—1911, £6,633; 1910, £4,950; 1909, £2,598. The net profit for the same periods, after deduction of mortgage interest, is £4,137, £2,622, £1,070. There has been a general increase in the sale of energy to all classes of consumers, included in which the directors are pleased to note the increase in supply to local authorities and others holding electric lighting orders, as showing a growing appreciation of the advantage of purchasing in bulk from the power company in preference to generating at their own stations. Extensions of mains and plant have been made during the past half-year to meet new demands for the company's supply. The capital expended upon these has not yet become wholly productive. Further agreements have been made for the supply of energy to power users, which will again increase the company's revenue. The balance available at June 30th last was £13,613, made up as follows:—Net profit for the year ending June 30th, 1911, £4,137; net profit accumulated up to December 31st, 1910, £9,886; less preference dividend paid to December 31st, 1910, £410. The directors recommend a dividend (less income-tax) for the half-year ending June 30th, 1911, at the rate of 6 per cent. per annum on the amount paid up on the cumulative preference shares amounting to £1,136, and to carry forward £12,476. Applications for 6 per cent. cumulative preference shares continue to be received, and at the date of this report over £83,000 had been applied for out of the £100,000 authorised.

German Electrical Companies.

The Elektrizitäts Gesellschaft vorm. Schuckert & Co., of Nuremberg, intimates that the dividend for the year 1910-11 is estimated at 7 per cent. This announcement is intended to dispel the report that a higher rate will be distributed.

The Elektrizitäts Gesellschaft vorm. C. Buchner, of Wiesbaden, reports that the turnover in 1910 slightly increased, and the net profits amounted to £1,900, as compared with £2,100 in 1909. It is proposed to pay a dividend of 8 per cent, the same rate as in the preceding year. The course of business in the present year has hitherto been satisfactory, and the company is well supplied with orders.

The report of the Gesellschaft für Elektrotechnische Unternehmungen, of Munich, records a loss of £11,000 for 1910, as against a loss of £31,000 in the previous year, the total debit balance being thereby increased to £49,000 on a share capital of £100,000 and loans of £49,000. As to the cause of the loss in 19 the directors' report states that this was due as regards £8,500 to provision made for the winding up of Austr transactions owing to the bankruptcy of the debtor, whilst remainder was due to the damage to the Illachmuhle electric works by high water, and to a business loss. The company's th electricity works experienced a satisfactory development, and receipts promise to further increase in the present year.

The Isaria Zählerwerke, of Munich, which entered into a co munity of interests with the Brown-Boveri Co. last year, states t the net profits amounted to £15,000 in 1910-11, as contrasted w £13,600 in the previous year. It is intended to pay a dividend 10 per cent. on the share capital of £75,000, being the same rate in 1909-10. The directors' report remarks that the turno increased in all departments, but the augmentation was only possi by agreeing to competitive prices which again largely decli without reason during the year. The expansion in business and adoption of new manufactures induced the company to extend factories in Munich and Schwenningen, with the result that creditors rose from £12,000 in 1909-10 to £92,000 in 1910-11. the other hand, the debts owing increased from £29,000 in 1909 to £76,000 in 1910-11 in consequence of the larger turnover and necessity for following the example of the large firms in grant excessively long credits. It is intended to raise the share capital £105,000.

Central London Railway Co.

The thirty-second ordinary general meeting of the shareholders this company was held on Thursday, last week, at the Holb Restaurant, Mr. H. F. Parshall presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 147), said that dealing first with the cap account, in April last an issue was made of £380,000 4½ per ce preference stock, practically the whole of which was allotted to shareholders of the company. During the half-year £51,464 1 been expended on capital account, of which £40,282 was on acco of the extension to Liverpool Street, and £2,617 for the h level subway connection with the City and South London Railw at the Bank Station. The work in connection with the Liverp Street extension was proceeding satisfactorily, and certain arrar ments had been made with the contractors by which the w would be completed six months ahead of the original contract ti As they expected that the extension would very considerably h their revenue, they had thought it worth while to do everything t could to accelerate its opening, and it was anticipated that unl anything occurred to delay the present rate of progress, it would opened for traffic next year. The high level subway at the ba which was opened last May, had proved a great convenience, son thing like between 3,000 and 4,000 people making use of it dai During the last half-year the railway had carried over 20 milli passengers, showing a decrease of 658,609 passengers compared w the corresponding period of 1910. This decrease was undoubted due to the increased motor-'bus competition along the compan line of route, which had been greatly assisted by the extrem favourable weather which had prevailed. In this connection might be pointed out that from observations made as to the numb of motor-'buses passing their Lancaster Gate Station going ea ward they found a one-minute service of 'buses. Twelve mont ago 162 'buses passed this point in four hours, whereas the servi had now been increased to 205 'buses, carrying an estimated numb of 5,200 passengers, being an increase of 43 'buses with an increa of 1,400 passengers. At certain times of the day as many as eig 'buses had passed their Oxford Circus Station in one minute goi Citywards, and in both directions, in one complete hour, 240 'bus had passed the station, equal to four per minute, with a seati accommodation of 8,160. The decrease in passengers might al be accounted for, to some extent, by the fact that the attendan at the Coronation Exhibition had been much less than former years, owing presumably to the large number counter attractions which had been opened this seaso It was satisfactory to note that under the new organisation, wit out in any way diminishing the efficiency, there had been decrease in the working expenses of £3,420, which had been brough about by economies effected in all the departments. The gro receipts amounted to £150,109, and after deducting workin expenses, there was a balance to net revenue account of £65,90 After providing for debenture interest and other payments, an including the amount brought forward from last half-year, the had a balance of £75,655. A dividend on the ordinary stock at th same rate as last year, viz., 3 per cent., would absorb £27,351, an the preferred would take £11,766, leaving a balance of £36,53 From this balance they proposed to carry forward to the dividen suspense account the sum of £5,883 on account of the deferre stock at the rate of 2 per cent. per annum, which would leave net balance forward of £30,665. The Bill to secure throug running to the Ealing Station of the Great Western Railway ha been passed by both Houses of Parliament, and now awaited th Royal Assent. There was every reason to believe that this connec tion would bring a large amount of extra traffic to the line, ther being large opportunities for development in the neighbourhood of Ealing and Acton, and it was believed that plans were bein made for building on the undeveloped land. During the Coronatio festivities a heavy train service was worked, and on the three days

June 21st, 22nd and 23rd they carried no less than 730,000 passengers, the trains running from 3.30 a.m. to 2.30 a.m. the next day. It was gratifying to say that the vast crowds were safely carried in a comparatively short space of time without a hitch of any kind. The staff worked admirably throughout this trying period, and the Board of Trade had intimated that his Majesty the King had decided to grant Coronation medals to two members of the staff in appreciation of the splendid way in which the crowds were handled. The directors were leaving no stone unturned to make the railway as attractive as possible. On July 1st last, season tickets were inaugurated, and there was no doubt that these had been highly appreciated by the public, with satisfactory results to the company. There had been inaugurated a parcels express service, which had also proved remunerative and was a rapidly growing business. Improvements had been and were being effected at their various stations, in order to make them more attractive to the travelling public. A system of ventilation (the "Ozonair" system) was being installed throughout the line, and would be completed in the very near future. By this system some 80,000,000 cb. ft. of ozonised air was being pumped daily into the tunnels, which would be the means of rendering the atmosphere exceptionally pure. Favourable comment had already been made as to the great improvement which had been effected in the atmosphere at the Bank Station, where the system had been in operation for some weeks.

Lord St. Aldwyn seconded the motion.

Mr. Mather inquired whether the company's engineers had considered whether the time had not come to install fresh plant at the generating station. He thought that considerable economy could be effected by putting in turbine plant instead of the present engines.

The Chairman said that they had had the question of turbines under consideration, but there would not be any justification for their scrapping their existing plant at Shepherd's Bush in order to replace it with turbines. They had Corliss engines of the very best type, and to-day they were running at less than 3 lb. of coal per kilowatt-hour, which was a very fine record for a power house. There was no station in the kingdom—certainly there was none in London—which showed such good working results as they did at Shepherd's Bush.

Mr. Mather said that at Lot's Road power station they were generating on 2¼ lb. of coal per unit.

The Chairman reminded Mr. Mather that at Lot's Road they were generating upwards of 150 million units a year, while the C.L. Co. were only generating 18 millions. He might say that they had considered the question of obtaining a supply from Lot's Road, but taking the capital into consideration, they found that they could generate cheaper for themselves.

The report was adopted.

Capital Expansion in Germany.

A further augmentation of considerable extent is proposed in the capital of the Siemens-Schuckert Works, which will be remembered as being the amalgamation of the heavy electrical engineering departments of the Siemens & Halske Co. and the Schuckert Electricity Co., which hold in almost equal halves the whole of the capital in the first mentioned company. When the A.E.G. became closely associated with the Felten & Guilleaume Co. in September, 1910, and took over the latter's dynamo works at Frankfort, it was reported that the Siemens-Schuckert Works would be compelled to equalise matters, either by increasing the share capital so as to maintain the turnover on the level of the A.E.G., or that the company would have to absorb another electrical manufacturing undertaking. The name of the Bergmann Electricity Co. was mentioned in this connection, but the latter has preferred to retain its independence, and signified its decision by the announced intention of raising a loan of £500,000, which is now being admitted to quotation on the Berlin Stock Exchange. It is stated, however, that quite apart from any considerations of rivalry with the A.E.G., the Siemens-Schuckert Co. has found it necessary to raise additional capital so as to cope with the development of business which started before the A.E.G. became associated with the Felten & Guilleaume Co. In December last the Siemens & Halske Co. and the Schuckert Co. made an advance of £1,500,000 to the Siemens-Schuckert Works, and it has now been arranged to convert this advance into a non-redeemable loan bearing interest at the rate of 6½ per cent., though other creditors are given a preferential right over the loan. In addition, a 4½ per cent. obligation loan of £1,500,000 is to be issued by a syndicate headed by the Deutsche Bank, thus increasing the loan capital of the Siemens-Schuckert Works to £2,500,000, whilst the ordinary capital remains unchanged at £4,500,000. We thus have a total capital of £7,000,000, of which £3,000,000 represents increases in the course of seven months; and the former amount compares with a total share and loan capital of £9,000,000 in the case of the A.E.G. It is now announced that as the demand continues, and the turnover has experienced a very considerable increase in recent months, it is no longer possible for the Siemens-Schuckert Works to postpone extending the works and augmenting the working capital. It is estimated that sites and buildings in recent months have involved an expenditure of from £500,000 to £600,000, of which £50,000 represents the new offices on the Nonnendamm, in Berlin, where £350,000 has expended on the dynamo works completed last year. A further large sum relates to the Gartenfeld estate near Spandau, where a new cable factory is in course of erection; new transformer works at Nuremberg are costing from £250,000 to £300,000, whilst the meter factory is to be extended on the old site in the same town. It is stated that the company hopes to find profitable employment for the fresh loan capital which is being raised at the low rate of interest of 4½ per cent., although the non-redeemable loan of £1,500,000 cannot be said to be cheap at the rate of 6½ per cent.

As far as the Siemens-Schuckert Works Co. is concerned, it is mentioned, as an example of the expansion in business, that since the issue of the last annual report the number of workers employed has increased from 49,000 to 61,000, and as a consequence the augmentation in the working capital merely takes into account the effective requirements of the undertaking. The Siemens & Halske Co., whose financial policy rests in the hands of the Siemens family, and is of a tolerably conservative character, does not propose to make a fresh issue of capital. The company's last issue of an obligation loan took place in 1900, when the share capital was also raised from £2,250,000 to £2,725,000, and the last issue of shares was from £2,725,000 to £3,150,000 in 1908, for the purpose of strengthening the parent company's holding in the subsidiary companies. In the case of the A.E.G., it is announced that a fresh issue of bonds will presumably be made in the autumn in order to increase the working capital, although the question is understood to have been previously brought forward at a board meeting in the spring of the present year. At present the company is still in possession of considerable liquid funds, which are stated to amount to £2,500,000, but one-half is required for covering liabilities, and large sums will later on be needed for the extension of the business. The loan debt now reaches £2,550,000 on a share capital of £6,500,000. The last loan was issued in 1908, and amounted to £750,000, whilst the last issue of shares took place at the end of 1910 in connection with the absorption of the Frankfort dynamo works and the acquisition of a considerable number of shares in the Felten & Guilleaume Co. Although no definite information has been published in regard to the prospective loan, it is estimated that the requirements will be represented by about £1,500,000.

The prospectus issued by the Bergmann Elektrizitäts Gesellschaft, relating to the admission of £500,000 in 4½ per cent. bonds to the Berlin Stock Exchange, states that the turnover invoiced by the company to the end of May amounted to £1,150,000 as compared with £800,000 in the equivalent period in the preceding financial year, whilst the orders on hand also exceeded those on the books at the corresponding date in 1910. A further decline in sale prices has not only not occurred this year, but a slight improvement has taken place in various branches of manufacturing. It is added that if the present course of business continues it may be expected that the company's profits for the current year will be better, although it has to be remembered that the share capital participating is greater than in 1910. The Siemens-Schuckert Works Co., in announcing a further increase in capital, also reports an extraordinary augmentation in the orders received in the course of the past few months, as contrasted with the position a year ago.

The Moore Light in Germany.

The Moore Licht Aktien-Gesellschaft, which was formed in March, 1910, with a share capital of £60,000, increased the capital to £87,000 in the following August for the purpose of acquiring further foreign patents. A loss is now reported for the first financial year of £17,000, of which £5,600 represents provision made for dépreciation of patents, £2,800 is written off for preliminary expenses, and £2,400 for the organisation of the Franco-Belgian business. The deficiency has been extinguished by the surrender by the directors of 340 shares, totalling £17,000, and the shareholders are now asked to agree to make an additional payment of 25 per cent. on their shares, which would then be converted into 6 per cent. non-cumulative preference shares. A Frankfort newspaper, in referring to the matter, draws a comparison between the present position of affairs and that represented over a year ago. It is stated, for instance, that in a circular issued in April, 1910, it was mentioned that orders had been received in seven weeks for about 5,000 installations of the Moore light extending over a period of three years, and that the orders would yield a profit of £112,000, whilst negotiations were proceeding in respect of the conclusion of a large number of further contracts. It was assumed that in three years from 1910 the company would earn net profits of from £150,000 to £200,000, and would be able to pay high dividends and to write off the patent account. But in a fresh circular recently issued to the shareholders, reference is first made to the unfavourable financial results for the past year, and then to the existence of extraordinary difficulties, particularly in regard to the supply of materials and in connection with the erection of the lamps. It is also stated that the yellow colour of the light has not proved advantageous for many purposes, although a solution of the colour question has already been found, and that it likewise appears necessary to still further reduce the consumption of energy. It is also considered essential to extend the company's sales organisation and to open offices in the principal towns concerned, as too much time is said to be lost in concluding business through representatives. The Frankfort newspaper, in commenting on the circular, states that the company's shares were issued much too early, that the Moore light was not ready in a technical sense for general requirements, and that it is to be regretted that the public participated in the risk.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Aug. 2	3,484	+ 340	9	14,851	+ 1,139	..	..
Ayr	„ 5	1,078	+ 67	12	5,040	+ 14	8	..
Bath	„ 5	1,994	— 183	31	25,423	+ 703	..	..
Belfast	„ 4	9,104	+ 977	18	83,240	+10,274	40	3
Birkenhead	„ 6	2,302	— 88	18	21,347	+ 814	13·7	..
Birmingham Corp.	July 29	18,091	+4,758	17	123,271	+16,810	56·8	..
Blackburn	..	..	..	..	..	..	..	..
†Blackpool Corp.	„ 27	2,364	+ 275	..	21,784	+ 3,882	..	..
Blackpool-Fleetw'd	Aug. 5	2,751	+1,283	5	6,925	+ 702	..	..
Bolton	„ 6	5,120	+ 89	19	47,700	+ 3,428	26	..
Bournemouth	„ 2	4,063	— 419	18	32,3 9	— 2,526	22	..
Bradford	July 29	11,420	+ 755	17	97,818	+ 8,334	56	1
Brighton	Aug. 6	3,079	— 551	18⅔	20,229	+ 1,087	9·5	..
Bristol	„ 4	14,749	+ 286	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	July 28	395	+ 40	30	6,486	+ 35	3·65	..
Barnsley	„ 28	367	+ 32	„	5,895	+ 338	..	..
Barrow	„ 28	711	+ 45	„	8,319	+ 568	5·37	..
Devonport	„ 28	1,206	+ 376	„	14,242	+ 1,964	8·85	..
Gateshead	„ 28	2,2 7	+ 141	„	30,840	+ 1,696	11·25	..
Gravesend	„ 28	502	+ 25	„	6,194	+ 173	6·5	..
Greenock	„ 28	1,592	+ 200	„	21,009	+ 2,663	7·25	..
Hartlepool	„ 28	711	+ 90	„	7,733	+ 678	6·72	..
Kidderminster	„ 28	311	+ 55	„	3,312	+ 255	..	..
‡Leamington	„ 28	509	+ 103	„	4,940	+ 173	..	..
Merthyr	„ 28	445	+ 28	„	6,164	+ 112	2·9	..
Metropolitan	„ 28	19,792	+4,478	„	259,952	+41,796	22	..
Middleton	„ 28	780	+ 78	„	9,990	+ 689	8·5	..
Mid. Joint Com'tee	„ 28	8,918	+ 163	„	171,989	+ 2,166	..	..
Oldham—Ashton	„ 28	1,211	+ 46	„	16,874	+ 488	9·13	..
Peterborough	„ 28	270	+ 22	„	3,725	+ 391	5·31	..
Potteries	„ 28	3,882	+ 302	„	57,582	+ 5,655	29	..
Rothesay	„ 28	1,500	+ 12	„	5,546	— 192	2·75	..
Southport	„ 28	777	+ 35	„	8,867	+ 368	8·17	..
S. Metropolitan	„ 28	2,036	+ 384	„	25,357	+ 1,422	..	..
Swansea	„ 28	2,461	+ 157	„	33,476	+ 2,241	12·5	..
Tynemouth	„ 28	850	+ 94	„	7,196	+ 24	3·75	..
Weston-s-Mare	„ 28	862	+ 290	„	3,886	+ 443	3	..
‡Worcester	„ 28	693	+ 47	„	8,562	+ 454	5·75	..
Wrexham	„ 28	210	+ 15	„	2,946	+ 102	..	..
Yorks. Wool. Dist.	„ 28	2,401	+ 185	„	31,299	+ 2,244	17	..
Miscellaneous	„ 28	523	+ 23	„	6,578	+ 352	..	..
Burnley	Aug. 5	2,838	+ 248	..	..	..	11·73	1
Burton-on-Trent	„ 6	621	+ 4	18	5,403	+ 441	6·6	..
Bury	„ 6	2,894	+ 452	18⅔	24,082	+ 2,023	22·5	..
Cardiff	July 29	5,422	+ 766	17	44,064	+ 4,786	..	..
Chatham and Dist.	Aug. 3	2,020	— 182	31	25,865	+ 112	14·98	..
Cork	„ 3	1,146	+ 77	31	15,333	+ 350	9·9	..
†Croydon	July 21	1,940	+ 260	..	30,432	+ 2,756	..	..
Darlington	Aug. 5	240	+ 21	19	4,211	+ 452	..	..
Darwen	„ 4	513	+ 40	18	4,935	+ 437	4·36	..
Dover	July 29	613	+ 96	17	4,488	+ 782	4·75	..
Dublin	Aug. 4	12,504	+ 385	..	38,674	+ 8,504	54·2	..
Dundee	„ 2	2,446	— 42	11⅔	13,970	— 126	15	..
East Ham	„ 5	2,151	— 118	18	20,229	+ 1,137	7·87	1
†Exeter	July 15	404	+ 30	..	5,296	+ 409	5·5	..
Glasgow	Aug. 5	36,092	+4,395	..	180,275	+15,597	98	·75
Hastings	„ 3	2,652	— 479	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 5	5,762	+ 87	18	52,033	+ 2,522	14·5	..
Ilkeston	„ 3	282	31	18	2,431	+ 95	..	..
†Ipswich	July 29	527	— 63	17	7,905	+ 715	10·5	..
Kilmarnock	„ 29	565	+ 146	11	2,018	+ 241	4·25	..
Lancashire United	Aug. 2	2,856	— 30	31	41,145	+ 1,009	39	..
†Leeds	July 29	8,016	— 342	17	132,055	+ 9,833	108	..
Leicester	..	..	..	..	..	..	..	..
†Leith	„ 29	751	+ 98	10⅔	7,738	+ 679	8·72	..
Liverpool	„ 29	24,475	+1,348	30	345,089	+13,575	116	2·5
‡L.C.C.	„ 26	90,255	+7,934	..	761,321	+55,167	141	9
London United	Aug. 5	14,774	—1,271	..	202,994	+ 7,076	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
Manchester	„ 5	32,295	+ 906	19	293,330	+16,223	183	..
Newcastle	„ 5	8,864	+ 190	..	79,135	+ 5,131	14·5	..
Newport	July 29	1,456	+ 80	17	12,742	+ 935	14·5	..
†Oldham	„ 30	2,052	+ 188	18	36,392	+ 2,211	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
†Preston	„ 26	789	+ 54	17	13,513	+ 1,030	..	..
Salford	„ 31	10,021	+ 422	17⅔	87,019	+ 5,190	..	..
Sheffield	Aug. 8	12,738	+ 681	19	123,321	+ 8,295	40	..
Southampton	„ 2	2,836	+ 241	18	24,564	+ 2,750	..	..
Southend-on-Sea	„ 2	1,890	— 117	18	12,461	+ 1,489	..	..
†South Shields	July 29	709	+ 108	17	11,130	+ 1,510	..	..
Swindon	Aug. 2	315	— 18	18	2,834	+ 327	..	..
Tyneside	„ 2	1,272	+ 94	5	2,705	+ 116	..	..
Wallasey	„ 5	2,539	+ 123	18	21,073	+ 3,202	..	..
Walthamstow	„ 5	1,645	— 152	18	14,759	+ 1,179	9	..
West Ham	July 27	5,650	+ 663	17	47,547	+ 5,275	15·25	..
Wolverhampton	Aug. 2	2,035	— 25	18	18,198	+ 1,221	25	..
Cen. London Rly.	„ 5	8,568	—1,817	5	23,192	— 4,534	6·32	..
City & S. Lon. Rly.	„ 6	6,200	— 92	5	15,576	+ 6	7·26	..
Dublin-Lucan Rly.	„ 4	335	+ 68	5	814	— 46	7	..
G.N. and City Rly.	„ 5	2,703	+ 118	5	6,928	+ 241	3·5	..
†L'pool Overh'd Rly.	July 30	1,637	+ 120	..	6,481	+ 628	6·8	1·3
†Llandudno-Col. Bay	„ 29	575	+ 2	34⅔	7,922	+ 392	..	..
London Elec. Ry. Co.	Aug. 5	23,455	— 65	5	62,275	+ 1,305	21·25	..
Mersey Railway	„ 5	3,725	— 398	5	9,500	— 467	4·5	..
Metropolitan Rly.	„ 6	32,805	— 278	5	85,147	+ 429	24·5	..
Met. District Rly.	„ 5	21,107	+ 488	5	54,011	+ 2,967	24	..
Anglo-Argentine	„ 5	83,563	+1,145	..	1,510,698	+143,402	..	..
§Auckland	June 30	17,327	+2,469	52	210,167	+22,754	23·3	·6
Bombay (B.E.T.)	July 7	5,664	+ 623	27	77,101	+ 4,617	..	..
Brisbane	May	21,099	+2,609	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 5	7,706	+ 745	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	June	8,649	..	..	20,434	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	July 31	1,584	+ 191	..	23,630	+ 1,717	..	..
§Montevideo	July	22,012	+1,328	..	226,257	+12,894	..	..
Perth (W.A.)	Aug. 4	3,122	..	..	50,084	+ 5,756	22	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

THE August Bank Holiday recess did little to quiet the minds of those who had been troubled by the variety of foreign and domestic crises which assumed, perhaps, undue gravity in the middle of last week. Chief amongst the markets to feel the changes of sentiment has been the Home Railway, which, after being flat, took a turn for the better on the considerations of good earnings up to date, and the prospect of their being maintained during the current six months, but again gave way on the labour difficulties. There is more doing in Electric Lighting shares, and the Telegraph market still has as its principal object of interest the lively gamble which continues in Marconi shares.

The Electricity Supply market is strengthened by the declaration of a batch of good interim dividends, particulars of which have appeared, and are appearing, in other columns of this paper. The distributions seem to have aroused a little public interest, and investors have begun to take a hand in the shares. It was early in June that a slight buying movement started on account of the expectations as to the companies doing well by reason of the Coronation illuminations; but stagnation has been once more the prevailing conditions for the last six weeks. It cannot be pretended that there is much business going on, but the better tone of the market as a whole testifies to the greater willingness of people to put money into the shares.

The report of the British Electric Traction Company has aroused a considerable amount of criticism which, it seems to us, is entirely justified in attacking the scheme as not being sufficiently drastic. The market comment is on very similar lines. The scheme appears to us to be inadequate in dealing with the present situation, because to have brought the capital into line with the assets, the knife should have been applied for more deeply. It is, we submit, rather ridiculous to perpetuate the exaggerated Ordinary capital by splitting it up into Preferred and Deferred stock. Unless something like a financial miracle should happen, the Deferred will have to be wiped out sooner or later, and surely it would be better to face the situation boldly at once, rather than have another reorganisation of the capital hanging over the company. It is, however, not too late for the scheme to be re-modelled. Everybody would be glad to see this company flourishing and prosperous, but it seems to us hopeless to look for any return on the deferred stock under the plan proposed at present. There are other points for criticism, but none of them more important than this; and though the Ordinary shares may profit at the expense of the Preference for the time being, in the long run the directors' proposals will work out badly for both classes of shares, unless we are very much mistaken. The Ordinary and Preference shares have risen 5s. apiece on balance.

Further rises in the prices of the Mexican Light and Power issues are the feature of this group. The common stock went up 3, but lost 2 points later on; while for the bonds there is still a strong demand. Mexico Trams, on the other hand, have gone back on news from various parts of Mexico showing conclusively enough that the country is still in an exceedingly unsettled state. Rio Trams have been inclined to droop a little, and Shawinigan Capital stock fell 2, but the firmness of the group, as a whole, is noteworthy, the strength appearing more particularly in the prior charge descriptions.

In the Home Railway market, the spread of the dock strike at the end of last week led to renewed depression, which was afterwards wiped out by big rises throughout the list as the situation grew more pacific, only to be renewed on Tuesday after the holiday. Brighton Deferred stock is one of the favourite gambling counters for the reasons indicated here last week, the chairman's speech at the meeting showing how greatly the electrification had assisted in the excellent progress of the traffic receipts. After rising to 104, however, the price fell back to 103. East London Ordinary dropped to 5¾ because of the dock strike, and the definite electrification proposals have so far had little effect upon the prices of the company's stocks, which, of course, had risen in advance. Metropolitans and Districts, after being flat, only partially recovered, and the report of the Great Northern and City Company, reporting more favourable profits, had no effect upon the price of the shares, which remains at £1. In Central Londons there has been a further decline in the price of the Deferred, whilst City and South London lost a point, the market being anything but a good one.

Marconi's maintain their reputation for liveliness and strength, the price shows a further advance of 2s. 6d. Anglo-American Telegraph Deferred has gone back slightly in sympathy with depression in the American Railroad market. Other telegraph descriptions have been inanimate. Telephone varieties show a good deal of firmness. National Telephone Preferred stock, and the third Preference shares are rather higher. United River Plates and Chi Telephones have both improved. The manufacturing group is quiet. A seller of Willans & Robinson Ordinary put the nominal price down to the extent of ⅝ before he was able to realise his shares at a shilling apiece! Castner-Kellner's have hardened a trifle.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	* 10	5⅓	5⅓	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12⅛ — 12⅝	+ ⅛	5 10 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅞ xd	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½ xd	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4⅝	4⅝	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	1/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 2⅝	— ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5½	6	4⅛ — 4⅜	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Hove	5	8½	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6⅞ — 7⅛ xd	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞ — 4⅜	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜ — 3⅝ xd	..	5 3 3
Do. 5 % Pref., Non. Cum.	5	5	5	3⅞ — 4⅛	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	6 5 6
Oxford	5	7	7¼	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9½ xd	+ ⅛	5 5 3
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛ xd	+ ⅛	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅞	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7¾ — 8¼	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	110 —115	—1	6 1 9
Do. 7 % Pref.	$100	7	7	121 —125	+1	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	3/4 — 7/8	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86 — 88	..	5 13 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	1/16 — 3/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	90 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	89 — 91	+1	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	110 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97½ — 99½ xd	+1½	5 0 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	6	7	171 —175 xd	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	45 — 47	..	10 12 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	117 —119	—2½	3 7 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108½—110½	..	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	139 —141	..	5 13 6
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3⅜	67 — 69 xd	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111½—112½	..	5 6 8
Do. Def.	Do.	25/-	30/-	25¾ — 26	— ⅛	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6 15/16 — 7 3/16 xd	+ 1/16	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10¾ — 11	+ ¼	5 9 1
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅝	..	5 14 8
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4¼	4½	7⅞ — 8⅜	..	5 7 5
Direct W. India Cable, 4½ % Rcg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101½—103½	..	3 17 4
Eastern Extension	10	7	7	13¼ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100 —102 xd	..	3 18 5
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½—101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅜ — 11¼	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Jackay Companies Common	$100	4	5	88 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2¼ — 2⅜	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	103 —105 xd	+ ½	5 14 3
Do. Def.	Do.	6	6	119 —122 xd	..	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜ xd	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜ xd	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 7/16 — 5 1/16 xd	+ 1/16	4 7 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102¼—103¼	..	4 7 2
Oriental Telep. and Elec.	1	8	8	1 9/16 — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅝ — 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98½—100½	..	4 9 7
United River Plate Telephone	5	8	8	7 5/16 — 7 7/16 xd	+ 1/16	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	¾	2⅝ — 2⅞	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅞ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅝ — 14⅛	..	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	+1	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 8th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Batb Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅝	.	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1⅝	+ ¼	Nil
Do. 6 % Pref.	10	1½	1½	3¾ — 4¼	+ ¼	3 10 7
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	68 — 70	..	4 5 9
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	49 — 51	—1	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	31 — 32 xd	— ½	4 13 9
Do. 5 % Pref., 1891	100	5	5	108 —110 xd	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105 xd	..	4 15 3
Do. Do. 1903	100	5	5	102 —104 xd	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12¾ — 13½	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅞ — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼ — 2⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3½ — 4	..	Nil
Do. 4 % Deb.	100	4	4	73 — 76	—1	5 5 3
Metropolitan Railway Consol.	100	1	1⅜	46 — 46½	—1¼	3 15
Do. Surplus Lands	100	2¾	2¾	66 — 68 xd	..	4 4
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14
Do. 3½ % Pref.	100	3½	3½	88 — 90 xd	+ 1	3 17
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89 xd	..	3 18
Metropolitan District Ord.	100	Nil	Nil	26¾ — 27½	— ¾	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3¾	90 — 92	..	3 10
Do. 3½ % Gtd.	100	3½	3¾	74 — 76	..	4 9
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32 — 1 1/32	..	5 6
Do. Def.	1	Nil	Nil	⅛ — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	29/32 — 1 1/32	..	4 17
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15
Potteries, Ord.	1	2	2	7/32 — 11/32	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	7 5
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18
South Metro. Trams, 6 % Pref.	1	3	6	1/32 — 3/32	..	10 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9
Do. 6 % Income	100	Nil	1	64 — 66	..	1 10
Do. Power House Debs.	100	..	4	101 —103	..	3 17
Yorksbire (West Riding), Ord.	5	Nil	Nil	¼ — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16 — 5 5/16	..	5 3 6
Do. 2nd Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼ xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	96½ — 98½	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	6½ — 7	..	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	119 —123 xd	+1	4 17 7
Do. 5 % Pref.	100	5	5	106 —119	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102½—104½	+1	4 6 2
Calcutta Trams, Ord.	5	4½	6	5¾ — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	3/32 — 1/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5¾	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf,	1	6	6	1 5/16 — 1 1/16	..	5 13
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	..	5 7
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18
Mexico Trams Com.	$100	7	7	120⅜—122½	— ½	5 14
Do. Gen. Con. 5 % Bonds	..	5	5	99 —100	..	5 0
Do. 6 % Bonds	100	6	6	99 —101	..	5 18
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛ — 7½	..	6 13
Do. 6 % Pref.	5	6	6	5⅞ — 5⅞	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	5/8 — 11/16	..	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝ — 5⅞	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10
Rio de Janeiro Trams	$100	1	4½	116 —117	— ¾	4 5
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18
Do. 5 % Mort. Bonds	100	5	5	97¾ — 98¾	+ ¼	5 1
Sao Paulo Tram, Lt. and P.	$100	10	10	180 —183	—1	5 9
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Soutbern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98 xd	..	5 2
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	5/8 — 3/4	..	8 0 0
Do. 6 % Pref.	1	12	9	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	24	26	5½ — 5⅝	..	6 1 0
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾ — 7⅜	..	6 15 7
Do. Pref.	5	6	6	5¾ — 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/32 — 1/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/4 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	..	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 18 0
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	+ 1/32	4 7 5
Castner-Kellner	1	14	17½	3½ — 3⅝	..	4 17 0
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅛ — ¾	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2
Dick, Kerr	1	6	5	13/16 — 15/16	..	5 6
Do. Pref.	1	6	6	31/32 — 1 1/32	..	5 9
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	9/16 — 11/16	..	Ni
Do. fully paid	5	Nil	Nil	1⅝ — 2⅜	..	Ni
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3
Electric Construction	2	Nil	2½	11/16 — 13/16 xd	..	6 3
Do. Pref.	2	7	7	1 1/16 — 1 1/8 xd	..	7 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8¼	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	8½ — 9	..	5 11
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	15	12⅜ — 12⅝	..	5 16
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7
Do. Deb.	100	4½	4½	106 —108	..	4 3
India-Rubber, G. & T.	10	10	10	11½ — 13½	..	7 8
Do. Pref.	10	5	5	9⅞ — 10⅜	..	4 16
Telegraph Construction	12	17½	20	35 — 37	..	6 7
Do. Deb.	100	4	4	99 —101	..	3 19
Willans & Robinson	1	Nil	Nil	1/32 — 5/32	— 5/32	Ni
Do. Pref.	5	1½	Nil	½ — 1	..	Ni
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

NOTES ON POWER PLANT WORKING.

[COMMUNICATED.]

In the running of power plant it is always desirable that the engineers should be able to know very closely what it is costing to produce the article they supply. By this it is not meant that they should know next Saturday or next Monday what have been the manufacturing costs during the previous seven days, but that, if possible, they should know this minute the present rate of expenditure. It is not desirable to keep too elaborate statistics involving much clerical work.

Many workshop system organisers allow themselves to be carried away by these systems, so much so that some American shops have been, perhaps somewhat humorously, described as resembling offices rather than workshops, so busy has every man been filling up the forms and tickets essential to the system.

In a power house a very elaborate system is not necessary. Far too many statistics are sometimes kept or worked out. Economy of manufacture of electrical energy depends upon a few principal items. First and greatest in a station of any serious dimensions is the cost of coal. Oil will usually come next. Water may or may not cost money, and when it does not cost money the charge may be direct or indirect. Lighting is a charge which may be large or small, and after these items stores generally, once they have been cut down to a minimum, may be lumped together and the total watched.

Enough has been written on the subject of the purchase of coal on its calorific value to rouse men not only to the importance of this as a base of action, but to awaken in them the sense that other qualities than thermal units per penny also demand some recognition. It is a little difficult nowadays for a vendor of coal to come forward and, while admitting an inferiority on the part of his coal in the matter of thermal units, to claim that this is more than outweighed by other qualities. He would be regarded as plausible and yet he might be perfectly right. But this sort of truth lies with the station engineer to discover. Coal consumption can very well be known by some system of weighing more or less near to the actual point of user, the nearer the better for absolute work. The water evaporated can be known and doubly checked by a feed meter and a Lea recorder, the latter probably fully as accurate as the former. The Lea recorder is a particularly valuable instrument because by it can be known in a few minutes the answers to questions, which without the recorder have given in those long steam-engine tests which are so wearisome to make and cost so much, and are so apt to be deprived of much of their value by some mishap during the progress of the test.

The elaboration of oil separation plant in reciprocating engine stations sometimes seems to indicate that it might be better to throw away the water and use new water warmed in tubular heaters by the hot waste water.

It is certain that where water can be got from a well it will cost less than when purchased from the ordinary type of water authority. It is a poor pump and motor combination that will not pump water from a well at 50 per cent. mechanical overall efficiency, and the work done is simply calculable in foot-pounds from the height raised and the gallons per minute. To this cost must be added that of softening, which may or may not be equally chargeable to both purchased and pumped supplies.

The question of independent water supply has of late undergone some modification by reason of the fact that it is now possible to bore deep wells for considerably less cost than a few years ago, before the wide spread oil drilling industry had brought rapid drilling into prominence. A few years ago a bore hole of 1,000 or 1,500 ft. was regarded as a matter of two or three years' working, and progress was very slow. Now with a modern oil drilling rig depths of 100 and 140 ft. have been done in a day in the London area, and the average progress is much more rapid than was the case but a few years ago.

In throwing away greasy hot water, the cost balance includes on the one side the cost of pumping fresh water; the cost of softening; the loss of heat; the interest on the pumping plant, and on the heat transfer plant. On the other side are the cost of regulants, and the cost of make-up pumping, the interest on the smaller pumping plant, and on the oil separation plant. It does not seem to be generally known that very good oil separation can be effected by centrifugal machines; though they are not, perhaps, certain preventives of oil in boilers, they will recover most of the oil clean, and fit for use.

Since records have, as their primary object, the maintenance of economy at the highest figure, it appears unnecessary to work out results as some do in terms of I.H.P., B.H.P., and kilowatts, for these three items do not vary seriously between themselves, and except for occasional tests to find mechanical and electrical efficiencies, the cost per KW.-hour is the figure to be known.

A steam engine is a machine which for a certain use of steam will give a fixed regular amount of work; and more accurate results can be obtained to-day from observations of the instantaneous order than are possible to be got from a prolonged test. A recording instrument shows the rate at which feed water is being used. This rate does not exactly correspond with the rate shown by the wattmeter at the same instant of time, for the water recorder has a few seconds lag behind the wattmeter. But this lag can be closely approximated by observation of the recorder and by sudden change of load. Thus, let the load be changed or the L.P. rate of expansion be changed, and in a few seconds the effect will travel through the condenser and wet-air pump, and show at the recorder. Reverse the changes, and again in a few seconds the recorder will begin to tell the effect. Once determine the lag and afterwards the wattmeter can be read so many seconds ahead of the water recorder. The lag in time is merely the number of seconds which elapses between the time when the governor admits more or less steam to balance the changed resistance of the load, and the time when that steam, condensed to water, has found its way through the resistances of the condenser, through the air pump and into the recorder tank or V chamber. The change begins to be shown almost at once, but a few seconds longer are required for the complete effect to be visible in the float chamber.

It is not possible to watch such a recorder at work without becoming convinced of the extreme regularity with which a steam engine works, and of the futility and money waste of prolonged tests. Perfectly satisfactory tests can be made upon an engine as soon as it has arrived at normal condition. Thus it would conduce to inaccuracy to take a test reading within a few minutes of starting an engine, especially if it has only been warmed through while standing at rest. It takes some time for an engine to become fully hot, and during that time it will show larger steam consumption than when fully heated.

The present expensive tests on the engines at colleges are all very well in their way as exercises in taking readings, but for gaining information on the effects of changed conditions they are altogether too cumbersome. With the suggested method it would not take long to demonstrate the effect of an uncovered cylinder end, or side or of a bare length of steam pipe. Indeed, there is no limit to the statistics that may now be cheaply and quickly secured.

ELECTRICAL POWER AT THE RANDFONTEIN CENTRAL MINES.

A RECENT issue of the *Colliery Guardian* gave some interesting particulars as to the use of electrical power at the above mines, where there are five shafts. The following figures for horse-power were given :—

	Expected max. load.	Total installation.
Ore reduction works	5,710	7,255
Winding...	3,500	5,750
Air-compressors	2,400	3,200
Shaft pumps	1,000	1,575
Lights—		
8,000 incandescents, 140 arcs... ...	500	650
Workshops	150	200
Haulages	120	150
Miscellaneous	620	700
	14,000	19,480

The generating plant includes 24 Babcock boilers, using coal dust costing 6d. to 9d. per ton at the pit, and 10s. 6d. per ton delivered; these supply steam to two 1,000-KW., three 2,000-KW., and two 6,000-KW. Parsons turbines with condensing plant, driving 50-cycle three-phase alternators giving 6,600 volts between phases. These are designed to give their full output at ·7 power-factor, the regulation at unity power-factor being 18 to 20 per cent.

The H.T. switchgear is remote controlled, and mechanically or electrically operated according to size; it supplies 17 H.T. feeders, of three-core paper lead-covered and armoured cable laid direct at about 2½ ft. depth. Standard static sub-stations of 6,000 and 3,000-KW. capacities, consisting of 500-KW. single-phase transformer units are employed. The transformation ratios are 6,600/2,200 and 6,600/550 volts.

The capital cost of the whole plant was over £300,000, and for the power station only, £16 per KW. installed; a typical month's works costs, when over 5,000,000 units were generated, and nearly 4,700,000 units distributed, came to ·247d. per unit—fuel accounting for ·153d. of the total.

At each of the five shafts there are two Ward-Leonard type winders, one for men and the other for rock. The shafts are inclined and rectangular in section, and it is intended to limit the first stage of winding to a depth of 2,800 ft. The following details were supplied officially :—

Maximum speed when winding rock ...	2,000 ft. per min.
,, ,, ,, men ...	1,600 ft. ,,
Total time occupied for winding rock ...	130 seconds.
,, ,, ,, men ...	173 ,,
Interval for loading and unloading rock ...	28 ,,
,, changing men	48 ,,
Weight of rock skip	4,740 lb.
,, skip for men	4,000 ,,
,, rock hoisted per trip	7,000 ,,
,, men, 28 at, say, 150 lb.	4,200 ,,
,, rope...	2·2 lb. per ft.

In the case of a three-phase hoist, the voltmeter indicates whether power supply is on or off, but nothing else; the ammeter under normal conditions indicates torque exerted. Under normal conditions, such as when exerting torque to retard speed, its indications cannot be relied upon unless the power factor is known.

With regard to the first cost of the three-phase and Ward-Leonard systems, the Ward-Leonard hoists were tendered at £8,500 each, as

compared with £6,500 for the three-phase type. Allowing for excavation and the cost of erection, the total cost worked out :—Ward-Leonard system, £10,700 ; three-phase system, £8,300 ; a difference of £2,400 in favour of the three-phase type.

8 Regarding working costs, those of maintenance will not differ much in the two cases. A comparison of power costs, obtained by constructing load curves indicating the speed and power required throughout the day's work, is as follows :—

	Total overall efficiency.	Units per shaft horse-power.	Units per trip.	Cost per trip at ·3d. per unit.
WARD-LEONARD—				
Rock hoisting ...	49·0 %	1·5	13·6	4·08d.
Men hoisting ...	31·0 %	2·36	13·0	3·9d.
Men lowering ...	—	0·159	0·875	0 2625d.
THREE-PHASE —				
Rock hoisting ...	47·5 %	1·55	14·17	4·2d.
Men hoisting ...	28·0 %	2·62	14·4	4·32d.
Men lowering ...	—	2·2	12·1	3·63d.

The costs per day would compare as follows :—

WARD-LEONARD.

470 trips with rock at 4·08d. ...	£7	19	9
54 trips with men at 3·9d. ...	0	17	6·6
54 trips lowering men at 0·2625d....	0	1	2·1
Total power cost per day ...	£8	18	5·7

THREE-PHASE.

470 trips with rock at 4·2d. ...	£8	4	0·5
54 trips with men at 4·32 ...	0	18	7·2
54 trips lowering men at 3·63d. ...	0	16	4
Total power cost per day...	£9	18	11·7

The number of men is taken at 1,500 per hoist. The net result shows a saving on the Ward-Leonard system of, roughly, £1 per day, or £300 a year, which, when established, more than makes up for the difference in the capital costs of the two systems, not to mention the advantages as regards operating possessed by the Ward-Leonard type. Another consideration is the effect of the two systems on the power station.

The electric winders for rock have drums 10 ft. diameter by 4 ft. wide, and are driven by two D.C. motors of 350 B.H.P. each. The brakes are operated by compressed air from the mains, a small auxiliary compressor automatically keeping the pressure above a fixed minimum. A tacheograph provides a record of each trip. Immunity from accident is obtained by utilising the indicators by a simple automatic device opening the circuit, and at the same time applying the brakes, whilst in case of failure of supply from any cause, the brakes are automatically brought into operation. The motor-generator set consists of a 2,000-volt A.C. motor of 800-H.P., driving a D.C. generator at 485 R.P.M. It is intended eventually to extend the electric hoists to the other mines of the group, thus bringing the number up to at least 20.

A NOVEL FORM OF SWITCHBOARD CONSTRUCTION.

A VERY interesting development in switchboard construction for high and medium pressures has recently been originated by the firm of Messrs. Vedovelli, Priestley & Co., of Paris, and in connection with the sub-stations on the North-to-South Underground Railway in Paris switchboards constructed in alabastrine, on the principle about to be described, have been installed. So successful has been the use of this material, which is a substance somewhat resembling cement, but taking longer to harden, and when hard closely resembling marble in durability and finish, that other installations have been effected, and the firm now builds a line of standard panels for high-pressure work, to which reference will be made.

The switchboards are constructed on the cubicle system ; that is to say, each piece of apparatus and each main conductor has its separate chamber or duct at the back or front of the board. Fig. 1 is an illustration of the switchboard of the Muette sub-station, which feeds the old section of the Champs-Elysées, at Paris, and which is constructed entirely with Vedovelli-Priestley apparatus and the alabastrine construction. The arrangement of the cubicles contained therein can be easily seen, the operator being protected from contact with the live parts by means of open metallic screens. This arrangement has been found to be most economical and safe, and the erection of the whole installation was carried out with the greatest facility.

As another example may be shown the cellular construction of alabastrine monoliths employed on the high-tension three-phase switchboard at the Necker sub-station of the North-to-South Underground Railway in Paris. This is seen in fig. 2, this being a corridor at the back of the board. The line voltage of 10,000 or 13,000 volts is transformed to a working secondary voltage on a three-wire system of 600 volts between outer and neutral, the rail being made the neutral conductor on the actual traction system, and both the high and low-pressure boards are constructed on the system mentioned. As the control and safety devices of an important traction system of this nature must be above suspicion, it is evident that alabastrine as a mode of electrical construction is worthy of attention.

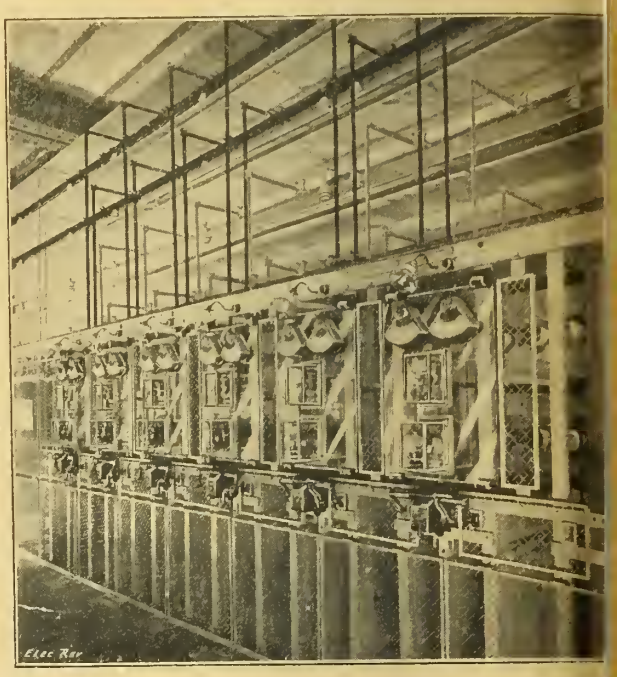


FIG. 1.—FRONT OF VEDOVELLI-PRIESTLEY SWITCHBOARD.

Reference has been made above to the very slow-setting nature o alabastrine. It takes about a month for a useful hardness to b attained, but the process continues until, at the end of about thre months, an extraordinary durability is reached. In addition to it mechanical solidity, it possesses electrical insulating qualities in very marked degree. In some recent tests on an alabastrine she or partition, a distance of 20 millimetres between contacts, an of a surface equally extended, was subjected to high voltage, an its insulation broke down at about 15,000 volts after about 15 minute subjection to pressure. The same test taken with porcelain on a spa

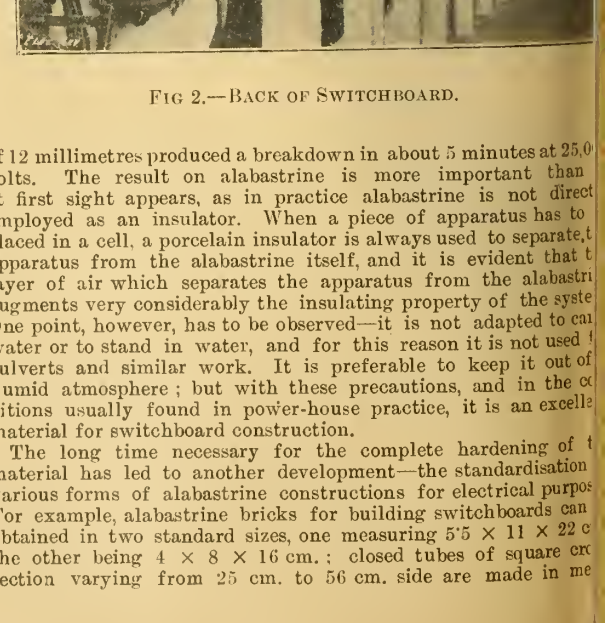


FIG 2.—BACK OF SWITCHBOARD.

of 12 millimetres produced a breakdown in about 5 minutes at 25,0 volts. The result on alabastrine is more important than at first sight appears, as in practice alabastrine is not direct employed as an insulator. When a piece of apparatus has to placed in a cell, a porcelain insulator is always used to separate t apparatus from the alabastrine itself, and it is evident that t layer of air which separates the apparatus from the alabastri augments very considerably the insulating property of the syste One point, however, has to be observed—it is not adapted to ca water or to stand in water, and for this reason it is not used culverts and similar work. It is preferable to keep it out of humid atmosphere ; but with these precautions, and in the c ditions usually found in power-house practice, it is an excell material for switchboard construction.

The long time necessary for the complete hardening of t material has led to another development—the standardisation various forms of alabastrine constructions for electrical purpos For example, alabastrine bricks for building switchboards can obtained in two standard sizes, one measuring 5·5 × 11 × 22 c the other being 4 × 8 × 16 cm. ; closed tubes of square cr section varying from 25 cm. to 56 cm. side are made in me

engths; channels for the enclosure of high-pressure conductors of he cross-section shown in fig. 3, in which dimension *a* varies from 60 to 600 millimetres, and dimension *c* from 200 to 520 millimetres, re standardised in 2-metre lengths, while partitions of the shape hown in fig. 4 of height *a* ranging from 400 millimetres to 700 nillimetres are used for general switchboard construction. In ddition to this a complete range of monoliths is made, the most nteresting examples of which are complete panels of the cellular ype, each comprising all the apparatus for a transformer, feeder, enerator or measuring panel as the case may be. A typical nonolith, with the apparatus mounted thereon, is shown in ig. 5; this represents a panel containing a section of the ain bus-bars at the top of the board, each in its separate duct, rom which connections are taken through isolating links to the hree poles of a three-phase oil-break switch, each phase being in

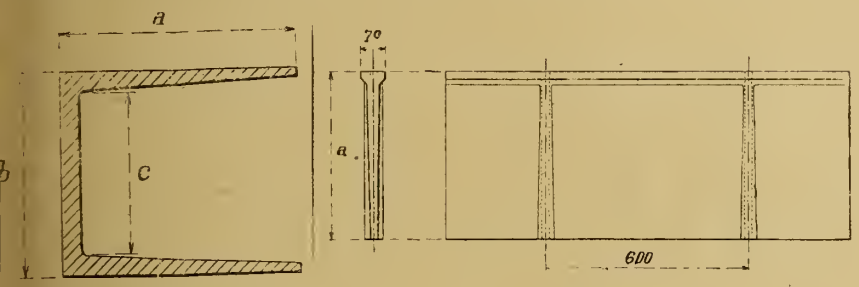


Fig. 3. Fig. 4.

Alabastrine Channel and Partition.

separate oil tank. The lower part of the board has a throw-over witch, so that either of two cables may be utilised.

These monoliths are standardised to a uniform height of three netres, a width of 9 centimetres, and a depth of 9·5 centimetres, nd are capable of dealing with working pressures up to 10,000 olts. The current-carrying capacity of the contacts is 150 amperes, nd the power which can be dealt with by the circuit interrupters s about 2,000 kw. These figures of course, refer to the standar- ised models, though there is no reason why alabastrine and porce- ain insulators should not be applied to higher voltages, or why the nonoliths should not be constructed for larger power units. An dvantage of this form of construction is that a switchboard can be imply and quickly put together by ranging an appropriate series f monoliths side by side and connecting up the bus-bars and a few imple auxiliary connections.

SOME PROTECTIVE RELAYS FOR ALTERNATING-CURRENT CIRCUITS.

By Kenelm Edgcumbe.

(*Concluded from page* 165.)

Number of Relays Required for the Adequate Protection of Various Systems.—Whereas in the case of measuring nstruments, it is only under normal conditions that their erformance need be considered, with relays, on the other and, it is particularly under abnormal conditions that their orking must be irreproachable. For this reason, many of ne methods of connection which are admissible in the former se are by no means advisable in the latter. As an example, three-phase three-wire system with insulated neutral may e cited. It is well known that in such a case the sum of the ree currents is always equal to zero, so that two trans- rmers connected to three ammeters will indicate the cur- nts in each of the three phases, and this is, in fact, the andard method of connection for such a system. It is hown in fig. 15, where C T_1 and C T_2 represent the current ansformers, and A_1, A_2 and A_3 the three ammeters.

When, however, relays are substituted for these latter, it always advisable to add a third current transformer in ne 3, for the following reason. It is quite possible for the sulation of the neutral point of the generator, or of the inding in phases 1 or 2, to become very low, without this ct being apparent under ordinary working conditions. On the occurrence of an earth in main 3 (fig. 15) a heavy current may return to the generator without flowing through lines 1 or 2 at all, and thus neither of the relays would trip.

It may be argued that this is a hypothetical case, and one

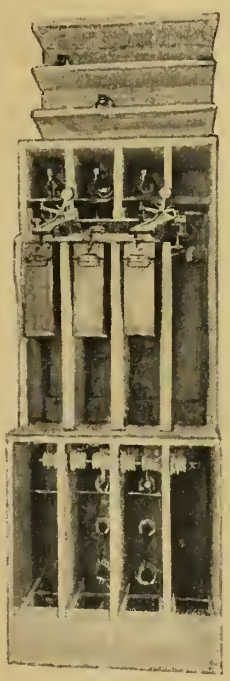


Fig. 5.—Standard Panel.

which is not likely to occur in practice. Unfortunately, it is precisely the least likely occurrences which have to by guarded against in devising protective devices, and probable in no part of the switchgear is economy so misplaced. To save a £5 note on a generator or feeder panel in this way

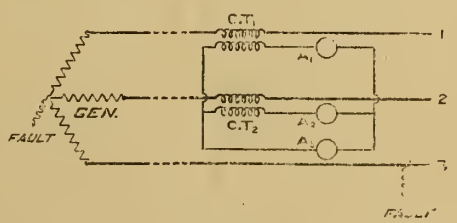


Fig. 15.

may mean endangering not only an expensive generating set but the entire station, and what is often of even greater importance, the continuity of supply throughout the whole system.

Another frequently unsuspected source of trouble may be mentioned as having recently come under the notice of the writer. It has reference to the installation of reverse relays

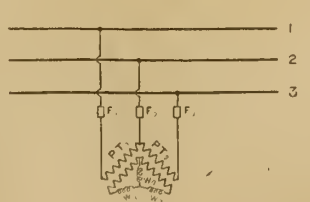


Fig. 16.

on a three-phase system. The usual connections are shown in fig. 16, where P T_1 and P T_2 represent two pressure transformers connected across the phases, and having the pressure windings of the reverse relays W_1, W_2 and W_3 joined up to them in star. Protective fuses F_1, F_2 and F_3 are inserted

between the transformer terminals and the lines. Suppose fuse F_3 to open circuit for any reason, then the idle secondary winding of $P T_2$ forms a link connecting the outer end of W_3 to the outer end of W_2, so that W_2 and W_3 are in parallel with one another, and in series with W_1, across the terminals of $P T_1$. As a result, the current in W_3 is in phase with the line voltage between phases 1 and 2, so that a current in phase 3, lagging by 30°, will have the effect of a reverse current 60° out of phase with that in W_3. Hence, since $\cos 60° = \frac{1}{2}$, a forward load equal to twice that at which the relay has been set to trip will be enough to actuate it. This difficulty can be entirely overcome by using either three single-phase pressure transformers or one three-phase transformer, in place of the two single-phase shown in fig. 16. If the system has an earthed neutral, three single-phase transformers or one three-phase are always to be preferred, and to avoid complications due to triple frequency currents, they are best connected in star, with their neutral points earthed on both primary and secondary sides.

It should hardly be necessary to add a word of warning against the use of combined double and triple relays (that is to say, induction relays, consisting of a single disk acted upon by either two or three electro-magnets), were it not that these instruments are still occasionally put forward. In the case of a three-pole relay of this pattern, each of the electromagnets is connected to the secondary of a current transformer in one of the phases, so that an excess of current in all or any of the three phases will tend to rotate the disk and to trip the relay. Under normal conditions, each phase thus contributes one-third to the total torque, and the relay must therefore be set so that, with the three phases equally loaded, it will trip with the required overload. If, however, the fault occurs on one phase only, it is evident that the relay will not act until the current in that particular phase has risen to three times this value. For this reason, the protection afforded by such apparatus is most precarious.

The following table may prove useful as showing the number of relays and transformers required for the adequate protection of various systems. Two alternatives are given in each case, so that in less important installations, where expense is of primary importance, a more economical system may be adopted if this is thought advisable :—

System.	Number of relays overload or reverse.		Number of current transformers.		Number of pressure transformers for reverse relays.	
	Minimum.	Recommended.	Minimum.	Recommended.	Minimum.	Recommended.
Single-phase insulated	1	2	1	2	1	1
Single-phase earthed	1	1	1	1	1	1
Two-phase (4-wire) insulated	1 × 2	2 × 2	1 × 2	2 × 2	2	2
Three-phase (3-wire) insulated	1	3	2	3	2 single ph.	3 single ph. or 1 3-ph.
Three-phase (3 or 4-wire) earthed	2	3	3	3	,,	,,

In what has been said, so far, no attempt has been made to distinguish between the various types of fault which may arise—such, for example, as short circuits between phases, faults to earth, the seizing of motor bearings, and so forth. The outward and visible sign of all such faults is an excess of current flowing in the line, so that in general no attempt is made to differentiate between them, simple overload protection being provided for dealing with faults of every kind.

In many cases, however, it is of importance to be able to single out an "earth" for special treatment. This question has recently been brought into special prominence by the recommendations of the Home Office Committee, appointed to consider the working of the existing rules as regards the use of electricity in mines. This Committee strongly advocates the provision of some arrangement whereby the circuit shall be immediately opened on the occurrence of an earth, while not being disturbed by a mere overload, which may b quite temporary.

In the case of a three-phase system with insulated neutra a dead earth may develop on one main without its presenc being known to anyone, unless some form of leakage indicato

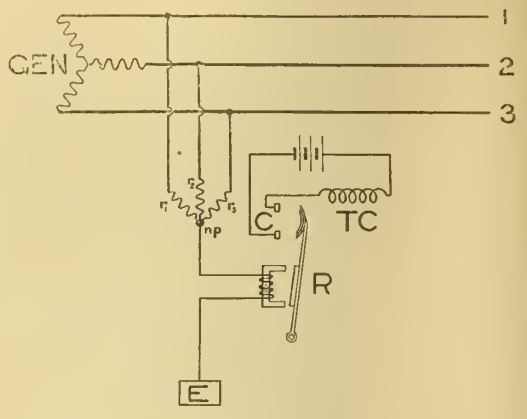


Fig. 17.

is in use. Fig. 17 shows the simplest form of automat protection against earths on such a system. The resistanc r_1, r_2 and r_3 are joined up so as to form an artificial neutr point $n p$. Between this and earth, a relay R is connecte which latter device may either be instantaneous in its actic or be provided with a time lag.

Normally the neutral point $n p$ is at the same potenti as the earth, so that no current flows through the coil of th relay R. If an earth develops on any main, this balance disturbed, a current flows through R, the contacts C a closed and the tripping coil T C acts.

Instead of connecting the relay between $n p$ and earth, may be joined between the neutral point of the generato and earth, provided this neutral point is accessible. high-tension systems, a three-phase transformer takes th place of the resistances r_1, r_2 and r_3, these latter and th relay R being connected to the transformer secondaries.

When the neutral point is permanently earthed at th generating station, a fault to earth at once shows itself by want of balance between the three currents. So long as th insulation is sound, the sum of the currents in the thr lines at each instant will be zero, no matter whether the loa be balanced or not. The writer, some years ago*, propose to employ this fact as a means of protection by the use of current transformer having three primary windings, on connected in each line, and a common secondary windin joined up to an indicator or relay. This arrangement ha since then, been employed by Messrs. Merz and Price an other engineers.

Mr. E. B. Wedmore has recently devised the ver ingenious and satisfactory method of protection shown fig. 18. It is applicable to all three-phase systen

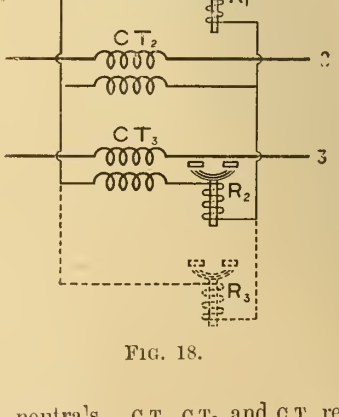


Fig. 18.

having earthed neutra's. C T_1, C T_2 and C T_3 represent thr current transformers, one being connected in each line. and R_2 are two relays, and neglecting, for the moment, th

* Electrical Review, June 16th, 1905, page 968.

connections shown by dotted lines in the figure, it will be clear that an overload on any one or more of the phases will inevitably trip either R_1 or R_2.

These relays, therefore, provide adequate protection against overloads. Should an earth develop on any of the three lines. the current will return to the neutral point of the generator through the earth and a corresponding secondary current will necessarily flow through the relay R_3. With this arrangement accordingly, it is possible to adjust the two sets of relays quite independently of one auother, as regards both tripping current and time lag. For example, the two overload relays may be set to trip with a 50 per cent. overload and a time lag of 20 seconds, whereas the leakage relay setting may be, at the same time, 25 per cent. of full load, and instantaneous in its action.

The advantage of being able to discriminate in this way between an earth and a pure overload will be at once evident, and it will be observed that the arrangement does not entail the installation of more than the three current transformers and relays which have been already advocated.

General Considerations.—There are two main methods of tripping in use. The one consists in closing an auxiliary continuous-current circuit through the circuit-breaker, while in the other the secondary current of a current transformer is employed. The first method is shown in fig. 2. It is of universal application, and, wherever an auxiliary source of continuous current is available, is strongly to be recommended. As a 200-volt or 500-volt circuit is usually employed for this purpose, it is advisable never to break the current at the relay contacts, but to provide a contactor which is automatically opened by the circuit-breaker when it comes out. It is clearly inadvisable to employ a potential transformer for the purpose of tripping, owiug to the fact that on the occurrence of a fault the pressure may fail.

For the relay contacts, carbon rods are the most satisfactory, as they have no tendency to stick and are practically indestructible. For low-voltage tripping, however, laminated copper contacts are sometimes preferred, owing to their smaller resistance.

Fig. 19 shows the second method of tripping—namely, by means of a current transformer C T. The contacts C are normally closed, so that the trip coil of the circuit-breaker

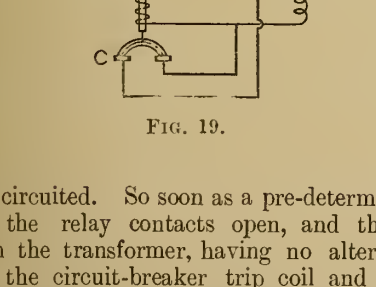


Fig. 19.

T C is short-circuited. So soon as a pre-determined current is exceeded the relay contacts open, and the secondary current from the transformer, having no alternative path, flows round the circuit-breaker trip coil and operates it. For the purpose of such a relay, it is essential that the resistance of the contacts should be low, and, for this reason, mercury cups are often used.

This system of current transformer tripping is only applicable to relays intended to protect against an overload. In the case of reverse relays protecting generators, it cannot often be employed owing to the fact that the relay setting corresponds, as a rule, to too small a current to satisfactorily work the circuit-breaker. In some other cases, such as where reverse relays are employed to protect feeders, this difficulty does not arise.

A further disadvantage of this system, as compared with that just described, is that it is not possible to trip the relays by hand with a view to seeing that everything is in satisfactory working order.

Most reverse relays are so deficient in power, as has already been seen, that it is not deemed advisable by the makers to allow them to close even the relay contacts direct. This is often done accordingly by tipping over a balanced contact arm, or by releasing a spring which presses the contacts together. Both these arrangements suffer from the great disadvantage of not being self-resetting, so that they have to be opened by hand before the circuit-breaker can be again closed.

To obviate this necessity, the form of contact shown in fig. 20 is fitted by Messrs. Everett, Edgcumbe & Co. to all their reverse relays. In series with the contact C, and the trip coil T C, is an auxiliary electro-magnet A M, which, when

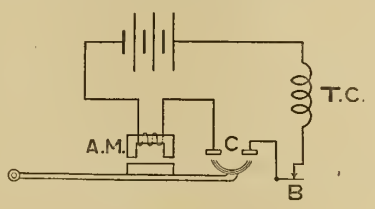


Fig. 20.

excited, draws up the iron keeper attached to the relay contact arm, and so presses the contacts C firmly into place. The lightest contact at C is enough to excite the auxiliary magnet, and a reliable contact is instantly made. The circuit-breaker in coming out opens the circuit at B, and the relay then resets itself and is ready to operate again. The advantages possessed by this arrangement, as compared with mercury cups on the one hand, and a non-resetting device on the other, are obvious.

As regards the most suitable time lags, no definite rules can be laid down, as the best interval must necessarily depend very largely upon the nature of the plant, the length of the feeders, the character of the load, and so forth. For this reason the time lag should be easily and accurately adjustable, and, as has already been said (p. 128), it is essential, in the case of relays intended for working in series, that the time lag curves should neither pass through the zero line, nor meet one another, however great the overload to which they are subjected.

In the case of feeder protection by means of overload time limit relays, it may be said that the time lag of the relays on the feeders leaving the power house should be made as long as possible, while those on the various feeders branching out from them should be set for shorter and shorter intervals as the more distant parts of the system are reached. This arrangement ensures that the relay nearest the seat of the disturbance shall trip before any of those between it and the power house. In a good many stations, settings of 15 or 20 seconds on a 50 per cent. overload are found to meet all requirements as regards outgoing feeders, but in other cases, very much shorter times, down to, say, $1\frac{1}{2}$ seconds, are found necessary. This is particularly the case where synchronous machinery is in use in the sub-stations, since, if a long time-lag is given, a bad short-circuit may produce a hunting of the synchronous motors, which increases in severity until one or more of them drops out of step. In such cases, the only satisfactory method is to adjust the time lags empirically after the plant is running.

Artificial Rain.—A booklet has come to hand describing an invention by Mr. E. Olsson, of Buenos Ayres, called the artificial rain system combined with electricity for agriculture. Quotations from local newspapers are given regarding the system, which consists mainly in watering the plants under cultivation by means of revolving sprinklers. There is nothing new in this, and as might be expected, the plants so treated thrive. Unfortunately, however, electricity is dragged into the scheme, being applied by passing a current of a few amperes through the water in a tank; a report by a local "Quimico é Ingeneiro" and an "Electro-quimico" is quoted, describing the changes produced in the water, and certifying that "the water electrified with 5 amperes 110 volts was able to kill locusts perfectly. The same effect is produced by a current of 3 amperes 110 volts passing through water." We do not doubt this for a moment; in fact, we would willingly stake our reputation on the ability of London tap-water to kill any locust, with or without 3 amperes. "We also confirm that incandescent lamps were made to light and an electric bell to ring by means of a current which you conducted through the well-water," say the learned reporters. We accept this statement also. But we protest against the second title of Mr. Olsson's brochure—"Electrified Water as Food for Plants (patented)," and for the benefit of any Argentine reader who may be misled by the inventor's claims, and of the inventor himself, we must point out that this sort of "electrification" is utterly useless, and the idea is evidently based upon ignorance of electrical phenomena.

EXPERIMENTS ON THE INSULATING PROPERTIES OF LEATHEROID AND PRESSPAHN.

By D. H. OGLEY, B.Eng., Royal Technical Institute, Salford.

A large number of specimen pieces of the above materials having been selected at random, they were divided into four groups, which were then subjected separately to the following treatment :—Group A, vacuum dried ; Group B, normal condition : Group C, exposed to damp atmosphere ; Group D, impregnated.

The thickness of the material was as nearly as possible ·2 mm. and ·5 mm., and all dielectric strengths were taken between brass disks 1 in. in diameter. The frequency of supply being 50, National Physical Laboratory conditions were agreed with.

To eliminate as far as possible errors due to varying conditions, all the tests were taken on the same day, and the specimens were allowed to remain before being tested 10 minutes in the test-room atmosphere. The following results were obtained :—

Group A (Vacuum dried).

·2 mm. Presspahn. (Actual Thickness, ·22-·23).

Breakdown voltage.	*Time in seconds.*
2,310	45
2,520	40
2,000	Withstood this pressure for 10 minutes without breakdown.

·5 mm. Presspahn. (Actual Thickness, ·5-·53).

Breakdown voltage.	*Time in seconds.*
7,056	45
7,250	10
6,700	4 minutes.
6,000	10 minutes without breakdown.

·5 mm. Leatheroid (Actual Thickness, ·45-·47).

Breakdown Voltage.	*Time in seconds.*
7,980	45
8,100	25
7,890	27
7,100	4 minutes
6,900	10 without breakdown

Group B (Normal condition).

·2 mm. Presspahn (Actual Thickness, ·22-·235).

Breakdown Voltage.	*Time in seconds.*
2,310	45
2,100	50
2,600	10

·5 mm. Presspahn. (Actual Thickness, ·5-·53).

Breakdown Voltage.	*Time in seconds.*
7,100	45
6,500	120
6,400	180

·5 mm. Leatheroid (Actual Thickness, ·46).

Breakdown voltage.	*Time in seconds.*
3,528	45
2,700	60
2,510	90

Group C (Exposed to damp atmosphere).

·2 mm. Presspahn (Actual Thickness, ·21-·235).

Breakdown voltage.	*Time in seconds.*
2,000	30
1,930	120
2,200	20

·5 mm. Presspahn (Actual Thickness, ·48-·55).

Breakdown voltage.	*Time in seconds.*
6,130	10
5,540	35
5,400	60
5,880	30

·5 mm. Leatheroid (Actual Thickness, ·48-·99).

Breakdown voltage.	*Time in seconds.*
2,940	40
2,700	20
3,070	10
2,520	10 minutes without breakdown.

Group D (Impregnated).

·2 mm. Presspahn (Actual Thickness, ·31-·32).

Breakdown voltage.	*Time in seconds.*
10,400	3
10,000	4
8,900	30
6,300	3 minutes.

·5 mm. Presspahn (Actual Thickness, ·63-·68).

Breakdown voltage.	*Time in seconds.*
11,000	45
12,000	10
8,010	4 minutes.

·5 mm. Leatheroid (Actual Thickness ·52-·55).

Breakdown voltage.	*Time in seconds.*
11,610	45

Some samples of presspahn were placed in an oven an kept at 100° C. for a week, and the following results wer obtained :—

·2 mm. Presspahn (Actual Thickness, ·2-·22).

Breakdown voltage.	*Time in seconds.*
2,180	30

(This result was obtained at six different places, showing grea uniformity after treatment.)

2,016	2 minutes.
1,840	10 „

·5 mm. Presspahn (Actual Thickness, ·5-·53).

7,400	45 seconds.
6,500	3 minutes.
5,880	10 „

The treated material was impregnated with insulati shellac compound.

The results indicate that presspahn retains its insulati properties under varying conditions. Thus, after being a damp atmosphere for a week, the puncturing voltage w very little lower than after being heated for the same leng of time to 100° C.

Also, under normal conditions the dielectric strength very little inferior to that obtained after heating.

Leatheroid, however, deteriorates rapidly as an insula if damp, or even under normal conditions. For slot lini presspahn would therefore be more suitable.

After impregnating, the dielectric strength increas enormously for the ·2 mm. presspahn. Being the same f ·5 mm. presspahn and ·5 mm. leatheroid, it is obvious that t increase is merely due to the layer of compound, and not any improvement in the material.

In the case of presspahn, with the exception of impregnati special treatment seems of little value ; but leather requires heating to improve its insulating properties.

In all cases the pressure was brought up to breaking str in as nearly as possible 30 to 45 sec.

Copper.—The decrease in the visible supplies for J has not been so heavy as was to be anticipated from mid-monti returns. From Messrs. Merton's circular we learn that Europ visible supplies now stand at 68,025 tons, a reduction of 2,147 t on the returns for the end of June. Stocks in Havre have increa 50 tons, making the total reduction for English ports 1,772 t Afloat from Chile are 575 tons more than at the end of June, w from Australia come 1,000 tons less. Rotterdam has increased stocks 350 tons, and Hamburg is estimated to be holding 300 t more, the net decrease in Europe being thus 1,122 tons. Supp from North America to this country are above average, to Europe slightly below. Spanish supplies are low to England France, but above average to all Europe. Shipments from C are above average, from Australia slightly below. Deliveries 38,791 tons to an average of 41,363 tons. American supplies drop 3,922 tons during June, and the world's visible supplies 6,263 t The average decrease in European supplies for the past 12 mon has been 2,456 tons, in the world's supplies for the past four mon (*i.e.*, since the present falling-off set in) 3,534 tons.

Power from Peat.—The Gorlitz Maschinen Anstalt states that a system has been devised which affor solution of the problem of utilising peat moors for the produc of power that is of great importance. An installation of this h has been erected at the Posen Exhibition, where the result years of experiments are shown to the public for the first t and a similar plant has been erected in Russia, and is in reg operation.

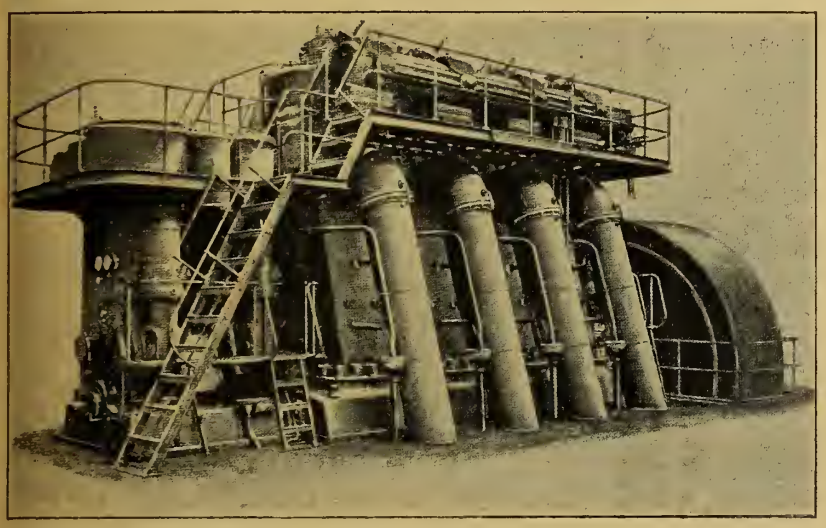
PROCEEDINGS OF INSTITUTIONS.

Modern Diesel Oil Engines.

By F. Schubeler.

(Abstract of paper read at the Zürich Meeting of the Institution of Mechanical Engineers, *July*, 1911.)

As regards reliability the Diesel oil engine can now be considered as fully equal to the steam engine, only the question of economy in each individual case deciding which of the two prime movers takes the preference. There was one principal difficulty which had



2,000-2,400 b.h.p. Two-Cycle Diesel Engine.



Diagram of Two-cycle Diesel Engine.

be overcome. The extremely high pressures and temperatures of the Diesel process put a limit to the dimensions of the cylinders, which will hardly exceed a diameter of 30 in. This corresponds to an approximate cylinder output of 300-400 H.P., assuming 150 P.M. of the shaft and the ordinary Otto cycle. It is not advisable to provide for more than six cranks, and a larger number would produce an inadmissible twisting of the shaft. Furthermore, such units require a great amount of space and would become extremely costly. These reasons called forth the necessity of seeking other means by which to increase the specific cylinder output of the ordinary single-acting Otto-cycle engine.

For this there are the following possibilities:—

1. By making the single-acting Otto-cycle machine as a double-acting one.
2. By adopting the single-acting two-stroke cycle.
3. By adopting the double-acting two-stroke cycle.

The double-acting Otto-cycle cylinder under (1) corresponds approximately to a doubling of the cylinder output.

Almost the same result can be obtained by the procedure under (2), which, however, necessitates, as will be explained later on, the provision of special scavenging pumps.

The solution under (3) would theoretically even quadruplicate (in fact about 3·4 times) the output of the ordinary Diesel engine cylinder and mean the adoption of the usual working process of steam engines for the oil engine.

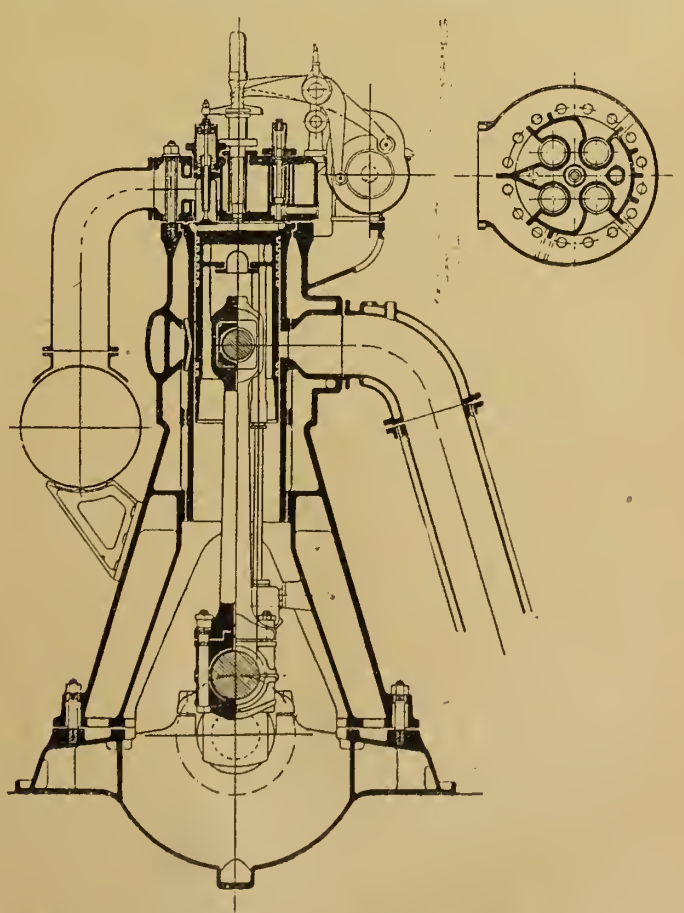
For smaller and medium size units the single-acting Otto cycle takes the preference, involving the smallest working strain on the cylinder. Although this type of engine necessitates a more or less frequent cleaning of the internal parts, especially of the exhaust valves, the author is informed that such machines have worked for periods of six to eight weeks without interruption, even in cement factories and mills.

The normal type of the single-acting four-stroke engine is a vertical one with trunk piston and without special crosshead. This has not only the advantage that the wear and tear of the piston is very slight, but also others with regard to the construction of the inlet valve and the symmetrical shape of the combustion-chamber. The space required is comparatively small, which is frequently an important advantage, and permits of good utilisation of the foundations upon which the enormous free forces of the cylinders are transmitted vertically.

The horizontal type, which is carried out by various firms, is especially suitable where small head-room is essential, and resembles in its construction that of the normal gas engine. The free forces are more awkward to deal with, and some difficulty also arises with regard to the formation of the combustion-chamber and the introduction of the fuel into the cylinder.

In the single-acting two-stroke cycle engine an exhaust valve is dispensed with, the piston uncovering, at the end of its outward or downward stroke, slots arranged in the cylinder wall through which the burnt gases escape from the cylinder. By means of a special scavenging pump an air pressure of about 4 lb. is produced. This lightly compressed air enters the cylinder through a valve arranged in the cylinder cover, drives the burnt gas out of the cylinder, and fills the latter again with a new charge of air as soon as the piston in its upward motion covers the slots. The air valve being closed, the air is compressed as in the ordinary Otto cycle engine, and also the fuel introduced in the same way at the end of the upward stroke. The whole process of driving out the gases, and the refilling of the cylinder take place within a very short time at the end of the outward or downward stroke. The length of the slots is about one-fifth of the stroke. With the ordinary Otto cycle machine two entire strokes are available for this process.

As to the two-stroke cycle process, this is the same as the well-known one employed with the highly-developed gas engine (Körting, Oechelhäuser). It is even more suitable for the Diesel engine. The two-stroke cycle gas engine scavenges also at the stroke end with fresh air, the difference, however, being that at this stage of the process the combustible mixture is introduced into the cylinder by a special gas pump, even before the exhaust slots are entirely closed. It therefore is impossible to prevent part of the combustible gases escaping unused in the exhaust, creating thereby a possible danger with the engine. With the Diesel engine the fuel is only introduced at the end of the compression stroke, thus preventing any losses of fuel and danger of preignition. The Diesel engine has, furthermore, the advantage that the rather bulky and



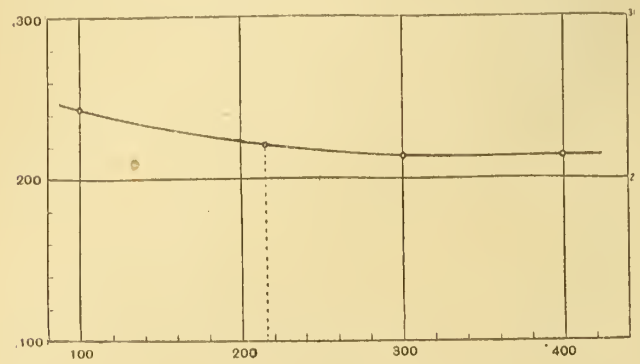
Vertical Section. Section through cover.

Two-Cycle Diesel Engine.

power-absorbing gas pump can be dispensed with. It has also been ascertained that two-cycle gas engines show an increased fuel consumption at partial loads, whereas the two-stroke cycle Diesel engine has with smaller loads, consumptions which only differ slightly from those obtained by normal load. Of course, the consumption of the two-cycle engine is somewhat larger with respect

to the effective output than for the single-acting Otto-cycle engine. This must amount at least to the percentage of the energy absorbed by the air pumps. There must also be another increase due to the short cleaning and filling process of the cylinders, which does not allow as perfect scavenging as with the four-cycle engine. With the latter under its worst conditions about 7-10 per cent. of the cylinder volume (representing the compression space) is liable not to be fully replaced by fresh air.

As one great advantage, it may be mentioned that the turning moment is much more favourable, and consequently the revolving masses for obtaining a certain degree of cyclic variation are much lighter. The two-cycle engine furthermore guarantees better starting and better conditions for regulation, which is specially important for engines direct-coupled to alternators. The space required is considerably smaller and the engine is also lighter, and therefore cheaper. The difference in price between an ordinary single-acting



Consumption Curve of 400-b.h.p. Marine Diesel Engine.

four-cycle and a single-acting two-cycle engine for an output of 1,000 h.p. amounts to about 25-30 per cent., which figure would have to be considerably increased if larger units were compared. Furthermore, the lubricating oil consumption is somewhat smaller per horse-power, as the same cylinder and bearing dimensions are sufficient for producing about double the output.

The chief advantage of the two-stroke engine is the elimination of the exhaust valve (or two with larger units). Some difficulties cannot be avoided with the latter as soon as it attains large dimensions. Generally speaking, the fewer working parts coming into contact with the hot gas the better. The scavenging valve (or valves) in the cylinder cover may be dispensed with. Only a part of the cylinder slots are then used as exhaust slots, the remainder on the opposite side being used for the introduction of the scavenging air. A special shape is given to the top of the piston to guide the current of scavenging air and to guarantee a thorough removal of the burnt gases. The scavenging valve is thus removed from the high temperatures, and only the fuel valves and starting valves are exposed to them.

In the gas engine the stuffing-box problem may be regarded as solved. On the other hand, it must be admitted that with the Diesel engine the conditions to be dealt with are much more unfavourable, only to mention the higher pressure. It will therefore be preferable to avoid the difficulties with the stuffing box in the first instance, and to develop the new type on the lines of the single-acting four-stroke cycle engine.

A large number of the component parts remain the same for either type of Diesel engine, especially the fuel pump, fuel valve, air pump, piston, &c. The air pumps are to-day generally carried out as two or three-stage piston pumps with inter-coolers. Whereas smaller units have as a rule an air pump attached to each cylinder, driven by a lever from the connecting rod, it is a general practice to provide for larger units one large common air pump producing the injection air for three or more cylinders. The pump may be arranged either horizontally or vertically at one end of the bed-plate. This arrangement reduces the number of engine parts to be controlled and also the first cost. The valves are generally metallic ones, which alone are able to stand the high temperatures.

Messrs. Sulzer Bros. use the crosshead of the scavenging pump as low-pressure stage for the injection pump.

For lubricating the cylinders, special small oil pumps, that is, one for each cylinder, are provided. For bearings, connecting rods, &c., forced lubrication is generally advocated. The pump for the forced lubrication is driven direct from the shaft, and may be a piston or cog-wheel pump. The engines fitted with forced lubrication are totally enclosed. The cylinders are always cooled, but the pistons only from a certain size upwards. The water is generally led to the engine by gravity and only under a small head. A very simple arrangement for the piston cooling, which does not require any stuffing-box, and the working of which is absolutely reliable, deserves mentioning. With this arrangement the water does not entirely fill the cooling space of the piston, the water being only squirted against the highly-heated surfaces and draining off through a pipe which surrounds the spray pipe. By this arrangement all additional pressures and strains are eliminated. The exhaust valves for small engines are not cooled. Some firms use no cooling device even for large engines.

In practically all types the fuel-valve is operated through levers and rollers by cams fixed on a side shaft, which open the valve during 10-15 per cent. of the stroke, irrespective of load. The amount of fuel allowed by the regulator for any specified load accumulates around the fuel-valve spindle in a space filled with the highly compressed air, which, at the opening of the spindle, forces the oil through an atomiser into the cylinder. At smaller loads the regulator acts upon the fuel-valve in such a way as to reduce the amount of oil. The fuel-pump has a constant stroke, and the regulating of the fuel quantity takes place by the governor acting upon the suction valve, through which part of the fuel can flow back into the suction chamber. If a greatly reduced oil quantity is delivered to the fuel-valve, or, in other words, at small loads, it may happen that no ignition is effected, probably on account of the great air surplus extinguishing the forming flame. To avoid this the air pressure has to be reduced at smaller loads, which is done by hand in the case of smaller engines. Should this regulation be forgotten no danger arises with the engine, the result being only a decrease in the number of revolutions until the regulator again delivers a somewhat increased amount of fuel For larger engines and especially where the conditions for synchronising are more stringent, the regulation of the injection air is done automatically by the regulator.

There is a large selection of cheap liquids available for fuel, the most important being: Crude mineral oils, mineral oil residues (crude naphtha, mazout), also gas oils, that is, intermediate products of oil refineries from which the lightest constituents, such as benzine and petroleum have been distilled, and the gas oil-tar of water-gas works. More recently it has been found possible to utilise the by-products of the distillation of coal and paraffin, tar solar and paraffin oil. Explosions or danger of fire on account of the high flash-point are eliminated, and any quantities of such fuel may be stored without danger and without being subject to legal restrictions.

For standard low-speed single-acting four-cycle engines the number of revolutions lies between 150 and 300 at respective capacities of 1,000 and 15 h.p. These engines have the best fuel consumption, but have also the disadvantage that they are heavy and expensive. For this reason a single-acting multiple cylinder high-speed four-stroke cycle engine was designed, which is especially suitable for direct coupling to dynamos. The speed varies between 220 and 350 r.p.m. for outputs varying between 1,000 and 100 h.p. These high-speed types are just as reliable in service as the low-speed types. They have, however, a slightly higher fuel consumption. On account of their smaller first cost they are especially suitable where the Diesel engine is intended as a standby.

Single-acting two-stroke engines with outputs ranging between 700 and 3,000 h.p. are made with speeds of 160-140 r.p.m.

The calorific efficiency, with respect to mechanical output, may attain 30-40 per cent.; 25-30 per cent. is lost in the cooling water and the rest is contained in the exhaust gases. Of the latter heat about 20 per cent. can eventually be utilised for heating purposes, and in adding also the heated cooling water the total efficiency of a Diesel unit may go up to 80 per cent., which is certainly remarkable. Messrs. Sulzer Bros. have brought out a special waste-gas utiliser.

With regard to the actual costs per b.h.p.-hour, assuming a fuel price of 50s. per ton (which is certainly an outside figure) this will amount to about 0·11d. to 0·13d., or about 0·16d. to 0·2d. per kW hour. These figures are the actual figures maintained during actual service.

The Heating of Cables with Current.

By S. W. Melsom, A.M.I.E.E., and H. C. Booth.

(*Abstract of paper read before the* Institution of Electrical Engineers, *June 11th*, 1911.)

The object of this paper is to describe an investigation which was made at the National Physical Laboratory, at the request of the Wiring Rules Committee of this Institution, in order to determine the temperature rise and current density for a given temperature rise in cables of various sizes and with different types of covering.

Lengths of 40 ft. of various sizes of cable were tested, the small rubber-covered cable being tested when laid under various conditions, such as in wood casing, iron tubing, &c.

The insulation of the cables was of the standard pattern, the paper-insulated ones being lead-covered, and the rubber-insulated (with the exception of the 0·3 sq. in., which was only rubber-covered and taped), being taped, braided, and compounded. The rubber-covered cables marked A on the curves, and the paper-insulated lead-covered cables marked E, were in each case laid out flat along the wood

TABLE I.

Diameter of cable.	Total area of both cables.	Area of inside of tube.
0·23 in.	0·08 sq. in.	0·33 sq. in.
0·40 in.	0·25 sq. in.	0·60 sq. in.

floor of the room, the lead and return being close to and touching each other. The concentric paper-insulated lead-covered cable P1 on the curves, were laid straight out along the floor, the current being led into the inner and returning by the outer lead. In the case of the rubber-covered cables in casing, marked B on the curves, the casing used was in each case twin and of the standard size for the various cables. The casing in some cases allowed of a rather larger air-space than in others. The ideal condition, from the point of view of dissipation of heat, is to have the cable nicely filling the

groove. The casing was laid flat along the floor. Observations made with it screwed to a board and supported on one edge, with the wires one above the other, showed no difference whatever from those made with the casing laid flat and with both wires in the same horizontal plane.

The iron tubes used were supplied by the Wiring Rules Committee for the various sizes of cables. In each case both the lead and return cables were drawn into the same tube. The dimensions of the tubes and the size of the cables are given in Table I. It will be seen that there was a considerable amount of air-space inside the tubes which would tend to retard the dissipation of heat.

The cables marked C on the curves were drawn into the iron tubes and laid staight out along the floor. In the case of those marked D and D′ the tnbe was embedded in a block of plaster running the whole

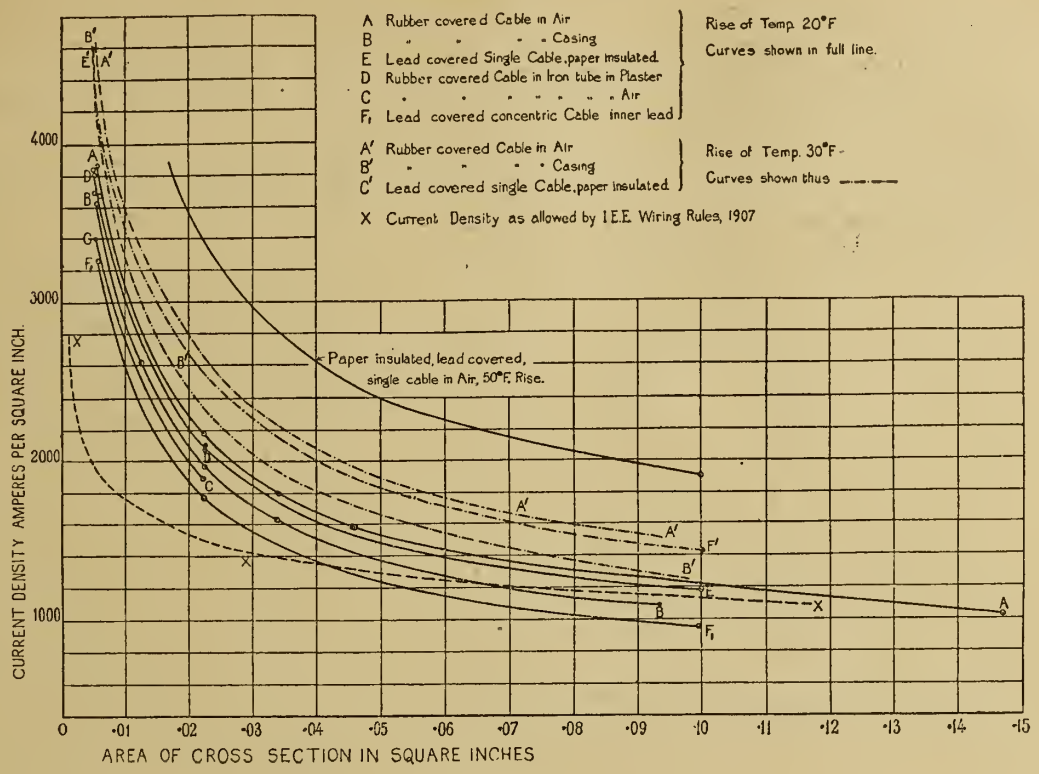


FIG. 1.

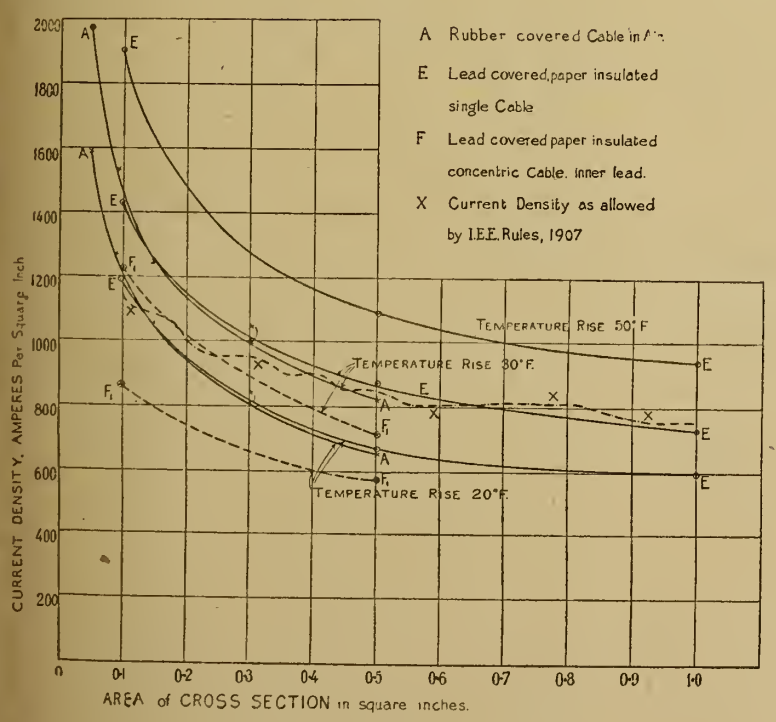


FIG. 2.

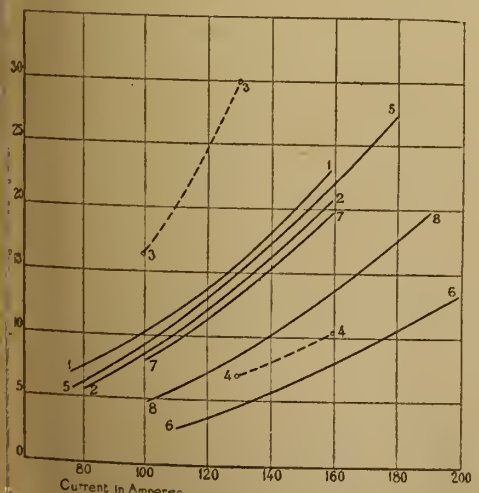


FIG. 3.

Curve No. 1.—Paper-insulated lead-covered cable laid out along floor.

Curve No. 2.—Rubber-covered, in iron tubing, each conductor in separate tube.

Curve No. 3.—Rubber-covered, lagged with blanket along its whole length.

Curve No. 4.—Rubber-covered, laid inside a ventilating shaft, along which a current of air at about 16° C. was being drawn by a fan.

Curve No. 5.—Solid bare copper conductor, of the same cross-section as the stranded cable, suspended in still air from insulator supports.

Curve No. 6.—Paper-insulated lead-covered cable buried direct in wet earth 4 ft. down.

Curve No. 7.—Paper-insulated lead-covered cable enclosed in 3" earthenware pipe and buried, same as No. 6.

Curve No. 8.—Rubber-covered cable in earthenware troughing filled in with bitumen and buried, same as No. 6.

length of the tubes, the plaster being 4 in. deep by 6½ in. wide.

The increase of temperature of the cables was determined by measuring the increase of conductor resistance.

The temperature coefficient of the cables was determined over the range of temperature covered by the tests, and is expressed by the formula—

$$R_t = R_{15}\{1 + 0{\cdot}0040\,(t - 15)\},$$

where R_{15} is the resistance of the conductor at 15° C. and R_t its resistance at t° C.

For the cables to which the wiring rules would apply there is little, if any, difference between the heating with direct and with alternating current.

Generally the current-carrying capacity of the rubber cables for a temperature rise of 20° F. is about 10 per cent. less when they are run in casing than when they are laid out along the floor—*i.e.*, in air (the latter, of course, approximates to the conditions of cables cleated to a wall or in a wood chase). There is very little difference between the rubber and paper-insulated cables when laid under similar conditions. The difference between rubber cable in casing and in iron tube in air (*i.e.*, laid along the floor) is very small. When, however, the iron tube is embedded in plaster the cooling is distinctly better, the curve being nearly the same as that obtained with the lead-covered single cable.

Figs. 1 and 2 are curves showing the result for the whole series of cables tested in current density per square inch of conductor for a given temperature rise.

Each of the cables examined was run with a steady current until a final maximum rise of temperature above that of the surrounding air was attained. The time required for this varied according to the size of the cable, from two up to five or six hours.

It was found that in certain cases—*i.e.*, single rubber-covered cables in air and in wood casing and paper-insulated lead-covered cables, both single and concentric—the connection between cross-section and current density could be fairly represented by a formula of the type $i = K(D/S)^n$, where n is a constant and K depends on the system of units adopted and the amount of the temperature rise. If i is the current density in the copper conductor in amperes per square inch, S the cross-section of the copper in square inches, and D the diameter of the outside covering of the cables in inches, the following table shows the value of these constants in the cases indicated.

For concentric and twin cables the formulæ are the same as for lead-covered single cables

if s, the total cross-section, is taken as being both that of the lead and the return conductors.

The dotted curves marked "X" in figs. 1 and 2 give the current-density allowed by the 1907 Wiring Rules. It will be seen that this gives a temperature rise of about 20° F. for cables of from 0·05 sq. in. to 0·15 sq. in. rising to rather more than 30° F. for cables up to 1 sq. in. section. For cables smaller than 0·05 sq. in. the temperature-rise with the current density at present allowed is much less than 20° F. (in the case of a 3/18 cable in casing it is only about 7° F.).

The conductivities of the wires in five of the cables were tested, and they all were found to be between 99 and 100·3 per cent.

TABLE II.—For Temperature Rise of—

Type of Cable.	20° *F.*	30° *F.*	50° *F.*
Rubber covered in air	$i = 364\ (D/S)^{0·616}$	$i = 457\ (D/S)^{0·616}$	—
Rubber covered in casing ...	$i = 309\ (D/S)^{0·66}$	$i = 358\ (D/S)^{0·66}$	—
Lead covered ...	$i = 429\ (D/S)^{0·50}$	$i = 536\ (D/S)^{0·50}$	$i = 688\ (D/S)^{0·50}$

In the curve on fig. 3 are shown results obtained with 19/14 cable laid under various conditions. These results were preliminary, and the observations were not made so accurately as in the case of those before described. It will be seen that there are very large differences between the various methods of laying.

The extent to which the nominal rating of cables might be modified where the load is intermittent in character was also investigated. The larger sizes of cables only attain their final steady temperature after running for some hours; as a consequence of this effect, cables which are only working intermittently may be run considerably above their normal rating without at any time exceeding the maximum temperature rise permissible.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIAN COMMONWEALTH.—With reference to the notice which recently appeared in the Electrical Review, regarding a revision of the Australian Customs requirements as regards the declaration of origin of goods imported into the Commonwealth for entry under the British Preferential Tariff, the Australian Customs Authorities have now issued a decision in which it is notified "that, in connection with the British Preferential Tariff of the Commonwealth, it has been decided that goods in which all manufacturing processes are performed in the United Kingdom, from unmanufactured raw material of foreign origin, are entitled to preference, irrespective of the proportion of the value produced by British labour.

"The wording of paragraph 2 of the Certificate required in connection with shipments of British goods for which preference is claimed is to be so interpreted."

Note.—For purposes of reference it may be stated that paragraph 2 of the Form of Certificate which is required to be produced with entry and invoices of goods entered under the British Preferential Tariff reads as follows:—

(2) That every article mentioned in the said invoice has been either wholly or partially produced or manufactured in the United Kingdom.

Samples liable to Duty.—A Customs Order (No 1,432), dated June 14th, 1911, has been issued stating that samples of merchandise are frequently sent by English manufacturers to residents of the Commonwealth. These samples are posted in consignments of some hundreds. It has been decided that in such cases duty is to be charged notwithstanding that the amount to be collected on an individual package does not exceed 1s.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,874. "Methods of producing electrical oscillations." W. H. Eccles and A. J. Makower. July 24th.

16,875. "Contact breakers for use in electric ignition systems of internal combustion engines." B. Brooks and F. H. Alston. July 24th.

16,878. "Distributors of magneto-electric machines for internal combustion engines." B. Brooks and F. H. Alston. July 24th.

16,894. "Memorandum and like appliances for use in connection with telephone and other purposes." E. F. M. Branson and F. H. Bowden (trading as Branson & Bowden). July 24th.

16,902. "Manufacture of magnetic electrodes." Chemische Fabrik Buckau. (Convention date, July 22nd, 1910, Germany.) July 24th. (Complete.)

16,907. "Earthing devices for electrical circuits." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke, Germany.) July 24th. (Complete.)

16,919. "Reversing switches for electric motors." Easton Lift Co., Ltd., and J. Huggett. July 24th.

16,923. "Electric lampholders." A. Rickards and A. C. Beale. July 24th.

16,952. "Glowing body for incandescent electric lamps." W. F. Moha and F. Hansen. July 24th.

16,954. "Telephone instruments (receiver)." E. C. R. Marks. (G. R. Webb, United States.) July 24th. (Complete.)

16,955. "Transmitter for telephones and other sound transmitting instruments." E. C. R. Marks. (G. R. Webb, United States.) July 24th. (Complete.)

16,956. "Telephone instruments, including transmitters." E. C. R. Marks. (G. R. Webb, United States.) July 24th. (Complete.)

16,962. "Electromagnetic circuit breakers." Compagnie des Compteurs Aron. (Convention date, July 27th, 1910, France.) July 24th. (Complete.)

16,968. "High-pressure current distributors for electric ignition apparatus." W. Heyer. (Convention date, July 23rd, 1910, Germany.) July 24th.

16,986. "Multiple contact in thermo-electric elements." P. Ferra July 25th.

16,992. "Process and arrangement for forming an electric arc." B Duschnitz. (Convention date, July 29th, 1910, Germany.) July 25th. (Complete.)

17,006. "Wind power electric storage installations or apparatus." W. P Perry. (Divided application on 13,430, of 1911. June 6th.) July 25th.

17,007. "Electrically-heated cooking apparatus." W. P. Perry. July 25th

17,020. "Method of effecting telegraphic or telephonic communication between distant points at sea or between a ship and the shore, or across strip of water." J. R. Quain and F. L. Roudebush. July 25th.

17,027. "Telephone receiver of the radiating field type." A. Vojen. (Convention date, August 30th, 1910, Belgium.) July 25th. (Complete.)

17,028. "Application of radio-active phenomena to telephony." A. Vojen (Convention date, March 4th, 1911, Belgium.) June 25th. (Complete.)

17,039. "Electric lamps or filaments therefor." M. Weertz. July 25th.

17,040. "Alternating-current commutator generators." Siemens Bros Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) Jul 25th. (Complete.)

17,046. "Safety device for electric cables." Siemens-Schuckertwerk G.m.b.H. (Convention date, July 25th, 1910, Germany.) July 25th. (Complete

17,051. "Electric alarm clock." F. Goss. July 25th. (Complete.)

17,053. "Make and break device for the primary circuit of electr magnetic ignition." W. Heyer. (Convention date, July 25th, 1910, Germany July 25th. (Complete.)

17,060. "Electric furnaces." British Thomson-Houston Co., Ltd. (Gener Electric Co., U.S.) July 25th.

17,061. "Electrical igniters for gas, oil and similar internal combustio engines." A. R. Bellamy. July 25th.

17,064. "Signalling apparatus." Graham & Latham, Ltd., and L. Graham. July 25th.

17,086. "Automatic electric burglar alarm, working with its circuit open o closed, and fed by a double circuit connected to the two terminals of single battery producing a constant current." H. C. Basuyau and V. A Leroux. July 26th.

17,110. "Means for cooling enclosed electrical machines." E. Huther (Convention date, July 26th, 1910, Germany.) July 26th. (Complete.)

17,121. "Electrical switches particularly adapted to electric light sockets. H. W. Lake. (R. A. Schoenberg & Co., U.S.) July 26th. (Complete.)

17,132. "Manufacture of electric accumulator electrodes and means fo use therein." R. Pape. (Addition to 905 of 1911.) July 26th.

17,140. "Electro-pneumatically or electrically-operated organ or multipl instrument-playing mechanism and the like." A. R. Trist. July 26th.

17,142. "Magnetically-operated switch." C. B. Larzelere. (Conventio date, August 2nd, 1910, United States.) July 26th. (Complete.)

17,149. "Electrical oscillation apparatus particularly adapted for use i wireless telegraphy." G. C. Dymond. (Ges. fur Drahtlose Telegraphie m.b Germany.) July 26th. (Complete.)

17,151. "Telegraphic systems." P. Faiella. (Addition to No. 4,920/191 Convention date, July 30th, 1910, Italy.) July 26th. (Complete.)

17,162. "Magnetic-control of buoyant figures and the like floating in liquid." T. Sendall. July 27th.

17,179. "Manufacture of electric steel." V. Stobie. July 27th.

17,189. "Means for direct-coupling internal-combustion engines an dynamos." V. R. Nicholson and H. R. Ricardo. July 27th.

17,204. "High-tension distributors for electrical ignition systems for interna combustion engines." F. H. Royce and Rolls-Royce, Ltd. July 27th (Complete.)

17,208. "Current transformer for high voltages." Siemens Bros. & Co., Lt (Siemens & Halske Akt-Ges., Germany.) July 27th (Complete.)

27,211. "Semi-automatic telephone exchange systems." F. T. McBeat (Convention date July 27th, 1910, United States.) July 27th. (Complete.)

17,214. "Devices for controlling cooks, switches and the like." D. Anderso July 27th.

17,263. "Earthing device for electrical conduit fittings." W. K. Partingto July 28th.

17,281. "Electric cells." A. P. H. Pouteaux. July 28th. (Complete.)

17,284. "Automatic circuit breakers." E. A. Fagerlund. (Conventio date August 8th, 1910, Sweden.) July 28th. (Complete.)

17,286. "Electric switching devices." H. S. Hatfield. July 28th.

17,294. "Supports for electrical conductors." Callender's Cable an Construction Co., Ltd., and C. W. Kay. July 28th. (Complete.)

17,300. "Telephones." B. Gwozne. (Addition to 11,234 of 1911. Conven tion date, December 2nd, 1910, Germany.) July 28th. (Complete.)

17,304. "Method of and device for locking the high tension of electrically driven vehicles." Allgemeine Elektricitats Ges. (Convention date August 13th, 1910, Germany.) July 28th. (Complete.)

17,347. "Wiring for electric lighting and for analogous purposes." W. T Henley's Telegraph Works Co., Ltd., and W. F. Bishop. July 29th.

17,357. "Process for the removal of scale and oxide from iron and steel surfaces and the like." S. O. Cowper-Coles. July 29th.

17,358. "Apparatus for use in electroplating." S. O. Cowper-Coles July 29th.

17,359. "Apparatus for scouring or cleaning tubes, rods and the like." S. Cowper-Coles. July 29th.

17,360. "Apparatus for use in electro-plating." S. O. Cowper-Coles July 29th.

17,361. "Apparatus for pickling and electro-plating small articles." S. Cowper-Coles. July 29th.

17,362. "Electro-galvanising." S. O. Cowper-Coles. July 29th.

17,363. "Telephones." B. Gwozdz. (Convention date, June 3rd, 191 Germany.) July 29th. (Complete.)

THE
ELECTRICAL REVIEW.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1911 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE STRIKE TROUBLE.

BREACH of faith, contempt for the very laws they have forced on the community, pillage, arson, and, at Liverpool, even homicide; such is a brief catalogue of the week's misdemeanours of men who, without reason, have elected to strike at the expense of the whole community. There is a very fever of striking in the hot summer air. Indeed, it is arguable on many grounds that this semi-insanity has its origin in the physiological effects of that long-continued heat and brilliant sunshine which students of the different races of mankind tell us are not the climatic conditions in which the Aryan people have attained their best development. A few days of downpour would probably be the best thing we could hope for.

It appears to have occurred to the promoters of the strikes that transport of goods and of food offered the best field for their destructive energies, and so they set themselves to place London and other places in a state of siege. We may take it that the men who are striking are a small minority of the community more or less reinforced by every blackguard hooligan who never has, nor never will, try to do a good day's work. The method of procedure is first to cease work in defiance of all obligation. Men under the Conciliation Act who have been glad to seize the benefits of an arbitration when it has gone their way are literally cursing this very Act which they forced, on the railways more particularly, four years ago, and since the Government persuaded the employers to accept this Act, and so *loose* control of their own business to that extent, the Government are bound to see to it that the other parties adhere to its provisions. But what do we see?

Carts and vans overturned, and their drivers intimidated by that travesty of words "peaceful picketing." Such a thing never did exist, does not exist now, and never can exist, for were picketing ever to become peaceful, it would imply an intelligence that would scorn to use such a weapon.

Do the men realise their own case? They strike against the community. If unsuccessful, they fall back on the poor law to support them and their families. Suppose the community struck, and withheld their poor rates and rose *en masse* against the Guardians, where then would be the strikers?

There is a proper and peaceful way of putting forward requests for improvement. But these strikers go out without recourse to the very machinery organised for their benefit. Most of them are in receipt of regular employment. Their pay may be small, though we do not believe it is so little as that of many men in less certain work, and it is much more than that of many—perhaps most—casual labourers. Yet we find some of the strikers crying out that they are paid less than the dockers' 8d. But the docker is casual; he works like a Trojan on a particular job, draws £3 in a comparatively short time, and then, perhaps, stands

off as long or twice as long, waiting for the next job, yet compelled to be on the watch for it.

The L.C.C. tramway men are threatening to strike, and they make a very unreasonable demand, for they ask special pay on public holidays. Tramway work is special work. Men are only too glad to get into it. They know what it is they are undertaking. Every L.C.C. employé knows that public holidays are busy tramway days. If a carpenter asks for extra pay on a public holiday, it is a reasonable asking, for he is a member of the public. But a policeman who starts to grumble on account of night work, or a sailor who would not pull a rope on Sunday, would be on a par with a tramway man who asks special pay on public holidays. The police, the tramway men, railway men, postmen, and all the similar classes of labour, are not strictly to be regarded as members of the public. They are, by choice, the servants of the public, and they all have certain advantages which more than make up for their various hardships. The real public, who pay these men, must be the final arbiters, for some of these malcontents are better off than very many of the ratepayers.

If a man is dissatisfied with his position, he has perfect freedom of action, and may give in his notice, draw his final week's pay and seek other and more congenial work. But he elects to punish his employers, who can really do without the tramways at a pinch, as they did without them until quite lately. We dwell on the tramway threat because tramways, both in London and elsewhere, are a portion of the electrical industry which has been so fastened upon and so hopelessly muddled by the municipal men of this country. There is no real discipline in municipal tramway working —perhaps we may except Glasgow. It is notorious that the employés of the L.C.C. tramways are regarded and regard themselves from the standpoint of voters. Every trivial matter must go to the Highways Committee. Of discipline in the ordinary business sense there is none, but let the Council stand firm for once and refuse to be coerced. We think the public would, for a while, put up with the walking if the cars were stopped.

But to return to the strikers' picketings.

As a body, the strikers belong to that class who raise the cry of "the right to work." But how do they act on the principle? By preventing others from working, by intimidation, van wrecking, and even by turning a harmless passenger and his baggage out of a cab.

This howling mob has been permitted to cripple London's food supply without let or hindrance. Thousands of tons of food have been destroyed, trade disorganised and the community put to severe loss because the Government, in a moment of great emergency, have refused to support law and order, and to enforce the terms called for by the very men who now refuse to be bound by them.

The sympathetic strike is also very much in evidence. Because Jones has a grievance and goes out, Smith must break his own employer's windows out of sympathy.

Smith who might far better help Jones out of his own wages, elects to idle with Jones in the ditch of pauperism. It seems silly to write of such things. They are incomprehensible, if not unbelievable. And so we see factories full of silly girls throwing up their work and parading the streets out of "sympathy," and on the top of it all, the men's leaders climbing to wealth and power, using the ignorance and summer madness of the men as a ladder on which to climb, as in 1897.

Yet the men who are striking are, all round, in steady work, and steady work at moderate pay is far better and more remunerative than casual labour. They are, as said above, in receipt of far better incomes than some of the ratepayers or taxpayers. Probably much of the trouble arises from sheer economic ignorance. It is a very common fallacy of belief that the Government, and the C and the town have a bottomless pocket of money, out which it is possible to pay every man what he wants. these authorities have power only to squeeze money out taxpayers, and taxpayers are wanting to know why t should pay so much to men who are better off than th selves. Is it possible after so many years of compuls education that ignorance of these matters prevails throu out the mass of what we might rightly term the privile workers? Do they believe that by rioting, pillage and cendiarism they will enable the public the better able to b the increased expense which the extravagant demands n entail on all of us if acceded to?

On Tuesday morning the Prime Minister and President of the Board of Trade called into conference w them the Presidents of a number of important employ associations, for an exchange of views concerning present position of affairs, and to consider the possibi of improving the means available for preventing shortening industrial wars. Sir Andrew Noble and Alexander Siemens were representatives of the enginee trades at this Conference. Mr. Siemens, it will be recal was a leading spirit in the Engineering Employ Federation which successfully coped with the enginee strike of 1897. On the afternoon of the same day re sentatives of the principal trade unions were likewise ca into conference with the same Ministers.

It is to be hoped that the pulse of industry and la being thus hurriedly felt, may do something to Ministers a better understanding of the position. profoundly hope also that they will, by the whole serie very disastrous events, be brought to see that S interference with industry brings the most serious sequences to everybody.

The State has interfered of late in many ways entirel the supposed interests of the labourer. Such interfer has not been by any means an unmixed benefit for class. Much of it has sapped the independence of people. And in this matter we should like to the people display real independence. Is it not hat to read how workers in certain lines complain of the scar of tips? Is not this question of tips a disgrace? Are tips and the potential of receiving tips inevitably sidered in the wages paid? The public who read the lowness of pay and the almost entire lack of wonder what becomes of the tips they are parting with every turn. It is all part of the loss of respect independence of the people. Our pauperising Acts Parliament are busy catering for a class. The so-ca benefits of these Acts are withheld from the most ne Their effects are visible in these abnormal and wic strikes. A little early firmness would have checked lawlessness. These strikers need to learn that "Free is the liberty of all men to do as they ought, not the lib to do as they like." And public freedom, so gre violated, must be reinstated at any cost. Force is remedy, but it has been made a necessity, and should rigidly employed, for the people of this country will permit a small section of malcontents to tyrannise them.

Do not let it be forgotten that when Mr. Lloyd Ge brought the railway companies to agree to the Concilia Agreement in 1907, there was an understanding that general striking such as was even then threatened, woul made illegal. It was, we believe, distinctly suggested arbitration would be made compulsory. And so Conciliation Boards were established, and yet the men out of work in a body, and even in some instances when doing so, that they have no grievances.

The Midland men and the North-Western men in Li pool go out with *expressed regret*. They say they satisfied. But though there are so many of th they allow themselves to be terrorised. One w think they would fight to hold the work and pos

ith which they were satisfied. But no! Any talker n Tower Hill seems to mesmerise them, to sap their anliness, so out they come instead of standing like men gainst the tyranny of the mob. It is a pitiable exhibition. ne would like to suggest a remedy. But what remedy ill fit minds who reject the remedies they have demanded? hat will suit men whose ideas of freedom are so perverted? e do not pretend to say who is responsible for the present utbreak. If it is the officials of unionism, we think they have one a bad day's work for their cause, for they have carried nto every home the knowledge that a few men have no are for the many, and they are defeating the best ends of nionism. In fact, the present strike fever is an exhibition f inhumanity such as was displayed in '97 by the A.S.E. owards the unskilled men in the shops. It is not as if he men had not every chance. If they are not satisfied ith the conciliation system as it has worked—generally in heir favour—they could at least move constitutionally to mend it.

And finally, lest we be misunderstood, be it far from ither our wish or our intention to deny that the strikers, or ome of them, may have many or even serious grievances, r what may be as bad, may be suffering under annoying ttle vexations. Such are part and parcel of the employ- ients of us all. With this we are not concerned at the oment, save to say that there are means for putting these rievances before impartial assessors. But conditions such s those of the tramway men—conditions better than many f them possessed when the tramways first started; such as he carmen have worked under for some time; such as the ailway men have lived in since their last step upward—such onditions have not been so onerous that they can be held to ustify this foolish threatened strike.

They are not new conditions even; they are a state of etterment on pre-existing conditions. They cannot by any tretch be argued to justify violence and intimidation. If hese regularly-employed men think they are so badly treated hat they must cease the work, let them cease and join the nprivileged army of workers, any one of which army would e glad to gain the rejected steady work.

The strikes of the past week, in face of the existing ma- hinery for attending to grievances, are actually worse in their oncomitant violence than those of years gone by, when the bsence of all remedial means left no choice. We are not enying that there are matters that should be adjusted. ut every right-minded citizen condemns the disgraceful ccessories of this foolish attempt to coerce the whole public y terrorism. It will not serve.

MINERS' SAFETY LAMPS.

Ever since the introduction of electricity for lighting pur- oses, it has been thought that such a light would be the leal one for the underground worker, provided it could be ut into a suitable portable form. In the early stages the reat objections were the excessive weight and cost. With mprovements, however, in the manufacture of accumulators he weight began to diminish, until portable electric miners' amps may now be obtained with a burning capacity of 10 o 12 hours, which weigh little more than an ordinary oil afety lamp.

The great objection, however, which is still held against he electric lamp by—we may say—most mining engineers, s that it gives no indication of gas, and failure to do this, hey say, must be fatal to any lamp. We admit that there s certainly something in this, but not to the extent that he mine manager would have us believe: in fact, he eally does not believe it himself for the simple reason, hat there seemed to be so little chance of an electric safety amp being produced that would at all compare with the ordinary oil lamp, that very little thought was given to the question.

At present, however, there is every indication that very considerable attention is going to be given to the electric lamp, and the offer of a prize of £1,000 for the best electric safety lamp is evidence that something better than the ordinary oil lamp, with all its advantage as a gas indicator, is very badly wanted, and in all probability the time is not far distant when the electric lamp will take the place of the oil lamp. This undoubtedly will be a boon to the miner and the mining industry, for nothing is so much wanted—next to fresh air—as a good light, and it is generally admitted that an electric lamp gives nearly twice the light of the common safety lamp. At one colliery in the county of Durham such lamps have already been intro- duced and nearly 2,000 are in use, and they are also being introduced into the collieries of the Whitehaven Colliery Co. Previous to their introduction at one colliery, considerable difficulty was experienced in connection with the oil lamps being all put out by an outburst of gas, which left the miners in darkness, so that they had to extricate themselves from the workings as best they could. One can imagine the disastrous results that might occur from a broken oil safety lamp under such conditions, but with the electric lamp there is no danger, as the light is entirely shut off from the outside atmosphere, and though one or two oil lamps may be necessary to indicate the presence of gas, these can be placed in such a position that they are more or less free from harm, and after being put out or otherwise giving an indication of the presence of gas, the light may be lowered or extinguished, and carried carefully in a safety zone, by the aid of the electric lamp. The chief point of interest about the introduction of electric lamp is that the number of oil lamps—although some may still be necessary for making examinations or other- wise indicating the presence of gas—will be greatly reduced, and consequently the risk of explosion due to a faulty or damaged lamp will be reduced in proportion—nay, more so, because the few oil lamps that would be in use would be in the hands of responsible officials who would naturally take every care of them. In fact, every oil lamp taken out of the pit lessens the danger in the mine, and every electric safety lamp introduced adds to the personal safety of the worker.

As to the possibility of the heated filament in the bulb of an electric safety lamp igniting gas, there is no question that this remains—and we are afraid will ever remain—a danger attached to any form of light. Safety in the electric lamp lies in the fact that the bulb entirely encloses the light- giving filament, and that the light almost instantaneously goes out when the bulb is fractured. The bulb itself is also protected by a thick glass, and the ideal lamp would be one so constructed that when the outside glass became cracked or broken the bulb would be automatic- ally disconnected from the battery. But irrespective of this point, the electric lamp is undoubtedly safer than the oil lamp, as it is free from the danger of overheating, there is no wick or flame to watch and adjust, there is no gauze to get accidentally broken or overheated, and, most of all, there can be no tampering with an electric lamp, and if for any reason the light fails it must be sent to the surface, which at once gets rid of all "relighting troubles." Experience has shown, moreover, that ahe electric lamp is more reliable as regards retaining its light than the oil lamp. Often the slightest knock, being overturned, or going into a high velocity air current, will cause the latter to go out, and a non-lighted lamp usually means that work is stopped until it is either relighted or another lamp is procured.

As a means of detecting gas, at best the oil lamp is crude, and we have every hope that science will soon produce some- thing to take its place that will be both more efficient and equally as reliable. With the oil lamp an experienced man can only estimate about 2½ to 3 per cent. of gas, and we have no doubt that once the mining industry begins to seriously appreciate the efforts of inventors in this direction, it will not be long before the several known appliances for gas detection will be developed and more or less perfected.

D

HINTS TO MANUFACTURERS.

The manufacturers of electrical apparatus are, no doubt, constantly on the look out to discover the varied needs of their customers, and are anxious, with a view to extending their own business, to meet any demand which may arise. The steps by which they must arrive at their knowledge of these needs are, however, somewhat lengthy—the want being first felt by some wireman who grumbles about the matter to his foreman : the latter mentions the subject to his manager who in turn brings it to the notice of the travelling representative of some manufacturing firm ; he, in his turn, speaks of it to one of his directors, who discusses it with his works manager, and if there seems to be money in it—if there is sufficient demand and the cost of production is not prohibitive—an article to meet the difficulty may eventually be put upon the market. Indifference or forgetfulness on the part of any link in this chain may obstruct or delay reform.

From time to time, therefore, it is helpful to bring directly before the notice of the makers of electrical supplies, from the point of view of those who are actually engaged in fixing them, some of the minor alterations in their apparatus which would be of most assistance in the carrying out of installations.

Take the case of the usual run of distribution boards. The stock sizes of these have the panels mounted on inch or inch and a quarter battens. For use when all the work is carried out with conduit buried in the plaster, such boards are possible, although, considering the projection of the terminals and cable sockets behind the panels, the space is undesirably cramped, and even a thin sheet of asbestos to keep the wires from contact with the wall may press them against the metal work—possibly of opposite polarity.

In the case of surface work, however (and very few installations of any size do not have at least one board where surface work is necessary), the effect of checking the batten over the conduit is to bring the live metal in dangerous proximity to the pipe. It would be a simple matter to replace the battens by thicker ones, but, unfortunately, this would not deepen the polished case, but would leave a gaping space between it and the wall. The workman's usual solution of his difficulty is the making of a $1\frac{1}{2}$-in. frame (unless a joiner is available the mitres are not always as neat as could be wished) on which to mount the whole fuseboard and case.

The simpler and better way would be for manufacturers to provide more depth behind in the first place. It would increase the cost ? Well, yes, it would slightly, but there are actually some contractors who could be persuaded to spend a few pence extra on the cost of material in order to save a shilling or two (and, incidentally, to make a better job) in labour. Makers will protest that they already supply such things when asked to do so. That is not the same thing at all : the foreman, though aware of the annoyance, may not think of asking for what is not listed ; the contractor is afraid of the extra cost of anything not of standard pattern ; in any case the delay in getting anything but "stock" articles is often prohibitive.

A somewhat similar trouble occurs with switch blocks. The usual thickness is a bare inch ; "extra thick" blocks do not exceed $1\frac{1}{4}$ in. To cut these out to go over a piece of inch barrel or the end of a $\frac{3}{4}$-in. tee, leaves insufficient thickness for screwing to, and the block splits. An inch pipe may sound a large size, but it is nevertheless one in frequent use for ease in looping. With the larger blocks for a number of switches, *e.g.*, $6\frac{1}{2}$ in. × $6\frac{1}{2}$ in., 9 in. × $6\frac{1}{2}$ in., &c., there are frequently several conduits brought to the block, and to fit the glued-on fillet over even a $\frac{5}{8}$-in. pipe will cut right through it, and perhaps dislocate the mortice at one corner. There is no possibility of covering a $\frac{3}{4}$-in. conduit with lock nuts on the end for connecting an earthing wire across, nor, if the various pipes are finished into a three or four-way box, could that be covered. If wood casing is being used only the smallest sizes will finish nicely against the flat part of the side ; the larger ones, whether containing mains or bunches of switch wires, having to have their capping fitted to the members of the moulding. Undeniably the thin blocks are much neater in appearance where sunk work admits of full advantage being taken of them, but thicker ones should also be listed as stock sizes.

The Institution rules (No. 56) recommend looping in preference to jointing, and the electrical contractor complies willingly, for experience has proved it economical. The accessories manufacturer has obliged by turning out ceiling roses and switches with larger terminals ; but, if Rule 57 is to be conformed to ("the whole of the separate wires forming the stranded or flexible conductor must be contained within the terminal") something more must be done than has yet been attempted.

It would be fairly safe to assert that not one installation in 50 complies with this rule throughout. In any installation where the runs are lengthy *and proper allowance is made to avoid excessive drop in voltage*, there would be nothing uncommon in having a 7/21½ and two 3/20 wires to loop into a single terminal. This is a bad case, but by no means an extreme one, and yet it is unprovided for. It is hopeless to attempt to enlarge the hole in the brass terminal much more, and the only solution the wireman has is that of cutting out many of the strands before twisting the three wires together. One would suggest to the makers that *double* terminals be provided ; the price would be increased somewhat, but that cannot be helped.

The same remarks apply to wall-sockets and to small cut-outs. Unfortunately they apply also to lampholders, which, on account of their small size, present a far more difficult problem. Nevertheless, it is one deserving the attention of designers who might, either by elongation or by a diametrical enlargement, whichever appeared to them least unsightly, gain space enough to contain double terminals. Even if it were sufficient for one pole only to be so treated, it would be a great help, for it is usually only the live wire and not the switch wire, which has to be looped. Needless to say, the $1\frac{1}{8}$-in. barrel of the lampholder cannot be altered, or neither standard bayonet-cap lamps nor standard pattern shades could be used with it.

The fittings makers have ever been creators of worries for the long-suffering wireman ; from early days, aided and abetted by the architect and the householder, his designers have delighted to produce brackets and electroliers, abounding in artistic flourishes and tasteful curves, but abounding also in sudden kinks and acute angles taxing the utmost skill to wire. Even with the plainer brackets the size of the tube is often insufficient. It is very unusual to find an ordinary 6-in. bracket listed of more than $\frac{1}{2}$-in. tube, and if one of $\frac{5}{8}$ in. is ordered specially, it will often be found on delivery (after some weeks' waiting) to be finished off with a nipple which reduces it at the end to take a $\frac{1}{2}$ in. or $\frac{3}{8}$ in. lampholder. The larger fittings and electroliers, though apparently made of $\frac{3}{4}$-in. tubing, are very frequently stiffened internally by $\frac{1}{2}$-in. gas barrel—a strong, substantial fitting mechanically, but too small for easy looping (and looping which is *not* easy is not safe).

To design good fittings is not, in itself, sufficient ; all badly-designed ones must be kept out of the catalogues. It is disappointing for a customer, who has chosen a fitting he likes, to have cold water thrown on his choice by the contractor. Mankind, and especially womankind, ever desires forbidden fruit the more, and it is not always politic for a contractor to oppose a client's wishes in such matters.

But, if fittings manufacturers are affected by Rules 56 and 57 in common with the makers of accessories, they are the ones *principally* affected by Rule 45, and yet have done nothing to help contractors to conform to it. Part of Rule 45 says :—"The connection between flexibles and hard wires may only be effected by screw-down terminals." The conduit maker has done something to this end by supplying porcelain connectors to fit in his junction and terminal boxes ; the wood-block maker has provided a somewhat similar contrivance ; the fittings maker has done nothing. Further, he should very possibly be blamed for having necessitated the enactment of this rule, in the first place, by having made his fittings with such small and shallow bases in the past that the joints crammed into them proved unsatisfactory. Whether that be so or not, he has failed to list fittings containing mechanical connectors such as would meet the requirements of this rule, although the rule has

been in force since April, 1907—and might have been anticipated.

Of course, there must be difficulties in contriving a neat and artistic arrangement in many cases, but there is nothing impossible in it. The brackets are likely to be the most troublesome, without enlarging the base out of proportion to the arm. With electroliers, pendants and standards, a deep base-spinning is an easy matter without spoiling the effect of the stem, &c. If this were done, and a ceiling-rose base (or some neater connector in two parts, so that the stem of the fitting can pass through between) fixed on a block inside it, any alteration of our present lampholder could generally be dispensed with.

Some rare fittings do have connectors in the ball at the bottom of the stem : good—if the stem is large enough to take the wires, say two switch wires and a looped black (one of which may be 7/21½), that is satisfactory, though, had it been at the top it would often have saved either wire or a joint, as it is impossible to know beforehand whether to leave the wires long enough to reach to 8 ft. from the floor, or whether to cut them short near the ceiling.

There are many excellent watertight fittings on the market, but most of them suffer from one defect—they are watertight everywhere but at the base. Of course, the maker has nothing to do with the fixing, so he is content to leave to others the problem of sealing the joint between his baseplate and the conduit, the former being made apparently with the idea that it would be screwed on to a wood block.

There are two ways of wiring for outside lights—one by running the conduit on the outside of the wall, the other by running it inside and punching through at the point where the light comes.

In the first case the bracket will be fixed on a box into which the conduit will be screwed. The standard conduit-boxes are not usually suitable for carrying a heavy watertight fitting, as they are of small diameter and only offer two shallow $\frac{3}{16}$-in. tapped holes for screwing to—not enough to support the weight nor to make a watertight joint. The best way would be for the fittings to have metal boxes, 1½ in. deep, supplied with them, their baseplates being fitted to the box as a lid.

To meet the second case the tube of the fitting should be screwed to take the coupling of, say, a ¾-in. conduit (*not* gas thread), and the backplate should be merely decorative, sliding on the tube and fixed where desired by a grub-screw. This would apply also, except as to size of pipe, to the large brackets from which arc lamps are hung ; the pipe from them, whether on the corner of a building or on the flat side of a wall, usually has to be carried through the wall and tightened by a locknut on the inside of the building. Such brackets are often made on the job, as those shown in a catalogue need too much adapting.

Reference has been made to the weakness of conduit-boxes as fixings for watertight fittings. It is a matter the conduit makers themselves should look to, not only for watertight fittings, but for fixings for *all* brackets and electroliers. As a rule, the boxes are covered by a disk of ebonite, or similar material, which is fixed on by two $\frac{3}{16}$-in. brass screws. If it is possible to screw through the baseplate of the fitting directly into these tapped holes, the ebonite is dispensed with, but usually the base overlaps the box, or, at all events, has three screw holes, so that wood screws into the disk have to be used ; in this case the ebonite is bent away from the box, except at the points held by the two screws. Even without the weight of the fitting the ebonite curls up when it gets damp (as it is sure to do during the plastering), so that it is most desirable that it should be held by three screws instead of two. If the ebonite were made thicker—say ⅜ in. in all—it would be better, both because it would stiffen it considerably, and for another reason. In sunk work the building clerk of works insists on the conduits being buried perhaps a full ⅝ in. below the finished surface of the plaster, as, otherwise, in drying, the plaster is liable to crack along the line of the pipe. With existing fittings it is necessary to make a slight double set from this depth to bring a box cover just flush on the wall, and even then a 6-in. length on either side of the box lies too near the surface, and the socket-lug of the box much more so. With thicker disks much of this could be obviated, and it would also provide a simple means of levelling one side slightly by planing off if the face were not quite lineable with the plaster. The teak blocks of the same thickness which are sometimes substituted, are certainly much too thin, even for fixing switches and ceiling roses on, as teak, even in stouter blocks, has a great readiness to split.

In using both ebonite and porcelain interiors, conduit makers are admonished to select only the very best of qualities, as these are, time after time, found to be responsible for bringing down the insulation test on an installation.—P.B.

[Note.—The numbers of I.E.E. Rules given above are taken from the 1907 edition. No. 56 is omitted now : No. 57 is re-numbered 75 and No. 45 is No. 53 in the new edition.]

A NOTE ON FLEXIBLE POLE-LINE SUSPENSIONS.

[communicated.]

In the earlier forms of power pole-line transmissions the practice in installing the insulators carrying the conductors was universally that of placing them on a rigid support attached to the pole, or a bracket placed upon it, thus following the practice at first found advisable in telegraph and telephone work. Comparatively recently, however, a new method of suspension giving an increased degree of flexibility has been introduced ; and as this advantage is combined with a type of design rendering the problems of insulation much easier of solution than with the rigid pin type of insulator, it has found a considerable degree of favour. Without in any way detracting from the undoubted advantages of the flexible type of pole-line suspension, however, it is worth while mentioning a point which, unless properly guarded against, may lead to trouble in particular cases.

Without entering into a detailed discussion of the properties of the catenary curve which is assumed by the conductor thus supported, the conditions of the case may be seen from one or two simple diagrams. Considering, first of all, the stresses upon a pole forming part of a straight pole-line transmission in flat country, we have such conditions as those shown in fig. 1. If P represents diagrammatically the

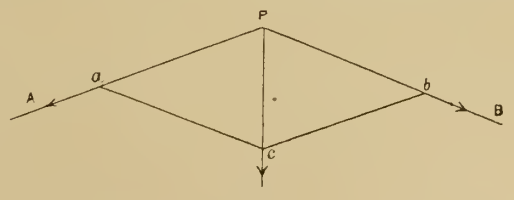


Fig 1

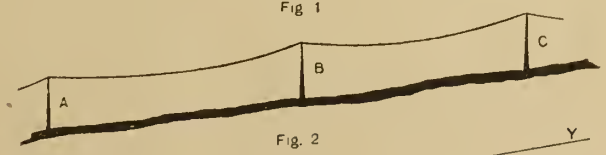


Fig. 2

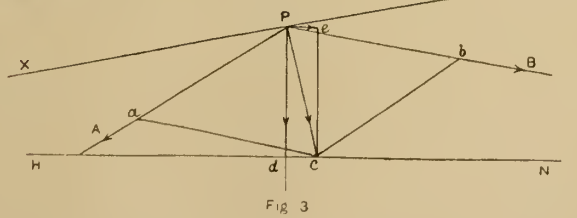


Fig 3

point of support, and P A, P B represent the directions of the first elements of the spans passing to right and left of the pole, we may mark off distances P_a, P_b to represent the directions and magnitudes of the pulls at the end of the spans considered on the support P, due to the weight of wire in each span. Assuming that each span is equal in length, P_a and P_b will be equal, and their horizontal components will be nil. By completing the quadrilateral we find a component P_c, which is the vertical stress on the support of the insulator at P. Under normal conditions this value of P_c will be equal for each support, and equals the weight of one span of wire, except at the terminal poles of the transmission line when the force P_a or P_b is unbalanced, and

is resisted in full by the terminal pole or tower. It will be seen that so far as intermediate supports are concerned, it does not matter whether these are rigidly fixed or flexible, as the horizontal components are balanced, and P will not move laterally. The stresses both on the intermediate and terminal supports therefore remain unchanged within practical limits.

In considering the case where the transmission line passes over undulating country, however, the vertical contour of the country introduces disturbing factors. Suppose we take as a simple example the case of a long incline (fig. 2), on which there are three poles A, B, C, and consider the effect of converting the suspension at B from a fixed into a flexible one. The conditions of things at B can be seen from diagram, fig. 3, where the inclination of the ground and the sag of the wire have been exaggerated for the sake of clearness. If X Y represents the slope of the ground, and P the point of support, the elements of the two spans adjacent to P will branch off as shown at P A, P B, and it will be noticed that P A has a much steeper dip referred to the horizontal line H N than has P B. But since action and reaction in every element of the wire is equal, and as we assume the tension in adjacent spans to be equal, we can say that the pull P_a along P A, and the pull P_b along P B, are equal, and are represented by equally long lines. Completing the parallelogram in C we obtain an inclined resultant pull on the support P shown by P_c. Resolving this into horizontal and vertical components, we have a vertical stress on the point of support, P_d, and also a horizontal unbalanced pull (so far as the conductor is concerned) of P_e. When the point P is rigidly fixed, both these pulls are taken up by the supporting structure, P_d being taken as a weight and *c d* as a pull on the pole in the direction of the line, or in the case of a bracket or arm, as a twist on it. The spans between A and B, and B and C are, however, anchored at B as well as at A and C, so far as the rigidity of the poles will permit.

Now, suppose at B (fig. 2) the point of support is made flexible instead of fixed ; that is to say, suppose the insulator is hung from the point of support by a flexible system of links. The horizontal pull P_e will draw the end of the link attached to the conductor in the path of the line uphill until the link lies in the path of the resultant of the forces exerted along the elements P A, P B. The effect of this is obviously to decrease, in a smaller degree, the sag in the line between poles A and B, and to increase it between B and C (fig. 2). Now the result of this on post A will be to make a flatter catenary at that point, and hence to reduce the vertical component of the forces acting upon it, *i.e.*, virtually to diminish the weight resting on it. Conversely at C the increase of sag increases the depth of the catenary, increases the vertical component of forces acting on it, and increases the weight on it. In other words, making B a flexible support has thrown weight from A at the bottom of the hill on to C at the top. One such transference may not matter, but on a long incline the multiplied effect, unless corrected in some way, may lead to unexpected happenings.

Not only is this the case, but by reducing the number of fixed points at which resistance is encountered to the horizontal component of the whole weight of wire contained in a series of spans, the whole duty of providing resistance is thrown on a few points, which may be either the end towers of the transmission line or the poles at which a change of level occurs. It will be seen that with a fixed suspension the horizontal component of the tension in the conductor is taken up in detail at the end of each span ; free those ends in a large number of cases, and an accumulated effect is concentrated on a few points where the ground contours are uneven.

It is, therefore, evident that such conditions may, under certain circumstances of hilly country, involve a serious problem in the distribution of the stresses over the poles of the transmission line, as the highest pole tends to take more than its due proportion of the stresses. This difficulty has already been found in long pole lines having large spans passing up long inclines, even where the rigid type of support has been used, inasmuch as there is a certain amount of flexibility in the poles used. Where the supports are purposely made flexible, the matter needs to be even more carefully watched. Probably the best way of overcoming the difficulty is to space the poles more sparsely in the valleys and concentrate them more towards the top, giving shorter and flatter catenaries at the crests of the hills, and thus reducing the vertical components on the supports, while larger and deeper catenaries in the valleys would tend to level matters up as regards vertical stresses. This, combined with a judicious use of fixed supports where the horizontal components tend to congregate, in the way that a steam main is anchored at suitable points to prevent shifting, while leaving the body of the pipe work free to expand and contract, will probably render the flexible transmission line a most useful asset, even in most hilly country.

FUTURE PRACTICE IN ELECTRICITY SUPPLY.

Possible Amalgamation of Gas and Electrical Interests.

By "METROPOLITAN."

Perhaps the most astonishing feature connected with the inaugural address by the President of the Institution of Electrical Engineers last year was the almost entire absence of comment upon, what must have appeared to many connected with the electrical industry, the enormous field for development in the near future.

Either the majority of electrical engineers in this country regard that address as the words of "a dreamer of dreams," or they hold that a definite change in the practice of electricity supply of the nature indicated cannot be brought about within the lifetime of the present generation, and they are therefore apathetic on the subject.

There is no doubt that the aims and aspirations, as set forth by the President, are so important and far-reaching, embracing as they do not only the whole field of production in this country, but many important ethics of social reform, that angels (otherwise electrical engineers) "fear to tread" in these intricate paths of prophecy, and are content to wait in apathetic silence the coming of the "electrical age" by the sure process of evolution. But it is perhaps well in the interests of the present age to review in some measure the probable steps leading up to the future practice in electricity supply.

In the first place, there is neither room nor necessity for both electricity and gas in the industrial world.

The enormous improvement in electric supply and the increase in the applications of electricity within the past few years clearly prove that gas as an illuminant and agent of motive power must sooner or later become extinct.

In the domestic world electricity is now able to assume the supremacy for lighting, heating, cooking, &c. Recent improvements in cooking apparatus have shown us that not only is electrical cooking superior in every way to gas but the cost is not greater, while subsidiary saving on food stuffs is quite an important matter. The arguments which have been used in the past regarding the superiority of electric lighting over gas lighting, viz., benefit to health, subsidiary saving in the way of decorations, and, latterly, equality in cost, can now be relatively applied to electric cooking.

The only obstacle in the way of a fight *à outrance* with the gas industry is the short-sighted policy of supply undertakers in their methods of charging for energy used.

The actual cost of generating and distributing energy in most areas ranges from one-fifth to three-tenths of a penny per unit. If the standing costs of any undertaking are borne, as they should be, in due proportion by each consumer the sale of current at ½d. per unit for any purpose will produce a revenue sufficient to yield a handsome profit. In other words, every million units sold will yield £833 to £1,250 net profit after providing for interest and depreciation.

In municipally-controlled undertakings these profits are available for extending business by wiring consumers' premises, connecting to mains, and supplying meters, without the necessity of incurring debt for these purposes, which has in the past proved a serious obstacle to progress.

In the writer's opinion it should be an established law with every well-founded undertaking that capital should be raised only for land, buildings, plant and mains, and that normal extensions to plant and mains should not exceed the amounts set apart for depreciation and sinking fund.

By the adoption of a financial policy on these lines, it would be found possible to obtain sufficient annual revenue from consumers to pay all fixed charges upon any undertaking, and these charges would decrease as the extension of business permitted the adoption of larger generating units and corresponding increasing density of load upon the mains.

The fixed charges having been so arranged as to automatically decrease until an irreducible minimum is reached, the prospect of reducing the price per unit is one that must command the attention of engineers now as in the future. It has frequently been stated that gas undertakers could afford to supply their commodity at a nominal price relying upon their by-products to supply profits. This may be correct while they possess a monopoly of the markets for those by-products, but under any circumstances a sufficient return on the capital and administration costs of supplying gas would have to be obtained.

This appears to be the full extent to which electricity undertakers may be called upon to fight the gas industry ; but it appears, without an entire revolution in the practice of electricity supply, as though it would become an unequal fight. When the cutting process is in full force (in some districts it has already commenced) electrical engineers will be compelled to adopt the practice, already foreshadowed by the President of the Institution, of distilling gas from coal for the purpose of firing boilers or driving internal combustion engines, and entering the market in competition with the gas industry for the sale of by-products.

In the writer's opinion there is no serious obstacle to such a practice being adopted and equal terms of competition with the gas industry thereby established. The result is obvious : without an outlet for the gas produced, the present producers could not exist. In the interests of public health, gas would not be allowed to waste to atmosphere, and therefore the industry would become extinct.

Considering the huge amount of capital, public and private, invested in gas undertakings, it is probable that the fight we are now entering upon will not be allowed to finish, and the possibility of amalgamation must be considered.

Already municipalities controlling both gas and electrical undertakings are finding the pinch of competition, and are adopting retrogressive tactics to avoid disaster to one or other of their trading concerns.

The only method of amalgamation which appears to be practical, allows for a universal supply of light, power and heat through the medium of electricity by utilising, at a nominal price, the available gas from the production of what are now known as by-products of coal. In the public interest it will probably be found more economical to utilise the existing plant and mains devoted to the production and distribution of gas, rather than to seek fresh capital for the development of gas plant in connection with electricity supply, thereby annihilating a large amount of public and private capital, a result which might be considered in the light of a national calamity.

In view of the emphatic prognostication of the President of the I.E.E., and the time and energy now being expended by engineers in advocating the claims of internal combustion engines, gas and oil, and generation of energy in sub-stations, it would perhaps be well if engineers generally devoted some time to the study of future practice in electricity supply from the aspect which appears to the writer to be the only logical and true form of evolution from existing methods of supply.

Compensation Claim.—At Burnley County Court, on August 11th, there was a claim by John Clague, of Castletown, Isle of Man, and Eliza Crossley, of Burnley, for compensation in respect of the death of John Clague, jun., electric overhead wireman, who was fatally injured whilst in the employ of the Burnley Corporation. On June 18th, deceased was repairing wires in Church Street when a portable furnace burst, and the petroleum set fire to his clothing. He sustained injuries which resulted in his death. Deceased's father was totally dependent on his earnings. The case was adjourned, and it was agreed that the father should receive 8s. per week and the sum of £10 down.

CONSUMERS' ACCOUNTS.

By GEORGE JOHNSON.

For recording the accounts of consumers there are what may be termed various principal methods in vogue, with such devices incidental thereto as the magnitude of the undertaking may render necessary in the general interests of economy and efficiency. Most of these methods culminate in the provision of the familiar consumers' ledger, which may assume varying forms, as, for instance, the following, viz. :—

No.	Name.	Address.	March Quarter.												
				Debits.				Credits.							
			Arrears brought forward.	Electricity.	Meter rent.	Hire.	Total. *	Folio of cash book or journal.	Cash.	Discount.	Allowances.	Total.	Amount outstanding and carried forward.		

* The amount in this column includes "arrears brought forward," if any.

Arrears brought forward.	June Quarter.									
	Debits.				Credits.					
	Electricity.	Meter rent.	Hire.	Total.	Folio of cash book or journal.	Cash.	Discount.	Allowances.	Total.	Amount outstanding and carried forward.

Arrears brought forward.	September Quarter.									
	Debits.				Credits.					
	Electricity.	Meter rent.	Hire.	Total.	Folio of cash book or journal.	Cash.	Discount.	Allowances.	Total.	Amount outstanding and carried forward.

Arrears brought forward.	December Quarter.									
	Debits.				Credits.					
	Electricity.	Meter rent.	Hire.	Total.	Folio of cash book or journal.	Cash.	Discount.	Allowances.	Total.	Amount outstanding and carried forward.

On this basis the meter readings and consumption of energy as per the Meter Reader's Book, and other details, may be recorded in the Consumers' Register of energy supplied, which contains the details of the consumers' quarterly accounts, and after the former have been checked and the accounts prepared therefrom, such information as the debit columns of the Consumers' Ledger connote may be transferred thereto, the cash being posted to the credit columns from the Cash Book. As already indicated, there are other practices which vary more or less in working detail, but which do not call for any special observation. The meter readings and the consumption may be incorporated in the Consumers' Ledger without the intervention of a Consumers' Register if so desired.

The accounts unpaid, or the outstandings, are brought forward at the end of each subsequent quarter. For example, March quarter outstandings are brought forward at the end of June and inserted in the outstanding column commencing that quarter ; similarly in June, September and December.

The total amount owing on consumer's account at the end of the year is, therefore, that shown in the "arrears brought forward" column under December quarter, in addition to the debits for the December quarter for energy supplied, the accounts for which are not rendered, of course, until January.

The amount thus owing is required to be specifically shown in the Board of Trade form of Balance Sheet, and we may proceed to prove the sum by the following simple procedure :—

Amount owing at beginning of year ...	
Add total debits for—	
March quarter	
June quarter	
September quarter	
December quarter	
Deduct—	
Cash received as per Cash Book ...	
Discounts allowed	
Other allowances	
Contra accounts, or amounts set off as per journal	
Amount of sundry debtors on consumers' account at end of year ...	

The motor accounts may be kept separately, and it may be noted that in the case of the sale of motors on the hire-purchase principle, each payment combines principal and interest. For instance, if a motor be purchased for £100, and sold on the hire-purchase basis for £120, to be satisfied by the payment of a quarterly payment of £15, extending over a period of two years, we may, without entering into a strictly correct actuarial computation, allocate the quarterly payment of £15 as to £12 10s. to the credit of the hire-purchase account, representing the repayment of the principal, and the difference of £2 10s. to interest, or hire, being the profit on the transaction, which is sufficient for all practical purposes.

TRADE STATISTICS OF MEXICO.

THE following figures, showing the imports of electrical and similar materials into Mexico during the year ended June 30th, 1910, are taken from the recently-issued official trade statistics ; the figures for the previous year are given for purposes of comparison, with notes of increases or decreases :—

Peso = 4s.

	1908-9. Pesos.	1909-10. Pesos.	Increase or decrease. Pesos.
Copper, brass or bronze wire, covered with other materials.—			
From Germany	58,000	70,000	+ 12,000
,, Austria	5,000	1,000	— 4,000
,, United States ...	279,000	389,000	+110,000
,, France	1,000	—	— 1,000
,, Great Britain ...	1,000	1,000	—
,, Other countries ...	1,000	—	— 1,000
Total ...	345,000	461,000	+116,000
Copper, brass or bronze wire, bare.—			
From Germany	24,000	26,000	+ 2,000
,, United States ...	87,000	119,000	+ 32,000
,, Great Britain ...	5,000	11,000	+ 6,000
,, Other countries ...	1,000	13,000	+ 12,000
Total ...	117,000	169,000	+ 52,000
Cables of copper, brass, &c., not armoured.—			
From Germany	51,000	41,000	— 10,000
,, Austria	4,000	4,000	—
,, United States ...	449,000	242,000	—207,000
,, Great Britain ...	3,000	2,000	— 1,000
,, Other countries ...	2,000	4,000	+ 2,000
Total ...	509,000	293,000	—216,000
Cables of copper, &c., armoured.—			
From Germany	90,000	61,000	— 29,000
,, United States ...	50,000	64,000	+ 14,000
,, Great Britain ...	17,000	53,000	+ 36,000
,, Other countries ...	5,000	5,000	—
Total ...	162,000	183,000	+ 21,000
Iron wire.—			
From Germany	125,000	167,000	+ 42,000
,, United States ...	231,000	342,000	+111,000
,, Great Britain ...	13,000	27,000	+ 14,000
,, Other countries ...	8,000	13,000	+ 5,000
Total ...	377,000	549,000	+172,000
Rails.—			
From Germany	59,000	403,000	+344,000
,, Belgium	40,000	101,000	+ 61,000
,, United States ...	2,894,000	4,340,000	+1,446,000
,, Great Britain ...	274,000	780,000	+506,000
,, Other countries ...	2,000	23,000	+ 21,000
Total ...	3,269,000	5,647,000	+2,378,000
Insulators of glass or porcelain.—			
From Germany	30,000	28,000	— 2,000
,, Austria	3,000	5,000	+ 2,000
,, United States ...	59,000	95,000	+ 36,000
,, Other countries ...	2,000	1,000	— 1,000
Total ...	94,000	129,000	+ 35,000
Commutators, interrupters, contacts, safety cut-outs, &c.—			
From Germany	144,000	77,000	— 67,000
,, Austria	10,000	5,000	— 5,000
,, United States ...	308,000	191,000	—117,000
,, France	7,000	2,000	— 5,000
,, Great Britain ...	4,000	12,000	+ 8,000
,, Other countries ...	7,000	1,000	— 6,000
Total ...	480,000	288,000	—192,000
Arc lamps.—			
From Germany	35,000	20,000	— 15,000
,, United States ...	29,000	32,000	+ 3,000
,, Other countries ...	5,000	1,000	— 4,000
Total ...	69,000	53,000	— 16,000
Incandescent electric lamps.—			
From Germany	67,000	275,000	+208,000
,, Austria	4,000	25,000	+ 21,000
,, United States ...	53,000	360,000	+307,000
,, France	—	10,000	+ 10,000
,, Great Britain ...	—	26,000	+ 26,000
,, Switzerland ...	—	8,000	+ 8,000
,, Other countries ...	3,000	—	— 3,000
Total ...	127,000	704,000	+577,000
Machines for industries, mining, &c.—			
From Germany	2,310,000	2,116,000	—194,000
,, Austria	16,000	6,000	— 10,000
,, Belgium	68,000	70,000	+ 2,000
,, Canada	18,000	—	— 18,000
,, Spain	55,000	32,000	— 23,000
,, United States ...	12,108,000	13,352,000	+1,244,000
,, France	497,000	371,000	—126,000
,, Great Britain ...	3,571,000	2,891,000	—680,000
,, Italy	35,000	17,000	— 18,000
,, Sweden	39,000	91,000	+ 52,000
,, Switzerland ...	145,000	159,000	+ 14,000
,, Other countries ...	15,000	31,000	+ 16,000
Total ...	18,877,000	19,136,000	+259,000
Carriages of all kinds for railways, &c.—			
From Germany	41,000	40,000	— 1,000
,, United States ...	1,489,000	1,747,000	+258,000
,, France	95,000	—	— 95,000
,, Great Britain ...	189,000	119,000	— 70,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	1,814,000	1,907,000	+ 93,000
Asbestos sheets, &c.			
From Germany	3,000	6,000	+ 3,000
,, United States ...	94,000	106,000	+ 12,000
,, France	2,000	1,000	— 1,000
,, Great Britain ...	1,000	3,000	+ 2,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	100,000	117,000	+ 17,000
Scientific instruments and apparatus.—			
From Germany	84,000	94,000	+ 10,000
,, United States ...	155,000	199,000	+ 44,000
,, France	56,000	82,000	+ 26,000
,, Great Britain ...	27,000	11,000	— 16,000
,, Italy	3,000	15,000	+ 12,000
,, Other countries ...	4,000	9,000	+ 5,000
Total ...	329,000	410,000	+ 81,000

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

"Australia for the Australians."

On April 28th you printed a very interesting interview with Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Australia, and I have been watching to see whether the British manufacturer had anything to say in his own defence. As he has remained, as usual, tranquil; and, as they say, "Onlookers see most of the game," perhaps you will kindly permit me to reply to some of Mr. Wickes's remarks. I have seen something of the Australian game, and I do not think the other side of the case should be left unstated.

First, then, take the "crying need" of Australia for new blood from Old England.

How does she treat it when she gets it? I am told by a working man, lately returned from that land of *promise*, that he was going to advise all his pals to stay here or go anywhere rather than to Australia. He said Melbourne was full of unemployed skilled men walking about looking for a job. They are tempted over by promises of work for all; and by that delightful little poem:—

Eight hours' work, Eight hours' play,
Eight hours' sleep, and Eight bob a day.

Arrived in Australia with his family, the skilled man soon finds himself reduced to that interesting condition so ably described by "The Self-Made Merchant":—"Root, hog, or die"!

He must work at something or see his family starve. The Unemployment Bureau is duly shocked at his quite exceptional misfortunes; promises work, but intimates that in a new country it doesn't do to be too particular—too "John Bullish" or "stand offish." So our skilled painter, glazier, fitter or boilermaker is sent up country as a labourer to the man who really wants him, and at whose instance the whole swindle is arranged, viz., the farmer.

There he is taken on as a "new chum." This engaging title means that not being Australian-born he must not be allowed indoors with the Australian labourers, who are nominally in the same rank and position.

There is a nice warm comfortable barn for him, with straw to sleep on, and plenty of fleas and rats for company.

He has to work hard at unaccustomed jobs; and is lucky if he just manages to send enough to keep his family in their lodgings in the city, till the harvest or the shearing is over, when he is promptly pitched out by the farmer and drifts once more in the streets—the noble representative of an imperial race!

I am told that fortunate ones sometimes get enough scraped together to get home—no assisted passage this time.

As to the British manufacturer, you say (or Mr. Wickes says) that he is shortsighted, that he is badly represented, and that he appears indifferent. We have heard all this before.

But the British manufacturer is a discriminating person; and there are lines of business which he really prefers to leave to his German and American friends. He does not at all mind their airs of superiority when they have secured the work.

You complain that it is not at all uncommon for British firms to ask the buyer—"usually a public body of some kind or other"—to inspect the goods and pass them at the works over here.

The Australian buyer asks, why do British manufacturers keep on asking for this? Why on earth shouldn't they? What *honest* reason can the buyer have for refusing such a reasonable condition. Surely if anything is wrong it is only reasonable that it should be discovered and rectified before the machine leaves the works. This is in the true interests of the *honest* buyer as it saves enormous delay and difficulty if anything is wrong.

The Australian buyer asks, "Why do not British manufacturers apply their own tests and satisfy themselves that the machine is going to do the work required?" Innocent buyer! Guileless dove! I will give him his answer. It is because the British manufacturer knows full well that it is not himself he has to satisfy in order to get his money. He has found by experience that perfection, as far as he can attain it, will not ensure the acceptance of the machine on the other side. He has discovered that public bodies in Australia are like public bodies here, only much more so, and that highway robbery is not quite extinct. Why are these people not willing to inspect at the makers' works?

There are plenty of reliable consulting engineers in London who would give an independent certificate as to whether the tests were satisfied or not. The reason why the Australian buyer prefers to have the goods first is obvious, and I may add that the system of getting the goods and then declining to pay for them is getting the colony a very bad name.

The British manufacturer supplies his best, pays carriage and an enormous import duty, and he then has to choose between fighting it out in an Australian Court, or compromising on a sacrifice of 20 to 30 per cent. of his money, and the object of the Australian buyer is attained.

I would respectfully ask Mr. Wickes whether he would not do better to advocate a fair and reasonable system of buying and selling, for after all he is the representative of that downtrodden worm, the British manufacturer.

Onlooker.

Olympia Electrical Exhibition.

While quite in accordance with the general contents of Mr. Seabrook's article in this week's REVIEW, in case it is not replied to officially, I certainly think if he will only "wait and see" he will find that the Executive Committee have made ample arrangements for the cooking side of the industry at Olympia.

With regard to his last paragraph, Mr. Seabrook has forgotten, or is not aware, that the caterers are appointed by Olympia, Ltd., and their methods of cooking cannot be controlled by the Executive of any exhibition held there.

At the same time the Executive made strong efforts to induce Messrs. Lyons to meet them with regard to electric cooking, but without success.

P. A. Lundberg.

Islington, N., *August 11th*, 1911.

Direct Coal Supply for London Electricity Supply Stations.

The present difficulty in obtaining coal in London owing to workers' strikes, tends to emphasise the suggestions contained in previous articles upon this subject which have appeared from time to time in the ELECTRICAL REVIEW.

That the present position of many concerns, more particularly up-river electricity works, is serious, no one will deny; and I take this opportunity of once again attracting attention to the advantages of bringing fuel from the coalfield seaports direct up-river alongside wharves in London. For this purpose any small steamer would serve, providing it was able to take the shore at low water without damage. Orders could be booked advantageously at the mining districts for f.o.b. at the nearest seaport, and the vessel would steam from there round the coast and proceed up river direct to its destination, without the delay and expense of unloading and barging. The only alterations to any vessel necessary to enable her to clear bridges would be that all standing rigging must be so arranged as to come down whilst proceeding up the higher reaches; it would not be a great expense to convert any ship in that manner.

The many electricity supply stations situated on or near the riverside in London offer splendid opportunities for a trial in this direction, which, I am sure, would prove successful and be a means of saving money by considerable reduction in coal bills. I mention trial here, in the sense of trying to bring a small vessel up river under bridges, with coal for an electricity works, although I know at least one other station, besides other firms, which have already tried the experiment with a hired ship, the result being a saving under those circumstances. Again, the gas companies, even up nearly to Putney, made a trial years ago, and results speak for themselves; they never reverted to the old method.

Of course, certain strikes would affect private ships, but little difficulty would be experienced in continually working a ship as suggested here. The crew would be picked men:

unloading arrangements in London would be secured; whilst with a little extra expense, delay in loading at the seaport would be overcome.

This matter is one affecting interests in many districts, and I commend it for consideration by those in authority at places on the river side up even so high as Putney, Hammersmith and Barnes. Money can be made at the business. The remarks recently published in the daily Press having reference to the annual report of the rival gas, more than confirm it.

Interested.

Ventilation and Ozone.

In reply to the inquiry addressed to me by Mr. Ronald Grierson in your last issue, the formation of nitrogen compounds from air, during the use of high frequency apparatus, is due to the high temperature resulting from the spark discharges, and also to the dust and moisture present in the atmosphere.

A well-designed ozonizing apparatus avoids the conditions which produce these nitrogen compounds, in the manner described in my article. Both the Siemens & Halske and the Ozonair Companies are prepared to furnish clear proof that the ozonized air produced by their apparatus is free from these deleterious oxides of nitrogen.

John B. C. Kershaw.

West Lancashire Laboratory,
Waterloo, Liverpool, *August 14th*.

Telephone Charges.

The present outcry against excess charges for calls may possibly be due, in some cases, to the spite of the operators: it may also arise from the unauthorised use of the instruments by male and female assistants having conversations with their friends—which would not be recorded by the former.

It would appear that if counters (on wire) could be supplied to customers, as in the case of gas meters, the record on the dials could be compared at any time with the customers' record, and this would check most effectively any incorrect charges at whichever end of the line they originated.

Ernest Benedict.

August 14th, 1911.

The Insulating Properties of Leatheroid and Presspahn.

I have read the article on the above subject with much interest, but, whilst the results of Mr. D. H. Ogley's experiments are indisputable, I am of the opinion that his deductions are hardly justified.

He states that "presspahn retains its insulating properties under varying conditions . . . . Leatheroid, however, deteriorates rapidly as an insulator if damp . . . . For slot lining, presspahn would therefore be more suitable."

To gauge fairly the relative qualities of these materials, it is necessary to consider them under working conditions.

In every large works armatures are impregnated in a vacuum oven after winding. Now this operation has little effect in the case of presspahn but makes all the difference to the leatheroid. This is due to the fact of the presspahn having been previously dried out in the process of manufacture and its pores sealed by glazing.

It is well known that once this glazing is injured the insulating properties of the presspahn are very greatly diminished, and creasing is almost certain to take place whilst forcing the presspahn into the slots.

In the opinion of the writer the experiments made by Mr. Ogley, although in accordance with the practice of the National Physical Laboratory, do not make comparison easy, as two variables, time and voltage, are introduced. This difficulty is added to by the fact of the breakdown voltage not being inversely proportional to the time of application.

An easier comparison can be arrived at by keeping the time constant and raising the voltage gradually until breakdown occurs, taking, say, 20 seconds to accomplish this.

Some time ago the writer conducted a series of experiments on these lines which proved that leatheroid had a higher puncture voltage than presspahn. For instance, leatheroid 0·5 mm. thick punctured at 10,250 R.M.S. volts after having been dried for 12 hours at 100° C., whereas presspahn punctured at 7,500 R.M.S. volts.

To sum up, leatheroid is much tougher than presspahn and in consequence is far less likely to get damaged in the shop; it has a higher puncture voltage when dried out, and when impregnated is totally unaffected by moisture.

Presspahn is undoubtedly preferable for use in small shops not in possession of a vacuum oven, but these are in the minority.

Thos. J. Sack.

Walthamstow, E., *August 11th*, 1911.

Sag of Line Wires.

Mr. J. B. Sparks refers, in your issue of June 2nd, to the practice of measuring the sag, or dip, of wire by releasing one from its insulator and allowing it to hang free. He states that double the span gives four times the sag, and so by this method an easy way of measuring the latter is obtained.

I have used this system myself, and had no idea that it is not mathematically correct until I saw on page 207 of Vol. CLXIX of the *Proceedings* of the Institution of Civil Engineers a statement by Mr. Trotter as follows:—

"If a wire falls away from an arm it will hang with double sag on a double span."

Investigating, I found the formula to be $L = l + 8d^2/3$, and not $L = l + (8d)^2/3\,l$.

Possibly, though wrong in theory, the old system may be correct in practice, on account of the give of the poles. It certainly used to be given in the Telegraph Construction Code of the Indian Government, and has been largely used without bad results. Can any one of your correspondents throw a light on the matter?

Chili.

July 12th, 1911.

[The correct formula was given by Mr. Sparks in our issue of June 16th.—Eds. E.R.]

The Sphere of Government Influence.

It was with very great interest that I read your leading article in the issue of August 11th on "The Sphere of Government Influence"; it has always seemed to me to be a pity that a greater interest is not shown by trade papers in matters of this description. In one particular trade they say, "Our trade our politics." I do not wish to go as far as that. I do say, however, that if we viewed business more from the standpoint of political economy it would be better for us all.

A great deal of trouble at the present day is caused by misunderstanding as to the actual relationship existing between employer and employed, the laws of exchange and the fundamental conditions of life; in many instances we mar our Edens.

For the past 22 years I have been getting my living, and have worked as railway clerk—in running sheds, City offices, engineers' offices, shops, showrooms, as piecework foreman in iron and steel constructional work, labourer, foreman wireman, &c. I have always had this fact before me that if you wish to retain a position you must invariably give satisfaction.

Having been engaged in diverse occupations, I have had an opportunity of studying the problem of employment from different standpoints, and I am thoroughly convinced that a solution of the labour problem does not lie in an increase of wages, but in a better understanding between "employer" and "employed," not overlooking the fact that an employer is also an employé, and so *ad infinitum*, and that both have in many instances interests in common, *i.e.* the use of land, &c.

I have said if you wish to solve the labour problem, or endeavour to solve the problem, a better understanding must exist between employer and employé. You may ask what I mean. As a clerk my employer would always acknowledge me and return the salutation, he would provide decent lavatory accommodation, fire in office, &c., and my hands face, clothes and general condition were such that I could go to a decent restaurant or tea rooms and secure decent meal with good company and congenial surroundings: the wages all round were lower than those of mechanics, but the

tandard of general contentment was greater, simply because he employer acknowledged us and treated us more on he same footing.

How did my treatment as a mechanic compare with my reatment as a clerk? Well, in the first place, as a rule I ave always found the lavatory accommodation very poor—ometimes filthy and abominable, and in some cases so disusting that a decent man would be unable to use it. his is a thing which ought not to be allowed to exist; how an you expect to have a healthy and vigorous body of men round you unless you provide them with decent accomodation? As a rule, they have nowhere to keep overalls or ash their hands; and the decent, well-educated oungster soon degenerates and acquires the habit f the pig; he certainly is not a *persona grata* t any decent restaurant, even if there is one handy to the orks. The consequence is, when meal times come he djourns to the nearest dirty coffee shop or four-ale bar, here he pays the maximum amount of money for the minium amount of refreshment, and you expect him to return the works a refreshed, invigorated and contented worker.

I am well aware that many works provide mess rooms, ut, as a rule, they are cheerless and badly managed affairs. Iy contention is, that a cheerful and well-conducted mess oom and lavatories, managed on proper lines, would pay for hemselves in every way. If only 10 per cent. of the employés or a start, used them, you would find that even they would ave a leavening effect on the remainder, especially if the overnor or manager looked in occasionally and told them ow trade was going, &c., and treated the men as friends, ot as inferior beings and enemies.

The fact is overlooked that many men are very sensitive nd require careful handling, and that all foremen and anagers, &c., are not necessarily possessed of tact, but are t times apt to be abrupt and brusque; thousands of ounds per annum are spent in our boiler houses, engine ooms and generating plants, individuals spend pounds on ooks and hours studying machinery and how to work it at ts greatest efficiency without damage or detriment; but ow about the study of man? We overlook the fact that the ages bill is generally the largest item in expenses, and hat man is the most erratic and fickle machine we have to andle, and that to handle him efficiently and keep him rom running hot we must manage him and know his funny ays and weaknesses; or, in other words, if you wish to ontrol men you must make a study of mankind generally, emembering that he is not some sort of lathe or milling achine attachment, but a thing of flesh and blood—ortal, weak—and at times possessed of a liver and a wife.

We hear a great deal about the duty of the State to the ndividual; let us hear more about the duty of the individual o the State. Teach him and guide him; let him know t is not the money he earns, but the way he spends it. We ant less economic waste and more useful expenditure of the ation's earnings, regardless whether a man earns £1 per eek or £5,000 per annum.

The day of the small employer, who could take an indiidual interest in each of his employés, is past, and big ombines, without a soul or conscience, have taken his place; nd it seems as if the State is almost compelled to say to he employé, "If you are not wise enough to make provision gainst adversity and old age, we must legislate in such a anner that you will not be overlooked."

Space prevents me from writing more. We ought all to emember that, in many instances, circumstances make the an, and that man is very often debased or improved, ccording to his surroundings.

A. W. Wyatt.

Tasmania.—At a recent conference between a special committee of the Hobart City Council and representatives of the local tramway company, with respect to the proposal to municipalise the company's system, the latter said that if £250,000 were offered for the purchase, the matter would be considered. In its report the committee expresses the opinion that the limit the Council should go to should be £150,000.—*Australian Mining Standard.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Armorduct Conduit Fittings.

In the new conduit catalogue of the Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., there are several fittings deserving of special notice. One of these, shown in fig. 1, is their latest type of the patent "Universal" screwed "knock-out" junction box. This box, under the most recent patents, is supplied stop-tapped to every one of the films, and it answers equally well as a one-way, two-way straight through, two-way corner, three-way or four-way junction box, and is also made with a back outlet.

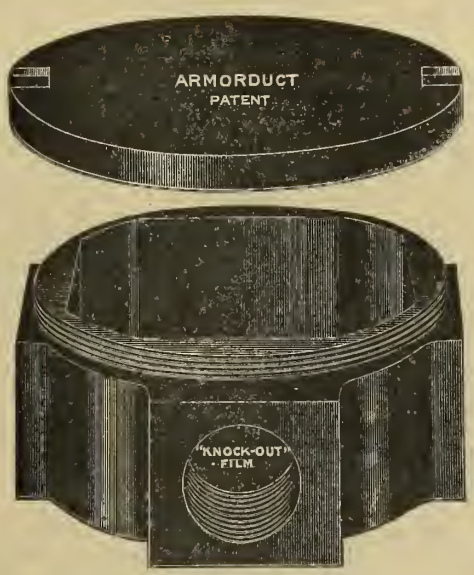


Fig. 1.—Universal Screwed "Knock-Out" Junction Box.

Apart from the master patent covering the "knock-out" principle, the stop-tapping of the inlets is the subject of a separate patent. The boxes are supplied as standard with a heavy cast-iron cover, held by screws securing a watertight joint, but they are also made with improved-type screw-on lids. The inlets are of sufficient depth to provide six clear threads, thus affording electrical continuity and watertightness. Whereas it was previously necessary to carry a stock of five or six different types of boxes, one will now

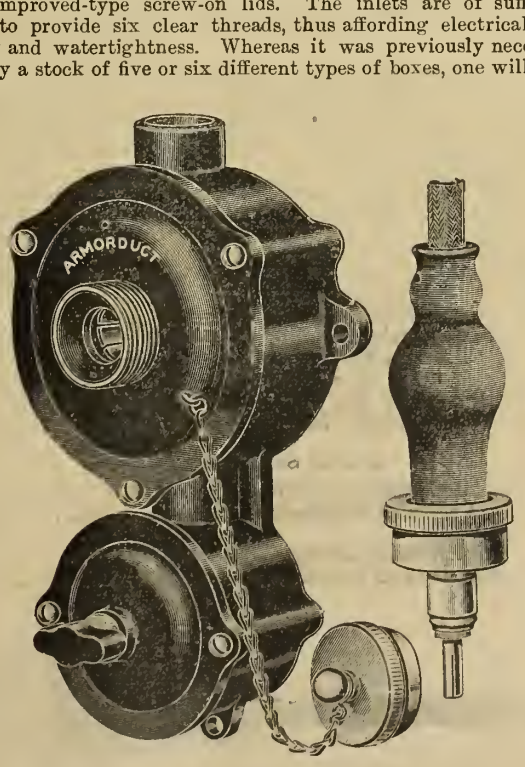


Fig. 2.—Combination Switch-Plug.

supply all wants. Other items include multiple oblong junction boxes, of which a want has long been experienced; distribution interiors designed for modern and high-voltage work, the special feature being that conductors do not cross each other or live parts of opposite polarity; floor inspection boxes which can be fitted with oak or brass covers, and for any size of conduit up to 1¼ in. Among a variety of switch fittings is shown the combination switch-plug device appearing in fig. 2, which is a 10-ampere fitting particularly suitable for use in fiery mines, chemical works, &c., where special care is necessary owing to the existence of explosive vapours; also a line of multiple fittings boxes for surface work with interior mounting, a full selection of watertight lamp fittings, and a patent adjustable fittings box for flush work.

E

A Cavalry Wireless Set.

The August *Marconigraph* mentions, as an interesting instance of the various uses to which wireless telegraphy can be put, the employment of two Marconi portable wireless telegraph sets at the recent Investiture at Carnarvon of H.R.H. the Prince of Wales.

The two stations in question, which are of the Marconi's Wireless Telegraph Co.'s standard cavalry type, are the property of the Westmorland and Cumberland Yeomanry.

The stations are similar to those recently employed on the demonstrations in Turkey and Spain, and have been specially designed by the Marconi Co. to be capable of easy and rapid transport and to afford a means of communication between cavalry or other mounted units and the main body. Owing to the rapidity with which these portable sets can be erected and dismantled, the whole process lasts only a few minutes, and they are consequently of the greatest value from the military point of view. These sets have been spoken of in terms of the highest praise by the above-mentioned regiment, by whom they are employed regularly on all manœuvres.

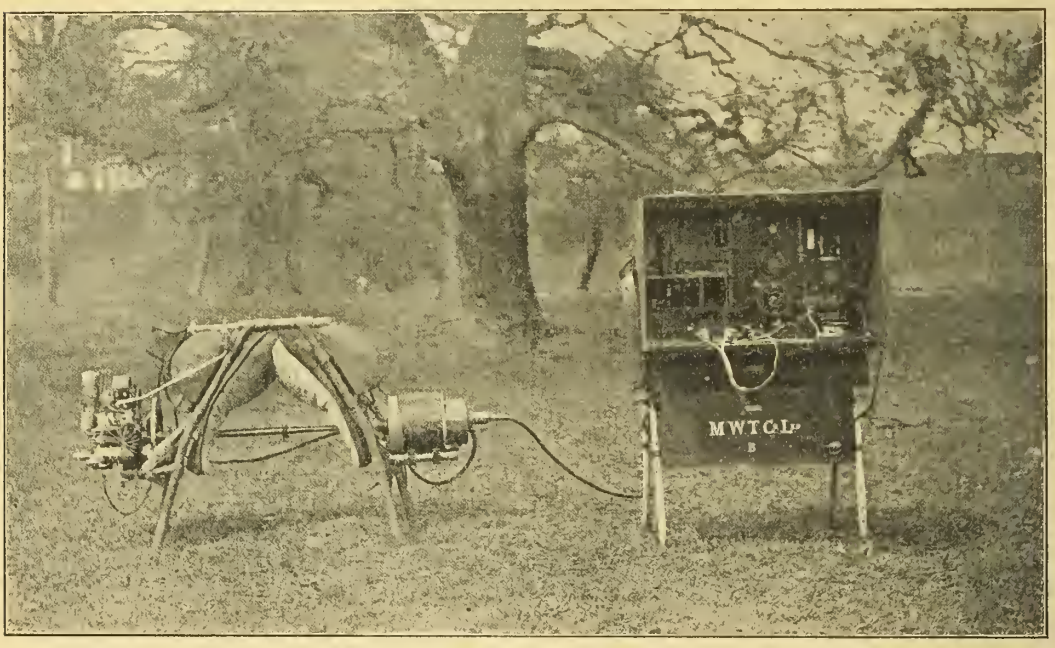


Fig. 3.—Marconi Cavalry Pack Set, comprising Engine and Dynamo, Transmitting and Receiving Apparatus.

The two portable stations accompanied the Yeomanry to Carnarvon, to which place the regiment had been ordered for the Investiture ceremony.

One of the stations was erected in the neighbourhood of Carnarvon Castle itself, the second being situated in the vicinity of the headquarters camp, and by means of these two installations, constant communication was established between the Royal yacht and the units of the fleet and the shore. Communication from the Carnarvon Castle installation was also established with the Government station at Liverpool and with the headquarters camp.

Constant communication was maintained between the Royal yacht and Carnarvon Castle by means of the Marconi system of wireless telegraphy. A respectful message of congratulation was sent from Poldhu by Mr. Marconi to the Prince, who graciously acknowledged this message from his yacht, also by means of wireless.

Patent Screwdriver.

The Benjamin Electric, Ltd., of 117, Victoria Street, S.W., are introducing a patented friction-drive screwdriver, suitable for the electrical trade.

This, as shown in the accompanying view, has a fluted insulating handle moulded on to the blade, with a loose cap which turns the handle and blade by a friction drive. A spring in the handle releases the cap on the reverse movement of the hand; the spring maintains a slight pressure on the screw constantly, holding the the blade in the slot. The driver will work in either direction, and is made in about a dozen sizes. It is simple in construction and comparatively inexpensive.



Fig. 4.—Friction-Drive Screwdriver.

The Multax Flame Arc.

The Globe Electrical Co., Ltd., of 11, Farringdon Avenue, E.C., has recently issued a pamphlet, M 60, describing the recent improvements in the Multax flame arc lamp, shown in fig. 5. The lamp is of the long-burning type, and suited for either A.C. or D.C. circuits; the working parts are completely encased an protected from fumes, while a patent replaceable inner globe now provided, which, in addition to preventing deposit on t outer globe and protecting the arc itself from air curren increases the burning hours by 25 per cent. the 20-hour patte giving 25 hours, and the 32-hour pattern giving 40 hours' burnin with the same carbon consumption. This represents a reduc burning cost, which the makers state is now approximately 25 p cent. below that of any other lamp employing Norris-Excello carbons; the trimming costs are also reduced in proportion.

A special feature of this lamp is the patent light-distributing reflector, fig. 6, consisting of a squat hollow glass ring, of tri-angular section, with inclined reflecting surfaces, heavily silvere inside, the result of which is that the maximum angle of the light altered from about 70° to the more useful angle of 30° to th horizontal, an innovation of particular value in street lightin and similar work.



Fig. 5.—Multax Fla Arc Lamp.

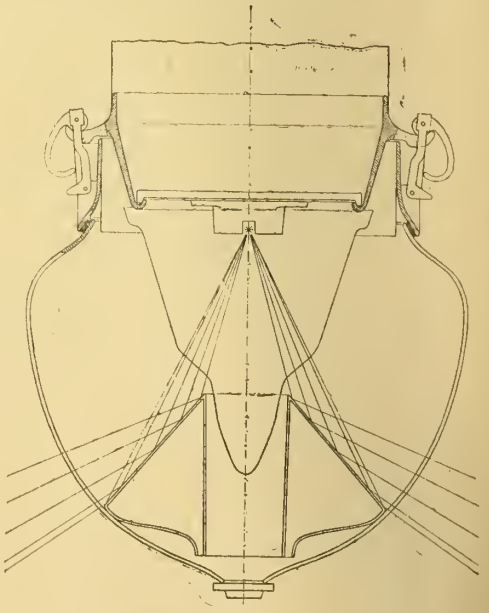


Fig. 6.—Light Distributing Reflector, Multax Lamp.

The list M 60 gives full particulars and prices of these lamps ar accessories.

A New Insulating Material.

A new insulating material, known as "Pelollit," which hai from Cologne, but will be manufactured in Wolverhampton ver shortly, is being put on the English market by Mr. A. J. Faulding of 265, Strand, W.C.

The material, which is claimed to be an excellent electrical ar heat insulator, is put on in layers, consisting alternatively of a elastic filling material and an agglutinant, and has a smoot

, non-cracking surface. It is impervious to moisture, and, rstand, comparatively cheap in cost.
e present time Pelollit is being applied for heat-insulating to the handles of saucepans, for coating the insides of c., and in place of moulded insulation and insulating for electrical work.
ple insulation which we have examined was composed of rs, giving about 1 mm. thickness, and is suitable for insu-00° F. temperature or electrically insulating 2,000 volts

Metal-Filament Lamp Fittings.

RS. J. & H. GREVENER, of 40, Southwark Street, S.E., have h considerable success in their lanterns and fittings of types for metal-filament lamps, of the newest of which we strations herewith.
7 illustrates one of the firm's No. 305 fittings, for which ve received, amongst others, an order from H.M. India or 2,300 fittings for use at the Delhi Durbar Coronation es. This is a well-finished fitting, suitable for lamps up to



FIG. 7.

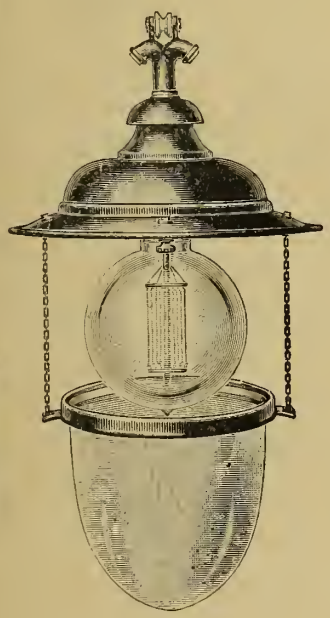


FIG. 8.

., and is supplied with clear or opalescent globe; it is made lamp lines, with sound insulation for suspension and -in wires, and the holders are provided with stout porcelain

s is an aluminium fitting, with either clear or opalescent lobe. The design is a comparatively cheap one, but is ly reliable.

Reyrolle Motor Starters.

accompanying illustration shows the latest lever type motor made by MESSRS. A. REYROLLE & CO., LTD., of Hebburn-e. these starters are fitted with the firm's patent "current-g" resistance, which, by the use of carbon, obviates the



FIG. 9.—REYROLLE MOTOR STARTER, OPEN TYPE.

icy of resistance wires to fuse or break, and at the same time see the property of allowing the current to increase while the remains on the first stop, until the motor starts. The type ated is provided with no voltage and overload releases.

"S.V.P." Motor.

THE ELECTRIC CONSTRUCTION CO., LTD., of Wolverhampton, have recently introduced a cheap but well designed small motor, known as the "S.V.P.," which is at present offered in the ¾ B.H.P., 1,000 R.P.M.; 1 B.H.P., 1,400 R.P.M.; and 1½ B.H.P., 2,000 R.P.M. sizes.

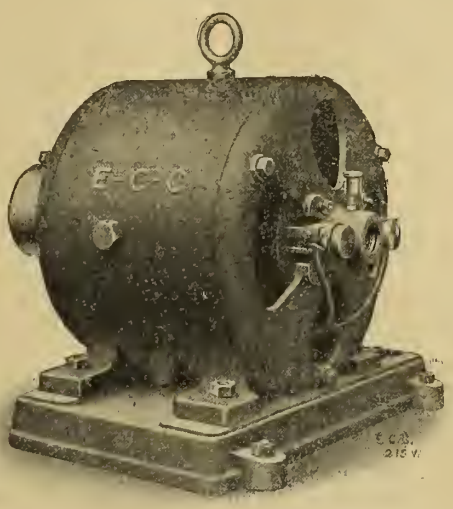


FIG. 10.—"S.V.P." MOTOR.

A temperature rise not exceeding 70° F. after six hours' full load running and an overload capacity of 25 per cent. for two hours and 50 per cent. momentarily are claimed. The feature of the S.V.P. motor is its vertical commutator shown in our view. The brushes are spring controlled and adjustable as to pressure, and the design enables them to be easily got at, although the machine is of the protected type—it also results in a shorter machine.

SMOKE ABATEMENT IN LONDON AND HAMBURG.

BY JOHN B. C. KERSHAW.

THE reports of the London and Hamburg Smoke Abatement Societies for the year 1910 have been published recently, and they contain much of interest for readers of this REVIEW. It has been left for Glasgow to discover that the electrical engineer, apart altogether from his occasional appearances in Court as an offender against municipal by-laws in connection with smoke emission, is very directly concerned with this problem of smoke abatement. In the autumn of 1910, the Glasgow Corporation organised a Smoke Abatement Exhibition for the benefit of their citizens, and achieved a success both as regards attendance and receipts, which was far beyond that realised at any previous Exhibition of this character. Whether this success was due to the unusual spectacle of the engineers and chairmen of the Gas and Electricity Committees of the Glasgow Corporation fraternising together in friendly rivalry, instead of slanging each other in the columns of the local and technical Press; or whether it was due to the organising ability of those who arranged the Exhibition, and the genius possessed by Glasgow people for making a success of anything; the fact remains that the attendance averaged 4,000 people per day during the three weeks for which the Exhibition was open, and that a large amount of business was obtained by the exhibitors as a direct outcome of their displays at the Exhibition. A further result of the Glasgow Exhibition was that sufficient public interest was aroused to justify the organisation of two series of public lectures on smoke abatement for the winter of 1910-11; one for working men and boiler attendants, and the other for householders and the general public.

In view of these facts, and of the intention of Manchester and London to hold similar joint Smoke Abatement Exhibitions in November and May of 1911 and 1912 respectively, the following summaries of the Reports of the London and Hamburg Smoke Abatement Societies for 1910 should prove of value.

London.—The most striking feature of the Report of the London Society is the table showing the great improvement

in London's atmosphere, for the three periods of nine years each, since 1883. The following are the figures and comments from this section of the Report :—

Period.	Days with fog.	Hours of bright sunshine.
1883-4 to 1891-2	29·9	55·6
1892-3 to 1900-1	20·7	70·1
1901-2 to 1909-10...	10·6	93·5

During the winter of 1909-10 there were only seven foggy days, and there were 118 hours of bright sunshine.

It is not, of course, suggested that this welcome result is more than partially due to the suppression of smoke nuisances in connection with factories and trade concerns, for the domestic chimney, which in the past has been a great offender, has certainly also shown remarkable improvement. This, no doubt, is largely due to the increasing use (for heating and cooking) of gas, electricity and solid smokeless fuels, such as anthracite, carbo, coalexld, coalite and coke. In this connection it should be remembered that Dr. W. N. Shaw, F.R.S., the director of the Meteorological Council, has stated that 20 per cent. of the fogs in London are wholly due to smoke, while the density of all other fogs is greatly increased by the presence of smoke in the atmosphere.

Although it is not specifically mentioned in the report, the period covered by these figures coincides with that which has witnessed the rise and development of the electric light and power industry in this country, and electricity can certainly claim its share in bringing about this marked improvement in the London atmosphere.

Concerning factory smoke, the Committee of the Society reports that within the area known as Greater London, there are no fewer than 35,000 factories and workshops. When the Society commenced its operations in 1899, it may be safely said that the large majority of those premises more or less frequently emitted black smoke. Now, only a small minority offend, for most manufacturers have learnt that, to their own pecuniary advantage, they can carry on their work without causing smoke nuisances. The effect of the Society's system of inspection is really striking. Observations are made in a district, and in a short time the Society's reports generally lead to the temporary cessation of nuisances.

As regards the active work of the Society during the past year, 1,094 cases of smoke emission were reported by their inspector, and were investigated by their Committee, and in the majority of instances the Society reported the nuisance or complaint to the Borough Council or other local authority concerned. The Committee state that, on the whole, Borough Councils may be said to discharge their obligations to the public is suppressing smoke nuisances. The inaction of a few public bodies, such as the Southwark Borough Council, stands out in unpleasant relief. It is to be hoped that the time will arrive, when it will be universally recognised that to foul the air we breathe is as reprehensible as it is to pollute the water we drink, or to adulterate the food we eat. Then, perhaps, it will also be fully recognised that smoke nuisances may be abated without harassing trade, and also that such abatement results, in most cases, in considerable profit to the manufacturers.

The failure of the London County Council's attempt last June to amend the law in relation to smoke nuisances within the metropolis ; the Conferences and Exhibitions held in 1910 at Edinburgh, Sheffield and Glasgow ; and the deputation organised by the Smoke Abatement League and received by Mr. John Burns on June 23rd, 1910, are dealt with in the remaining paragraphs of the Report. The following appeal closes the Report :—

"It is only by incessant vigilance and effort that the smoke evil can be successfully encountered, and the Society appeals for funds to enable it to continue its work on the lines of that of the past 13 years. The Committee feels that the Society's efforts deserve greater support than has hitherto been bestowed upon them. With an income of only £200 per annum, much has admittedly been accomplished by the Society. It has been shown that smoke abatement is no idle dream ; that, without harshness to manufacturers, local authorities can deal satisfactorily with a great deal of factory smoke ; that, indeed, the manufacturer can in almost all cases effect striking economy in his working expenses by using the means which modern research has rendered possible for securing the maximum advantage from bituminous coal ; and, finally, that the private hou by using smokeless methods of heating and cook contribute his share to the cleansing of the atmosph

"But much remains to be done before the ide practicability of a pure air can be spread broadca minds of the public, and the Society appeals for a extension of the financial support hitherto accorde efforts."

Hamburg.—The eighth annual report of the Society is as usual much more technical in charac the report of the London Society, and it is unfortu the eight valuable reports of this organisation are widely distributed, and read and studied in this The difficulty is, of course, partly due to the fact t are only published in German, and that the educated Englishman's acquaintance with this lan limited. Some enterprising publisher or public might, however, arrange for the translation and pu of these reports in this country as they appear. The County Council, which has been empowered to spe per year "in investigating and advancing measu respect to smoke consumption and the abatement of arising from smoke," might devote a portion of to the purpose named ; or, possibly, the London Co Abatement Society, or the Smoke Abatement Leag undertake the duty.

The Hamburg Society, as the writer has more t explained in print, is a voluntary Association of ste with works located in or around the city of Hamb the Society maintains its own staff of engineers an instructors, who have the complete control and ov the steam-raising and heating installations of its m

The Society is managed by a Committee of its who are themselves all manufacturers, and has a four engineers and four firemen-instructors devo whole of their time to the plant of the members.

The Committee of the Hamburg Society have t for 1910 a decrease in the membership, due not t off in support, but to the formation of a new branc with its headquarters in Helsingfors, Finland. Th tion of this new society, on the lines of the Hamb has carried off the Finnish members of the parer and the register of the latter now contains the 401 members, with 1,325 boilers and furnaces, u control of the Society's officials. The Committee report refer to the publication of a new monthl entitled *Rauch u. Staub*, the Editorship of which wa to the officers of their Society ; and also to the their work in connection with the abatement of sm steamers lying in the port or river of their city.

The chief engineer of the Society in his Rep marises briefly the aims and methods of the Society, and these may well be reproduced here benefit of those of our readers who are not acquain its history or organisation.

As regards the aims of the Society, the chief (Herr Nies) states on page 7 of the Report governing idea is to improve the skill and efficienc firemen, and to develop, at the same time, their int the subject of smoke abatement. These aims are by the education of the stokers in the management boiler fires ; and by the continuous oversight of th exercised by the officers of the Society. The work i by the completeness of the combustion process, as i by the absence of smoke, and by tests of the exit order to determine the amount of excess air, which passed with these gases up the chimney.

A further department of the Society's work r proposals for improvements in the construction or of grates and boilers. The object here is to save of the Society from excessive or unnecessary expens recommend only appliances or designs which ha proved by actual trial to be of value. Advice relati purchase of fuel is also given by the officers of the and here again expense is saved, by dispensing wit of the high-priced smokeless fuels, except in speci The advice as to coal purchase is based upon the and calorific determinations of the many hundred samples that have been made at the Society's insti the years 1909 and 1910, the results of which are in

t two reports. The calorific value is also employed, ossible, as the basis of the contract between buyer and

egards smoke prevention, the officers of the Society chiefly upon the regulation of the secondary air since in most cases this method can be applied with- at or expensive structural alterations in the grates or s. The fact that smoke is most generally caused by a ıcy in air supply rather than by a deficiency in ature, proves (they consider) this method of treatment orrect, and alterations in the furnace structure to be d for. The investigations of mechanical methods of during the past year have been confined principally chain-grate stoker and to the underfeed stoker. The economisers has been recommended in many cases neat losses were occurring, either as a result of too emands upon the boilers, or of bad design and arrange- f the heating surfaces of the boiler and flues.

egards the active work of the Society, the Hamburg ation, unlike the London one, devotes itself chiefly to ervation of boiler fires and flues, rather than to the ıg of chimney tops, and has the following record of erformed during 1910 :—43 first tests of boiler tions : 76 second tests ; 664 revision tests ; total, 783 As the larger number of these tests represented an ours' steam trial of the boiler or boilers, with all the ncidental tests of feed-water, fuel, steam, and waste t will be seen that the officials of the Hamburg are kept fairly busy. The revision tests, it may be are carried out at regular intervals, to see if the d efficiencies due to the earlier trials as the result oved stoking, or alterations in draught or furnaces, are aintained.

inal section of the 1910 Report, which extends to s, is devoted to a record of the 800 odd fuel tests, out at the official testing laboratory of the Society burg during 1909 and 1910. The larger number tests refer to English and Scotch coals, and that of the Report containing the test figures can be l as a separate pamphlet.

German methods of carrying out the tests, and of ng the calorific value of the fuel, are different how- n the English methods (see Electrical Review, y 10th, 1911), and those of our readers who obtain phlet must make allowance for this difference when ıg the English and German test results for the sses of coal.

BUSINESS NOTES.

ılar Notes.—Canary Islands.—The British Las Palmas reports that the electric tramway was com- August, 1910, and since then a most excellent service of been run between Las Palmas and Puerto de la Luz— It is interesting to note the various sources of supply for e construction. Boilers, generating sets, iron chimney station, cranes, and much machinery and tools are British ; merican. The dynamos, switchboards and road posts, as arriages, are all from Germany. Rails and all roadway also ironwork for sheds and power station building are ium. Storage batteries are from Spain, and copper cables ice.

.—The British Consul at La Rochelle reports that the hting of La Pallice, at present supplied direct by the La ighting station, is to come into the hands of the Chamber rce, which will have a transforming station at the dock the quays and various warehouses.

-The British Vice-Consul at Savona reports that the ettrica Riviera di Ponente Ing. Negri, which was formed the hydraulic powers of the Roia, has found it necessary t Savona a steam-electric central station of large power, cope with any eventual deficiencies of hydraulic power. ny supplies power to the Societa Giderurgica of Savona local gas company, and also to several small towns and nong which are Albasola and Celle.

—The British Consul at Nagasaki reports that the laying cable from Mogi (about 5 miles from Nagasaki) to ormosa, a distance of 655 miles, was completed in st, and the service was at once opened. The cable came nited Kingdom. In October the Department of Communi- uired from the Great Northern Telegraph Co. the submarine een Fusan and Tsushima. A new telegraph rate to Corea ingly resulted, and a message can be sent from Japan to Corea at the rate of 40 sen (10d.) for the first five words, and 5 sen (1½d.) for each additional word, with the same rate to Formosa instead of 30 sen (7½d.) a word as formerly. The purchase price is given as 160,000 yen (about £16,000.)

Spain.—The British Consul at Seville reports that the monopoly hitherto held by the Compania Sevillana de Electricidad, a Spanish company with German capital, is likely to be invaded by competition. The Sociedad Catalana de Alumbrado por Gas, a powerful Spanish company, till now a producer of gas only, has decided to supply electric current for lighting and industrial purposes. This company already has a contract for lighting the town by gas, but in response to the desire of the Town Council, this will now be substituted by electricity. The necessary contract will be given to the Spanish company as soon as it is in a position to carry out the work. An Englishman, Mr. Bailey, is the local manager.

The British Consul at Cordoba reports that no progress has been made so far in the projected electric tramways for the city, though various schemes have been propounded, and the authorities are anxious to see them carried out, more especially one to facilitate access to the charming southern slopes of the near Sierra, which are attracting more visitors every year in search of a mild winter climate amongst the orange orchards of this delightful neighbourhood.

France.—In connection with the scheme for the construction of an enormous barrage across the Rhône at Genissiat, below Bellegarde, which would form above stream a lake stretching up to the Swiss frontier and covering over 900 acres and down stream a waterfall with a drop of some 220 ft. capable of generating electric power averaging 170,000 H P., to be conveyed by overhead wires to Paris for various industrial purposes. H.M. Consul at Lyons now reports that this project, to which reference has already been made in the Electrical Review, has encountered considerable opposition from various local interests affected, partly on the ground that it would involve the disappearance beneath the waters of the artificial lake of whole villages on or near the river banks, and would, moreover, destroy the famous Perte du Rhône, close to Bellegarde, where the river takes a headlong plunge into the bowels of the earth and is lost to sight for some 100 yards—a curiosity which attracts about 4,000 tourists a year to the spot—but chiefly on the score that it would rob the neighbourhood of its vast natural heritage, in the shape of the white coal, latent in the waters of the river, and would carry it off to Paris. Two counter schemes have, therefore, been formulated to take the place of this project and they are receiving considerable support locally. The first of these has been presented by the French company who are actually exploiting the natural fall of the Rhône at Bellegarde, 50 ft. high, and distribute the electrical energy thus generated among a number of consumers in the Departments of the Ain and Savoie. The scheme involves the construction of a large barrage on the site of their existing dam, above the Perte du Rhône, which would thus be preserved, forming a lake stretching up to the Swiss frontier, which, unlike the Genissiat Reach, would not engulf a single dwelling. Two large power houses would be constructed, one at Coupy, close to the barrage, and the other at Elvise, which, together with the existing station at Bellegarde, would be capable of generating nearly 200,000 H.P. in summer and 100,000 H.P. at low water in winter. The second scheme, formulated by another French company, is not in antagonism with the first, but rather serves as a complement to it, and contemplates the construction of another barrage, creating a second smaller lake three miles long, below the larger one, and forming a fall some 65 ft. high, capable of generating a minimum of 30,000 H.P. The total electrical energy thus produced would be at the service of the industries of the neighbourhood, and would, doubtless, lead to the erection of many electro-metallurgical and electro-chemical works in the area which it would serve. It need therefore be scarcely a matter for surprise that these alternative projects are regarded with more favour locally than the more ambitious Genissiat scheme, which is designed to carry off to Paris the power which, in the opinion of the Departments interested, should be kept for home use.

The Government will shortly erect, at an estimated cost of £40,000, a large power house on the River Drac (Isère) for generating by water-power the electricity required for working a new railway to be constructed by the State from La Mure, the coal mining centre, to Gap (Hautes Alps) on the Paris, Lyons and Mediterranean Railway from Briancon to Marseilles, thus connecting the coalfields directly with the chief port of France.

H.M. Consul also reports that the experimental installation at Lyons of the Lorimer system of exchangeless telephones, though originally designed to last for 12 months, beginning November, 1908, was eventually prolonged for another year, and only came to an end towards the close of 1910. The unqualified success of the experiment after so thorough a trial was signally proved by the general reluctance displayed by those favoured persons—200 in number—who had been supplied with the apparatus, at being compelled to return to the ordinary method, after having tested the joys of a telephone that worked independently of a central exchange. There does not, however, appear to be any immediate prospect that the State will definitely adopt the Lorimer system, though the question is still under consideration.

Shortly after the disastrous post office strike in 1909 a wireless telegraph station was temporarily established by military engineers on the metal tower that stands on the height commanding Lyons, but after some months the experiment was discontinued. Wireless communication has, however, again been opened with Paris—this time through the enterprise of one of the principal watchmakers, who has established an apparatus in the metal tower which receives the time daily from the Eiffel Tower in Paris and transmits it to his establishment in the centre of the town.

A New Austrian Cable Factory.—It is reported from Vienna that the Ganz Electricity Co. and the Austrian Siemens-Schuckert Works intend to establish a cable factory at Pesth.

Belgian Enterprise in Russia.—The Société de Tramways et d'Electricité en Russia, which was recently formed in Brussels with a share capital of £400,000 for the acquisition from the German Electrical Enterprises Co., of Berlin, of the latter's supply works or tramways in Russia, is now one of the promoters of the Tramways et Eclairage Electrique de Simteropol which has been constituted in Brussels with a capital of £1,400,000. The other promoters are the Belgian investment companies, known as the Société Générale Belge d'Entreprises Electriques, and the Financière de Transports et d'Entreprises Industrielles.

York as an Industrial Centre.—A good deal of useful information regarding the City of York as an industrial centre is given in a recently issued pamphlet of 20 odd pages. A plan of the River Ouse navigation—Hull to York—is one of its features, and the matter in the booklet tells of the situation of the City, its transport facilities by rail and by water, coal and water supplies, electricity supply and the charges therefor, existing industries, tramways, factory sites, population, and rates, &c.

Co-operation in Germany.—A temporary cessation in the co-operation of the leading electrical firms in Germany has now been replaced by two associations. The first instance is the formation of the Ozone Co. by the A.E.G., the Siemens & Halske Co., and the Felten & Guilleaume Co., and the second the constitution of the Hydraulic Power and Smelting Corporation by the A.E.G., the Siemens-Schuckert Works and the Electrical Enterprises Co. As pointed out by a Frankfort newspaper, these cases show that notwithstanding the competition still prevailing, the principal firms continue to combine as a closed force where their interests are identical. It is noteworthy in this connection that the third of the still completely independent firms—the Bergmann Electricity Works Co.—also stands in no relation to the other firms in respect of the two transactions in question. This circumstance leads to the supposition that the Bergmann Co. not only still possesses its complete independence at the present time, but also that the company intends to proceed on its own way, and despite the reports a little time ago of schemes of association with the Siemens group. It is concluded, in any case, that the development of the mutual business relations between the large firms deserves constant attention, as it can offer certain bases as to how far and how long the existence of independently working firms can still be spoken off as existing in Germany.

Filaments of Adamant.—The accompanying illustration has been reproduced from an untouched photograph taken of an Osram lamp sent to the G.E.C. by Rawlings & Co., of 303, High Street, Lee, Kent. This lamp has recently undergone and withstood an unusual test. For some considerable time past it has been burning in a private garage in Kent, and on Thursday last it was struck by the rear part of a car backing into the garage. It is of interest to record that the only damage done to the lamp was the indentation of the cap as shown in picture, the filament after the collision being found absolutely intact.



Fires.—Mr. H. W. Teeton, electrical and mechanical engineer, announces that owing to a fire which occurred on 11th inst., resulting in the total destruction of his premises and stock at Foundry Works, Hanley, he has removed temporarily to 19A, Lichfield Street, Hanley. The whole of his catalogues, lists, &c., having been destroyed, and he will be glad to receive further copies from manufacturers and factors.

Messrs. H. N. Morris & Co., Ltd., Gorton Brook Chemical Works, Manchester, ask us to state that the fire which occurred at their works on August 7th will not in any way interfere with the output of their products.

Street Lamp Lowering Gear for M.F. Lamps.—We have before us some street views showing some of the installations of lowering gear recently carried out for metal-filament lamps by the London Electric Firm, of Croydon. Though at first sight it might not appear warrantable to fit such gear, seeing that the lamps only require attention (either for cleaning, replacing defectives or worn-outs), say, once a month; yet a calculation of the cost of such attention, with the time and labour involved in the use of tower wagons, is claimed to amply justify the installation of such gear. In cases where the gear is already installed for arcs, it can be used without any alteration whatever, except in cases of two (or more) circuit clusters, and in these cases the cost of alterations are very small. The contact-suspension device is of the firm's positive-acting weight-relieving type, and the winch of their self-sustaining pattern, without ratchets, pawls, springs or triggers. One of the views is of Watling Street, E.C., others hailing from Covent Garden, W.C., Croydon, &c.

Metal Lamp Patents.—We are informed that action brought in the Chancery Division of the High C Justice by the Osram Lamp Works, Ltd., against the Tungsten Lamp Co., Ltd., and Another, for infringement of Patent, an order was by consent made on July 26th, whereby it was (among other things) ordered that the defe their servants, agents and workmen be restrained during t tinuance of certain Letters Patent from importing into an making, selling, offering for sale, supplying and using, realm, any illuminating bodies or electric lamps con illuminating bodies made according to, or in manner descril claimed in, the specification of such Letters Patent, or accor or in manner only colourably differing therefrom, and g from infringing the rights of the plaintiffs under the said Patent, and that the defendants do pay to the plaintiffs t agreed for damages sustained by the plaintiffs, or to be susta reason of the infringement of the said Letters Patent defendants by the manufacture and sale prior to the date th lamps and filaments, and the sale of the lamps then in stoc reason of the user of such lamps and filaments, and t defendants do pay to the plaintiffs their costs of the said a be taxed by the Taxing Master.

Catalogues and Lists.—Messrs. Siemens Dynamo Works, Ltd., Caxton House, Westminster, S.W.— (M III 1) containing an illustrated description of the "Do motor equipment, with continuous-current motor, for sewing machines.

The Union Electric Co., Ltd., Park Street, Southwa —Small folder giving in a most compact form a table of "Union" d.c. motors; it will fit into an ordinary card-case pocket. A small table of fuse wires is also given. Contrac obtain these folders on application to the above address.

copy of list No. 5,022 (10 pages) containing desc tabulated outputs, speeds, sizes, code-words and p Union d.c. interpole dynamos and motors. A large r sizes is listed, and the machines can be supplied with mechanical protections to suit different purposes.

The British Aluminium Co., Ltd., 109, Queen Victori London, E.C.—Illustrated leaflets showing bare aluminiu mission lines erected for the War Office at Aldershot, and to the Northern Light, Power and Coal Co., Ltd., at Daw Klondyke; also braided aluminium transmission line erect the sea-coast at Lyme Regis.

Messrs. Tetley & Co., Falcon Electrical Works, Salford trated price lists of "Rex" switches, Poland knife s battery switches, Bedford and Falcon patent liquid dimm and fuse-boxes and other manufactures.

Mr. H. K. Lewis, 136, Gower Street, London, W catalogue of new scientific books and new editions add circulating library since April last.

The Armorduct Manufacturing Co., Ltd., Fa Avenue, London, E.C.—A very full and complete conduit of 112 pages has just been issued by this firm. It is con and effectively arranged with numerous illustrations acc by tables of sizes and prices of Armorduct steel conduit accessories. distribution boards, switchgear, also mill fittings. A number of new fittings are included, and to draw attention in our "New Devices" section to-day. The tion of the catalogue has naturally involved a great deal and expense; no doubt many of our readers interested in of installation work will desire to have a copy amon collection.

The India-Rubber, Gutta Percha and Telegrap Co., Ltd., 106, Cannon Street, London, E.C.—16-page giving clearly tabulated prices of their Silvertown batteries, medical batteries, Bleeck-Love primary batter also a 16-page price list (No. 27) of gutta-percha, indi silk and cotton-covered wires, jointing tools and materials.

Messrs. Wailes, Dove & Co., Ltd., 5, St. Nicholas Newcastle-on-Tyne.—Pamphlet giving particulars of thei "Bitumastic" enamel, with photographs of electrical a works, including blast-furnace plant, pipe line, track, &c., it has been employed.

Messrs. Simplex Conduits, Ltd., 116, Charing Cro London, W.C.—The current weekly mail card illustrates prices of a new line of extra-heavy and medium-heavy made lampholders now being introduced by the firm.

Russia.—Electricity Works Statistics.—The *Official Messenger* of July 18th publishes a list which drawn up by the Ministry of Finance, showing the towns out Russia possessing electric generating stations and The article includes a list of stations in existence of capacities, stations which have been established since the d inquiry, and also general and statistical information on t developments in the electrical industries of Russia. The containing further particulars (in Russian), may be seen t electrical firms at the Commercial Intelligence Branch of of Trade, 73, Basinghall Street, London, E.C.—*Board Journal.*

Economy in the Power Station.—We are that at the meeting of the Mersey Railway Co., Mr. J. the chairman, in reply to a question, stated that the Tir lator recently installed, was affecting a saving of £500 that it has abundantly justified itself. We also unders these regulators, installed in stations where the voltage v siderably, have kept the voltage constant within 1 per cen

Brazil.—£60,000 is to be spent by the Manáos Harbour Co. upon floating wharves and a fixed wharf with electric hoists at Manáos.

Bankruptcy Proceedings.—William Tully, mica merchant, lately trading at 16, Water Lane, Great Tower Street, E.C., as Tully & Straker.—This public examination was held on Tuesday at the London Bankruptcy Court. The statement of affairs showed total liabilities £535 (unsecured £466), and assets valued at £44, absorbed in the preferential claims. Replying to Mr. Walter Bayle, Assistant Official Receiver, the debtor stated that in 1890 he became superintendent engineer to a firm of London shipowners and brokers, and whilst in their employ he commenced for them the business of mica merchants, of which article he had made a study and become an expert in. Mica was largely used for the manufacture of lightning arresters for telephones. In 1899 witness and another person commenced business in partnership as mica merchants at Water Lane, under the style of Tully & Straker. The partner withdrew his capital in November, 1909, and subsequently witness continued the business alone, but, owing to lack of capital, he did not make sufficient profit to pay expenses. He gradually got into debt, and in March last a creditor, having obtained judgment and levied execution at his private residence, witness filed his petition. He attributed his failure and insolvency to loss on trading and want of capital. The examination was concluded.

Frederick Vickers (Fredk. Vickers & Co.), electrical engineer, 286, Oxford Road, Manchester.—Receiving order granted August 9th, on debtor's petition. First meeting August 23rd; public examination, August 25th, both at Manchester.

C. H. Pearson, electrical engineer, decorator and plumber, &c., Greenheys, Manchester (Pearson & Co., and the B.Q.A. Engineering Co.).—First dividend of 3s. 4d. in the £; payable August 18th, at 27, Brazennose Street, Manchester.

Dissolutions and Liquidations.—Alliance Electrical Co., Ltd.—A meeting is to be held at 23, Grafton Street, W., on September 12th, to hear at account of the winding up from the liquidator, Mr. H. V. Marriott. The company was wound up for the sale of its undertaking and assets to the Alliance Electrical Stores, Ltd.

Lepel Wireless Syndicate, Ltd.—A meeting is to be held at the Cecil Chambers, West Strand, on September 15th, to hear an account of the winding up from the liquidator, Mr. A. Holt.

Rosario Electric Co., Ltd.—A similar meeting of this company is called for September 12th at 52, Moorgate Street, E.C. Liquidator, Mr. H. E. Benthall.

Telegraphic Code Co., Ltd.—A similar meeting in this case is called for September 12th, at 318, Moorgate Station Chambers, E.C. Liquidator, Mr. A. W. Good.

Messrs. W. C. C. Hawtayne and G. A. Zeden, carrying on business as consulting engineers at 9, Queen Street Place, E.C., as Hawtayne & Zeden, have dissolved partnership by mutual consent as and from June 30th, 1911. Mr. William Charles Cloete Hawtayne will attend to debts and continue the business in his own name.

Trade Announcements.—The London and Rugby Engineering Co., Ltd., 10, Bush Lane, Cannon Street, London, E.C., have acquired the business of Messrs. J. L Cateaux & Co., including all assets and liabilities as from July 1st, 1911. Any accounts owing by Messrs. Cateaux will be settled by the new company (directors, J. L. Cateaux and E. W. Fraser), as they become due. The company will be managed by the principals of the old firm.

The telephone number of Messrs. Spencer, Chapman and Messel, Ltd., is now "Avenue 1588" (three lines).

The Polystat Electric Co. ask us to announce that all inquiries and orders for "Unica" battery sediment pumps "Duplex" under acid cell inspection lamps, and the gas soldering stoves with self-producing hydrogen jets, should be addressed to their new offices at 5, Kelvin Avenue, Sale, near Manchester.

Messrs. Richard Pape, Ltd., of Albion House, New Oxford Street, W.C., have now removed their registered offices to Belvedere Works, Belvedere, Kent.

The Armorduct Manufacturing Co., Ltd., have added a third telephone line. Their existing numbers, "400 and 401 Holborn," remain unaltered, and the new number is 6854 under the same Exchange.

Book Notices.—"Le Froid Industriel et ses Applications." Second edition. 1911. Paris: *Mois Scientifique et Industriel.* Price 2 fr. 75.

"Science Abstracts." Vol. 14, Part 7. Sections A and B. July 25th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"All About Patents." By C. W. Crossley. 1911. Guildford: Billing & Sons, Ltd. Price 9d. net.

"Year Book of the Michigan College of Mines." 1910-1911. Houghton, Mich.: The College.

"*Journal* of the Franklin Institute." Vol. CLXXII, No. 2. August, 1911. Philadelphia: The Institute. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." August, 1911. New York: The Society. Price $1.

For Sale.—The Great Northern Railway Co. (Ireland) has for sale a quantity of electric generating plant, now in position at its Belfast power house. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Aldrington.—The Hove T.C. has decided to supply current on a three years' agreement to Mr. Overton, who is establishing a factory in the Aldrington district. The extension will cost £215, and the guaranteed annual return is to be £85.

Australia.—The Waterloo Council (N.S.W.), has decided to sign a contract with the Sydney City Council for lighting the municipality with electricity and providing motive power for the many factories in the district. The City Council will now have in its hands the supply of electric light and power to Botany, North Botany, Alexandria and Waterloo. The other municipality in this division is Redfern, the Council of which has virtually agreed to accept the offer of the City Council to purchase its goodwill.—*Australian Mining Standard.*

Barnsley.—At the last meeting of the T.C. it was stated that preparations had been made for installing electric light in place of the present gas lamps, which would be dispensed with at the close of the year.

Burnley.—The R.D.C. on August 10th decided to consent to the application by Burnley T.C. to the B. of T. for the grant of a provisional order under the Electric Lighting Acts, authorising the supply of electricity within the parish of Reedley Hallows.

Biddulph.—The U.D.C. has provisionally adopted the E.L. scheme submitted by Mr. R. Heath, and referred to in our last issue. It is proposed to carry out the scheme by means of overhead wires, and to supply current at 3½d. per unit with meter rent. A canvass of the district is to be undertaken by the Council, and the B. of T. is to be asked to consent to the use of overhead wires throughout.

Chard.—The T.C. has decided not to entertain the E.L. proposals submitted by Messrs. Purves, of Exeter.

Chesterfield.—The Electrical Committee of the T.C. has recommended that the price of current for lighting shall be reduced by ¼d. per unit to all consumers.

Continental Notes.—Austria.—It is intended to erect a water-power station at Zengg in Croatia, of a capacity of 70,000 H.P. for the supply of lighting and power to the city of Fiume and neighbouring districts, also to the Hungarian State Railway Administration, which purposes electrifying the stretch of line between Fiume and Croatia. The capital expenditure is estimated at about 75,000,000 kronen.—*Elektrotechnische Zeitschrift.*

Belgium.—A somewhat new condition, as regards Belgium, is included in the conditions relating to the concession for the electric lighting undertaking in the town of Mons. It reads that "all the material, machinery, conductors, meters and apparatus employed by the concessionnaire must be manufactured by means of primary materials dealt with in factories in Belgium."

Germany.—The T.C. of Altona, in the Elbe district, has decided to sell outright the electrical undertaking, as it has become insufficient for the town's needs, and there are difficulties, in the present state of the money market, in the way of raising the M. 3,000,000 required for the construction of new works on a fresh site. Offers have accordingly been made from two quarters for its acquisition. The A.E.G. proposes to take back the old works and build an up-to-date new station on the strand at Neumühlen, and to guarantee the return of a *pro rata* portion of the yearly increased receipts to the town authorities. In the second place, the Siemens-Schuckertwerke has made a still more favourable offer. In consequence, the T.C. has nominated a commission to report on the competitive offers, and its decision is expected in October.

An experiment which appears to have been completely successful has just been made in the covered market at Altona with the Moore light. This light, as is well known, is founded on the principle of the Geissler tube. A large concourse of spectators attended to witness its first employment on so large a scale. It took about an hour to create a vacuum in the glass tube, which is about 122 metres long, and to charge it with electricity. The C.P. of the light was 7,500; the consumption of current was about 8·8 KW. per hour, the cost per hour being about 1s. 1d. Ten business firms have, it is said, placed orders for similar installations. The Moore light is also to be installed in the tunnel under the Elbe at Hamburg and in a number of theatres and concert halls at Hamburg and Altona.—*Revue Pratique de l'Electricité.*

From statistics officially prepared for the year 1907, it appears that the electric driving power employed in German industries reached the figure of 1,544,801 KW., while non-electric power of all kinds totalled 8,831,434 H.P. The latter was thus 5·72 times greater than the former. Electric machinery and appliances were employed in 2,905 main and 184 subsidiary industries, out of a grand total of 252,912 main and 18,063 subsidiary industries.—*Elektrotechnik und Maschinenbau.*

Russia.—Promoted by the Imperial Russian Technical Society, an Exhibition is to held at Baku in September, of electric and internal combustion motors and automobiles. Exhibits re-exported within six months will have the duty refunded.

Dublin.—The L.G.B. has sanctioned the borrowing of £100,000 for electricity purposes, including the £50,000 already sanctioned for this purpose recently.

Gravesend.—The Kent Education Committee has decided to have the E.L. installed at the new Technical Schools.

Greenock.—It was reported at the meeting of the T.C. on Tuesday (15th inst.) that the net profits of the electricity department for the year were £5,520. Two years ago the net profits were £1,045; a year ago they were £3,247, and now they had risen to a sum hitherto unrecorded in the history of the department. This was after paying all charges for interest, sinking fund and depreciation. The power output was responsible for the largest part of this increase, but, at the same time, there was an increase of 21 per cent. in lighting, and 13 per cent. for traction. The policy of the Committee had been shown to be a correct one—to attract large power consumers instead of allowing them to set up electric power of their own. They were unanimous in placing £1,500 to the reserve fund, and they had £4,020 as the sum left for allocation, which would be dealt with at the next meeting. It was also pointed out that this was the largest increase recorded in any one financial year, and the department was on a thoroughly sound financial footing. The accounts were approved.

Glasgow.—At the last meeting of the T.C. ex-Bailie Willock (the convener) submitted the annual accounts and reports of the Electricity Committee pointing out that it was pleasant to note that the depression from which the department had suffered during the past three years was now rapidly disappearing. The revenue account showed a substantial increase, and the general cost of work was improved, and after the deduction of depreciation, there had been a net increase over the year of £30,251. The revenue had increased by £14,567, largely derived from power consumers. Notwithstanding that 5,826,000 more units had been generated this year, as compared with last year, the coal bill had only gone up £1,231, and that was wholly due to the extra 9d. per ton paid for coal. As a matter of fact, the saving in coal consumed during the past year was equivalent to about 15,000 tons, equal to a money saving of £6,000. The other items in the cost of generation had fallen $\frac{1}{10}$th of a penny per unit sold, or a total saving of £2,500. There had been slight unavoidable increases in the cost of distribution, but the average price received during the year had been just over 1½d. per unit, and the cost of production just under 1½d. per unit. The difference between the two was a surplus of £6,680, which the Committee was empowered to place to the reserve fund, as the sum was not sufficient to permit an effective reduction to any class of consumer. It was confidently anticipated that next year a reduction affecting some section of consumers would be possible. Bailie W. F. Russell, the convener of the Tramways Committee, suggested that the time had now arrived when there should be some amalgamation of his department with that of the electricity department. The report and accounts were approved.

On the evening of Friday, 11th inst., Lady M'Inns Shaw, the wife of the Lord Provost of the City, inaugurated the scheme of electrical illumination at the Scottish National Exhibition at Glasgow. The scheme covers practically the whole Exhibition area; in all about 50,000 incandescent lamps have been used.

Grimsby.—The borough electrical engineer is to report to his Committee upon a proposal to reduce the charge for electricity to private consumers from 3¾d. to 3½d. per unit.

Hessle.—The U.D.C. on Monday decided that at the earliest possible date the Council should proceed to put into execution the powers of the E.L. order, 1905, and that plans, specifications, &c., for the laying of mains and the equipment of the transformer stations be prepared: providing satisfactory terms can be obtained, current in bulk will be taken from Hull T.C., but the control of the distribution and supply within the district will be retained by the U.D.C.

Heywood.—At the quarterly meeting of the T.C. last week, it was decided to apply for borrowing powers for £3,000 for the electricity and tramway services.

Irvine (N.B.).—The Harbour Trust has unanimously agreed to appoint a qualified engineer to report on the probable cost of electric lighting at the harbour and its adoption for power purposes.

Japan.—The municipal authorities of Yokosuka have passed a resolution in favour of municipalising the undertaking of the Yokosuka Electric Light Co., and are negotiating with the company with regard to the purchase.

Kirkheaton.—The D.C. has placed the contract for the lighting of the central portion of the district by electricity for a period of five years with Mr. T. W. Broadbent.

Liverpool.—On July 16th at All Saints' Church the inauguration of the new electric lighting installation took place. The work was carried out by the Northern Electrical and Ventilating Co., Ltd., of Liverpool. The already existing artistic gas pendant fittings were utilised.

London.—Islington.—The Lighting Committee reported at the last meeting of the Council having informed the Finance Committee that it was prepared to agree that the price of electricity supplied for public lighting should be reduced by £1,000, and that a similar sum should be applied to the relief of the general rate. In the course of the discussion, Alderman Vorley said that owing to the assessment having been increased, they had now to pay £900 a year extra in rates. The charge for public lighting, he said, was now 1·67d.; the average for all London was 1·63d., while outside London it was 2·05d. The price was slightly below cost, but the cost was falling. It was true that in the early years of the undertaking the Committee had overcharged for public lighting. While the Council had paid them £18,000 more than cost price, the Committee had also supplied the Council with electricity under cost to the amount of £12,000, so that the Council had paid a sum of £6,000 in 15 years above actual cost, without making a charge for depreciation. After the summer vacation he intended to bring up a scheme of development.

Newport.—The future of the electricity and tramways undertaking was under discussion by the T.C. last week, when a proposal to appoint a commercial manager was withdrawn in favour of a motion to obtain a report from the Electricity and Tramways Committee on the position and administration of the undertaking, and as to what changes, if any, were necessary in its control and management, which was carried by 21 votes to 1. The manager, Mr. Collings Bishop, was away at the time, and this fact was mentioned by one speaker. A further discussion took place in regard to the recent resignation of Mr. Ellis, the secretary of the department.

Radcliffe.—At a meeting of the D.C. held on Monday, it was announced that the Lancashire Electric Power Co., which has its generating station in the district, is applying for a provisional order to supply electricity in the urban district.

Sheffield.—The Electric Light Committee of the City Council has recommended that, in view of the large and continually increasing demand for electricity, application be made to the L.G.B. for sanction to borrow a further sum of £61,099, in connection with the Neepsend generating station extension. This £61,099 is part of the sum of £250,000 provisionally approved by the Consultative Committee on July 1st, 1908, for the report of the special committee of inquiry.

Southport.—The Electricity and Tramways Committee of the T.C. having decided that it is desirable that a system of electric clocks should be established in the borough, a report is being prepared as to the best system to adopt.

South Africa.—The Johannesburg (Transvaal) Municipal Electric Supply is making continuous progress, the output for June last (1,693,364 units) comparing with 886,177 units in June, 1908. The present generating plant includes two 3,000-KW. Belliss-Lahmeyer turbo-alternators and a 1,000-KW. Belliss engine-driven alternator, also two 1,000-KW. and two 500-KW. Belliss D.C. sets and 1,750 KW. of motor-converting plant. The boiler house equipment includes 14 Babcock boilers and a Bettington dust-fuel boiler, and new coal-conveying plant and bunkers are to be provided at an estimated cost of £14,000. The town supply is on the direct-current three-wire system (460-230 volts), while the suburban area is supplied with 3,300-volt 50-cycle single-phase current, reduced at transformer stations to 200 volts pressure for consumers' use.

Stourport.—The U.D.C. has referred to a Special Committee a scheme for E.L. submitted by the Kidderminster E.L. Co. The use of overhead mains is suggested.

Walsall.—The assistant electrical engineer has been instructed to make good the damage caused by the recent fire at the Butts Road sub-station by altering the existing switchboards so as to bring them more up to date, at an estimated cost of £125. A coal elevator is to be provided for the new boiler at an estimated cost of £120. The tramway manager has been instructed to have one of the cars fitted with speed indicators, and to arrange for each motorman in turn to handle the car so as to provide some training in the judgment of various speeds.

Whitehaven.—At a meeting of the T.C. on August 10th, Mr. Graham drew attention to a charge of £56 for installing 20 electric lamps at the Hospital, and said that it was time that they should admit outside competition for wiring work, as local firms seemed "to put their heads together to keep up the price." The Corporation had four times as much power as they were supplying, and three-fifths of the ratepayers would take the E.L. if the cost of installations were not so great. Mr. Walker replied that he went through the tenders, and the highest was about double the lowest one. If Mr. Graham had seen the great disparity in the tenders he would not have thought there was any collusion on the part of local tradesmen. The Hospital was a difficult place to wire.

TRAMWAY and RAILWAY NOTES.

Ashton.—The tramway workers in the area have placed their demands for an increase of wages and alteration of working conditions before the local authorities. The T.C. is awaiting the report of a joint conference before taking action.

Australia.—Among the public works which have been sanctioned by the N.S.W. Legislature is the construction of an electric tramway from Darley Road, Randwick, to Little Coogee at a cost of £81,763.

The power house of the Adelaide Municipal Tramways Trusts at Port Adelaide, was officially opened by the State Premier recently. Energy is generated at 11,000 volts, and transmitted by duplicate overhead lines to converter sub-stations about 10 mile, away. The power house site is adjacent to the river, and gives ample water and coaling facilities.

(*Continued on page 263.*)

THE SWISS TOUR OF THE INSTITUTION OF MECHANICAL ENGINEERS.—II.

BY OUR SPECIAL COMMISSIONER.

In our first article we published four photographic views (figs. 4-7) illustrating the results of a curious accident to a water turbine, which, as occurring in a kind of machinery we English are not familiar with, may have special interest to our readers. The turbine was a vertical-shaft Francis machine. Every part was well and properly made, and all parts erected properly to specification. There was no weakness, accidental or otherwise, of material or of dimensions anywhere. The top "umbrella" cover of the turbine was bolted down with the proper number of bolts of the proper size. The nut of one of these bolts, however, was not tightened up so hard as it ought to have been, and apparently was not cottared. In starting to run all went well at low speed, but when the speed became high the vibration caused this nut to slack back. The bolt eventually got loose. It was sucked into the runner blades, while the nut was similarly carried by the water through the gates, guide blades and runners. The high rotary and centrifugal velocity drove these through the blades with such violence as to break and practically to strip the blades over the whole circumference of the wheel. The views show the result. In consequence, the whole had to be dismounted, and a new runner wheel and a new set of guide blades had to be supplied.

The first afternoon excursion took us to Neuhausen and Schaffhausen, to visit the hydro-electric plant there. After visiting these works we went to view the Rhine Falls, a mile or two lower down the river, and then joined the ladies at dinner in the Schweizerhof, which has a magnificent view of those wonderfully beautiful falls, returning to Zürich by train in the late evening. Fig. 1 shows a plan of the waterworks, which in their new development, not yet wholly complete, present in one respect uniquely interesting features.

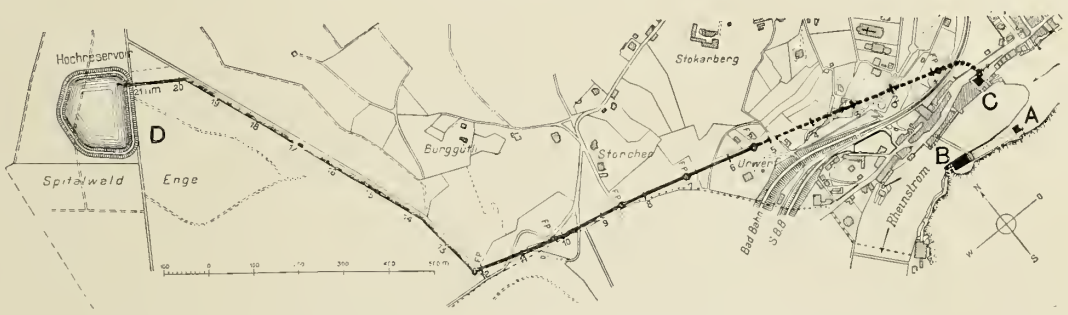


Fig. 1.—Plan of Storage Works and Stations A, B and C, Schaffhausen.



Fig. 2.—Part of the Pipe Line. Schaffhausen.

Historically these are the oldest waterworks of large size in Switzerland. The original power house, still in use, was placed in the position marked A on the plan; and the power was transmitted by ropes across the river to its north side. Twenty years ago the station B was built, and electric generation was commenced, but ropes from turbine to dynamo were used to obtain the necessary rotary speed in the latter. Since 1906 the works have been completely remodelled. The head and tail races at station B have been rebuilt, so as to allow of much fuller utilisation of the available water flow and head. It is designed for a fall varying from $3\frac{1}{2}$ to $5\frac{1}{2}$ m. with a flow in cb. m. per sec. ranging from 14·2 with the low head to 8·1 with the high head. The maximum horse-power per turbine is 520 with the maximum flow and minimum head, and ranges down to 450, the speed being 75 R.P.M. There are five of these turbines, built by Thomas Bell & Co., of Kriens, at station B, all Francis wheels on vertical shafts with 80-pole 505 K.V.A. three-phase Oerlikon generators set direct on top of the shaft. The periodicity is 50, and the voltage 2,100. Fig. 10 is a section of this turbine and generator, the former having double runners. The draught tube of the top runner is in the form of an inverted siphon, to which is applied a small air suction pump to produce vacuum at starting. It has, however, been found unnecessary to use this air pump except at the first start. The rotor of the generator weighs 26 tons.

The night load is very light, but the Rhine does not cease to flow overnight; and near the works there is no possible water storage. For this reason the new works at the positions C and D on the plan were designed, and are now at work, although their full development upon double their present working scale will come later. Fig. 4 is a view of

part of the power house at C. In the middle of the shaft of each unit is keyed a motor-generator alternately used as motor and as generator. At one end of the shaft is an Escher, Wyss high-pressure turbine; and at the other end a Sulzer 2-stage centrifugal pump. During the night the motor receives electrical energy from station B on the south side of the river and drives the centrifugal pumps, which deliver water to a high-level reservoir situated at D, 2·1 km.

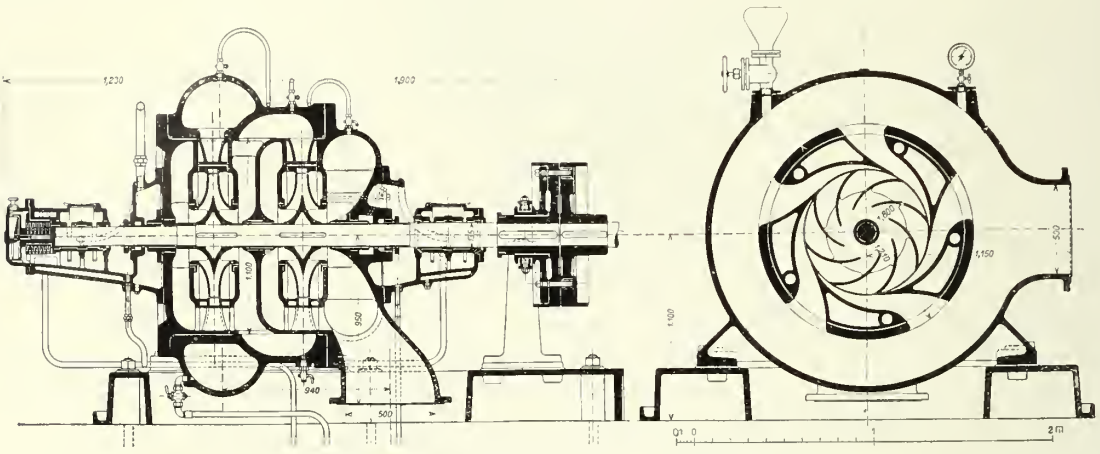


Fig. 3.—Sulzer Two-Stage Centrifugal Pumps, Station C.

distant. During the times of peak load in the day time, water flows back from this reservoir and drives the turbines, which again drive the generators and thus supply electric energy to the transmission network.

The overflow level of the reservoir is 155 m. above the pumps. In the flow of the water through this long pipe a head of 30 m. is spent in overcoming friction; so that this item alone brings the efficiency down to $(155 - 30)/(155 + 30) = 125/185 = 67\frac{1}{2}$ per cent. Besides this, there are the other items of inefficiency: (2) mechanical and electric loss from generator at B to motor at C; (3) mechanical loss in pumps at C; (4) mechanical loss in turbines at C; and (5) mechanical and electric loss in generator at C. In these are, of course, included the frictional losses at the bearings of the shafts. The result is that the overall efficiency is no more than 42 per cent.

Each unit is of about 1,000 H.P. The motor-generators are of Brown, Boveri manufacture with 2,150 volts and 25 per cent. half-hour overload capacity, the normal being 1,000 K.V.A., with $\cos \phi = 0{\cdot}7$ and a speed of 1,000 R.P.M. Fig. 5 is a section of this machine. When warm the insulation will stand 5,000 volts A.C. between the iron and the armature copper. Each pole has 100 windings of 1·4 by 35 mm. cross-section copper strip with 0·2 mm. thickness of paper insulation; and there are three pairs of poles. In the high-tension winding the copper section is 16 by 17 mm. cross-section, and the insulation is 2 mm. thick.

Fig. 3 gives two sections of the two-stage Sulzer centrifugal pumps. They are designed to deliver 350 litres per second per pump, and are of 980 H.P. at 1,000 R.P.M. The efficiency is 78 per cent. There is also a six-stage pump of small size for the special duty of filling the pipe when it has been emptied for cleaning or repair.

Fig. 6 is a section and plan of the Francis turbine, built by Escher, Wyss & Co., for a fall of 157 m. and 1,000 R.P.M. It has a spiral casing, and a duplex balanced runner with two symmetrical draught tubes uniting in one underneath the floor. The two branches are connected by a cross-pipe to ensure equality in the vacuums on the two sides. The runners are of gun-metal throughout, and have open tipped blades. The interior surfaces of the casing opposed to these blade tips are carefully ground smooth and to exact form for a close fit. The efficiency ranges from 74 to 78 per cent. at half and full gates.

Figs. 7 and 8 show two parts of the pipe line laid in open trench and in tunnel. The trench is filled in with loose soil for protection from frost. Near the reservoir the gradient varies from 3 to 30 per 1,000; there is then a stretch of nearly $\frac{1}{2}$ km. long at an average of nearly 240 per 1,000, the rest being sloped to a mean of less than 100 per 1,000. A $\frac{1}{2}$ km. length is taken through tunnel in hard rock. Near the reservoir the diameter of the pipe is 1 m.; but it is gradually decreased to 800 mm. at the power house.

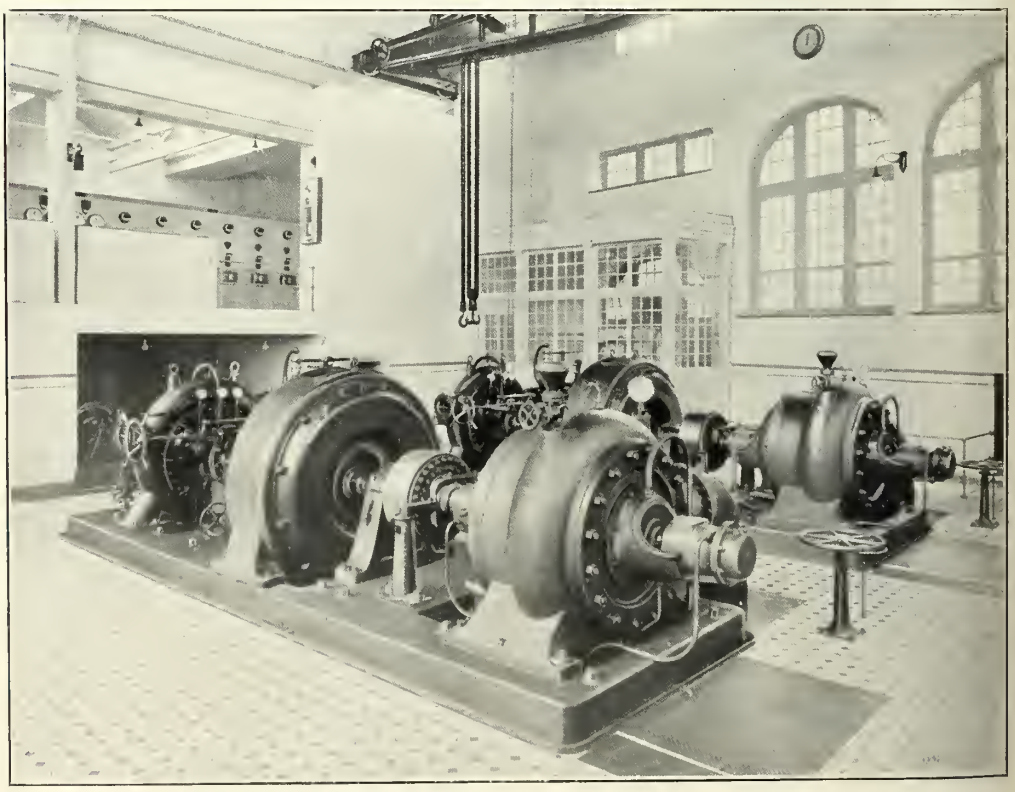


Fig. 4.—Motor-Generator, Turbine and Pump Sets, Station C, Schaffhausen.

The proper anchoring of the pipe to the rock in the tunnel and to concrete foundation beds in the trench, and the provision for temperature expansion between these anchorages are matters requiring very careful attention, but not offering any great difficulty. Fig. 2 is a pleasant bird's-eye view of part of the pipe line through the higher part of its reach.

The reservoir was formed by excavation on the site of an

old swamp. It has a water surface of 20,000 sq. m., and a mean depth of 5 m., giving a storage capacity of 0,000 cb. m.

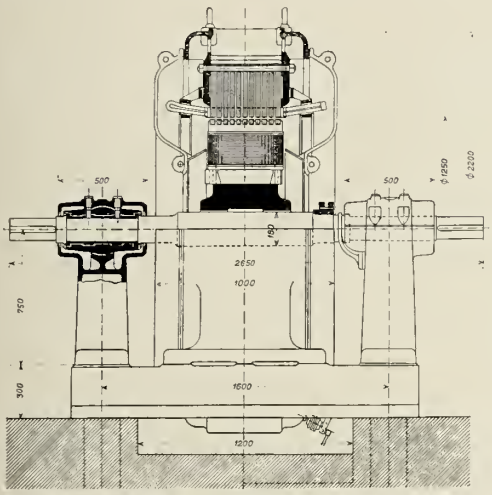


Fig. 5.—Brown, Boveri 1,000-h.p. Motor-Generator at Station C.

Fig. 9 is a diagram bringing together all the useful esults of this plant upon a base-line of water flow, the ottom scale being litres per second per unit plant.

A duplication of this storage plant is contemplated in the ear future. The eservoir will have its mbankments raised y ½ m., increasing the torage capacity to 0,000 cb. m.; and a econd pipe line of the ame size will be laid. The tunnel through he rock has been cut o take two pipes, nd the various oncrete anchorages ave been built for two ipes. The power ouse has, of course, lso been built to llow of this future xtension of plant. The large capital outay involved in this torage plant with its ong expensive pipe ine makes it of pecial interest; and many of our party wondered where the dividend-earning power came in. Such outlay would not be justified for the purpose in view, except in a country where native coal does not exist. The whole coal supply of the country comes chiefly from England and Westphalia, and, in smaller proportion, from France.

REVIEWS.

Principles of Wireless Telegraphy. By G. W. Pierce, A.M., Ph.D. 1910. London: Hill Publishing Co. Price 12s. 6d.

It is now possible to form a small library consisting of works on wireless telegraphy and literature relating thereto. The appearance of books by well-known investigators can, however, still be welcomed, and that forming the subject of this review may undoubtedly be included in the category. The work covers some 342 pages, with 28 chapters and appendix and abundant illustrations.

While touching upon the theory of electrical principles in general, and of electrical oscillations in particular, the author avoids the introduction of the more recondite mathematical investigations of the subject, and presents it in a popular manner. With the exception of Chapter II, the theoretical treatment is explicit and specially suited to lead up to the consideration of wireless telegraphy phenomena. Theories as to the nature of electricity are treated briefly in the second chapter, where the electronic theory is quickly unfolded. It

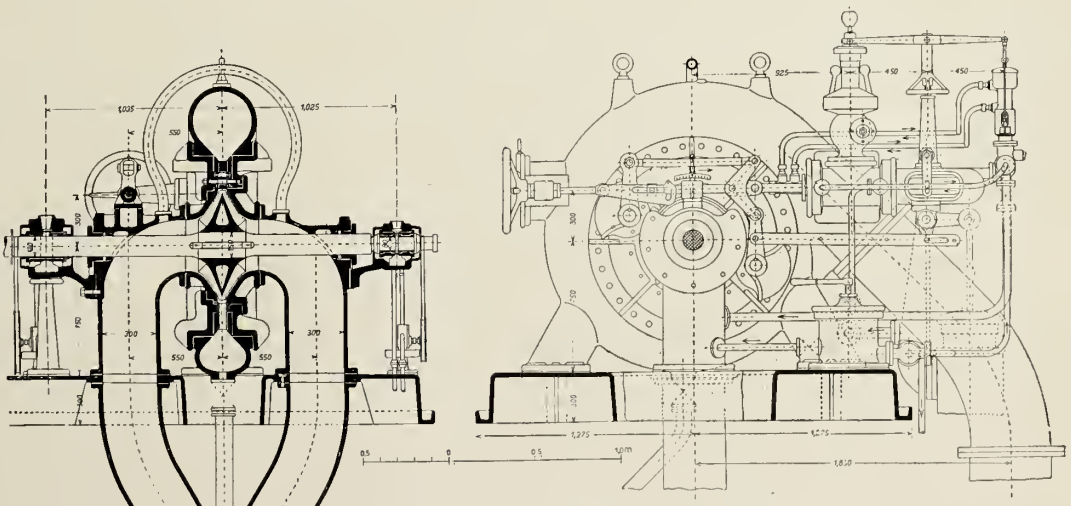


Fig. 6.—Escher, Wyss Francis Turbine at Station C, Schaffhausen.



Fig. 7.—Pipe Line in Open Trench.



Fig. 8.—Pipe Line in Rock Tunnel.

yet remains to be seen in what respect the electronic theory in its present crude and somewhat unhealthy development can assist the student in forming accurate conceptions of the operations involved in electromagnetic phenomena in general and wireless telegraphy effects in particular. That it will confuse and bewilder him is much more likely. Serious exception may, for instance, be taken to the idea expressed

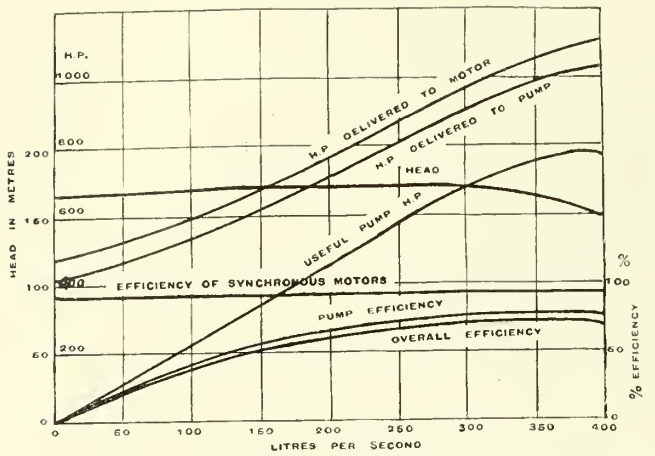


Fig. 9.—Efficiency Curves, Station C.

in Chapter II that the Leyden jar discharge may be pictured as a flow of negatively charged corpuscles from one coating to the other with periodic reversals of the direction of flow. Such a view is quite controversial.

In matters of experimental investigation in which the author of the book has been concerned and to which considerable attention is given, the information afforded is of a distinctly useful and helpful character. This applies specially to explanations and investigations of coupling and resonance questions as well as to obscure actions of electrolytic and crystal detectors. In these matters the author has done much useful work, and a *résumé* of the principal investigations and results is given. The effect of damping resistance in receiving systems is illustrated in some useful curves on page 226, whilst the selectivity curves in Chapter XXIV give a good idea of the degree of selectivity possible under stated conditions. The author has, however, omitted to make it clear that a considerable allowance is necessary in practice to provide for working margins of adjustment, variations in strength of radiation, wave length, sensibility of receiver, &c.

The comments on the early wireless patents of Lodge and Braun form suggestive reading, but are capable of being carried to a more definite issue.

In descriptions of apparatus and plant used for practical radiotelegraphy there is scope for much greater detail. Transmitters operated from power plants are practically untouched.

From the student's point of view the book may be classed as one of the most useful productions dealing with the subject which has yet appeared.

The Principles of Electric Wave Telegraphy and Telephony. By J. A. Fleming, M.A., D.Sc., F.R.S. Second edition. 1910. London: Longmans, Green & Co. Price 28s.

As indicated in the preface to the second edition of this well-known work, considerable revision and extension has been made, the title having also been amplified to include the subject of radiotelephony. The book now runs into some 906 pages as compared with 671 in the original edition.

The individual chapters have been revised and rearranged, many of them being considerably extended. Among the more important additions may be mentioned descriptions of the Gehrcke vacuum oscillograph tube—a handy and useful appliance for investigating high-tension current changes—the Poulsen arc system, Lepel and quenched spark dischargers, directive systems, including an account of the Bellini-Tosi method, descriptions of some of the more modern radiotelegraph stations and modern practical forms of tuning apparatus such as the Marconi multiple tuner. Attention is also given to developments in the way of measuring appliances and methods specially suited to the requirements of radiotelegraphy. In this direction, however, the last word has by no means yet been said. Several of the methods described and devices illustrated can hardly be termed exact in character. The concluding chapter (Chapter X) deals with the subject of radiotelephony so far as it has yet advanced. Mention is made of a number of devices for which very sanguine claims have been made by various inventors, but which have almost invariably been found to fall short of practical requirements. In one or more of the arrangements described, certain old ideas which were long ago found futile for ordinary telephony are brought out in a new garb. The present state of development of radiotelephony appears to be about summed up in the final paragraph of the chapter. The difficulties encountered have been greater than sanguine investigators had expected, and early promises have not been realised.

Some want of consistency is revealed in the diagrams in respect of the representation of inductance spirals. The zig-zag representation is more frequently adopted than the helical. It is suggested that the former is more appropriate for the representation of resistance.

The author still appears to perpetuate the idea (on pages 360 and 361) that in a true wave propagation the energy in each portion of the medium alternates between the kinetic and potential states, despite the statement also made that the total energy of a wave at any moment is half kinetic and half potential. Though these statements are not necessarily contradictory, the latter ought certainly to be amplified to make the author's meaning clear. We have been taught that Stokes has shown that for waves of light the potential and kinetic energies in the wave are equal and in phase with one another; also that the

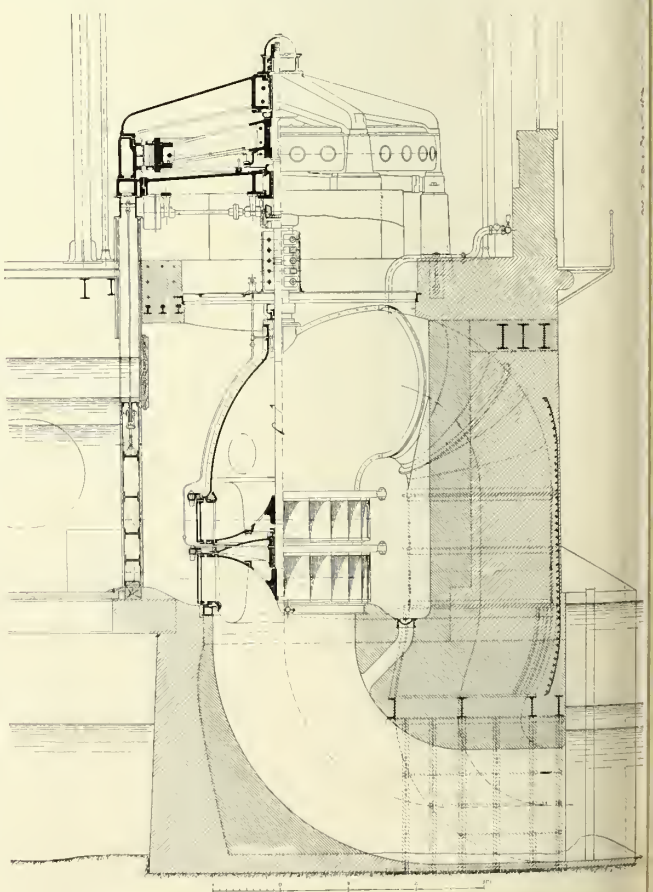


Fig. 10.—Turbine and Generator at Schaffhausen, Station B.

same thing is implied by Maxwell for all electromagnetic waves. A difference of phase would imply reactance of the medium, and a continuous reflection of some portion of the energy back upon the source. In a homogeneous medium this does not occur. No reflection is experienced unless some change in the constitution of the medium is encountered.

Town Scavenging and Refuse Disposal. By Hugh S. Watson. London: St. Bride's Press, Ltd.

This useful little treatise, which is a reprint of articles originally published in the United States, commences by drawing attention to the enormous importance of dealing with town refuse in a proper and sanitary manner.

The statement quoted from Dr. Germans as to the propagation of disease by dust, is in itself sufficient to show that the prompt and efficient sterilisation of all such matter is a necessity to the public health, and demonstrates that the absolute prohibition of any accumulation of refuse either by private persons or public bodies would be perfectly justified.

The carrying of disease germs by flies is not referred to, but the enormous importance of this view of the refuse question has recently been brought out by the researches of Dr. Simpson, of the School of Tropical Medicine, and others, and by various authorities who have lately reported to the Local Government Board on the subject.

Street cleansing is fully dealt with, and in connection with street watering, reference is made to the electrolytic production of a cheap and powerful disinfectant at Poplar under the supervision of Dr. Alexander, Medical Officer of Health of that borough. As the electricity at Poplar is in large part generated by power from the refuse destructor, this is a good example of the art of "making one hand wash the other."

The sanding of roads is referred to, and the use of clinker for this purpose is condemned out and out, on the ground that the clinker disintegrates too easily and forms dust.

With this we do not at all agree. At the present time Leeds and Bradford are saving large sums annually by utilising clinker in this way. The clinker is ground to the size of about $\frac{1}{8}$ in., and the fine dust sifted out of it and rejected. The granular material so produced is used not only for sanding slippery streets, but also for the tramway sandboxes where it replaces sand, which is always very costly, owing to the necessity of careful drying—in itself an expensive operation. Tramway and railway engineers might well weigh the possibility of using this cheap and useful substitute for carefully dried sand. The subject is mentioned again later on in the book, where it is stated that clinker prepared for this purpose realises at Leeds 2s. per cb. yard, and yields a large profit.

Waste paper, house refuse, trade refuse and street refuse are all discussed, and various methods of disposal are reviewed.

The leading destructor types are referred to in detail.

The costs of burning cited vary, as usual, so enormously as to destroy all confidence in the figures. It is (for instance) stated that in the Heenan & Froude destructor the cost of burning is 7·3d. per ton, or, with flue cleaning added, 8d. per ton; whereas the cost of burning at Shoreditch, in the Manlove destructor, is given at 3s. 8½d. per ton. It is perfectly obvious that the first figure excludes management clerks, auxiliary labour, repairs, depreciation and capital charges, and therefore bears no comparison whatever with the second figure, which appears to be official and inclusive. This loose handling of important figures seems to be characteristic of the subject, for we can hardly recall an instance in which reliable and comparable figures of cost have been made public. An interesting plate shows the design of the Horsfall automatically-charged destructor on the "Tubed" system, but no costs of working are given in this case.

There is a chapter on the utilisation of the waste heat. It is stated that at Liverpool 30 to 40 tramcars are driven 100 miles daily by steam from refuse, which is valued at 3s. 2d. per ton of material consumed.

At Hackney there is a credit for steam of £2,288 per annum, the net inclusive cost of destruction, after allowing for this credit, being 2s. 11½d. per ton. At Preston the power is used for driving the electric tramways. Five hundred H.P. is raised in the Fulham combined station from the refuse; and about 1,000 H.P. is produced and used at Bradford.

While welcoming this useful little compilation, we are bound to admit that a scientific and comprehensive work embodying the practice of to-day in connection with this increasingly important subject has yet to appear.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 258.)

Bath.—The management of the Bath Electric Tramways on Monday dismissed, on the men's demand, an official who had lately been re-engaged. The men had decided to leave work unless the demand was complied with.

B.E.T. Tramways.—The workmen in the employ of the British Electric Traction Co. engaged on the tramways on the Cradley Heath, Blackheath, Stourbridge, Brierley Hill and Dudley districts have, without solicitation, had their wages increased by ¼d. per hour, equivalent to 1s. 3d. per week. Needless to say, the workmen are greatly elated, particularly as the cost of living has recently increased.

Brierley Hill.—At the meeting of the U.D.C. on Monday, the Tramways Committee reported that a letter had been received from the B. of T., notifying that the latter had granted an extension of the time for the completion of the lines authorised by the Light Railway Order until December 15th next.

Brazil.—According to a private dispatch received in Hamburg, the engineer, Raoul Ribeiro, has applied to the Brazilian Government for a concession to build an electric railway from Rio de Janeiro to Santos. The gauge is to be 1·40 metres, and it is intended to make a junction with the existing Sao Paulo Railway at Santos, whereby the journey from Rio to Sao Paulo will be shortened from 12 to 6 hours. No Government subvention or guarantee is asked for.—*Zeitschr. für Elek. und Masch.*

Chile.—A decree, dated May 31st, has been issued by the Ministry of the Interior approving the plans submitted by Messrs. Cárlos Correa Larrain & Juan Gross for the installation of an electric tramway service and an electric light and power station in the communal district of Barrancas. Work must be commenced within six months and completed within one year from the date of the decree.

A similar decree, dated May 31st, has been issued, approving the plans submitted by Don Renato Saez Ruiz for the construction of an electric tramway in Vina del Mar. In this case also work must be commenced within six months and completed within one year from the date of the decree.

Continental Notes.—Hungary.—According to official figures there were in Hungary, at the end of 1909, five electric tramway systems, having an aggregate extent of 54¾ km., being an increase of 11 km. on the figures of the previous year. The capital city, Buda-Pesth, stands for half of the working track, and employs five of the electric locomotives and 22 of the electric cars running, the balance of six locomotives and 13 cars falling to the other three lines. The rest of the rolling stock consists of 45 passenger and 31 goods carriages. In the course of the year a total of 8,834,952 passengers were carried by the five systems. The capital of 13,000,000 kronen invested in these undertakings yielded in 1909 on the actual capital employed, interest at the rate of 1·16 to 7·87 per cent., the two Buda-Pesth systems earning the highest amounts, or 7·87 and 4·20 per cent. respectively. —*Elektrotechnik und Maschinenbau.*

France.—A new company has lately been formed in Paris, with a capital of £48,000 and the title La Société des Tramways Electriques de Loir-et-Cher, to acquire concessions for, and to construct electric tramways in, the French Department of that name.

Turkey.—The plans for the electrification of the tramways of Constantinople, prepared by the Société des Tramways de Constantinople, involve an estimated expenditure of £T400,000.—*Elektrotechnische Zeitschrift.*

Russia.—The T.C. of Winniza has decided to construct an electric tramway system, and in the towns of Kamenez-Podolsk and Mohlen-Podolsk an electric lighting service will be installed.—*Zeitschr. für Elek. und Masch.*

La Société des Tramways et Eclairage Electriques de Simferopol is the name of a new company which has just been formed in Brussels, with a capital of £140,000, to acquire and work a concession for the construction and operation of a system of electric tramways and for the supply of electrical energy for lighting and power purposes in the town of Simferopol, in the Crimea.

Italy.—The Società Elettriche di Brescia having purchased in 1907 the whole tramway network of the province of Brescia, has electrified a portion, viz., two important suburban lines having a heavy local traffic, and the line connecting the city of Brescia with Lake Garda and its Riviera. The problem of the electrification of these lines presented several difficulties, which have been successfully surmounted by adopting continuous-current at a pressure of 1,200 volts. To secure uniformity in the electrical material, it was decided to employ two motors on the suburban cars and four motors on the Lake Garda cars, the motors being of the same pattern in all cases. The four-motor equipment (supplied by the General Electric Co.), with Sprague multiple control, consists of motors permanently coupled two and two in series, so that the voltage at the terminals of each motor never exceeds 600 volts. The motors are of 50 H.P. capacity, and give a maximum speed of 40 km. per hour. The coach lighting current and that working the pneumatic brake is supplied by a little converter fixed

under the vehicle, which steps down the current from 1,200 to 600 volts. The cars for the suburban service are four-wheeled, and the two motors are permanently coupled in series, control being effected wholly by resistances. The sub-stations, one of which is situated at Brescia and the other at Salo, on the western bank of Lake Garda, are each equipped with two sets of rotary converters with a regulating battery. The overhead line, constructed by the Italian Thomson-Houston Co., is of the catenary suspension type, supported at four points by trellis-work posts placed at distances of 60 metres apart. The electrification took place without the least interruption of the previously-existing steam service, and the working of the electric service, with double the number of trains, was introduced from day to day without the least inconvenience.

Dewsbury.—The T.C. has under consideration the construction of a tramway from the Market Place to Dewsbury Moor, the latter being the only district in the borough for which there is not a service provided, with the exception of the Leeds Road route to Shawcross, for which a Bill is before Parliament. The Secretary to the Yorkshire (Woollen District) Electric Tramways, Ltd., has written to the Corporation stating that the company is not prepared to obtain powers to construct a tramway to Dewsbury Moor in compliance with notice served by the Corporation over six months ago. The company suggests that if the railless trolley system would be acceptable to the Corporation, it will be prepared to consider the matter further. The question has been referred to a Joint Committee of the Parliamentary, Electricity and Tramways Committees, the members of which have inspected the service of railless trolley cars running between Leeds and Farnley.

Dundee.—The Corporation Tramway Committee has resolved to adopt the railless trolley system on the Clepington Road, forming a connection with the Maryfield and Downfield systems. Mr. A. Spence, the tramway convener, said it would be some time before the system was in operation because of the time required to get the overhead equipment and cars ready. Bailie Don pointed out that the tramway department would be charged with a portion of the cost of remaking the road. The convener replied that if the department had to pay anything towards the maintenance of the road, then the system could not go in. They did not want a specially macadamised road as the cars could run on any road. Treasurer Soutar suggested that the tramway department should contribute £100 a year towards the upkeep of the road, but the convener retorted that they had no power to contribute towards the upkeep of the roads unless they laid rails. Ultimately it was decided that the system should be proceeded with, and that the question of the road should be deferred meantime.

Glasgow.—The city and suburbs have just weathered one of the most sharp, though short, labour struggles which has ever been experienced. As reported in the Review lately, the Corporation approved of the action of the tramways department in refusing to grant an application by the motormen and conductors for a working week of 48 hours and a 14 days' annual holiday with pay. Later, the T.C. granted the discontents an increase of 1s. per week in the case of all men with over two years' service; but while this appeared acceptable for a time, the employés' leaders came forward in a subsequent request for a 51-hours' week, a seven days' holiday with pay, and an all-round increase of 1s. per week. The matter was remitted to the Tramways Committee for reconsideration, but without waiting for the report of that body the men belonging to the Municipal Employés' Association, and forming the bulk of the service, decided to strike work on Saturday morning. This action for a time paralysed the service, though the men who had not come out, and were conveyed to the depôts in motor cars and under police escort, managed to keep up about 200 cars going on Saturday and Sunday. These cars were the objects of demonstrations, two of the vehicles having been dragged bodily from the lines, while the windows of many were smashed to atoms. Police on horse and on foot were on duty night and day, and on Monday evening the Argyll and Sutherland Highlanders, whose headquarters are at Glasgow, were summoned back from camp. For the three days ending Monday night the strikers were in almost continual conflict with the police, and over 100 arrests were made. On Monday afternoon the T.C. Committee met, but rejected a proposal to submit the points in dispute to B. of T. for arbitration, remitting the whole matter with full powers to Mr. Dalrymple, the general manager. In the meantime, many of the men had applied for reinstatement, and on Tuesday evening it was reported officially that the strike was at an end, over 80 per cent. of the men affected having been reinstated at the old terms, and the full service resumed. There is little likelihood of the men who took an aggressive part in the dispute being re-engaged. Fifty-five of them have handed in their uniforms and declined to return. Picketting is said to be again in progress as we go to press.

Ex-Bailie James McFarlane, a late convener of the T.C. Tramways Committee, has addressed a lengthy circular to his colleagues and the public generally, on the advisability of giving two of the present halfpenny car stages for a halfpenny. He quotes quite a plethora of statistics in favour of his arguments, and contends that the following safeguards and reservations must be made:—There must be paid to the common good a sum of at least £50,000; there must follow a readjustment of the average distance stages; a removal of unsuitable stations and overlaps; the penny fare will be restricted to a maximum of four stages; through minimum car fares, and no advance of wages to the employés.

Japan.—We learn by the latest Japanese mail that the amalgamation of the Yokohama Electric Co. and the Enoshima Electric Tramway Co. has been successfully carried through.

Liverpool.—At a meeting of the motor men and guards employed on the Liverpool and Crosby electrified section of the L. and Y. Rly. on the 10th inst., it was unanimously decided to do all in their power to assist their comrades, the goods workers on strike in Liverpool, by refusing to handle goods, and that, in the event of no immediate settlement being arrived at, they throw in their lot with those affected.

London. — L.C.C. — The tramway employés of the Council, after holding various meetings last week-end, have again asked the Council to receive a deputation in regard to a petition for various increases in pay, a more rapid rate of increase in pay to 6s. 6d. a day after 12 months: an 8-hour day spread over not more than 12 hours (*i.e.*, not more than four hours off between spells) and a pension fund. In commenting on this matter, the chairman of the Highways Committee pointed out that Conciliation Boards were formed in 1909 in conjunction with the men, who voted in favour of them. These boards have been called into action on three occasions since, the first decision resulting in an extra cost to the Council of £12,000 a year, and third in a further annual cost of £2,350. The fresh demands of the men would, he states, as regards the increased pay and 8-hour day above mentioned, amount to about £110,000 a year. The petition has already been considered by the Council, which was unable to grant the concessions asked for; it also decided against receiving a deputation, in view of the existence of the Conciliation Boards for settling such matters. At the present time the Highways Committee is on vacation, and notices were posted on Wednesday intimating that the members would not be recalled to consider the demands put forward.

A mass meeting of the men is to be held to-morrow, when a ballot will be taken to decide whether a strike shall be declared.

In connection with the above, it is stated that should a strike result, the Omnibus Companies' employés, together with those of many of the Tube and Underground Railways, will also leave work.

New Zealand.—The Christchurch Tramway Board is to borrow £35,000 for the purpose of doubling certain track and purchasing 18 cars.

Norton.—The R.D.C. has received a communication from the Dronfield U.D.C., stating that it had approached the Sheffield Corporation with a view to the running of railless cars to Dronfield. These, if provided, would run on the Sheffield and Chesterfield main road, and would serve Norton and Greenhill. The Corporation wished to know whether the Council approved the scheme, but before deciding it was resolved to obtain the views of the Norton Parish Council on the matter.

Oldham.—Much unrest prevails among the tramway employés, and the men have threatened to strike. The Tramways Committee has intimated that it will agree to the men's demand that in future no man shall be discharged for any offence without having full opportunity of giving an explanation. The Committee cannot agree to a suggestion to give a full day's pay to all regular men called out to work part time only, but every effort will be made to provide each man with a full week's work as far as possible. The last suggestion of the men, that they shall be compelled to join one of the unions after being employed one month, the Committee considered it could not accede to. A meeting of the men is to be held later in the week to consider the Committee's decisions.

Preston.—A strike has been threatened of drivers and conductors in the service of the Corporation Tramways. Alleging certain grievances last week, they tendered notices to the effect that, unless concessions were made, they would cease work on Saturday last. The decision was come to at a meeting of the men on August 10th, at which the grievances were fully discussed. Mr. J. F. Simpson, general manager of the tramways, is away from town at present, and on Friday a deputation representing the Tramway and Vehicle Workers' Union had an interview with Mr. Lafferty, the traffic superintendent. As a result of negotiations, certain modifications in regard to duty were arrived at, some of the men, who would probably have been called upon for extra duty, being granted release. Another dispute had reference to the rate of pay for overtime, and the men's representatives agreed that the point should stand over until the next meeting of the Tramways Committee.

Sheffield.—The Tramways Committee of the City Council has decided to double the single track on the Fulwood route near Riverdale Road, at a cost of £700.

Sunderland.—At a meeting of the T.C., on the 9th inst., it was decided that side lifeguards be fitted to the cars, at an estimated cost of £250.

Stalybridge.—Since the disastrous smash on the Stalybridge Joint Tramways at Ditchcroft Hill, Millbrook, on Whit Monday morning, the question of reconstructing the line has been under consideration, and it has now been decided to proceed with the work in order to render the line more safe. At the meeting of the T.C. on Monday the plans of the proposed reconstruction were approved.

Venezuela.—According to the British Consular report, there are openings at present for electric street railways in the town of Maracaibo. Sundry offers have been presented to the municipality of Maracaibo, but none has been approved so far.—*Board of Trade Journal.*

TELEGRAPH and TELEPHONE NOTES.

Anglo-Belgian Telephone Cable.—This loaded cable, 50 knots in length, manufactured by Messrs. Siemens, will be laid by the *Faraday* next Wednesday from St. Margaret's Bay to La Panne.

Brazilian Telegraphs.—The Ministry of Communications and Public Works is to spend about £36,000 for the construction of a building intended for the Postal Telegraph Office in Nitheroy, State of Rio de Janeiro.

London's Overhead Telephone Wires.—Last year, according to the City Engineer, seven miles 508 yards of derelict or disused wires were removed by the department. At the present time the National Telephone Co.'s spans crossing public thoroughfares total 735,136, as against 733,956 a year ago, and 260,000 in 1899.

Paris Telephones.—The *Journal Officiel* of August 1st publishes the text of a decree dated July 29th, authorising an expenditure of 11,667,700 francs (£466,708) for improving and extending the Paris telephone system.—*Board of Trade Journal.*

Rhodesia.—The *British and South African Export Gazette* states that purchases will shortly be made by the Administration of Southern Rhodesia of copper telegraph wire for installation along the railway from Salisbury to Bulawayo, and thence to the border of the Cape Province at Ramathlabama, the cost being estimated at £20,000. Considerable quantities of material will also be required for the installation of a double-wire telephone system at Bulawayo in place of the existing single lines, a scheme for which is under consideration.

The Telephone Transfer.—In the House of Commons on August 11th this Bill was further considered, and, after discussion and amendment, progress was reported. Early in the proceedings Mr. J. F. Hope moved to report progress, saying that there were important points still outstanding between the Department and the staff in regard to Clause 5 (provision as to superannuation of transferred officers), and urging that these points be held over until the autumn, in the hope that in the meantime agreement might be arrived at. Mr. Joynson-Hicks and Mr. Brady also supported the claims of the telephone staff. It was stated that there were about 400 men whose demands had not been conceded. The P.M.G. said that these men were doing work which was done by Post Office servants who were not on the establishment. The Post Office servants had been in the service many years, and they could hardly be expected to work side by side with men who were put in a better position (made pensionable) purely because they were taken over. The matter affected not only those 400, but 5,000 men now in the Post Office service, and to put all of these on a pension basis was a very large financial question. The matter was under the consideration of the Treasury. Ultimately Mr. Samuel said that he perceived that there was a general desire that a further attempt should be made to arrive at a settlement of the outstanding point, and he agreed that the postponed clause should come up for consideration one day this week, and if no settlement had then been reached, the Bill would go over to the autumn session. The motion to report progress was then withdrawn, and several amendments in Clause 6, which contains a number of temporary provisions for the transfer, were made.

Wire Stealing in Manchuria.—The cutting and stealing of the telegraph wires seems to be an everyday occurrence in Manchuria, the South Manchuria Railway Co. having experienced no fewer than 88 cases of the kind during the last three months.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—September 5th. (*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

South Australia.—August 23rd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" July 28th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

Melbourne.—October 3rd.—42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" to-day.

September 26th.—30 miles of paper-insulated telephone cable, also supply of various telephone material. Local representation. Deposit, with tender, 5 per cent. up to £1,000 and 2½ per cent. above. Specification, &c., may be seen at Office of High Commissioner, in London, 72, Victoria Street, S.W.

Bathgate.—Bathgate District Committee of Linlithgow County Council invite tenders for the supply and erection of one suction gas producer plant of 120 B.H.P. capacity and a 120-B.H.P. gas engine, vertical type, erected at Broxburn electric station, Broxburn. Mr. Wm. Sanderson, resident engineer, Electric Station, Broxburn.

Belgium.—September 13th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the overhead electrical equipment of the extension of the Charleroi-Jumet (Heigne) light electric railway to Lodelinsart (Saint Antoine).

Bolton.—August 24th. 25,000 tons of bituminous engine slack, for a year, for the Corporation electricity works. A. A. Day, Borough Electrical Engineer, Spa Road.

Cleethorpes-with-Thurnscoe.—September 2nd. Vulcanised bitumen distribution and feeder cables, for the U.D.C. See "Official Notices" August 11th.

Hungary.—September 30th. The municipal authorities of Beszterce are inviting tenders for the establishment of a central electric lighting station in the town.

Ipswich.—August 24th. Paper-insulated cables for a year for the Corporation. See "Official Notices" August 11th.

London.—G.P.O.—September 18th. Creosoting, &c., telegraph poles for the G.P.O. G. Morgan, Controller of Stores, G.P.O., 17-19, Bedford Street, W.C.

September 2nd. Battery boosters and switchboards for the Westminster Electricity Supply Corporation, Ltd. See "Official Notices" to-day.

Penang.—September 5th. One 500-KW. steam dynamo (engine or turbine), with ejector condensing plant and switchgear, for the Municipality of George Town, Penang. See "Official Notices" August 11th.

Roumania.—August 23rd. The municipal authorities of Calarashi are again inviting tenders for the concession for the electric lighting of the town.

Russia.—The municipal authorities of Omsk are about to invite tenders for the concession for the establishment and operation of a central electricity generating station for lighting and power purposes and also for the construction and working of an electric tramway in the town.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

Servia.—September 4th. The Servian State Railway Authorities in Belgrade are inviting tenders for an installation of electric lighting at the railway station at Nisch.

Spain.—The municipal authorities of Chilches (province of Castellon) have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

Stoke-on-Trent.—Coal and slack, for a year, for the four electricity works of the T.C. Electrical Engineer, Hanley.

Swinton and Pendlebury (near Manchester).—August 22nd. Electric lighting of new Cromwell Road School, Pendlebury. Particulars from J. T. Bushell, John Dalton Street, Manchester.

Syria.—September 15th. The Turkish Ministry of Public Works in Constantinople is inviting tenders for the concession for the construction and working of a system of electric tramways, and for the supply of electrical energy for lighting and power purposes in the town of Aleppo, Syria.

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" August 4th.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

CLOSED.

Ashton-under-Lyne.—The Electricity Committee has accepted the tender of Mr. John Robinson for No. 2 cooling tower foundation.

Australia.—Balmain.—The Balmain Electric Light and Power Supply Co., Ltd., have placed an order with Messrs. Willans & Robinson, Ltd., for a 500-kw. Willans impulse disk and drum mixed-pressure steam turbine coupled to a General Electric alternator and exciter. The turbine will exhaust into a vacuum augmentor surface condensing plant which Messrs. Willans and Robinson will also supply.

According to the *Australian Mining Standard* the Prahran and Malvern Tramways Trust has accepted the tender of Younger and Howitt, being the lowest tender, for construction of permanent way for the Dandenong Road line, at schedule rates.

South Australia.—P.M.G.'s Department. The same exchange also reports the following p aced contracts :—

3,000 zincs for primary batteries.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 8¼d. each.

Western Australia.—Railway Department :—

5,000 Cordeaux insulators.—Doulton & Co., Ltd., £171.

Barnstaple.—The T.C. has sealed an agreement with the D.P. Battery Co. for the supply and maintenance of a new battery of accumulators at the electric light works.

Bordon Camp Electricity Supply.—Messrs. Willans and Robinson, Ltd., have received an order from the War Office for three Willans-Diesel direct-current generating sets to the specification of Messrs. Kennedy & Jenkin.

Dundalk.—With reference to our note under this heading last week, we are informed by the Sandycroft Foundry Co., that the complete battery for which they have received the contract, will be manufactured in their own new accumulator factory at Sandycroft, the company having taken over the business of W. O. Rooper & Co., and the Epstein Accumulator Co.. some months ago.

France.—The French Post and Telegraph Authorities have just equally divided an order for 20,000 metres of steel tubes, for use in connection with pneumatic dispatch lines, between the Société Française pour la Fabrication des Tubes, of Louvroil (Nord), and the Société d'Exaut et Meuse, of Liége.

Gravesend.—The Electrical Committee has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for the supply of Lambton rough coal.

Middlesbrough.—Messrs. Fraser & Chalmers, Ltd., have just booked an important order for two of their Rateau turbines of the mixed pressure type for direct coupling to turbo blowers for Messrs. Bolckow, Vaughan, Middlesbrough, in connection with their extensive blast furnace works, making in all 12 turbines supplied to this company.

Plymouth.—The tender of Messrs. J. Baker & Sons, Ltd., has been accepted by the T.C., at £101, for suppying and fixing an electrically driven Hodgkinson dough-mixing machine.

Salford.—The Electricity Committee has accepted the following tenders for coal for the ensuing 12 months :—

Clifton & Kersley Coal Co., Ltd.—20,000 tons.
Andrew Knowles & Sons, Ltd.—10,500 tons.
The Earl of Ellesmere.—7,500 tons.

Sunderland. — The T.C. has accepted the following tenders :—Henley's Tel. Works Co., 440 yds. 19/20 cable, 220 yds. 19/16 cable ; British Insulated and Helsby Cables, 220 yds. 19/18 cable ; J. and R. Ritchie, Middlesbrough, and W. G. Farrow, Newcastle-on-Tyne, cast and wrought-iron pipe-work ; Gwynnes, Ltd., London, one low-lift pump.

Wallsall.—The T.C. has accepted the tender of Messrs. Isaac Storey & Sons, Ltd., for supplying and erecting two sets of jet condensing plant of the low level counter current type, at £1,163.

NOTES.

Australian Lamp Contract. — We read in the *Australian Mining Standard* that the Footscray (V.) City Council recently received a letter from Mr. W. C. Rowe with respect to the tendering for metal-filament lamps. The writer said he understood that his tender was the lowest, but was not accepted, because his principals, the Pope Electric Lamp Co., did not comply with the 1·1 watts per candle-power. He asked, that in fairness to himself and other tenderers, the spirit of the specifications be faithfully carried out, and the lamps tested by a competent and disinterested party. He tendered on the assurance that by candle-power the Council intended British candle-power. They had accepted German candle-power, which was only 89 per cent. of the British. One Councillor thought that some attention should be paid to the point raised ; another thought that the Council's electrical engineer should be relied upon ; the Mayor was of opinion that it would have been better if the letter had not been written. The letter was formally "received."

The House I Built.

Dedicated to the Top Dog.

My Training :

E'en while I tended the solder pot
I thought 'lectricity rather rot,
And finding I couldn't make wiring pay—
I started on the "Consultant" lay.

My Apotheosis :

I bought a hat with a glossy sheen,
I cultivated a stately mien :
I asked the Council and Mayor to sup
And, as expected, they snapp'd me up.

My Debut :

I got the job to prepare the plans
(I managed to crib another man's)
And specifications by the ream
For the Council's pet electric scheme.

My Specification :

As I haven't an Arbitration Clause,
My acts are above my Country's Laws ;
And my specifications all embrace
Suitable clauses to save my face.

My Site :

This is my site, and the Building stout
(As the roof went on the walls bulg'd out)
In case of collapse the Builder pays,
But if it endures—then mine the praise

My Boilers :

These are the boilers that burn my coals—
(I specified rivets in all the holes)
I am going to paint them duck egg blue
With a deep gold line around the flue.

My Conveyor :

This is my fuel conveyor set
'Twas built and designed in Scotland, yet
The Mayor and Council and I agree
That all the credit belongs to ME.

My Steam Pipes :

My steam pipes are steel and nearly round,
I specified this because I found
That pipes of tin with a soldered seam
Were not a success with high press. steam.

My Turbines :

Now we arrive at my Turbine sets—
It hurts me to think that Parsons gets
Some of the credit for their design
When the gold lined paint is wholly mine.

My Condensers :

My condensing plant is down below
With Edwards' pumps and turbulent flow ;
And other improvements in design
I don't understand, but claim as mine.

My Cables :

My cables are straight and dead in line
I never allow a bend in mine—
It throws the rotaries out of phase
When volts are trav'ling different ways.

My Switchboard :

My bosom the switchboard swells with pride,
As I couldn't design it though I tried
I left the makers to bear the brunt,
But I specified my name in front.

My Notices :

And every Saturday, more or less,
I get my puff in the local Press ;
(I've the reporters "under the quilt")
A wonderful house, the House I built.

Australian.

Working of Coal-Cutting Machines.—Before Hon. Sheriff-Substitute Watson, in Falkirk Sheriff Court last week, a case of great interest to those employed in mines where electricity is used, was heard. We referred to the matter briefly in our last issue.—George Ferguson, machine man, Carron View Terrace, Polmont Station, was charged with a contravention of the Coal Mines Regulation Act, 1887, and the special rule in force in No. 1 pit, Craigend Colliery, Polmont, in respect that, being the person in charge of the coal-cutting machine, he failed to observe the directions given him in printed form to the effect that before starting the machine he should have seen that the earth wires were properly fixed both to the machine and the gate-end box.—Accused admitted that he had not made the connection properly.—The prosecutor explained that the earth wires carry away the electricity. When not properly connected any person touching the machine was liable to a very serious accident, and deaths had been caused in such a way. In the rules it was laid down that the operator must see that the connection was properly made before starting the machine. The accused himself, the Fiscal stated, was a victim of his own negligence, and as a result of the shook received, he was off work for three weeks. Looking to the fact that accused had suffered, the Sheriff modified the penalty to one of 5s. He expressed the hope that the case would be a warning to others.

Carmarthen Electric Supply.—With reference to our description of the above undertaking in the Electrical Review of August 4th last, we may mention that the whole of the mains and street lighting work was carried out by Messrs. J. B. Saunders and Co., of York Street, S.W.

Institution and Lecture Notes.—City and Guilds (Engineering) College, Exhibition Road, S.W.—We have received from Prof. T. Mather a short syllabus of an advanced course of instruction on "The Systematic Design and Manufacture of Dynamo-Electric Machinery," to be given under his general supervision in the above college during the forthcoming session. The lecturer will be Mr. W. E. Robson, M.I.E.E., and the fee for the course is £22. We understand that the course will be unique, and it is intended to prepare men to take up positions as designers in electrical works. It will deal with the present-day problems in design, construction and testing in a thoroughly practical manner. An experienced designer and draughtsman, specially engaged for the purpose, will devote his whole time to the drawing office work in connection with the course. Communications should be addressed to the Dean, at the College.

Institution of Civil Engineers.—The Council have made the following awards in respect of students' papers read during the session 1910-11 :—The "James Forrest" medal and a Miller prize to Mr. D. Hay, B.Sc., Birmingham ; and Miller prizes to Messrs. D. A. Howell, Bristol ; R. Bonner, Bristol ; G. F. Walton, London ; R. G. Parrott, Manchester ; E. E. Farrant, London ; A. C. Dean, B.Sc., Manchester ; H. W. Coales, Birmingham ; A. H. Meade, London ; A. C. Swales, Leeds ; and H. J. F. Gourley, B.Eng., Manchester.

Electrical Association of N.S.W.—At a June meeting of this Association, a paper read by Mr. T. P. Strickland at the last meeting of the Association, entitled "Notes on the Earthing of the Neutral on Three-phase High-tension Systems," was discussed. Mr. R. D. Dixon read a paper on "Notes on Some Practical and Theoretical Considerations in Determining the Correct Position of Trolley Wires and Fittings."

Victorian Institute of Electrical Engineers.—According to the *Mining and Engineering Review*, a special meeting was held on June 29th, at which it was decided, "That it shall be a condition of election to the Council that the members named shall have had a contribution accepted by the Institute." At a subsequent ordinary meeting two notices of motion by Mr. Clement Newton were submitted, as follows :—(1) "That this meeting requests the Council to consider the practicability of bringing pressure to bear upon Government departments, corporate bodies, and others, to insert proper and fair arbitration clauses in specifications issued by them ; and to communicate with other similar institutions, with a view to their assisting to bring about the desired result." (2) "That this meeting is of opinion that it is advisable to formulate a code of ethics for its members on the lines of that issued by the Institute of Civil Engineers, London, and requests the Council to take steps to this end." It was decided, after some discussion, to try and induce other similar bodies to join in an effort to give effect to the first motion. The second motion was defeated, the feeling being that, as the Institute is not composed solely of consulting engineers, and as it is not a chartered body, it would be impossible to give effect to such proposals.

Electrical and Other Fatalities.—At an inquest at Cheltenham on the body of a workman who was crushed to death beneath an electric cable drum, which he was assisting to unload from a lorry, the jury found that no blame was attachable to any individual, but that, in their opinion, the electricity department did not provide sufficient staff or control for the weight the men in their employ were handling at the time of the occurrence.

The *Sunderland Echo* states that Frank Best, of Middlesbrough, was, on the 11th inst., killed at Smith's Dock, Southbank, while engaged in finishing a ship. An inquest was held at Middlesbrough on Tuesday on the body of Best, who was a caulker at Smith's Dry Dock. Along a jetty at the dock an electric crane runs, which gathers its power from three live wires with a pressure of 440 volts. These wires are in a conduit. Best, while walking along the jetty, dropped a packet of white lead, which fell into the conduit, and, in trying to recover it, he touched the live wires and was instantaneously killed. He was found lying across the crane rails, with his left arm through the conduit, and his hand grasping the live wires. A verdict of "Accidental death" was returned.

The tragic death of a Burslem boy, through a piece of wire he was carrying acting as a lightning conductor, was described on Monday to the North Staffs. Coroner at an inquest. Samuel Gater, a potters' placer, said that on Friday night he saw the deceased, Reginald Wright, aged 10 years, on a piece of waste land dragging a tin box by a piece of wire. He saw a flash of lightning apparently strike the box, and the boy fall to the ground. He ran to him and found him dead. Dr. W. T. Shields said that on the boy's right side there were two distinct lines, back and front, as though drawn by a pencil. The boy evidently had the wire over his shoulder. A verdict was returned in accordance with the medical evidence.

Electrical Workers' Agitation in Germany.—According to Reuter's agent in Berlin, 3,000 electrical engine fitters and assistant electrical engine fitters of Greater Berlin, forming the German Metal Workers' Union, decided last week to agitate for higher wages.

Lap and Wave Windings for D.C. Armatures.—In connection with the article on the above on page 213 of our last issue, the author points out that the formulæ in the 14th and 16th lines from foot of right-hand column, page 214, should read, $Y = \frac{Z \pm 2}{p}$ and $p \times Y = Z \pm 2$ respectively ; also the word "armatures" should read *armature*.

An Australian Conference.—According to the *Sydney Morning Herald*, a 10 days' Conference was opened there on July 13th of the electrical engineers for the several States. They were to discuss a wide range of subjects relating to the electrical services of the Post Office with a view of effecting improvements, as the result of mutual suggestions, and of bringing the methods of all the States into uniformity.

Appointments Vacant.—Shift engineer for Leigh Electricity Works (32s. 6d.) ; junior shift engineer for Lancashire Electric Power Co. at Radcliffe (£9 per month). Lecturer and instructor in telephony for Wimbledon Technical Institute. See our advertisement pages to-day,

Parliamentary.—In the House of Commons on August 9th, the East Kent Electric Power Bill was read a third time.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At the Grand Hotel, Middlesbrough, on Friday night last, a dinner and smoking concert was held in honour of Mr. C. H. Lydall, of the staff of the Cleveland and Durham Electric Power, Ltd., who is leaving England to take up an important position on the staff of Messrs. Merz & McLellan, as their representative in the Argentine. Mr. A. B. Gridley, manager of the Power Co., presided at the dinner, and in presenting Mr. Lydall, on behalf of the staff, with a fitted suit case and pipes, referred to the exceptionally good work he had done in the company's Bishop Auckland area, and wished him every success in his new appointment. Mr. Lydall suitably responded. A most enjoyable evening was spent in harmony and song.

On August 9th, the staff of the St. Pancras Borough Council Electricity Department presented Mr. J. H. Bryan with a handsome marble timepiece to celebrate the occasion of his marriage. The presentation was made by Mr. A. E. Pycraft, supported by other members of the staff.

The *Australian Mining Standard* states that the Newcastle (N.S.W.) Council has appointed Mr. Guy Allbut, who has filled the position of electrical engineer to the Tamworth Municipality for the past two years, as its electrical engineer at a salary of £350 per annum.

General.—The following changes in Post Office appointments are announced :—Mr. Edward Crabb, C.B., has been appointed second secretary in succession to Sir A. F. King, K.C.B., promoted to be secretary. In view of the approaching transfer of the National Telephone Co.'s business to the Post Office, and in order to secure a proper co-ordination of the work of the telegraph and telephone departments, the Postmaster-General has established a post of third secretary with supervision over those departments. Mr. A. M. Ogilvie, hitherto assistant secretary in charge of the telephone department, has been appointed third secretary. Mr. A. B. Walkley and Mr. L. T. Horne have been promoted from principal clerks to be assistant secretaries to the Post Office.

The *Times* for August 15th contains under "Marriages" the following announcement :—" Parshall : Johnson.—On August 5th, at Folkestone, Horace Field Parshall, D.Sc., M.Inst.C.E., of 59, Netherhall Gardens, N.W., to Bertha Johnson, of Scruton, Yorkshire." Congratulations.

Indian Engineering states that Mr. A. Leslie, deputy superintendent of telegraphs, has been deputed by the Government telegraph department for special duty at Calcutta for one year in connection with the Eastern Bengal and Oudh and Rohilkhand State Railway.

Mr. E. M. Herr was on August 1st elected president of the Westinghouse Electric and Manufacturing Co., of U.S.A. He had been first vice-president since 1905. Mr. Herr succeeds Mr. E. F. Atkins, who was elected in June, 1910, but this year declined re-election.

Mr. Philipp Laubach has resigned his position as manager to Messrs. Frampton & Paine, of Westminster, in order to take up the position of manager of the switchgear department of the Electrical Engineering and Agencies Co., Ltd., of New Oxford Street, W.C.

Mr. W. H. Hobbs, clerk at the Taunton Electricity Supply Works, recently resigned his post in order to take up a position with the British Thomson-Houston Co., Ltd.

NEW COMPANIES REGISTERED.

Flynn Manufacturing Co., Ltd. (117,137).—This company was registered on August 4th, with a capital of £1,000 in £1 shares, to carry on the business of machinery and plant manufacturers, insulators of wire, wire coil and other metals, &c. The subscribers (with one share each) are:—C. Terry, Southcrest, Redditch, spring manufacturer; A. E. Terry, Brambles, Redditch, spring manufacturer; A. V. Terry, Oakenshaw, Redditch, spring manufacturer; T. J. Flynn, 10 and 11, Billiter Square Buildings, E.C., merchant; H. Minns, 25, Abbots Road, King's Heath, manager; E. Clarke, Easemore Road, Redditch, clerk; A. E. Wheeler, William Street, Redditch, clerk. Private company. The number of directors is not to be less than three or more than seven; the first are C. Terry, A. E. Brambles, A. V. Terry and T. J. Flynn; qualification, 100 shares. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Braunton Electric Light and Power Co., Ltd. (117,202).—This company was registered on August 10th, with a capital of £5,000 in £1 shares (1,000 5 per cent. cumulative preference), to carry on the business indicated by the title, and to adopt agreements (1) between S. I. Knill and the Parish Council of Braunton; and (2) between the said S. I. Knill and Crompton and Co., Ltd. The subscribers are:—T. Yeo, Southlea, Braunton, Devon, land valuer, 50 shares; H. S. G. Clarke, East Hill, Braunton, Devon, master mariner (retired), 50 shares; J. K. Symonds, 1, The Terrace, Braunton, Devon, retired tea planter, 50 shares; F. W. Moon, West Cross, Braunton, Devon, baker, &c., 1 share; W. Manaton, Hillside, Braunton, Devon, tailor and outfitter, 1 share; T. Slee, Springfield, Braunton, Devon, retired grocer, 1 share; S. I. Knill, 71, Southport Street, Barnstaple, Devon, engineer, 1 share. Minimum cash subscription, £2,000. The number of directors is not to be less than three or more than five; the first are T. Yeo, H. S. G. Clarke and J. K. Symonds; qualification, £50. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venner Time Switches, Ltd.—Particulars of £5,000 debentures, created July 4th, and secured by trust deed dated July 10th, 1911, filed pursuant to Sec. 90 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustee: R. B. Young, 18, The Chase, Clapham Common, S.W.

Cutting Bros., Ltd.—Particulars of £4,000 debentures, created July 12th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Corona Lamp Works, Ltd.—Particulars of £2,000 debentures, created July 10th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Melbourne Electric Supply Co., Ltd. (63,334).—Trust deed dated August 3rd, 1911, to secure not more than £250,000 second debenture stock, charged on the company's assets, present and future, subject to first mortgage debenture stock. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

CITY NOTES.

Metropolitan District Railway Co.

The ninety-fourth half-yearly ordinary meeting of the shareholders of the above company was held on Thursday, last week, at the Westminster Palace Hotel, Lord George Hamilton presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 226), said that, dealing first with the capital account, the expenditure for the half-year amounted to £88,668, of which £10,686 was part payment of arrears of dividend on guaranteed stock. They had spent £12,100 on the development of surplus land, £9,085 on new works and additions, £12,472 upon reconstruction and improvement of stations, and £39,517 had been spent on the construction of new cars. For the forthcoming half year they estimated they would spend £90,000 on capital account, including £51,000 for new rolling stock, leaving a balance of £78,000 to be incurred in subsequent years. Shortly after the prior lien stock was created, they had an offer from the Tilbury Co. to purchase certain of their rolling stock for the sum of £130,000. They, therefore, undertook for the time being to reduce the further issue of the prior lien stock by this amount, reserving to themselves the right subsequently to issue the amount thus postponed after consultation with the debenture-holders. The holders of debenture stock now occupied a very much stronger position than they did at the time that understanding was arrived at, and as they would soon require additions to their rolling stock to enable them to handle their growing traffic, they proposed to acquaint the debenture-holders shortly with their intention to issue £130,000 prior lien stock thus reserved for the purchase of additional rolling stock to replace that sold to the Tilbury Co. Last year an order was placed for 51 additional carriages, but with the rapid growth in traffic this increase would not be sufficient for next winter's service, and a further order had been placed for 14 carriages. The half-year's working showed an increase of £27,124 in gross receipts, and an increase in passengers of 4,359,000 over the number carried in the corresponding period of the last half-year. The Coronation and its festivities contributed to this increase, also the opening of the Earl's Court Exhibition grounds. But quite independently of the Coronation and the crowds it brought to London, the traffic showed a general and satisfactory increase. The working expenses showed an increase of £9,410; this was due to improved and increased train service, extensions, improvements in the rolling stock, and to the exceptional outlay due to the Coronation period, including an extra day's pay to nearly the whole of the staff. Eliminating this exceptional expenditure, and taking a comparison between this half-year and the half-year ending June 30th, 1910, they found that the operating expenses per car-mile in pence showed a reduction of ·006, and per car-hour of ·259. The percentage of operating expenses to their gross receipts stood for the half-year at the ratio of 46·69. Analysing the increase in the passenger traffic over the corresponding period by class and tickets, they found the following:—First class, increase 5·96 per cent.; third class, increase 12·25 per cent.; workmen's tickets, increase 6·08 per cent.: season tickets, increase 21·04 per cent.; total increase, 12·05 per cent. The result of the half-year's working was that they had a balance available for dividends of £82,991. This balance showed an increase over the balance in the same period last year of £20,715, but that increase included the balance carried forward from last half-year of £2,020. This balance it was proposed to distribute as follows:—£28,714 18s. 10d. to the 4 per cent. guaranteed stock, which was at the full rate of 4 per cent. per annum; £6,250 in paying the third warrant for 10s. per cent. in respect of the arrears on guaranteed stock, and £33,750 in the payment of a dividend on the first preference stock at the full rate of £4 10s. per cent. per annum. This left a carry forward of £14,277, as against the balance of £8,528 for the corresponding period of last year—an increase of £5,749. Rapid progress continued to be made with the widening of the railway between Ravenscourt Park and Acton Lane Junction. They expected to work over the new lines no later than November of this year. This would afford the company an opportunity of working a closer and more regular service of trains to Ealing and other points on the western lines. It was also proposed to increase the number of non-stop trains during the "rush" hours in the morning and evening. Another improvement which would benefit the company was the extension of the London electric railway from Charing Cross to the Embankment Station, powers for which were obtained by that company this year. The extension would provide suitable interchange facilities between the District, Hampstead and Highgate, and Bakerloo Railways, and would result in increased traffic to this railway. At the last half-yearly meeting a question was put to him by a shareholder as to whether they were likely to embark in any heavy expenditure for the electrification of the East London Railway. The lessee companies had agreed upon a scheme for electrifying the East London Railway. Negotiations were now in progress with the East London Co., and it was hoped that matters would be finally adjusted so that the work could be put in hand at a very early date. The proposal was that the Metropolitan Co. were to work a through service of trains (four per hour), and a close service of local trains to work between Shoreditch, Whitechapel and New Cross, with convenient interchange arrangements provided at Whitechapel, so that passengers could conveniently change from District trains to East London trains. One of the lessee companies was to provide the necessary capital required for the electrification of the line. The East London Railway Co. were to enter into an agreement to apply their proportion of the receipts, when exceeding the minimum of £30,000 per annum, to the payment of interest at 4 per cent. per annum on the outlay so far as the receipts might be sufficient for the purpose, any balance remaining unpaid at any half-year, to accumulate at 4 per cent., and to be payable out of any future receipts above the minimum. Terms for the supply of electrical energy had been agreed to by the District Co. The Metropolitan District Railway Act, of 1911, the Bill for which had their approval on February 9th last, received the Royal assent on June 2nd. The negotiations with the Underground Electric Railways Co. of London, Ltd., for the sale of the power house to the Joint Committee of London Electric Railway and the District Railway Companies had been successfully concluded, and he could safely say that the bargain was a fair one for all parties concerned. It was proposed that the Lot's Road power house undertaking be transferred to the Joint Committee, which consisted of three members of the board of this company and three members of the board of the London Electric Railway Co. and leased by the Joint Committee to the two companies as from January 1st, 1912. The future outlook for the railway was bright. With the growth of their traffic they ought gradually to bring to more and more of their shareholders the benefit of a dividend. On the other hand, the location and environment of their enterprise were such that they would always be subject to keen and possibly to new forms of competition. Relations with their competitors and other underground railways continued to be friendly. They recognised that, through co-operation, and by each company giving the best possible service, they would bring the best results to the respective undertakings. They could not, therefore, afford to make a mistake. Caution must be combined with future developments, and under this associated impulse, their expansion—even if it were slower than was agreeable to all the shareholders—should be continuous and unbroken.

Mr. W. H. Brown seconded the motion, and the report was adopted.

"Harper" Electric Piano (1910), Ltd.—The directors have declared a dividend for the half-year ended June 1st, 1911, at the rate of 5 per cent. per annum on the participating ordinary shares, making, with the interim dividend already paid, 5½ per cent. for the year.

Tyneside Tramways and Tramroads Co.—The directors have declared a dividend of 1½ per cent. per annum (1s. 6d. per share), less income-tax, on the ordinary shares, for the half-year, placing £1,000 to reserve for renewals, depreciation, &c., making £10,100, writing £530 off preliminary expenses account, and carrying £620 forward.

London Electric Railway Co.

THE half-yearly ordinary general meeting of the shareholders of the above company was held on Thursday last week, at the Westminster Palace Hotel, Lord George Hamilton presiding.

In moving the adoption of the report, the CHAIRMAN said that the capital expenditure during the half-year had amounted to £47,222, the most important item being the cost of the escalator at Earl's Court, which work they hoped would be completed very shortly. Their Bill for extensions at Charing Cross and Paddington had received the Royal assent, and it was anticipated that the extensions would be a great convenience to the travelling public. Tenders for the work had been received, and it was hoped that a contract would be entered into within the next few days, the intention being to proceed with the extensions as rapidly as possible. During the year they had sold £150,000 of debenture stock, the proceeds of which would be used towards paying the cost of this work. Turning to the revenue, the gross receipts for the half-year had amounted to £392,817, being an increase of £27,193 over the corresponding period. The exceptional traffic associated with the Coronation festivities accounted for a certain proportion of that increase, but quite independently of such abnormal expansion the weekly traffic receipts for periods unconnected with the Coronation contrasted very favourably with similar weeks during the corresponding period. The working expenses had amounted to £174,919, being an increase of £7,699. As a result of recent assessments they had had to pay £2,900 more in local rates during the half-year, and increased and improved train services accounted for the rest of the additional expenditure. It was satisfactory to note that the ratio of working expenses to gross revenue had diminished and now stood at the low figure of 44·53. Including the balance brought forward, they had £124,156 available for dividend, against £105,000 for the same period last year. They proposed to pay the full dividend of 4 per cent. on the preferred stock, which would require £63,000 and 1 per cent. on the ordinary stock, which would require £46,639, leaving a balance of £14,516 to be carried forward, against £12,400 in the corresponding half-year. The ordinary stock outstanding amounted to £9,327,000, therefore 1 per cent. upon that stock represented £93,000 a year. To those who had invested in the preferred stock, it must be most satisfactory to note that in so short a period since its creation they were enabled to put £93,000 behind that stock as the dividend on the ordinary shares. Having referred to the arrangement by which the Lot's Road power house undertaking was to be purchased and worked by a joint committee, the chairman said that the figures he had given them demonstrated the growing financial strength of the enterprise, and if care were exercised in the planning, supervision and construction of further developments year by year, the company would become stronger and more remunerative.

SIR ALGERNON WEST seconded the motion, and the report was adopted.

Mexican Light and Power Co., Ltd.

THE report for 1910, which was submitted to the meeting at Toronto on 11th inst., is quoted in the *Financial Times* as follows :—The business has shown constant and satisfactory increases, well warranting the extension of the work, which was authorised and commenced in 1909. Most of this work has already been completed, and the remainder—namely, the construction of the Tenango and the Texapa reservoirs—is well advanced. The net revenue in gold for the year, after paying all expenses and fixed charges, amounts to $1,456,612, which, together with $149,385 brought forward from 1909 and $163,004 set aside from the profits of 1909 to provide for the accrued portion of the quarterly dividend on the ordinary shares paid January 15th, 1910, and the accrued portion of the half-yearly dividend on the preferred shares paid May 1st, 1910, makes a total credit balance of $1,769,002. Out of this sum the directors have paid during the year to the shareholders $860,150, being 7 per cent. on the preferred shares, and 4 per cent. on the ordinary shares. The balance carried forward to profit and loss account is $745,848, and the reserve account remains at $377,883. In view of the constant increase in the demand for electric power and other additional business which will be available for the company in the near future, it has been decided to further extend the system of canals and tunnels, so as to divert some of the other rivers included in the company's concessions, into the Necaxa water shed. Contracts have already been let for the construction of this work, which should be completed towards the end of the year 1912, and in time to meet the demand for power, which it is anticipated the company will be called upon to supply at that date. The purchase of the business and undertaking of the Compania Electrica e Irrigadora en el Estado de Hidalgo, S.A., was completed during the year 1910, and the results justify the action of the board in acquiring it. For the convenience of working, the business and the undertaking were vested in the Pachuca Light and Power Co. (Compania de Luz y Fuerza de Pachuca, S.A.), all the capital stock of which is owned by the Mexican Light and Power Co., Ltd. The Pachuca Light and Power Co. is now supplying light and power to all the customers of the old Irrigadora Co., and the earnings from the business are much larger than were estimated in last year's report. A transmission line has been constructed from the line of the Mexican Light and Power Co., Ltd., to the lines of the Pachuca Light and Power Co. at Pachuca. At the present time the Pachuca Co. is taking 9,500 H.P., which it is selling in addition to the regular output from its own plants.

Mexico Tramways Co.

THE directors' report for 1910, which was submitted to the meeting at Toronto on 11th inst., as abstracted in the *Financial Times*, states that the net revenue in gold for 1910, after paying all expenses and fixed charges, amounted to $1,417,303, which, added to $416,344, the balance brought forward from 1909, makes a total credit balance of $1,833,647. During the year two quarterly dividends of 6 per cent. per annum, and two quarterly dividends at the rate of 7 per cent. per annum, were paid to the shareholders, absorbing $939,581, thereby leaving a balance of $894,066, out of which $250,000 has been added to the reserve account, which now amounts to $2,513,087, and $644,066 has been carried forward. The ratio of operating expenses to gross income was 49·06 per cent., as compared with 50·02 for 1909. For the purpose of providing funds for the general purposes of the company, including carrying out extensions and making advances to the Mexican Light and Power Co., Ltd., in connection with the construction of its additional hydro-electric installations, the company during the year issued and sold a further 50,000 shares of its capital stock. The physical condition of the property, rolling stock and plant has throughout the year not only been well maintained, but in many respects the standard of its efficiency has been improved, nearly $700,000 having been expended during the year on maintenance. On December 31st, 1910, the system consisted of 179 miles of single track, of which 158 miles were operated by electricity, and 21 miles by mules, the electric track mileage having been increased by 13 miles, and the mule track having been reduced by five miles. Besides increasing the track mileage, as above stated, the company during the year built additional cars and finished the construction of car barns, sub-stations and shops, erected additional store-houses and passenger stations, and also completed the installation of fire protection appliances throughout the buildings. The operation of the new suburban line to Lake Xochomiloo and of the new city lines and extensions put in operation during the year has given very satisfactory results. The company proposes in the new future to extend its lines in various outlying districts.

Prospectus.—*Braunton Electric Light and Power Co., Ltd.*—The subscription list opened on Tuesday, and will close by August 31st, in an issue of 2,750 ordinary shares of £1 each and 500 preference shares of £1 each. Braunton (Devon) is rapidly becoming a popular residential resort, many new premises have been erected, and the demand for building land is good. Messrs. Crompton & Co., Ltd., the contractors, estimate the cost of the necessary works at £2,950, and £300 is required for preliminary expenses, working capital, &c. Consumers are to be charged 2s. per quarter for each approved 32-C.P. metallic-filament lamp or 8-C.P. carbon lamp in living rooms and shops, with a reduced rate for bedrooms and other "occasional" situations. Messrs. Crompton estimate the income at £419 per annum, and the expenses, including depreciation at £217, leaving £202 for dividends, directors' fees and office expenses, but increased profits are expected as the undertaking develops. A 5 per cent. dividend would require £162 10s.

Gandy Belt Manufacturing Co., Ltd.—The directors are paying an interim dividend of 4 per cent., against 3 per cent. a year ago.

Continental.—BELGIUM.—La Société des Centrales Eléctriques des Flandres is the name of a new company which has just been formed in Brussels with a capital of £4,000.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

Melbourne Electric Supply Co., Ltd.—20,000 7 per cent. first cumulative preference shares of £5 each, fully paid.

Notting Hill Electric Lighting Co., Ltd.—2,998 6 per cent. cumulative preference shares of £10 each, fully paid (Nos. 1 to 2,998); 11,402 6 per cent. non-cumulative preference shares of £10 each, fully paid (Nos. 2,999 to 14,400); and 27,050 ordinary shares of 1s. each, fully paid (Nos. 20,001 to 47,050), in lieu partly of the 10,852 ordinary shares now quoted.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 5 per cent. 50-year mortgage bonds of £100 each.

The Committee have appointed special days as under :—

August 16th.—Adelaide Electric Supply Co.—£100,000 5 per cent. debenture stock.

Mexican Northern Power Co.—Scrip, fully and partly paid, for $4,500 5 per cent. first mortgage 30-year gold bonds.

Wednesday, August 30th.—British Insulated and Helsby Cables, Ltd.—£200,000 5 per cent. mortgage debenture stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Shawinigan Water and Power Co.—Further issue of £205,480 4½ per cent. perpetual consolidated mortgage debenture stock; $500,000 additional common stock; and $250,000 additional 5 per cent. consolidated first mortgage bonds for $1,000 each (Nos. 901 to 1,050, and 1,694 to 1,793).

Adelaide Electric Supply Co.—£100,000 5 per cent. debenture stock.

Bombay Electric Supply and Tramways Co.—Further issue of £30,000 5 per cent. second mortgage debentures of £100 each, Nos. 1,701 to 2,000.

Chile Telephone Co.—Further issue of 22,000 shares of £5 each, fully paid, Nos. 44,001 to 66,000.

Mexican Northern Power Co.—Scrip, partly paid, for $4,500,000 5 per cent. first mortgage 30-year gold bonds.

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 6,982 to 7,001, and 7,498 to 7,617.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended June 30th, 1911, were 1,059,023, compared with 995,992 units in the corresponding five weeks of 1910.

MARKET QUOTATIONS.

Wednesday, August 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	„ Nitric .. .. „	22/-	..
a	„ Oxalic .. .. „	28/-	..
a	„ Sulphuric .. .. .. „	5/6	..
a	Ammoniac, Sal .. .. .. „	42/-	..
a	Ammonia, Muriate (crystal) .. per ton	£29	..
a	„ „ .. .. .. „	£30	..
a	Bleaching powder .. .. .. „	£5 10	..
a	Bisulphide of Carbon .. .. „	£18	..
a	Borax .. .. „	£16	..
a	Ferro-Silicon (50 %) .. .. „	£12 10	..
a	Copper Sulphate .. .. .. „	£20	..
a	Lead, Nitrate .. .. .. „	£24	..
a	„ White Sugar .. .. „	£22 15	..
a	„ Peroxide .. .. .. „	£32	..
a	Methylated Spirit .. .. .. per gal.	2/6	..
a	Potassium, Bichromate, n casks per lb.	8½d.	..
a	Potash, Caustic (75/80 %) .. per ton	£20	..
a	„ Chlorate .. .. .. per lb.	8½d.	..
a	„ Perchlorate .. .. „	4½d.	..
a	Potassium, Cyanide .. .. „	7d.	..
a	Shellac .. .. per cwt.	75/-	..
a	Sulphate of Magnesia .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. „	£6 10	..
a	„ Recovered .. .. „	£5 10	..
a	„ Lump .. .. .. „	£5 5	..
a	Soda, Caustic (white 70 %) .. „	£11	..
a	„ Chlorate .. .. .. per lb.	8½d.	..
a	„ Crystals .. .. .. per ton	£8 6	..
a	Sodium Bichromate, casks .. per lb.	8d.	..
a	„ Cyanide (basis 100 %) .. „	7d.	..
	METALS, &c.		
b	Aluminium Ingots, in ton lots .. per ton	£70	..
b	„ Wire, in ton lots .. „	£102	..
b	„ Sheet, in ton lots .. „	£120	..
p	Babbitt's metal ingots .. .. „	£87 to £145	..
c	Brass (rolled metal 2" to 12" basis per lb.	7¼d.	½d. inc.
c	„ Tube (brazed) .. .. „	8½d.	..
c	„ „ (solid drawn) .. „	7d.	..
c	„ Wire, basis .. .. .. „	8¾d.	..
c	Copper Tubes (brazed) .. .. „	9½d.	..
c	„ „ (solid drawn .. „	8½d.	..
g	„ Bars (best selected) .. per ton	£71	..
g	„ Sheet .. .. .. „	£71	..
g	„ Rod .. .. „	£71	..
e	„ (Electrolytic) Bars .. „	£58 10	5/- inc.
e	„ „ Sheets .. „	£74 10	10/- inc.
e	„ „ Rod .. „	£61 10	..
e	„ „ H.C. Wire per lb.	7¾d.	..
f	Ebonite Rod .. .. .. „	5/8	..
f	„ Sheet .. .. .. „	4/9	..
n	German Silver Wire .. .. „	1/11	..
b	Gutta-percha, fine.. .. .. „	8/6	..
b	India-rubber, Para fine .. .. „	4 6½	½d. dec.
l	Iron Pig (Cleveland warrants) .. per ton	47/3½	6½d. inc.
l	„ Wire, galv. No. 8, P.O. qual. „	£14	..
g	Lead, English Pig .. .. .. „	£14 10	5/- inc.
m	Manganin Wire No. 28 .. .. per lb.	6/6	..
g	Mercury .. .. per bot.	£9	..
d	Mica (in original cases) small .. per lb.	6d. to 2s.	..
d	„ „ „ medium „	2/6 to 4/-	..
d	„ „ „ large .. „	4/6 to 8/6	..
p	Phosphor Bronze, plain castings „	11d.	..
p	„ „ rolled bars & rods „	1/0½	..
p	„ „ rolled strip & sheet „	1/1	..
o	Platinum .. .. per oz.	172/6	..
c	Silicium Bronze Wire .. .. per lb.	8½d.	..
r	Steel Magnet, in bars .. .. per ton	£55	..
g	Tin, Block (English) .. .. „	£190 to £192	£3 dec.
n	„ Wire, Nos. 1 to 16 .. .. per lb.	2/1	..
p	White Anti-friction Metals .. per ton	£45 to £150	..
k	Zinc, Sh't's (Vieille Montagne bnd.) „	£32 5	£2 5 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, L
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Dublin and Lucan Electric Railway Co.—The directors' report to June 30th, 1911, states that the gross receipts for the half-year from all sources amount to £3,456, a decrease of £6 on the corresponding period of 1910, whilst the expenditure has increased by £277, mainly in coal and repairs to plant. After providing for debenture interest, there is an available balance of £920, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, which will absorb £475, and the balance of £445 is to be carried forward to next half-year.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the half-year ending July 31st, 1911, on the share capital. The dividend is payable, less income-tax, on August 31st.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from 18th to 31st inst. for the preparation of warrants for dividends payable 31st inst.

STOCKS AND SHARES.

Tuesday Evening.

Markets in the Stock Exchange have been, and still are, passing through a period more exciting than remunerative. The various developments of the great strike, with their startling changes, have caused prices in the Home Railway market and several other sections to sway violently. To-night (Tuesday evening) the situation is thought to be clearer, but what it may be before these lines are in print it is, of course, impossible to say.

Changes in the Electrical Railway department are of no great consequence. Central Londons remain weak, although they show no further falls. City and South London Ordinary shed 1½. Metropolitans and Districts are both decidedly lower. Underground Electric Railways 6 per cent. income bonds dropped 3 points, but for this there was the excuse that the recent statement is considered disappointing in view of the small dividend declared on these securities. One of the Home Railway stocks to suffer most has been Brighton Deferred, the price slumping to par, from which it had a smart recovery of about a point.

The Home Traction and Tramways division shows falls of ⅛ in British Electric Traction Ordinary, and of ⅛ in Bath Tramway Preference. London United Tramways Preference are easier, the price having been put down because it was feared that the grav disaffection of tramwaymen in Glasgow might be reflected in London; nor did the settlement of the Glasgow dispute help t restore the lost fraction from London United shares. Dubli United Preference are nominally harder by reason of the quotatio being narrowed, but actually there is no change in the price.

Rio Trams have been fluctuating considerably, although o balance there is no alteration. Sao Paulo Trams show a loss c 2 points, and Capes are ⅛ off. The Canadian-Latin group is fairl hard, but Northern Light and Power Bonds have started fallin again, and there is a fall of 5¼ in Montreal Light and Pow shares, from which it may be inferred that the rumoured amalgam tion scheme is, at all events, hanging fire. Shawinigan capit stock is ½ lower, and the Mexican issues are also a trifle dow with the exception of Mexico Tramways 5 per cent. bonds, whic have hardened to par.

English Electricity Supply shares remain very steady, the interi dividend announcements keeping the markets hard. City London Ordinary rose ⅛, while a similar fraction has been lo by St. James's Ordinary. Edmundson's went back to a slig extent, and other prices in the catalogue are practically unchang

Telegraph issues show a goodly list of improvements. The late strength of the market has been manifest for some time past in t steady way in which prices have appreciated. Now, there appea to be very little floating supply of stock, and the difficulty of getti hold of prior-charge descriptions is on the increase. Eastern Exte sion shares have gained ⅛, although Eastern Telegraph Ordina remained stationary. Anglo-American Telegraph Deferred fell ⅛ account of a sharp slump in American Rails.

That same weakness in Wall Street resulted in further depressi of the Mackay Companies' stocks and American Telephone a Telegraph capital stock. New York has been shaken rather ba by financial, labour and other troubles, with the result that m American stocks have given way substantially.

Speculation in Marconis formed the reason for a sharp dip in t price to 44s., but there appear to be eager buyers of shares on a relapse, and the price was quickly taken up again to 46s. 6d., which the market continues to look a decidedly good o National Telephone Deferred went back 1½, but the Preferred r a point.

The Manufacturing list is steady. Babcock's have commen to recover, and are ⅛ up. Henley's Preference are also a g market, and the Debenture stock has been in some request. T graph Construction receded 10s., but the Debenture stock show point gain. Rubber has been coming down a little, and cor quently rubber shares, besides being a very dull market, are mo easier.

Crossley Bros., Ltd.—The directors have declared interim dividend at the rate of 4 per cent. per annum on ordinary shares for the half-year to June 30th.

W. T. Henley's Telegraph Works Co., Ltd.—T directors have declared an interim dividend on the prefere shares at the rate of 4½ per cent. per annum, less income-tax, on the ordinary shares at the rate of 10 per cent. per annum, of income-tax, for the half-year ending June 30th last, payable September 1st.

Melbourne Tramway and Omnibus Co., Ltd.—T directors have declared a bonus for the year to June 30th at rate of 5 per cent. (6d. per share).

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations August 15th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½— 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞— 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝— 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12¼— 12¾	+ ⅛	5 9 10
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜— 7⅞ xd	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½ xd	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	1/16— 3/16	— 1/16	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛— 2⅜	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5½	6	4¼— 4¾	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Hove	5	8½	9	6¾— 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6¾— 7½ xd	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	79 — 83	+ 1	5 8 5
London Electric, Ord.	3	2	2	1⅝— 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅜— 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞— 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜— 3⅞ xd	..	5 3 3
Do. 5 % Pref., Non. Cum.	5	5	5	3⅜— 4⅜ xd	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7¼	6⅞— 6⅞	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅞— 9⅜ xd	— ⅛	5 6 8
Do. 7 % Pref.	5	7	7	6⅞— 7¼ xd	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½— 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜— 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜— 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	⅞— 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2⅜— 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅞— 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼— 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	110 —115	..	6 1 9
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	3/32— 7/32	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	87 — 89	+1	5 12 4
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16— 5/32	..	..
Do. 6 % Pref.	1	6	6	1/32— 3/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2¾— 3	— ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½— 90½	— ½	5 10 6
Mexican Lt. & Power, Common	$100	4	4	89 — 91	..	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	110 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97 — 98 xd	— 1	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½— 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	6	7	165 —170 xd	—5¼	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	43 — 45	—2	11 2 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	116½—118½	— ½	3 7 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	+1½	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜— 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98½—100½	+ ½	4 19 6
American Telep. & Teleg., Cap.	$100	8	8	137 —139	—2	5 15 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3¾	67 — 69 xd	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111½—112½ xd	..	5 6 8
Do. Def.	Do.	25/-	30/-	25/16— 25/8	— 1/8	5 15 11
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101½—103½	+ ½	4 16 7
Chili Telephone	5	8	7	6 15/16— 7 1/16 xd	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½— 89½	..	4 9 5
Cuba Telegraph	10	6	6	10¼— 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½— 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜— 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	+1	4 8 3
Direct United States Cable	10	4¼	4½	8 — 8½	+ ⅛	5 5 11
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	+1	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102 —104	+ ½	3 16 11
Eastern Extension	10	7	7	13⅞— 13⅞	+ 1/16	5 0 11
Do. 4 % Deb.	Stock	4	4	100½—102½ xd	+ ½	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	+ ½	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞— 11¼	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½— 58½	..	5 11 1
Mackay Companies Common	$100	4	5	86 — 88	—2	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	72 — 74	—3	5 8 1
Marconi's Wireless Telegraph	1	Nil	Nil	2¼— 2⅜	..	..
Monte Video Telephone, Ord.	1	6	6	⅞— 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106 xd	+1	5 13 2
Do. Def.	Do.	6	6	117½—120½ xd	—1½	4 19 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜ xd	..	5 11
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜ xd	..	5 11
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 7/16— 5 1/16 xd	..	4 7 1
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102⅛—103⅛	+ ½	4 7 0
Oriental Telep. and Elec.	1	8	8	1 9/16— 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛— 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	+ ½	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	+ ½	3 18 10
Reuter's	8	5	5	8⅝— 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131½—134½	+ ½	4 9 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —100	+ ½	4 9 1
United River Plate Telephone	5	8	8	7 5/16— 7 7/16 xd	..	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5¼— 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅞— 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	+ ½	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅝— 2⅞	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜— 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¼— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜— 14½	..	4 18 3
Do. 4 % Deb.	Stock	4	4	100 —102	+ 1	3 18 5
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— 5/16	.	Nil
Do. 5 % Pref.	1	5	5	⅜— ⅝	—1/16	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1¼	— ½	Nil
Do. 6 % Pref.	10	1⅜	1½	3⅛— 4¼	..	3 10 7
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	68 — 70	..	4 5 9
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	49 — 51	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	29⅜—30⅜ xd	—1½	4 18 4
Do. 5 % Pref., 1891	100	5	5	108 —110 xd	..	4 11 0
Do. Do. 1896	100	5	5	104 — 106 xd	..	4 14 4
Do. Do. 1901	100	5	5	103 —105 xd	..	4 15 3
Do. Do. 1903	100	5	5	102 —104 xd	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12⅜— 13½	+ ¼	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅞— 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¾	2⅜	2¼— 2⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3⅛— 3⅜	— ¼	Nil
Do. 4 % Deb.	100	4	4	73 — 76	..	5 5 3
Metropolitan Railway Consol.	100	1	1⅛	44¾— 45¼ xd	—1¼	3 0
Do. Surplus Lands	100	2⅜	2⅜	66 — 68 xd	..	4 4
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14
Do. 3½ % Pref.	100	3½	3½	88 — 90 xd	..	3 17
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89 xd	..	3 18
Metropolitan District Ord.	100	Nil	Nil	25¾— 26¼	—1	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3½	90 — 92	..	3 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 9
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32— 1 1/32	..	5 6
Do. Def.	1	Nil	Nil	⅛— 3/16	..	Nil
Do. 5 % Pref.	1	5	5	29/32— 1 1/32	..	4 17
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15
Potteries, Ord.	1	2	2	5/32— 7/32	..	..
Do. 5 % Pref.	1	5	5	5/16— 7/16	..	7 5
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 1
South Metro. Trams, 6 % Pref.	1	3	6	1/32— 1/32	..	10 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9
Do. 6 % Income	100	Nil	1	61 — 63	—3	1 11
Do. Power House Debs.	100	..	4	101 —103	..	3 17
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛— ⅜	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛— 2⅞	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 1

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16— 5 5/16	..	5 8 6
Do. 2nd Pref.	5	5	5	4 13/16— 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11¼ xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½— 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+ ½	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6½— 7	..	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	119 —123 xd	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —119	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4¼	4¼	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4¼	4¼	102⅜—104½	..	4 6 2
Calcutta Trams, Ord.	5	4½	6	5⅜— 6½	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16— 9/16	— 1/16	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅝— 5⅞	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	7/32— 9/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf.	1	6	6	15/16— 1 1/16	..	5 13
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	..	5 7
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18
Mexico Trams Com.	$100	7	7	120⅜—122½	..	5 14
Do. Gen. Con. 5 % Bonds	..	5	5	99½—100½	+ ½	4 19
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 1
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛— 7½	..	6 13
Do. 6 % Pref.	5	6	6	5¼— 5⅝	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½—101⅝	..	4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	2/32— 3/32	..	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜— 5⅝	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	+1	4 9
Rio de Janeiro Trams	$100	1	4½	116 —117	..	4 5
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18
Do. 5 % Mort. Bonds	100	5	5	97⅞— 98⅜	..	5 1
Sao Paulo Tram, Lt. and P.	$100	10	10	178 —181	—2	5 10
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98 xd	..	5 2
Un. Elec. Trams Monte Video	5	5	6	5⅛— 6	..	5 0
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	5/32— 3/32	..	Nil
Do. 6 % Pref.	1	12	9	1¼— 1⅝	..	7 7 8
Babcock & Wilcox	1	24	26	5 7/16— 5 9/16	+1/16	4 15 7
Do. Pref.	1	6	6	1⅜— 1⅝	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 7/32— 7 3/32	..	6 15 7
Do. Pref.	5	6	6	5 3/32— 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	3/32— 5/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/16— 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛— 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	..	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 18 0
Do. Pref.	5	5	5	4 7/16— 5 1/8	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3½— 3⅝	..	4 17 0
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2
Dick, Kerr	1	6	5	13/16— 15/16	..	5 6
Do. Pref.	1	6	6	1 3/32— 1 3/32	..	5 9
Do. Deb.	100	4⅜	4½	95 — 98	..	4 11 1
Edison & Swan, A, £3 paid	5	Nil	Nil	2— 2⅛	..	Nil
Do. fully paid	5	Nil	Nil	1¼— 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3
Electric Construction	2	Nil	2½	1 1/16— 1 3/16 xd	..	6 3
Do. Pref.	2	7	7	1 13/16— 1 15/16 xd	..	7 4
Greenwood & Batley, Pref.	10	7	7	7¾— 8¼	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	8½— 9	..	5 11
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	15	12½— 12⅞	..	5 16
Do. Pref.	5	4⅜	4⅜	4 15/16— 5 1/16	+ 1/16	4 6
Do. Deb.	100	4½	4½	106½—108½	+ ½	4 2 1
India-Rubber, G. & T.	10	10	10	11½— 13½	..	7 8
Do. Pref.	10	5	5	9½— 10⅝	..	4 16
Telegraph Construction	12	17½	20	34½— 36½	— ½	6 11
Do. Deb.	100	4	4	100 —102	+1	3 18
Willans & Robinson	1	Nil	Nil	3/32— 5/32	..	Nil
Do. Pref.	5	1½	Nil	⅜— 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

ELECTRIC HEATING AND COOKING IN THE UNITED STATES NAVY.

It is not so long ago that we were accustomed to look upon electric heating and cooking as an expensive luxury hardly to be contemplated as a serious economic possibility, and it is therefore of more than an ordinary interest to notice that the Navy Department of the United States has taken a most significant step in relation to the equipment of electric ranges and baking ovens on board the men-of-war of America. By the courtesy of the Secretary of the American Navy we are enabled to give some particulars of a report made by a board of Navy officers upon the subject, and the specifications and plans issued at the latter end of 1910 upon which such electrical apparatus are to be constructed. It is impracticable to give the report in full, but, in general terms, the substitution of the electrically-heated for the coal-burning units is recommended, on the score of cleanliness, convenience, improved hygienic conditions, and efficiency, where the necessary electrical energy is available. The No. 1 baking oven is capable of baking about 1,000 loaves of bread in 20 hours, and the No. 2 oven a proportionate number. The efficiency of the electric ranges, as compared with the several types of coal-burning ranges, is in the ratio of two of the former equalling three of the latter. The electric range is also slightly less expensive to operate.

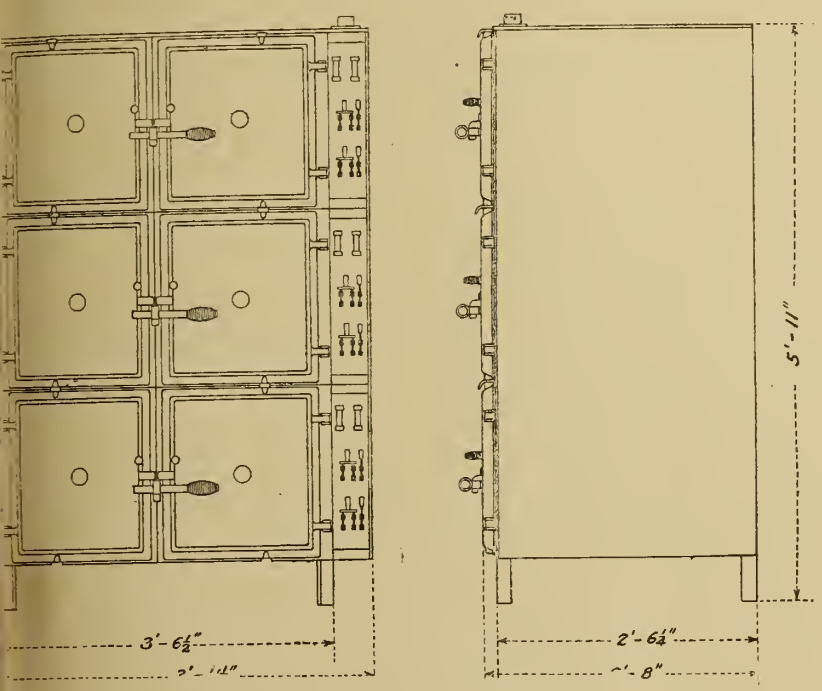


Fig. 1.—No. 1 Electric Oven; U.S. Navy.

We will deal first of all with the ships' electric baking ovens numbered "1" and "2." No. 1 oven accommodates 12 United States standard bread pans (each pan is 17 in. long, 16 in. wide, and 4 in. deep) in two rows, each six shelves high, and the No. 2 oven accommodates eight United States standard bread pans in two rows, each four shelves high. The general construction is in accordance with the side and end elevation, shown in fig. 1. It is divided into three baking chambers. The limiting dimensions (in inches) are :—

	No. 1.	*No.* 2.
Overall width not to exceed	48	48
Overall depth not to exceed	36	36
Overall height not to exceed	72	62
Inside width of each baking chamber not less than ...	38	38
Inside depth of each baking chamber not less than ...	28	28
Inside height of each baking chamber not less than ...	15	15

The switch panel is kept within the limit of the edge of the frame. All exterior sheet metal parts are of galvanised sheet iron 0·034 in. thick, and all interior sheet metal parts of sheet iron 0·025 in. thick. The oven rear frame is built up of 2-in. angle irons. The horizontal edges of the oven are stiffened by angle irons; the vertical angles extend below the bottom of the oven to serve as the supporting legs. The oven front frame is built of malleable iron castings forming the openings of the oven chambers and having angle irons extending downwards to form feet.

The baking chamber is distinct and separate from the heating chamber, and there are openings between them which permit of the circulation of air, 2 in. above the bottom of the baking chamber, so that the spilling of material cannot overflow into the heating chamber or contaminate the heating elements. The bottoms of the baking chambers are stiffened by reinforcing pieces of angle iron, securely riveted on to the underside, and having the rivet heads flushed with the bottoms. The tops of the baking chambers are horizontal, having the front edges stiffened by angle irons. Four pan racks are provided for each baking chamber. Suitable slides for the racks are securely riveted to the inside of the baking chamber at equal intervals apart. Each baking chamber is fitted with two doors hinged at the sides and giving the clear opening of the full width and height of the baking chamber, each door being double and the intervening space filled with heat-insulating material. Both doors of each baking chambers are closed by a single springless drop latch secured to the right-hand door and overlapping the edge of the left-hand door sufficiently to firmly secure it. Each door is provided with a device to secure it in the open position when required. The oven is double walled throughout, the intervening space being filled with heat insulating material having a thickness of not less than 1¼ in. The walls between the baking chambers are lagged in the same manner, so that each baking chamber may be independently operated with efficiency.

The heating elements and their terminal blocks are placed in heating chambers, which are distinct and separate from the baking chambers, so as to be entirely protected from mechanical injury from dirt, grease, and from the contents of the oven, and the heating units are easily removable from the front of the ovens. No. 1 oven is equipped with 12 heating units; No. 2 oven with eight. Each baking chamber has two units at the top and two at the bottom. The arrangement of the unit terminals is such that when the unit is pushed into place, the terminals automatically align with the proper clips in the terminal block. The clips in the terminal block are electrically connected to a two-heat regulating switch. The regulating switches are conveniently mounted in a compact group, each switch plainly indicating the baking chamber which it controls. These switches are protected from the influence of the hot air rising from the oven. Suitable enclosed fuses for the protection of the various units are mounted in conjunction with each chamber. Provision is made for the enclosure of all wiring to these switches, and also for running conduit directly into the casing of the oven and making connection with the main leads from the ship's circuits. Switches and fuses are so mounted as to protect them from hot water falling or dripping from above. The heating coils are of metal, having a specific resistance of not less than 570 ohms per mil-ft. at 75° F., and a melting point of not less than 2,200° F., and capable of running at 1,350° F. without detrimental oxidisation, and it is provided that the distribution of heat shall be even under all operating conditions. The heating units are so arranged that the air circulating in the interior of the baking chamber will come into direct contact with the wire which carries the heating current.

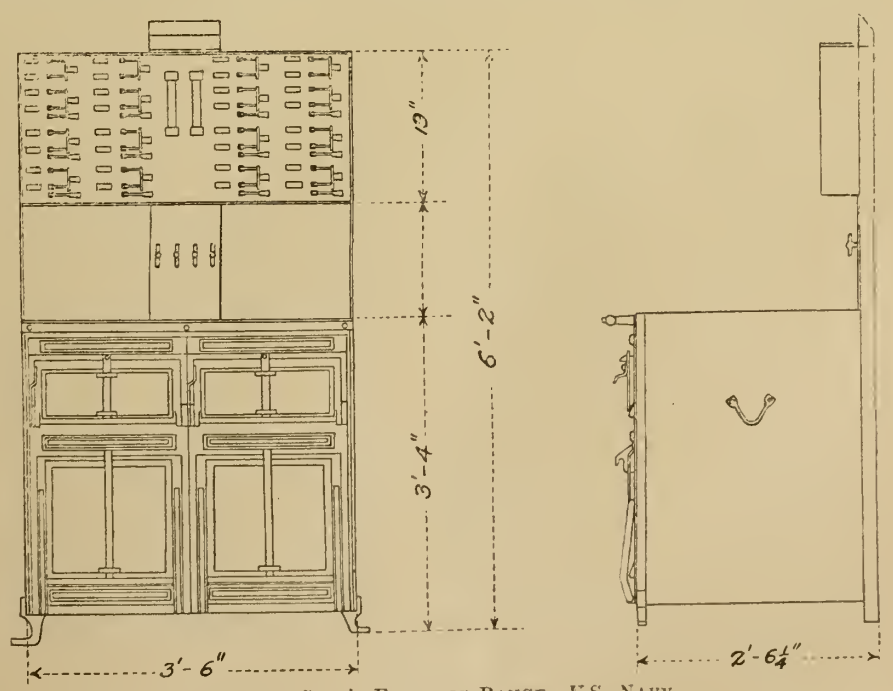


Fig. 2.—Ship's Electric Range; U.S. Navy.

No combustible material, or material which will deteriorate with the heat generated, is used in the construction of all the heating units. No. 1 oven is provided with six two-heat switches for controlling the current input in the top and bottom units of the three oven chambers respectively. No. 2 oven is provided with four two-heat switches for the same purpose. The wattage for each baking chamber is sufficient to maintain a baking temperature of 500° F. All exterior unfinished sheet metal parts are finished with two coats of black asphaltum paint; all other unfinished metal parts receive two coats of flat black. Each oven has to stand a dielectric test of 1,000 volts alternating current when hot with all current carrying parts in circuit, and must be capable of running without injury at 50 per cent. overload for 30 minutes.

The requirements for the ship's electric ranges are somewhat similar. Each range comprises two ovens, two broiling compartments (which can also be used as warming ovens), and eight stoves or hot plates, and have the general construction shown in fig. 2. The limiting dimensions specified are:—Overall width, not to exceed 42 in.; overall depth not to exceed 36 in.; overall height not to exceed 78 in.; height of stove tops not to exceed 40 in.; inside width of ovens, not less than 18 in.; inside depth of ovens not less than 28 in.; inside height of ovens not less than 16 in.; each broiling surface not less than 18 × 24 in.; top of each stove not less than 9 × 12 in.; size of switch panel about 19 × 42 in. (not to extend beyond edge of frame). Net weight of range, complete, about 1,000 lb. (not to exceed 1,200 lb.).

The main back frame of the range is built up of vertical angle iron 2 in. × ¼ in., stiffened by horizontal angle irons 1 in. × 1 in. × ⅛ in., the vertical angles to extend 4 in. below the bottom of the range to form feet. The main front frame is built up of malleable iron castings, forming the front openings of the ovens and boilers, and extending downward to form feet. All interior sheet-metal parts are of 0·025 in. thick sheet iron, the exterior side sheets being of 0·034 in. thick galvanised sheet iron, and the exterior back sheet being of $\frac{1}{16}$ in. thick galvanised sheet iron. The sides, top and bottom of the oven are flush with the opening, so that the oven can be easily cleaned out. The oven chamber is distinct and separate from the heating chamber for the same, and the opening between them, which permits the circulation of air, is at least 2 in. above the bottom of the oven chamber, so that any material spilled can not overflow into the heating chamber or contaminate the heating elements. The bottoms of the oven chambers are stiffened by reinforcing pieces of angle iron, securely riveted on the underside, and having the rivet heads flush with the bottoms. Two pan racks are provided for each oven. Suitable slides for these racks are securely riveted to the inside of the oven. Each oven is provided with a flue controlled from the top of the range, and is fitted with a door arranged to open downward, and when open to rest horizontally and flush with the oven bottom, so as to form a continuation of it, and to be capable when in this position of supporting a weight of at least 150 lb. without distortion. Each door is closed with a single springless drop latch.

The ovens are double walled throughout. The intervening space is filled with heat-insulating material, having a thickness of not less than 1½ in. This applies to the space between the ovens as well as around them. The heating elements and their terminal blocks are placed in heating chambers, which are distinct and separate from the oven chambers, so as to be entirely protected from mechanical injury, from dirt grease, and from the contents of the oven. The heating units are easily removable from the front of the range, and each oven is equipped with two heating units, one at the top and one at the bottom. The arrangement of the unit terminals is such that when the unit is pushed into place the terminals automatically align with the proper clips in the terminal block, and the heating units are so arranged that the air circulating in the oven chamber will come in direct contact with the heating unit. The wattage for each oven is sufficient to maintain a temperature of 500° F. within the oven when empty.

Each broiling chamber is provided with a rack or grill 18 in. wide × 24 in. long, and also a grease pan 18 in. wide and 24 in. long, so arranged as to protect the grease from extreme heat. Provision is made for adjusting the distance of the grill from the heating element. The broiling unit is located at the top of the broiling chamber, and is of the radiant heat type, protected from mechanical injury. The actual supports for the coils forming the heating element of the broiler units are of metal, so as to obviate the possibility of breakage due to excessive change in temperature. Each broiler is provided with a flue controlled from the top of the range, and the broiler heating units are easily removed from the front of the range. The arrangement of the broiler unit terminals is such that when the unit is pushed into place the terminals will automatically align with proper clips in the terminal block. Each broiler compartment is fitted with a tight door, arranged to open downward, and when open to rest horizontal and flush with the compartment bottom, so as to form a continuation thereof, in order that the broiler compartment may be used as a warming oven if desired, in which case it obtains its heat from the oven below it. The stoves or hot plates, of which there are eight on each range, are so arranged that they can easily be removed by lifting out of place, and as easily replaced. The terminal bars on the stoves automatically make contact with the terminal clips on the contact blocks attached to the range. The stoves are of cast-iron having flat tops stiffened at the edge by a downwardly projecting flange, and the wattage of each stove is sufficient to produce a temperature not less than 750° F. at the centre. The flues for the ovens and broilers, and the dampers controlling the same are situated at the back of the range. Each oven is controlled by two two-heat switches, one controlling the top unit and one the bottom unit. Each broiler is controlled by one single-heat switch, and each stove is controlled by one two-heat switch. Each switch is provided with a name-plate of brass having white letters engraved upon a black background designating its purpose.

Suitable enclosed fuses for the protection of the various units are mounted in conjunction with each switch. Provision is made for the enclosure of all wiring to these switches, and also for running conduit directly into the metallic casing behind the switch panel of the range for making connection with the main leads from the ship's circuits. Switches and fuses are so mounted as to protect them from water falling or dripping from above. Special care is taken that there is no exposed wiring in the vicinity of the electric range. The heating coils throughout are of metal, having a specific resistance of not less than 570 ohms per mil foot at 75° F. and a melting point of not less than 2,200° F., and capable of running at a temperature of 1,350° F. without detrimental oxidisation. The temperature of each unit has to be practically uniform throughout its coils under all operating conditions, and no combustible material or material that will deteriorate with the heat generated, can be used in the construction of the heating units.

Unless otherwise required, the ranges are designed for 120 volts D.C. The finish of the ranges is the same as that described above for the ovens, and each range has to stand a dielectric test of 1,000 volts alternating current when hot with all current-carrying parts in circuit. The ovens are capable of running without injury at 50 per cent. overload for 30 minutes, and the stoves and broilers at 25 per cent. overload for 30 minutes. One complete heat unit of each type is furnished with every five or less ranges installed on any vessel, as spares, and one set of spare fuses is furnished with each range.

It will be seen from the foregoing description and illustrations that the question of electric baking and cooking has received a amount of detailed attention from the United States Navy Department that sufficiently indicates the importance of electric heating as it appeals to them. It would appear that an equally earnest consideration of the subject would well repay not only our own Admiralty, but also the managing boards of our large public institutions, such as infirmaries, schools and workhouses, where the preparation of wholesome meals in large quantities is a matter of such vital importance.

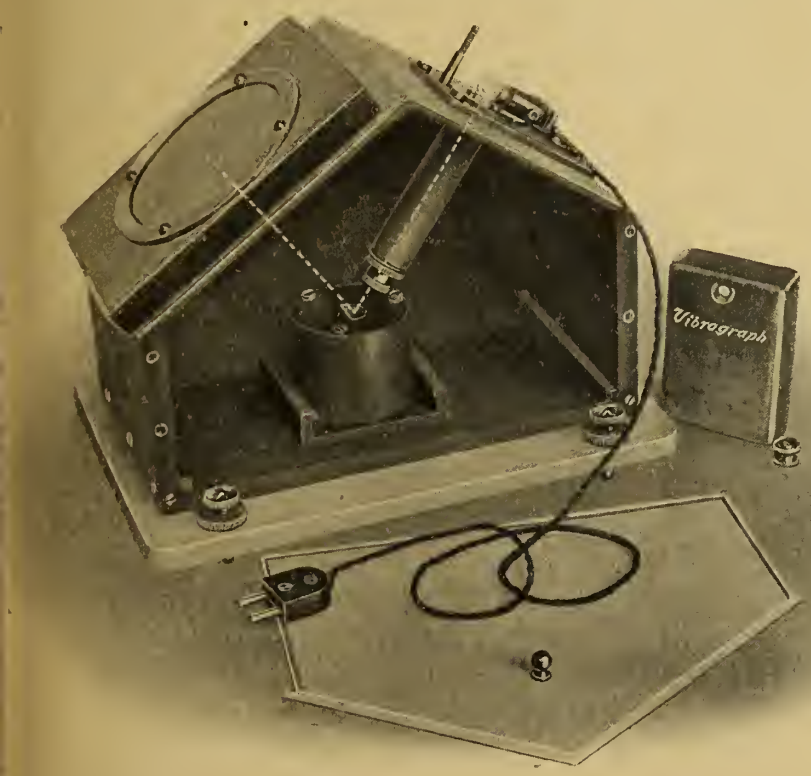
The Vienna Technical Museum.—We have received a circular stating that in commemoration of the sixtieth anniversary of Emperor Francis Joseph's reign, Austrian manufacturers, with the assistance of the State and the City of Vienna, initiated this new Museum. The foundation stone was laid on June 20th, 1909, and the building which covers an area of 20,000 sq. yd., and which is situated opposite the palace of Schoenbrunn, is now nearing completion, and will be a lasting monument of the monarch. The Museum is intended to demonstrate the development of industries and crafts in historical succession, also to do justice to the technical achievements of the present day, and to promote progress in this line by periodical exhibitions. It is to be a public educational centre spreading the knowledge of the scientific foundations and the national economic aims of technical pursuits. A considerable stock of objects has already been secured, as several large and valuable State collections are shortly to be brought together there. There are, however, many links in the chain of technical development still missing. Therefore, technical scientists, manufacturers, and craftsmen of all countries are invited to co-operate with the Museum authorities in procuring and selecting suitable objects. Everything pertaining to technical labour is acceptable, principally tools, machines, apparatus, models, materials, methods of working, finished articles, as well as plans, designs, books, illustrations and manuscripts. The Austrian Government has placed at the Museum's disposal the spacious hall of the Rotunde ("Prater") for the receipt and sorting of contributions. The names of donators will be inscribed on the gifts and in a memorial book. Further particulars can be obtained from the office of the Technical Museum, Vienna, I. Ebendorferstrasse 6.

The London and North-Western Railway Coronation Illuminations.—The decorations and electrical illuminations in connection with the Coronation, the Royal visit to Ireland, and the Investiture ceremonies, carried out by the London and North Western Railway Co. were on a considerable scale. We have received some interesting photographs of the night effects. The first shows the company's office buildings in Parliament Square, S.W., for the illumination of which 5,000 lamps were in use. The second photograph is of the company's steamer *Scotia*, lying in the Menai Straits, illuminated for the Investiture of the Prince of Wales at Carnarvon. The company's steamers *Anglia*, *Cambria* and *Hibernia* were also illuminated. The *Scotia* was berthed at Spithead for the Naval Review. In addition to the above, illumination schemes were carried out at Euston, Piccadilly Circus, Birmingham, Liverpool, Dublin, Carnarvon and Holyhead. Altogether the company had some 15,000 electric lamps in use for the illuminations. All of these schemes were prepared and carried out under the supervision of the chief electrical engineer of the company, Mr. F. A. C. Leigh.

Bowls at Blackpool.—The championship of the Blackpool and District Municipal Officers' Bowling League was decided on August 10th, the electricity department being defeated by the cleansing department by 58 points to 39. At the close of the game the trophy and prizes were presented to the winners by Mr. C. Furness, electrical engineer and tramways manager. Mr. Furness also presented the prize to the winner of the individual handicap decided in the previous week.

THE VIBRAGRAPH.

E influence of vibration in connection with the increasing esses with which the engineer of the present day has to deal, is vadays receiving full recognition. It is only necessary to recall problems of accurate balance connected with high rotative ed, such as have revealed themselves in the use of the steam



Transport Case, 13⅛" × 9⅞" × 8⅞" high; weight, with three mercury cups, two dry cells, six dark slides and transport case, about 24 lb.

Vibragraph with Side and Lamp Cover Removed showing Path of Beam of Light.

ine in both buildings and ships; the problems of moving loads ridges, and the tremours produced by tramways and railways. l all such cases the actual vibration has been a vague quantity definite measurement a matter of difficulty.

owever, Messrs. Siemens Bros. & Co., Ltd., of Caxton House, now introduced what appears to be a practical instrument for suring and recording vibration in defi- units, known as the Vibragraph. It is urate and gives records showing actual ements magnified at least 100-fold.

ur first view illustrates the complete rument, in which a mercury cup is rided with a floating mirror, so pivoted o avoid lateral movement, and the cury ripples caused by vibration result in angular movement of the mirror. beam of light emanating from the ll glow lamp, and reflected by the or, will, therefore, record on photo- hic paper a straight line if the ation is in one plane only, or a plex figure if the vibration be in es at different angles, such as is nearly ays the case in actual practice. When records are required, the photographic er can be replaced by a screen, thus itting of direct visual observations. n mercury cup has its own constants. three different cups are usually lied with the instrument so as to e the Vibragraph suitable for recording ng (say 0·3 mm.), medium (say 0·08 .) and small (say 0·02 mm.) vibrations. t of calibration curves is supplied with cup, which permit of the determina- from the photographic record of the al movement of the vibrating body in tions of inches or millimetres.

may be interesting to mention that the cury cups, although so highly sensitive, ire no special precaution in transport; may be tilted and turned upside- n without detrimental effect.

he apparatus has been put to practical tests for over 18 months h most satisfactory results, and the tests that have been carried include some for leading engineering firms in connection with h-speed turbo work; and for two large municipal electricity supply rtakings in connection with litigation in respect of alleged ance through transmitted vibration of the central station.

BRITISH TRADE WITH MEXICO.

In recent reports on the trade of this district, H.M. Consuls at Vera Cruz and Tampico make some interesting comments which should be studied by our readers. These comments may not apply particularly to the electrical trade, but they will doubtless be of considerable value as showing the conditions which exist, and the mistakes which must be avoided. From the electrical point of view Mexico is a country of considerable importance possessing vast water powers, and the possibilities of supplies for electrical purposes do not appear to have been grasped by British firms, or if they have been grasped, attempts which have been made to secure the trade have not been very successful. Much is said nowadays by way of criticism of British manufacturers, and such criticism is not always justified, but in South and Central America particularly British enterprise is lacking, and foreign firms in many cases have worked to greater advantage, owing to their methods being more suited to these markets. In this respect it is gratifying to note that somewhat increased numbers of commercial travellers are now visiting Mexico in the interests of British firms, but it is stated that they express considerable surprise at the apparent lack of attention to the market.

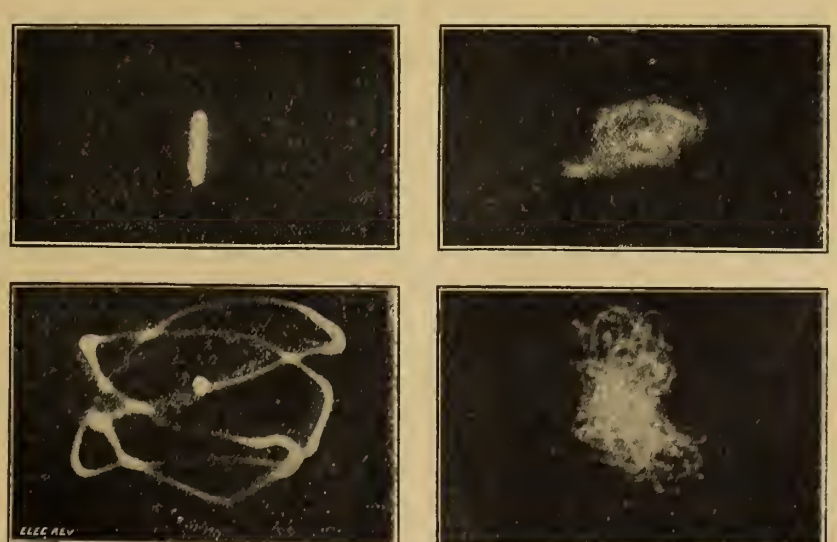
The great defect of British firms in Mexico is their indiscriminate use of foreign merchant houses as the channels for their business; this is one reason why their trade is not larger than it is.

Some of the matters affecting trade with Mexico, which, although small, are extremely important, are dealt with by H.M. Consul in Vera Cruz as follows:—

"This Consulate receives during the year inquiries relative to an infinite number of subjects, such inquiries generally being accompanied by a certain amount of printed matter, which, I am sorry to say, more often than not is printed in English and gives the cost of the goods at some home port. This printed matter when in such shape is really of very little use, and it is surprising that those desirous of increasing their trade by correspondence do not add some kind of information whereby possible customers would know what an article would cost them delivered at this port, exclusive of Customs duties and landing charges. Exporters can readily ascertain approximately what these charges will be by applying to any steamship agency, who would inform them whether the particular

Turbo-Generator.
Scale: 1 in. = 4 mils, actual vibration.

Two-Crank Engine.
Scale: 1 in. = 175 mils, actual vibration



Scale: 1 in. = 77 mils, actual vibration.
Crank Casing of Engine Driving 1,250 k.v.a. Alternator at 188 r.p.m.

Scale: 1 in. = 23·6 mils, actual vibration.
4-Cylinder Motor Car, Stationary, Engine running De-clutched.

Typical Vibragrams.

class of merchandise would pay freight on a weight or a measurement basis and the rates ruling at that time. (At the present there is very little fluctuation in ocean rates to Mexico, all the principal lines of steamers being in agreement on this subject.) While this would give the purchaser an idea as to the cost of the article he was buying, it would not necessarily mean that the ocean rates and charges quoted would be actually guaranteed. I would also call attention to the circumstance that this Consulate is frequently asked to undertake the distribution of trade circulars and printed matter compiled entirely in English. To do this properly would necessitate the translation of the major part of the papers or the sending of someone to explain to those in the trade the particulars of the object offered. This is quite impossible, as it would necessitate the employment of a large staff to attend to the requirements of all correspondents, and the men so employed would also have to be more or less experts in practically an unlimited number of trades. After many years' residence in this country, I am convinced that the only way of increasing trade is to send competent representatives as canvassers who can undertake probably two or three lines, bearing in mind that amongst other requisites essential to success is a knowledge of the Spanish language, which will conduce to a speedy acquaintance with the requirements and customs of the inhabitants of this country.

"I have often been told by leading dealers that they, as a rule, pay little or no attention to catalogues and other matter printed in foreign languages, especially where the weights and measures are not given in the metric system. In nearly every case the first question asked is, 'What will the goods cost me delivered in Vera Cruz?' Another point of trifling importance, but which seems to cause more irritation than the loss of a considerable sum, is the failure to put more than a 1d. stamp on letters destined to Mexico, whereas the postage from the United Kingdom, as everyone should know, is 2½d. Quite a number of letters are received at this Consulate in the course of the year insufficiently franked, and I might even mention one instance of this sort of thing. When replying to an inquiry I returned the envelope, in order to impress upon my correspondent the fact that I had to pay the overcharge; and although I received a letter of regret in reply, the said letter was also enclosed in an envelope with a 1d. stamp on it. Apparently while this is a small point, I wish to say that it is hard, perhaps, to realise the irritation that this causes, especially as in this country correspondence when insufficiently franked is held at the post office, and the person for whom it is destined is obliged to go to the post office, purchase the surcharge stamps, place them on the letter and obtain their cancellation before he can receive the correspondence, all of which is more or less loss of time for clerks or messengers.

"It is a matter of some surprise, too, that more use is not taken of the parcel post for the forwarding of samples and small packages instead of the very cumbersome system of turning goods over to a forwarding agent. For instance, a case was recently brought to my notice where a small parcel which if sent by parcel post would have cost the receiver about 8s. (with the double advantage that this would have covered delivery at any large town in the Republic), was sent through a forwarding agent, whose charges alone were much in excess of the total that would have been collected by the Post Office, and to this had to be added not only the steamship charges (always higher for parcels), but another agent's fee for clearing the goods at Vera Cruz, resulting in an expense to the consignee of upwards of £1 10s.

"The Chamber of Commerce at Vera Cruz is willing to accept articles for exhibition purposes in its rooms. The conditions and tariffs governing the same can be had on application to the Secretary, Camara de Comercio, Vera Cruz."

The Consul at Tampico writes :—

"The importance of good commercial travellers in opening up and extending trade relations is so generally acknowledged that it is needless to dwell on the subject. The representatives of British manufacturers, however appear to be much in the minority as compared with the representatives of American and German firms. Whilst some few British manufacturers are in the habit of having their travellers make periodical visits to Mexico, I generally find that these visits are so far apart that the trade is hard to hold. Mexican dealers, if they are satisfied with the goods they have previously purchased and with the general way they have been treated by the manufacturer, will often reserve their orders provided they know that the representative of the firm they have previously dealt with is likely to call upon them again before long. If the dealer does not know when the traveller is likely to return he will most likely place his orders with the representative of some other manufacturer who may happen to call and be able to produce an up-to-date line of samples. In making up an order the dealer is often greatly assisted by suggestions from the representative of the manufacturer, and it is to the interests of the manufacturer that any suggestions made by his representative should be *bona fide* and made with the view of assisting the merchant to increase and push his sales in certain lines. Cases have come to my knowledge where British manufacturers have expended large sums of money in sending out thoroughly efficient representatives to Mexico, who have introduced the articles manufactured all over the Republic and a good business has resulted. Unfortunately this trade has not been followed up, and the business, to secure which the manufacturer had expended a large sum of money, is being allowed to slip away. Manufacturers sending travellers out to Mexico should arrange for them to call on their customers at least once, if not twice, every year. In the interim let the manufacturer keep in touch with his customers by sending out monthly quotations printed in Spanish. leaflets calling attention to any changes or improvements in the goods manufactured, &c. The Mexican custom of sending out New Year's cards is not to be despised. I have known of several cases where business resulted through the extension of this small courtesy, especially the interior of Mexico.

"In cases where manufacturers do not wish to go to the expe of sending out a personal representative, I would suggest the est lishment of commercial agencies in the most important busin centres. At these agencies samples might be exhibited, catalogues and general price lists furnished. The expense running such an agency would be comparatively light if divi up between several different firms. The full working details these agencies would, however, have to be carefully studied by the manufacturers, and I would suggest that the Chamb of Commerce in some of our important manufacturing cent might be able to devise some practicable scheme for the establi ment abroad of commercial agencies such as I have suggested."

PROCEEDINGS OF INSTITUTIONS.

Electric Traction in Switzerland.

By E. Huber-Stockar.

(*Abstract of paper read at the Zurich meeting of the* Institution Mechanical Engineers, *July*, 1911.)

Electric traction on railways has occupied the minds of scienti and inventors as far back as the times of Faraday's memorable a fundamental discovery of the electro-magnetic mechanical prod tion of electric current. In those times Davidson experimen with an electric locomotive on the railway between Glasgow a Edinburgh. His locomotive weighed about 5 tons; it had t axles, each driven by an electro-magnetic machine, and current w supplied from two of Sturgeon's primary batteries carried on t locomotive.

Electric railways proved to be an economic possibility wh steam railways could no longer be financed. Especially in Switz land, where living and manufacturing had become very expens in the large towns, electric railways opened up agricultural a out-of-the-way districts for commercial enterprise, and furnishe system of communication by rail, thus completing and feeding t system of main line railways in a most beneficial manner.

Since 1890 electric traction has been adopted on one or anoth section of railway where steam traction appeared suitable.

At the present time a number of remarkable electrifications ha been carried out, or are in course of completion, so that it is n necessary to waste words in justifying railway electrification as subject of a paper to be read before a technical society, even n directly interested in electricity. The era of motors geared driving axles, as in street cars, has probably passed as far as more powerful vehicles are concerned, and the electric locomot of to-day is, with regard to its mechanical part, to a large exte the work of the steam locomotive builder.

The reason for dealing more particularly with railway electrific tion in Switzerland is not because greater progress has been ma in this direction, but because of the more general interest presents in comparison with many other countries.

Though railway electrification in Switzerland is inseparable fro the use of water power, and though this use is evidently benefici to the financial situation of the country in the long run, still must, for various reasons, be done in a way so as not to disturb t balance of traffic receipts on the one hand and the operati expense and interest on loans on the other. The time is still f distant when even State railways will be built, as the princip roads have been built all through the country and over t mountain passes, simply because they are necessary, no matt whether they are remunerative or not. Railways are still bui and operated for the greater part, and most fortunately so, even the State, on the basis of a commercial enterprise conducting household of its own. Therefore, more particularly in Switzerlan where railways are, on the whole, not making profits because cost of construction, heavy grades, rather irregular traffic, sho average distance of travel, high wages, low fares and so on, t problem of railway electrification is in every case a problem main of general economics of railway operation, since the technic problem has admittedly been satisfactorily solved so far.

The electrifications of importance that have hitherto been are being carried out are almost all either of an experimental preparatory character, or were brought about by considerations n directly or purely economical. In Switzerland the economy operation is having a decisive weight, which makes the problem, it is presented, difficult.

In Switzerland, as in other countries, the railways alread electrified, or about to be electrified in the near future, are suc that smoke nuisance would be an almost prohibitive feature steam, as in the case of the Simplon tunnel, or the cap bilities of steam are near exhaustion, as in the case of the S Gotthard Railway.

By railway is meant simply a line or system of lines of railwa comparable with a steam railway line or system of lines of mediu or great importance. This involves a somewhat high standard construction of passenger and freight trains, of a certain weigh and frequency, a traffic of a certain volume, and of a service high responsibility. It excludes railway lines of a purely loc character and smaller importance. There are in Switzerland onl two gauges—1·435 m. "normal" (English standard) and 1 met "narrow" to be considered. There are normal gauge interurba and branch lines similar to tramways, playing no *rôle* in the ele

rification problem except as experiments, and there are narrow-auge railways that are important in their district and in general, hich run trains exceeding in weight that of many normal-gauge team railways. These narrow-gauge railways must be included in he problem.

A table shows the slow progress of normal-gauge railways since bout 1883 and the rapid progress of narrow-gauge railways since bout 1887.

The extent of electric traction on rails in Switzerland, and par-icularly that of electric locomotive traction, is seen from Table I, ompiled from the official statistics for 1909. Special attention is rawn to the improvement in the electrical percentage of normal-auge railways at the present time—5·4 per cent. instead of ·9 per cent. in 1909.

A comprehensive statement of the character of the principal rail-ays is given in Table II.

Some of these railways are described in detail and illustrated.

Burgdorf-Thun (B.T.B.) Railway.—It is noteworthy that he first electric traction on a railway f the general character of normal-gauge ailways of medium importance was n the alternate current principle using hree-phase current. At the time of onstruction of the B.T.B., three-phase urrent was almost universally used for ll power transmission and distribution ver distances of some importance. The pply of electric power to the trains of he B.T.B., the terminal of which is urgdorf, is over 50 km. distant from the ource, where hydraulic power then was eady for use. Owing to the length of ailway, 40 km., and the means ien available, sectionising of the line as obviously necessary, 500 to 750 volts eing then still the limit of electric-raction voltage considered necessary, and ub-stations were also required. According the then practice, at least two such ub-stations with converting machinery nder constant attention would have been ecessary. The trains likely to be hauled ere of a weight, and the grades of a ngth, not yet customary in electric-raction practice in general; the sub-ations would have become in size and cost both of plant and eration not compatible with the small average useful load of he few trains. Briefly, the problem of electrification, with its kward features under average Swiss conditions, was set forth the case of the B.T.B.

The adoption of three-phase current involved a compromise of dvantages and disadvantages which are more or less evident. The dvantages were: the elimination of costly sub-station plant and eration, and the reduction in investment or loss of power or both the contact line, by making more sections of less length, sup-ied each with a simple transformer sub-station, the aggregate cost which was far below that of even a much smaller number of nverting sub-stations.

The disadvantages, on the other hand, were: a more complicated ntact line composed of two contact-wires that were to be inter-all up-grades as long as the electric current is on, and the torque of the traction motors corresponding to the resistance of the whole train keeps within certain limits, beyond which the motors get "out of step" and stop. This feature has, however, not been felt as a source of trouble, and will not be so felt if motor equipments and train loads are properly proportioned.

The B.T.B. was electrically equipped from the beginning; it is worked by the Emmentalbahn Co. operating a steam line of their own of 43 km. between Solothurn and Langnau. About 7 km. of track east of Burgdorf are common to both railways, and are therefore operated by steam and electricity at the same time.

Passenger trains of 90 tons weight are operated with motor-cars of the following type and equipment:—

Number of axles, all driving ...	Two 4-wheel bogies.
Total weight equipped, empty	32 tons.
Number of seats	66
Weight of electric equipment	10 tons.

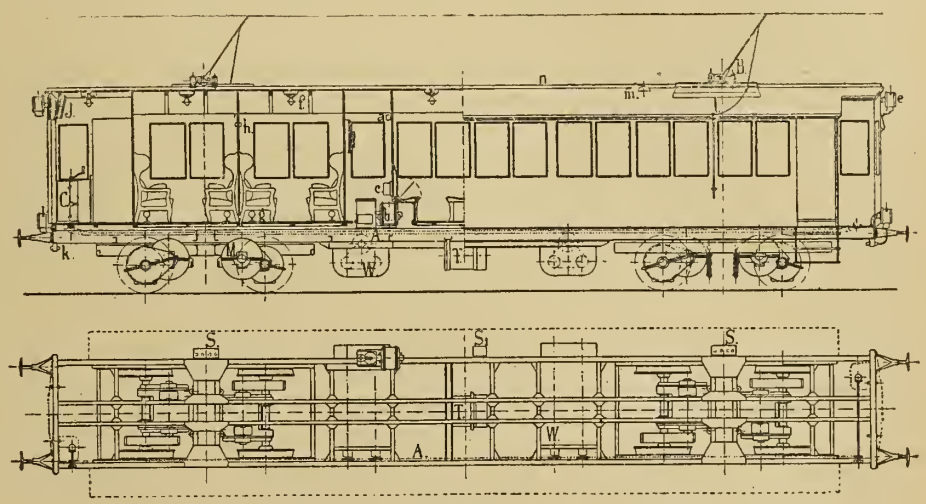


Fig. 1.—Motor Coach, Burgdorf-Thun Railway.

Diameter of wheels	1·020 m.
Motors, three-phase induction, rheostatic control for reduction of normal speed.	
Voltage of motors	750
Periodicity of alternating current	40
Power per motor, one hour rating	60 H.P.
Total motor power on car	240 H.P.
Gear ratio: single reduction	1 : 3
Normal pull on tread	1,800 kg.
Normal and maximum speed	36 km. per hour.
Contact: two-part bow.	
Brakes: compressed air.	

From the commencement there were two locomotives for dealing with freight trains of 100 to 150 tons weight; they could work



Fig. 2.—Three-Phase 800-h.p. Locomotive.

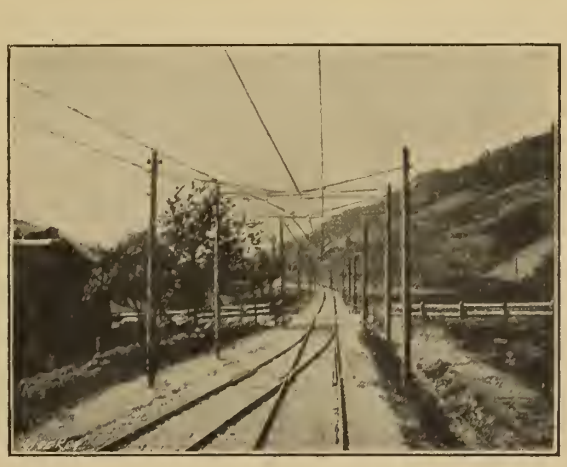


Fig. 3.—Three-Phase Overhead Work. Burgdorf-Thun Railway.

sulated, difficulties in the construction and operation of the ntact line above points and crossings of track, the impossi-lity of increasing by means of controlling apparatus the speed ove a certain almost constant speed, which had to be accepted the normal speed on load, also working at lower speeds being tended with considerable loss of power in the form of at. That speed depends on the fixed periodic cycles of y kind of alternating current and the unalterable number poles of the motors. The motor runs almost as if it as positively geared to the machines in the power station, d these features of three-phase motors of the times can roperly be called the one-speed feature and the gear-wheel feature. onsequently the speed of a train remains practically constant on with two different ratios of gearing, the one or the other gearing being clutched in, giving two speeds, 36 and 18 km. an hour, while the one-speed feature is reserved for each of these two particular speeds.

In 1910 another locomotive, of a type first introduced in the Simplon tunnel was added, which allows much heavier trains to be hauled. Instead of purely mechanical means of overcoming the one-speed inconvenience, not desirable in heavier traction, purely electrical means were adopted. The multi-speed feature, adopted and developed for other purposes than traction proper many years before, was resorted to and adapted to specially suit the case. By means of a controller-switch, sectionising the windings of the motors, four different numbers of poles are obtained.

Consequently the motors run, according to the number of their poles, by virtue of the position of the switching controller, at one of four particular speeds. It is seen that there are, so to speak, four different motors incorporated in one [motor, properly called a multi-speed motor. With reference to each of these four speeds, the one-speed and the gear-wheel features obtain, but there is, as experience seems to prove, a sufficient freedom of adjustment to the varying requirements of practical driving on the railway having such locomotives (B.T.B. and Simplon).

The two types of locomotive of the B.T.B. are of the following description :—

	Type 1899.	*Type* 1910.
Number of axles, all driving	2	two 4-wheel bogies.
Total weight equipped	30 tons	42 tons.
Weight of electric equipment	10 ,,	18 ,,
Weight on single wheels	7·5 ,,	5·0-5·5 tons.
Diameter of driving wheels	1·230 m.	1·230 m.
System of motors	Three-phase one speed, rheostatic control, slide rings and brushes.	Induction multi-speed intermediate voltage control, no slide rings nor brushes.
Voltage of motor	750	750
Periodicity of alternate current	40	40
Power of each motor, one hour rating	150 H.P.	400 H.P.
Number of motors	2	2
Mechanical arrangement	Gears (changeable) countershaft connecting rods	Gears, countershaft connecting rods.
Gear ratio	1 : 1, 88 and 1 : 3, 72	1 : 4
Contact	Two-part bow	Two-part bow, articulated.
Brakes	Compressed air	Compressed air.
Normal (economical, constant) speeds in km. per hour	18 36	15·75 21·0 31·5 42·0
Total power of locomotive in horse-power	300 300	500 600 700 800
Total pull on head, kg.	4,400 2,200	8,570 7,720 6,000 5,14

The mechanical part of the locomotives is by Winterthur, th electrical by Brown, Boveri.

Electric traction on the B.T.B. has been satisfactory. Di turbances interfering with traffic have practically disappeare and at no time has any dissatisfaction been notice

TABLE I.—Distribution of Electric Railways of Switzerland.

December 31st, 1909. Types and names of railways.	km. of railway operated by electricity.	Electric railways in per cent. of all railways.
Normal Gauge.		
Federal Railways, including St. Gotthard, excluding Brünig	21·7	0·8
Arth-Goldau	2·6	—
Burgdorf-Thun	40·2	—
Frieburg-Murtens-Ins	32·3	—
Orbe-Chavornay	3·9	—
Normal-gauge railways excluding Fed. Rly.	79·0	11·7
All normal-gauge railways	100·7	2·9
Narrow-Gauge Railways.		
Aigle-Leysin	6·8	—
Bex Villars-Chésière	13·8	—
Grütschalp-Mürren	4·3	—
Martigny-Châtelard	20·5	—
Sissach-Gelterkinden	3·1	—
Stansstad-Engelberg	22·5	—
Other electric narrow-gauge railways	464·1	—
All narrow-gauge railways (steam and electric)	535·1	49·8
All normal and narrow gauge railways	635·8	14·2
Rack Railways.		
Brunnen-Morschach	2·0	—
Gornergrat-Bahn	9·3	—
Jungfrau-Bahn	5·6	—
Montreux-Glion	2·7	—
Wengernalp-Bahn	(18·0)	—
Other electric rack-railways	9·1	—
All rack-railways (steam and electric)	28·7 (46·7)	30·0 (48·6)
All tramways	388·7	99·5
All rope-railways	22·3	69

TABLE II.—Character and Cost of Construction of Railway, Rolling Stock, Traffic and Operation.

Year 1909.	1 Orbe-Chavornay.	2 Stansstad-Engelberg.	3 Burgdorf-Thun.	4 Freiburg Murten-Ins.	5 Gruyère ch. d. f. el.	6 Montreux-Oberland bernois.	7 Martigny-Châtelard.	8 Simplon Tunnel.	9 Seebach-Wettingen.
Gauge, in metres	1·435	1·000	1·435	1·435	1·000	1·000	1·000	1·435	1·435
Length, in kilometres	4·0	22·5 (rack 1·5)	33·2 constructed 40·2 operated electr.	25·1 constructed 32·3 operated electr.	44·3	62·1	20·6 (rack 2·48)	21·7 (tunnel 19·803)	19·4
Grade maximum, per cent.	25	25 (rack 2·50)	25	30	30	67	70 (rack 200)	10	12
Lowest point, metres a. s. l.	450	438	535	435	672	398	470	630	391
Highest point, metres a. s. l.	473	1,002	770	632	861	1,272	1,227	705	459
Weight of rail in kilogrammes per metre	20·6	20·0	36·1	36·0	24·5	24·3	25·2-30·5	49·0	36
Number of electric locomotives	—	4 (rack)	2 (1911 : 3)	—	—	—	—	4	3
Number of motor-cars	4	10	6	4	13	24	12	—	—
Number of ordinary cars	4	26	17	55	104	145	29	—	—
Average number of trains over whole line	29·15	22·16	20·79	15·65	19·40	16·44	10·11	passenger 11 freight 5	16
Trains, kilometres run, 1,000	43	186	311	189	312	378	78	146*	
Passengers carried, 1,000	105	290	656	277	365	443	231		
Tons of all kinds of freight, 1,000	46	13	103	77	51	41	3		
Thousand francs per kilometre :—									
Cost of purchase of land	11	18	24	12	20	28	27		
Cost of electric line equipment	9	12	21	14	13	16	23		
Cost of buildings and station machinery	5	26	15	18	36	43	29		
Cost of construction complete	96	106	133	99	136	221	292		
Cost of rolling stock, locomotive and other	24	23	20	15	130	34	65		
Cost of railway complete	125	133	162	122	179	272	418		
Total amount	505	3,007	5,554	3,291	7,903	16,894	8,664		
Total operating expenses	48	223	420	243	333	519	207		
Total receipts from traffic	71	401	564	298	406	1,236	542		

Section of the Federal Railways. No individual figures available.

Experiments in 1906 and 1907. Regular operation from December 1st, 1907, until May, 1909.

* From June 1st, 1908, until May 31st, 1909 ; 22,933,000 ton-kilometres without, and 32,458,000 with locomotive weight.

TABLE II.—*Continued.*

Year 1909.	10 Locarno-Bignasco.	11 Bellinzona-Mesocco.	12 Seethal.	13 Martigny-Orsières, 1910.	14 Bernina.	15 Lötschberg. Spiez-Frutigen.	15 Lötschberg. Frutigen-Brig. (Building.)	16 Engadin (Rhätische Bahn). (Building.)	17 For comparison. St. Gotthard 1908.	17 For comparison. Federal Railways † 1909.
Gauge in metres	1·000	1·000	1·435	1·435	1·000	1·435	1·435	1·000	1·435	1·435
Length in kilometres	27·3	31·5	54·2	19·2	60·6	13·4	60·1	62·33	272·5 constructed 275·2 operated.	2,626 constructed 2,672 operated.
Grade maximum, per cent. ...	33	60	37	35	70	15·5	27	25·0	25-27	26
Lowest point, metres a. s. l. ...	217	231	357	469	429	631	681	1,290	205	277
Highest point, metres, a. s. l. ...	441	769	651	904	2,256	781	1,244	1,880	1,153	1,010
Weight of rail in kilogrammes per metre	20·7	25·0	—	36·0	—	36·0-42·0		23·5-27·0	36-51	25·0-51·0
Number of electric locomotives...	—	—	14 (steam) 25·0-36·0 before electrification		—	(1911) 2		11	169	1,178 steam 4 electric
Number of motor-cars	3	6	(1911) 10		15	(1911) 3		—	—	1 steam
Number of ordinary cars... ...	18	26	108		59	33		—	2,100	17,805
Average number of trains over whole line	13·74	12·86	18·88 (24 after electrification)		—	13 (1911 24 approx.)		20 (upper section 30)	43·63	33·47‡
Trains, kilometres run. 1,000 ...	140	150	379		—	71			1,449	31,547‡
Passengers carrried, 1,000 ...	188	229	786		274	211			1,051	76,285‡
Tons of all kinds of freight, 1,000	13	9	132		12	47			472	12,108‡
Thousand francs per km.										
Cost of purchase of land... ...	6	6	14			28			57	48‡
Cost of electric line equipment ...	10	11	—			—			—	(400 approx. Simplon Tunnel)
Cost of buildings and station machinery	9	15	16			19			78	45‡
Cost of construction complete ...	77	77	105			232			810	316‡
Cost of rolling stock, locomotive and other	9	15	23			26			95	66‡
Cost of railway complete ...	94	99	136			273			1,083	426‡
Total amount	2,573	3,125	7,365			3,664			296,823	1,023,089‡
Total operating expenses... ...	96	103	644			150			5,124	99,757‡
Total receipts from traffic ...	136	143	732		8·48688	254			8,510	158,745‡

Statistical figures not on hand. Figures not on hand. before electrification. In course of construction. In course of construction. before electrification.

† Excluding Brunig but including St Gotthard. ‡ Excluding St. Gotthard and Brunig.

A great benefit to electrical operation, especially since a powerful ...omotive has been added, is that power is supplied from a large ...wer-station near Spiez on the Lake of Thun, capable of dealing ...ith the heavy variations in load. The power station belongs ... a large power transmission and distribution enterprise, the ...rnische Kraftwerke A.G., who operate about 60,000 H.P., and are ...ntrolling a large additional power in course of development. ...l power is hydraulic.

The transmission voltage between Spiez and the 14 transformer ...b-stations along the B.T.B. Railway is 16,000.

The consumption of electrical energy is 68 watt-hours per ton-...ometre. The cost of energy at 4 centimes the kilowatt-...ur in 1904 was 0·284 centime per ton-kilometre and 18·35 centimes ...r train-kilometre. In the same year 290,807 train-kilometres ...re run. Lubrication amounted to 0·94 centime per train-...ometre.

Freiburg-Murten-Ins (F.M.A.) Railway.—This is interesting as the ...st normal-gauge railway which has undergone actual electrifica-...n. This railway is of invaluable service to the district traversed, ...t the financial results are unsatisfactory. The electrification was ...de possible by the controlling influence and financial interest of ...e State of Fribourg both in the F.M.A. (Fribourg-Morat-Anet) ...d in the electric power supply enterprise next door. The elec-...fication was completed in 1902 as far as Murten, in 1903 on the ...tension to Ins only then constructed. The whole electric equip-...nt of the railway was supplied by the Oerlikon Co. There are ...ly four motor-cars. Locomotives will be used if the freight ...ffic becomes sufficiently developed.

This electrification was the first, and is the only normal-gauge ...e in Switzerland carried out on the continuous-current system ...th a third rail. The pressure of 800 volts was a novelty in ...rd-rail practice at that time, and has proved safe and satis-...tory.

Three-phase current of 8,600 volts pressure and 50 cycles is sup-...ed from Hautersive, about 3 km. south of Fribourg, a power ...tion of 6,000-10,000 H.P. The third rail is fed from two converter ...tions, each equipped with converting machinery of relatively ...derate size and accumulator batteries to provide for peak ...ds.

The consumption of power is about 34 watt-hours per ton-...ometre, exclusive of losses in converting machinery and bat-...ies. Inclusive of these losses the consumption is estimated ...60-80 watt-hours according to circumstances.

The F.M.A. is the only railway on which a comparison of steam ...d electric operation is available. The result of electrification has been satisfactory, as far as could be expected with the hitherto small traffic.

The following figures cover the years from immediately before to immediately after the electrification. The increase in capital is caused both by the construction of the Murten-Ins extension (about 10 km.) and the electrification of the whole line of over 32 km.:—

	1901.	1902.	1903.	1904.
	Francs.	*Francs.*	*Francs.*	*Francs.*
Capital investment ...	1,715,658	2,292,174	2,692,952	2,895,676
Excess of operating expenses	31,254	29,904	—	—
Excess of receipts from traffic	—	—	13,025	35,548
Interest on capital investment	—	—	0·485 %	1·23 %

The electrical system requires no detailed description; it is sufficiently known from the large number of third-rail elevated, underground, tube and other railways in other countries.

The motor-cars (cars by Neuhausen and Rastatt, electric equipments by Oerlikon) are of the following description:—

Total weight, equipped	33-42 tons.
Weight of electric equipment	12 tons.
Number of motors in car...	4
System of motors	Continuous current. Series-parallel and rheostatic control.
Voltage of motors	400
Power of one motor, one hour rating ...	110 H.P.
Mechanical arrangement	Single reduction, usual spring suspension.
Ratio of gearing	1 to 4.
Total normal pull on tread	5,000 kg.
Normal speed	21 km. per hour.
Maximum speed	54 „ „
Contact	Third rail top contact shoe.
Weight of trains (with one motor-car)...	80 tons.
Maximum accelcration	0·15-0·20 metre per second per second.

(*To be continued.*)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SOUTH AFRICA.—The South African Customs Authorities have issued a decision to the effect that electrophones (Stolz), being a device for making the deaf hear, are to be dutiable at the rate of 15 per cent. *ad valorem*, but if of British origin at the rate of 12 per cent. *ad valorem*. Illumination devices for gas or electric light are to be dutiable at the rate of 3 per cent. *ad valorem* if of foreign origin, and to be free of duty if of British origin.

CUBA.—The Cuban Government have recently issued a law modifying the provisions of the law relating to Consular fees. The new law provides that invoices for goods shipped to Cuba of a value of less than *five* pesos shall not require Consular certification. Invoices in respect of goods of a value of five pesos or more, but less than 50 pesos, shall be certified, the fee being 50 centavos.*

The other fees for the certification of invoices remain unchanged at the following rates :—

Invoices for goods to a value of 50 pesos up to 200 pesos	2 pesos.
Invoices for goods of a value exceeding 200 pesos —for each 100 pesos or fraction thereof in excess	10 centavos.

The Law prescribes further that the bills of lading (*conocimientos de carga*) of goods for shipment to the Republic shall be presented at the Cuban Consulates, to be viséed, at the same time as the invoices are presented for Consular certification. The fee for the Consular visa of each set of bills of lading is one peso.

* Hitherto, invoices covering amounts of less than 50 pesos have not required Consular certification.

SAMOA.—The Governor of Samoa has recently promulgated a law providing that, from April 1st, 1911, the import duty on the articles included under No. 9 of the Customs Tariff of Samoa (*i.e.*, all articles not specially mentioned in the Tariff), was to be increased from 10 per cent. to 12½ per cent. *ad valorem*.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,377. "Apparatus for electrically operating planing machines and the like reciprocating tools." F. Stott. July 31st.

17,381. "Control for trackless trolley vehicles and the like having auxiliary batteries for independent propulsion." W. A. Stevens. July 31st.

17,383. "Method of holding carbons in hand-feed arc lamps and the like." Mansell, Ltn., and M. Mansell. July 31st.

17,387. "Telephones, electrophones, electric lamps, electrlo radiators and the like." E. V. Cheese. July 31st. (Complete.)

17,390. "Magnetic improvement in boots and shoes." G. Clamfitt. July 31st.

17,412. "Electric incandescent lamps." A. Bloch. (Convention date August 27th, 1910, France.) July 31st. (Complete.)

17,419. "Automatic regulating mechanism applicable to electric generators." L. V. Grillet and J. B. Truchetet. July 31st. (Complete.)

17,425. "Electrical connections for secondary batteries and for other purposes." E. W. Part. July 31st.

17,426. "Secondary battery plates." E. W. Part. July 31st.

17,429. "Telephones." B. Gwoznz. (Addition to No. 11,234 of 1911. Convention date, April 20th, 1911, Germany.) July 31st. (Complete.)

17,430. "Visible electrical signals and safety backing devices in connection with colliery winding engines." T. Charlton and P. F. Smith. July 31st.

17,435. "Method of producing an insulating substance for the purpose of damping the sounding action of exposed electric conductors." W. Steinert. July 31st. (Complete.)

17,438. "Process for making electric condensers." The firm of Robert Bosch. (Convention date, October 3rd, 1910, Germany.) July 31st. (Complete.)

17,441. "Telephone cabincts." O. Sterkel. July 31st.

17,450. "Tramway and like rails." H. Grudgington. August 1st.

17,452. "Electrical influence machine for the stimulus of plant life, the production of X-rays and ozone, therapeutic and other medical work, and wireless telegraphy." T. Clark. August 1st.

17,463. "Spark plugs for use in internal combustion engines," G. C. Davis. August 1st. (Complete.)

17,479. "Electrio heaters." W. G. Housekeeper. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,480. "Processes of preparing filaments for incandescent lamps." W. G. Housekeeper. (Convention date, August 5th, 1910, United States.) August 1st. (Completc.)

17,481. "Electrical terminal devloes." O. S. Schairer. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,482. "Supports for incandescent lamp filament." A. S. Knight. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,502. "Electrio switches." H. J. Furneaux and W. B. Rock. August 1st.

17,518. "Electrical timing devicos for races and the like." A. Griffiths and A. E. Comissiong. August 1st.

17,519. "Adjustable electrio lamps." H. Fairbrother. (Vesta Accumulator Co., United States.) August 1st. (Complete.)

17,530. "Tclephones." B. Gwoznz. (Addition to 11,234 of 1911; Convention date, April 21st, 1911, Germany.) August 1st. (Complete.)

17,550. "Life-saving belt for electricians." J. W. Brodie-Innes. (Ela, Archer, United States.) August 2nd.

17,567. "Electrically controlled clocks and the like." T. Burton. August 2nd.

17,587. "Thermic telephones." B. Gwozdz. (Addition to 11,234 of 1911 Convention date, April 22nd, 1911, Germany.) August 2nd. (Complete.)

17,593. "Electric terminals." E. G. Anness. August 2nd.

17,595. "Telephones." B. Gwoznz. (Addition to 11,234 of 1911; Conventic date, April 22nd, 1911, Germany.) August 2nd. (Complete.)

17,597. "Treating substances by electro-osmosis." Felten & Guilleaum Carlswerk Akt.-Ges. (Convention date, August 2nd, 1910, Germany.) Augu 2nd. (Complete.)

17,605. "Electrolytic manufacture of metallic sodium and potassium ar electrolyte for use therein." E. A. Ashcroft. August 2nd.

17,612. "Terminals for electrio storage batteries or other purposes." Olnham. August 2nd. (Complete.)

17,629. "Dynamometers." Heenan & Froude, Ltd., and F. Harriso August 2nd.

17,634. "Inductive wireless telephone and telegraphic installations." Von Kramer. August 3rd.

17,635. "Method for timing telephone calls." T. Dodnrell. August 3rd

17,653. "Spring points for tramways." R. W. Wilson. August 3rd.

17,654. "Tramway points." R. W. Wilson. August 3rd.

17,675. "Speed regulation of dynamo-electric machinery." H. Piepe (Convention, date, August 6th, 1910, Germany.) August 3rd. (Complete.)

17,678. "Apparatus for the destruction of flies and other insects by ele tricity." A. C. Pemberton. August 3rd.

17,690. "Carbon electrodes." M. P. Schiff. August 3rd. (Complete.)

17,708. "Regulating devices for electric generators or motors." H. Balcombe and J. E. Calverley. August 3rd.

17,716. "Electric motors and dynamos." T. L. R. Cooper. August 3rd.

17,717. "Telegraphy." E. D. Cather. August 3rd.

17,718. "Time switches and the like." A. G. Zenner. August 3r (Complete.)

17,723. "Arc lamp electrodes." British Thomson-Houston Co., Lt (General Electric Co., United States.) August 3rd. (Complete.)

17,724. "Electric switches." British Thomson-Houston Co., Ltn. (Gene Electric Co., United States.) August 3rd.

17,761, "System of electrical cab signalling for railways or the like." O. Field. August 4th.

17,768. "Driving of rotary field induction motors." Siemens Schuckei werke G.m.b.H. (Convention date, August 4th, 1910, Germany.) August 4 (Complete.)

17,778. "Electric arc lamps." J. Wetter. (Ges. für Maschinen-u Metall-Industrie m.b.H., Germany.) August 4th.

17,780. "Method and apparatus for shaping filaments for electrio inca descent lamps and the like." British Thomson-Houston Co., Ltn. (Gene Electric Co., U.S.) August 4th.

17,784. "Device for reducing the electrical disturbances produced electrical signalling circuits by the proximity of alternating currents." H. Emmuns. August 4th.

17,788. "Electric switches for use with timing or other predetermini mechanism." H. P. Allison and H. J. Arnold. August 4th.

17,791. "Means for regulating electrio lamp circuits." H. Leitn August 4th.

17,810. "Electrical heating apparatus particularly vulcanisers." W. Welch and H. Frost & Co., Ltd. August 4th.

17,820. "Telephones." B. Gwoznz. (Addition to 11,234, 1911. C vention date, April 22nd, 1911, Germany.) August 4th. (Oomplete.)

17,835. "Dynamo-electric machine." J. W. Greenwood. August 5th.

17,840. "Arc lamps." A. T. Dowdell. August 5th.

17,869. "Holders for electric lamps." Siemens Bros. Dynamo Works, L (Siemens-Schuckertwerke G.m.b.H., Germany.) August 5th. (Complete.)

17,874. "Registering device for telephone systems." Western Elect Co., Ltd. (Western Electric Co., United States.) August 5th.

17,875. "Telephone receivers." Western Electric Co., Ltd. (Weste Electric Co., United States.) August 5th. (Complete.)

17,900. "Telephones." B. Gwoznz. (Addition to 11,234 of 1911. Conventi date, April 22nd, 1911, Germany.) August 5th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtair of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Guide Sheaves for Ships' Telegraphs and the like. J. W. Ray. 28,8 December 6th.

Means for Controlling Electrically-Operated Driving Systems. Crompt and Co., Macfarlane, Burge and Williams. 29,727. December 21st.

Automatic Distributor for Electricity. H. Wolff. 29,810. December 22

Tools or Machines Operated by a Reciprocating Element and Means Driving them Electrically. R. S. Crawford and J. Scott. 13,716. June7

Electrical Ceiling Roses, Junction Boxes, Fuses and the like. H. L. Jol son and Loxley & Co. 14,042. June 10th.

Electric Clocks. F. Holden. 14,126. June 10th. (Patent of Addition granted.)

Electric Safety Fuses. M. Kallmann. 16,258. July 7th.

Braking Induction Motors. A. Rosenberg and S. Peck. 17,010. July 20th.

Control Systems for Electric Motors. Adams Mfg. Co. (Cutler-Hamn Mfg. Co.) 17,107. July 23rd.

Method of Manufacturing Spark Plugs. J. A. Anderson. 18,295. August 2

Ignition Apparatus, more especially Intended for Use with Internal C bustion Engines. A. H. Smith and Muirhead & Co. 18,794. August 9th

Electrical Heating Radiators. R. Cunnington. 21,848. September 14th.

Automatic Regulators for Electrio Circuits. S. Presser & Ges. fur Elekt technische Industrie. 22,198. September 24th.

Rotating Commutators or Similar Structures. Vickers, Sons & Maxim, Lt and R. Williamson. 22,507. September 28th.

Electric Relay Apparatus. Westinghouse Brake Co. (J. O. Taylor.) 28,8 December 8th.

Electricity Motor Meters of the Mercury Type. Compagnie pour Fabrication des Compteurs et Materiel d'Usines a Gaz. 30,297. Dece ber 30th. (May 2nd, 1910.)

1911.

Relay for Unnulatory Currents. E. Reisz and Strauss. 2,111. January 2 (March 30th, 1910.)

Homopolar or Acyclic Dynamo-Electric Machines. O. Schulz and Eyerma 2,369. January 30th.

Mounting of Electrio Conductors more particularly Filaments for Inc descent Electric Lamps. British Thomson-Houston Co. (General El tric Co.) 3,028. February 6th.

Electric Sparking Plug. Mazellier. 3,859. February 15th. (February 1 1910.)

THE
ELECTRICAL REVIEW.

VOL. LXIX. AUGUST 25, 1911. No. 1,761.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

All Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: LIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1911 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

BRITISH TRADE IN SOUTH AFRICA.

"BRITISH manufacturers have good reason to be gratified with their position in the South African market." These are the words with which Mr. R. Sothern Holland, His Majesty's Trade Commissioner for the Union of South Africa, commences an important Report. "By strenuous endeavour" British firms have "secured a full measure of success" in the revival that has been taking place in this great Colony during the past two or three years. The main outstanding cause is that "British manufacturers have been vigorous in their competition, and up-to-date in their methods," and where, in exceptional cases, there have been failures to reap benefit in the market, it is due to "the lack of oversea representation."

After this very interesting introduction, Mr. Holland proceeds to report upon the work that has been done by his own department, which we have for some time thought was proceeding along the right lines to assist the British manufacturer. Incidentally, Mr. Holland has something to say at this point on the duties of the efficient Trade Commissioner. Not only must he travel in the Colonial markets, but he must pay periodical visits home in order to tour the manufacturing centres for the purpose of making practical use of the knowledge so gained. With this observation we are in complete accord, for it agrees with what we have argued in these pages, though we have gone a little further by holding that the foreign trade or consular agent ought before beginning his foreign duties to visit the British manufacturing centres in order to obtain information that he may profitably employ in the markets abroad, where there has too often been displayed an ignorance of what our manufacturers are able to do.

One can gauge to some extent the usefulness of such a trade department by the growth of its correspondence. In the period of 2¼ years ended December, 1910, 3,304 letters were received covering 401 different subjects, and no fewer than 339 different British manufacturers applied for information. About one-fifth of these applied through the Commercial Intelligence Department of the Board of Trade, and the remainder wrote direct. Mr. Sothern Holland has not failed to let it be widely known here that his services were at the disposal of the British trader, hence the readiness of our firms to communicate. We believe that if all of our Consuls or commercial attachés were known to be as eager as Mr. Holland, far more assistance would be sought from them and there would be less questioning regarding the value of their service. From his analysis of inquiries, we find that 15 related to electrical machinery, &c., 18 to machinery and engineering, and 25 to mining machinery. But in addition to mere correspondence there are ample proofs that the inquiries have frequently resulted in actual business. A

file of 400 British catalogues card-indexed as to name and contents, and nearly 100 British trade journals, are always available at Cape Town for the benefit of Colonial buyers.

In Sec. 11 of the Report there is given an analysis of the trade of South Africa for 1910, with special reference to the position of British trade. A close examination is attempted of the position as revealed by the actual results of Great Britain's *competitive* efforts as against those of her foreign rivals. To arrive at this, there has been ascertained the actual "works value" of plant (excluding boilers) supplied in 1910 from Germany to the Victoria Falls and Transvaal Power Co., Ltd., namely, £671,670. He says:—

Now it is common knowledge that, owing to the financial arrangements of this company being in the hands of German banking institutions, British manufacturers were precluded from entering into competition, the condition laid down by these financial houses being that all orders for plant were to be restricted to German firms. The boiler plant alone, which the contractors *could not* supply, was purchased by them in England, so the value of this boiler plant has been purposely excluded from my calculation. The item of £671,670, I therefore contend, should fairly be taken into consideration in this analysis, as *non-competitive trade*. As a matter of fact, if this amount were deducted from the total imports of merchandise in 1910 from Germany, the result would show that, instead of Germany's trade being £3,618,472, as published in the trade returns, it would amount to £2,946,802, or a drop from 10·29 per cent. to 8·38 per cent. In other words, practically 2 per cent. of South Africa's total imports of merchandise accrued to Germany as a direct outcome of this one contract, for which British manufacturers were debarred from competition.

Mr. Holland thus arrives at the conclusion that Great Britain's share in the purely *competitive* trade of South Africa was 62·27 per cent of the whole, so that the trade of this country is better than the published figures indicate. He says that British manufactured goods hold the commanding position in the South African market, and that the sudden growth in the value of German trade with South Africa is accounted for by the Victoria Falls contracts, which were not obtained on a competitive basis. These contracts he holds to be "a purely temporary matter," and the present increase of German imports into South Africa cannot be regarded in the nature of a permanent growth, or the normal condition of her trade. "The erection of these large electric power stations must, of course, effect a certain measure of permanent increase in respect of replacements and spares, but such future imports will be insignificant in comparison with the enormous German imports of electrical plant required for the first equipment of the stations." Of course, we hope that what is here argued may prove in practice to be correct. We all know that the English manufacturer has not been ousted from the Rand, or anything like it, as regards other business, through the placing of that Victoria Falls contract, but, if we mistake not, there is likely to be a further very large electric plant importation for the same system during 1911, and may be 1912. That £671,670 does not represent anywhere near the total contract values booked in Germany for this undertaking. It was at one time feared that there would be a sort of German electrical supremacy for most power and lighting manufactures required on the Rand as the result of the financial arrangements, about which there has been so much discussion. This does not appear to be the case.

No doubt Mr. Holland is justified, for the purpose of showing our relative trade positions, in belittling the importance of that German financial *coup*. It is true that such finance is not a part of competitive manufacture or production, but it forms a very important influence in connection with competitive selling. If the contracts so secured are not obtained competitively in regard to price, our German competitors are able to control them because of the financial weapon which forms so strong a factor in their competitive efforts against us in all parts of the world.

The contracts mentioned may not materially affect the course or value of future business, but they do mean business lost to our firms at present, and they do mean that the British electrical position, as reflected by import figures, is weaker than it would have been had German firms not this sharpened weapon at hand, or had British firms such a system to assist them in conducting foreign negotiations to a speedy issue. We are afraid if we were to analyse the British position in all the foreign markets, and eliminate all business secured through the intervention of the financier, we should have to exclude much trade of a non-electrical character that comes to this country, and should also have to dismiss hundreds of thousands of pounds of German electrical exports to different parts of the world. But then, we feel, our position would always *appear* to be different from what it really was. Finance is undoubtedly part of the game. We use it ourselves in some branches of concession securing and business-getting; what our industrial authorities regret is that *electrical* schemes do not find such support forthcoming. Docks, harbours, railways and other such undertakings, we carry out to the tune of many millions sterling in all parts of the world, and it is the financial strength of our big contractors, as well as their reputation, that enables them to secure the business. In the electrical world this financial strength for securing and carrying out big concessions is not available either from ordinary banks, industrial banks or financiers. We are inclined to take little comfort electrically from Mr. Holland's ruling out of the Victoria Falls contract from the competitive business. We may stand high in respect of our *competitive* ability, but we cannot shut our eyes to the effect that in this case such ability was of no avail in absence of financial ability. The business has gone to the tune of millions sterling, and it is of little use crying over spilt milk. We will hope that the German financial element is to be "a purely temporary matter," and that the future course of business will not be seriously affected by it, and we will believe that continued effort on the part of our firms will secure for British electrical industry a big share of such business as is open to *legitimate competition*. But we will also await with interest fresh news concerning the industrial bank foreshadowed by Mr. Callender.

Later, in this very interesting Report, we read that the vigorous character of foreign competition in South Africa must not be minimised. There are directions indicated in which British trade might be strengthened, and among these are electric posts and fittings, tramway rails, tramway sleepers, tramway material, in which Germany still holds a major portion of the trade, though we are already active competitors. We also read that competition is severe, and requires greater effort on the part of British manufacturers, in all of the following lines:—Electrical machinery, electric wires and cables, mining machinery of every description, lamps and lampware.

The importance of proper overseas representation and the general methods of doing business, are discussed in sections of this report which we unhesitatingly recommend the trade to read. In respect of mining machinery, for instance, there is this statement:—"Catalogues received through the Post Office by the mine engineer are practically useless, and are generally destroyed. Only a local representative is able to point out to the engineer the advantages of specific details of design, a representative who personally introduces his principal's catalogue to the notice of the engineer is, at the same time, able to utilise it as a support to his arguments as to the special merits of the type or design of the machine he wishes to sell." "The matter of the personal interview is of the greatest importance. Without it the manufacturer has little chance of introducing his machine to the notice of the mine engineer who, after all, is the *real* buyer." In this connection we must remember that much of the electrical apparatus in South Africa is for service in or about the mines. "The engineer is generally glad of an opportunity for technical conversation with a man who knows his subject. Hence it is that the representative for mining machinery must be, to a great extent, an engineer as well as a good 'commercial.'" An additional argument in this direction lies in the fact that generally there is very little time allowed for tendering. Rarely is sufficient time allowed for an inquiry to be mailed overseas, for prices there to be estimated and submitted by mail. "The mail allow sufficient time for the local agent to work out a tender and, perhaps, to cable vital particulars to, and receive written instructions from, his principals. The time allowance of about four or five weeks is, however, rarely exceeded, though often reduced."

One other of the many interesting observations in the report, to which we will allude, is regarding the appointing

gents. It seems to be a mistaken policy to attempt to guard neself by insisting upon the agent guaranteeing a minimum urnover within a given period as a return for having eceived the agency. No agent, however good, can accu-ately forecast the business that he will do. This question of inimum turnover, it is suggested, could be safely left until uch time as the goods have earned a reputation in the arket. An instance is advanced of a firm of Transvaal gents who, after protracted negotiations, were granted an gency without guarantee, with great reluctance on the part f a British firm. The agents secured among their first rders one valued at £5,000, though the guarantee riginally required, and to which the agents would not agree, as only £2,000! Mr. Holland's advice in this respect is: emand no guarantees. First be sure of your agents, then the goods are right, and the prices are truly competitive, tisfactory business will result.

Reports by three other of H.M. Trade Commissioners are ound up in this same blue book (No. Cd. 5,674). One lates to Canada (Mr. R. Grigg), one to Australia (Mr. . Hamilton Wickes), and the third to New Zealand. For d. the Government printers thus place at our disposal four ports of considerable value concerning British trade interests these Colonies.

THE STRIKE.

ATE on Saturday night some sort of a settlement, which ight just as well have been brought about on the eve of e strike, was arrived at in regard to the railway upheaval, t not until deplorable loss of life had been incurred.

In one matter this strike has differed from most others. was a case of deliberate warfare upon the community. here was not only no care taken to carry running trains to eir destination, or even to a station, but wilful desertion them on the line. "Peaceful picketting" appears to clude forcibly turning drivers and firemen off their engines, utal intimidation, the burning of signal boxes and railway ucks, general incendiarism, cutting of telegraph and tele-one wires, the wholesale looting of shops and destruction everything in them (including foodstuffs), and, in gallant tle Wales, Jew-baiting.

These are the "ordinary operations" of men on strike, cording to Mr. Ramsay MacDonald, M.P., and, he declared the House on Tuesday night, "Organized labour in this untry will not allow these operations to be hampered and terfered with by the needless display of force."

The part played by the Right Hon. John Burns in the eat dock strike of over 20 years ago is still green in the mory of many of us. He doubtless profits very consider-ly to-day from his recollections of the "peaceful" mass etings in Trafalgar Square, in 1886, which ended in two rs' unchecked riot, wholesale robbery and ransacking, ting £11,000, and he remembers with vividness the afalgar Square riots of 1887, when the men used iron s and knives freely upon the police, and when he and . Cuninghame Graham, M.P., a magistrate, and many ers were arrested. But the offence of honest John, as he s called, was mild in comparison with the mischief wrought the iniquitous and nefarious strike leaders of to-day; is oo much to hope that the more prominent of these men yet be arrested and placed under restraint.

Another feature of the strike was its success in completely nating the public, even those of their own class who inarily would be sympathetic with the men. The men's lers make much of the recognition of the Unions. Rail-y managers are much abused for refusing to do this, but North-Eastern Railway, which did recognise them, does not appear to have ever been out of hot water since doing so. Trade Unionism is perhaps an ideal state of affairs, but it does not commend itself to the public as a rationally conducted undertaking. We are told that the riots are made by a few hooligans, and not by strikers. Well, it may be so, but—why were the few hooligans permitted by the strikers to sully their otherwise good name?

There is no doubt that at the bottom of this strike is the desire on the part of the "leaders" for the nationalisation of the railways. This, we fear, would be a poor remedy. There is a saying, "They order these things better in France," but the Government working of railways in that country has not been such an unalloyed blessing as to encourage much hope of success here.

There is one other noticeable feature. The interests of the shareholder are absolutely ignored. It is regarded solely that everything should be distributed as wages to the men. But shareholders who find the capital for industrial enterprise will cease to find more on such a basis of confiscation as apparently rules the minds of Unionists. True, the Unions if they obtained full sway might double every man's pay for a time, and do this by charging higher rates on industry, as, according to the terms of the settlement, appears likely to be the case. But this process has a limit.

Electrical Enterprise in Turkey.

According to the German newspapers of just over two years ago, remarkable achievements were to be accomplished in Turkey by the Union Ottomane, Société pour Entreprises Electriques en Orient of Zurich, which was constituted in July, 1909, with a share capital of £480,000, of which one-half was paid. The company was created for the promotion of electrical enterprises in Turkey by an international group headed by the Deutsche Bank, the other constituents being French, Belgian and Swiss financial institutions, and the Continental Electrical Enterprise Co. of Nuremberg. But after an existence of two years the Union Ottomane has failed to succeed in its objects, and the directors now propose that the company should go into liquidation. All that the Union was able to do was to acquire from the Continental Electrical Enterprise Co. ordinary and deferred shares in the Constantinople Tramways Co. of the value of £175,000, and it is now intended to dispose of these shares and then wind up the company. No dividend was paid for the first financial year, and the accounts for 1910-11, including the balance of £3,360 brought forward, show a surplus of £3,600, which is mostly carried forward. It is of some international interest to recall the fact that the Union Ottomane competed for the telephone concession in Constantinople in association with the German Telephone Works Co., and it also sought in conjunction with German and French electrical firms to secure the concession for the establishment of electric light and power stations in the European portion of the Turkish capital. But both these transactions passed into other hands, the telephone concession devolving upon a British-American group, and the lighting concession on a Hungarian-French group. The scope of the Union Ottomane has, therefore, been limited to the Constantinople tramways, which are now to be converted to electric traction under the concession granted at the beginning of the present year. In these circumstances the directors have deemed it advisable to discontinue the company, although it is said that the conversion of the Constantinople tramways will not be renounced by the financial group associated with it. The tramways remain within the scope of the Deutsche Bank which is also closely connected with a Belgian group which has offered to purchase the holding of the Union Ottomane in the tramways. It is said that the Belgian group proposes to form a new Belgian company for the acquisition of the shares, the payment for which will be mostly effected in cash, and the balance in shares in the new company. The history of the Union Ottomane is certainly a brief one, but it proves that even the support of powerful financial institutions is not always able to ensure the successful execution of an elaborate programme such as is indicated by the promotion of electrical enterprises in Turkey.

D

ELECTRICITY IN CINEMATOGRAPH THEATRES.

By A. E. BREWERTON, A.M.I.E.E.

The advantages which electric light and power have over their respective rivals renders their progress inevitable: yet these rivals do exist, and are likely to cling to life by the same providential influence that has protected the last of the deservedly famous Watt engines and the equally infamous oil lamps.

With cinematograph theatres, however, the position is unique, and although the regulation which necessitates the use of electricity wherever possible may have no direct bearing upon the fact that they are truly termed "electric theatres," it makes very refreshing reading. How really useful it would be if the Home Office could issue a similar regulation for street lighting.

There can be no doubt that electrical engineers have put a considerable amount of energy into this new industry, and from the exterior alone it is patent in many cases that full advantage has been taken of the monopoly. Cases do exist, however, where true economy is not obtained; this, in many instances, may be due to cost-cutting, but in others it would seem that the whole of the facts concerning the installation, and the saving to be effected by using converters and so forth, are not properly brought home to the buyer.

The projector is not usually included in the electrical contract, being supplied together with an adjustable resistance by some firm specialised in cinematograph apparatus. In wiring up, however, there are several points which might well be observed.

Two projectors are universally used, and it is an advantage to make arrangements so that both arcs cannot be on circuit at one time. Accidents will happen, and the writer has come across more than one case where malicious damage has been done in this way.

A D.P. change-over switch could be used, but since the conditions suggest an iron-clad type, probably the most suitable arrangement is to link the handles of two separate switches to obtain the same results, one, of course, being inverted.

It is an advantage to have both a voltmeter and an ammeter in the box for regulating the arc. In many cases only one instrument is used, but this appears inadequate with a varying or variable resistance. The only other point in connection with the apparatus in the operating box is to only have just sufficient resistance inside to afford proper regulation; so much heat is given off by the arc itself that the room becomes insufferably hot, and any additional heating should be avoided.

These are, of course, minor points as compared with the question of rotary converters. It is surprising the number of cinematograph theatres up and down the country in which the arcs are connected direct to 200-volt mains through resistances. This surely can safely be attributed to lack of knowledge upon the part of the management or of enterprise upon the part of electrical contractors.

The current required for a projector is about 50 amperes, varying, of course, with the area of the screen and, additionally, with individual taste and conditions: in fact, in many cases 40 amperes is considered sufficient current, while in others (with the same size of screen) operators say that a good picture cannot be obtained with less than 70 to 80 amperes. This, no doubt, is largely due to the amount of foreign light entering the hall. We will, however, take 50 amperes as an average, and compare the costs with a resistance and with a rotary converter.

On a 200-volt supply the consumption per hour, at 50 amperes, is 10 units, and working at the rate of 30 hours per week, including intervals, the cost, at 2d. per unit, is £2 10s.

With a rotary converter the secondary pressure should be, say, 65 volts, which equals, at 50 amperes, 3¼ units per hour. On to this, however, must the added the losses in the rotary converter or motor-generator which are taken at 70 per cent., and which increase the consumption from 3¼ to 4·65 units per hour, which, for one week working at 2d. per unit, costs £1 3s. 3d.

It does not seem that the first cost of a converter is likely to be sufficient, in proportion to other initial expenses, to be of much account in face of such a saving; and even if the interest on capital, depreciation, and all such items, are assessed as high as 25 per cent., this, on £60, only comes to about 6s. per week.

The expediency of installing a resistance as a means of obtaining an alternative source of supply in the event of failure of the converter, is often questioned. It certainly does seem unnecessary when due regard is given to the reliance which can be placed upon motors and generators. Yet, when we remember that the converter may not receive the very best of attention, the spasmodic nature of the load is likely to result in sparking, the great possibilities of excessive overloads and the cost of shutting down the show, it will be agreed that for the very small additional cost which is entailed a subsiduary resistance should always be installed.

When the source of supply is alternating it would appear obvious that a transformer and choking coil, or a leakage transformer with an additional adjustable resistance, should be used. Many cinematograph halls are worked quite satisfactorily upon these lines; yet, notwithstanding, there are many objections to the use of alternating current. Firstly, the humming of the arc is objectionable, then, of course, the light efficiency is very much reduced. A more important point is the production of black patches, which seems to be due to the shutter momentarily synchronising with the supply periodicity. These troubles, like those which are always met with in alternating current arc lamp work, begin to disappear, no doubt, as the frequency increases. It can be quite understood, however, that something uncanny may result when the variations of an arc on 25 cycles are allowed to augment the flickering which is natural to cinematograph pictures. It would appear, therefore, that in most cases one is justified in transforming to direct current; and, since the increased arc efficiency is likely to go a long way towards compensating for the lower efficiency of a rotary machine compared with an A.C. transformer, the prime cost is the only real consideration.

THE LIGHTING COMMITTEE.

By DUMB FRIEND.

Most municipalities now boast of an electric generating station, and most of the staff of a municipal generating station, being controlled more by the Lighting Committee than by the chief engineer, do not boast about it. And why? Chiefly because the Lighting Committee, as a rule, are nothing to be exceptionally proud of.

They are mainly composed of more or less prosperous tradesmen, with an occasional schoolmaster or gentleman of independent means thrown in. It is a very rare occurrence for a man with electrical experience is to be found on the Lighting Committee, unless having a small flat electrically illuminated or a couple of flame arc lamps outside a shop, can be counted as electrical experience. Yet it is with these men that the lighting of our streets, and the development of the undertaking as a whole, rests. And what is the result? Development may be sure—the value of electricity in the household and factory secures that—but it is extremely slow.

It is not an infrequent occurrence that a new scheme suggested by a competent engineer takes not only weeks but actually months, to be put into operation. First, the matter is brought before the Lighting Committee, a fort night later to be placed in the hands of a sub-committee then the first committee see it again, perhaps modified. It is next sent on to the whole Council, and then referred back and finally, after a lapse of about six months, the scheme is passed, but in a form quite unrecognisable to the engineer who propounded it. In fairness to the Committee, let it be said that this does not happen to every measure, and perhaps it is as well.

Now the ratepayers, to whom the undertaking really belongs, are curious people, inasmuch as they are either easily satisfied or, on the other hand, easily dissatisfied; but in

he case of an electrical concern, as long as there is a profit f some sort they are perfectly contented. Perhaps in their norance they do not realise that had the engineer been ree to work without the hindering criticism of the Lighting ommittee he might easily have turned the profit of, say, 2,000, into one of at least double that amount. But, erhaps, you ask how? Let us take a concrete example.

The gas companies, who have no Lighting Committees, ave recently tried, with a large amount of success, to obtain he universal adoption of high-pressure gas for outside lighting. he prices charged by them for supply and maintenance are diculously low; in fact, much lower than the present rates or the most used electrical lamps, namely, the flame arc mps. Handicapped by the lack of privilege to experiment ith the ratepayers' money, the electrical engineer has to olve theoretical schemes (but which are founded on pre- ious experience), to endeavour in some way to out-do his vals. A reduction in the price of current for outside light- g is, of course, his ultimate aim, but this is not the sort f thing that the Lighting Committee will agree to without me weeks of discussion. Finally, when they are really rsuaded that the engineer has advised them well, it is too te, for the gas company have not been idle, and the high ressure gas is now installed from one end of the street to he other.

Heartbroken, the engineer hunts for another idea which ill, no doubt in time—perhaps a long time—be sanctioned y the Lighting Committee and put into operation; but gain too late. The private company is once more in front him. And thus we often find the municipal engineer ith any number of schemes, none of which are fully eveloped.

It must not be imagined that this "work of obstruction" carried on indiscriminately by each Committeeman; that is ot so. On most Committees there are some business en, but there are, unfortunately, obstructionists also. hese, in a large number of cases, consist almost ntirely of schoolmasters, who like to think that they live a sphere of their own; that they are far superior to the dinary citizen to whom they (the schoolmasters) have nparted the elementary knowledge of which they are ssessed. Further, have they not, with the aid of a uple of pith balls suspended on silk fibres, a stick of onite and a cat-skin, and perhaps one or two permanent agnets, taught electricity and magnetism to the children der their care? Surely this has fitted them for the work censure—which they undertake with a zeal worthy of a tter purpose. Again, in order to obtain their certificates ey have had to study logic, and in some mysterious anner logic becomes linked with electrotechnics, although ually with disastrous results.

A prominent member of the staff of one of our largest nicipal undertakings was once heard to remark that he ordinary small tradesman could be instructed and rsuaded by the engineer, but," he added, "heaven protect from schoolmasters."

That members of Electric Light Committees are really norant of electrical matters may be shown by the follow- g incident:—On one occasion, in a certain Metropolitan rough, it became necessary for the engineer to advise the rchase of a new static transformer. The specification was a 50-kilowatt transformer, which a clerk at the works d written as a "50-KWT." transformer. This rather annoyed of the teaching fraternity, who advised the engineer to rhaul his clerical staff, for, said he, "In all my life I have er before seen the word hundredweights abbreviated t." How foolish this man must have felt after the gineer's explanation, is better left unsaid.

There are other councillors who will insist in measuring ctricity in "cubies," or who seem determined to do away h the word "phase," replacing it with "phrase."

Yet another "highly educated" member of the same mmittee has so little faith in his chief engineer, and electricity generally, that he openly asserts that it is a ctical impossibility for any electrical instrument to be ntifically accurate. This belief originated a compara- ely short time ago when this particular gentleman had her a heavy quarter's bill to meet.

These typical instances go to show the absolute technical orance of those who take it upon themselves to govern and control the engineer whom they themselves have appointed as adviser in electrical matters.

Can it be that they think the training of the engineer consists only of instruction in the maintenance of the machinery he is to look after, and that the commercial side must be left to those who are responsible for the teaching of the manipulation of figures. A mere study of the distribution and arrangements of the lights in the dwellings of these notable people is sufficient to show that it is useless to leave such matters in their hands, since success depends to a very great extent on suitable arrangement. It is most unfortunate that lighting committees will not be advised by engineers, instead of trying to exercise their authority over them. If the exercise of this authority is so essential, then classes should be arranged so that prospective committeemen could have some idea of what they were going to undertake; and, further, no one should be allowed to sit on the committee unless he could satisfy the Council that he was not entirely ignorant of the application of electricity.

Left to the discretion of the engineer, progress would be rapid, and the mutilation of schemes which are looked upon by the Committee as wild, to say the least, although they are the results of previous experience, would soon be at an end. Something *must* be done to convince committees that it is only electrically-trained persons who can successfully cope with electrical problems, no matter how simple they appear. It is not doing one's duty as a Councillor to interfere with a practical man who is working to the best of his ability in the interests of the ratepayers. Schoolmasters should remember that just as they would object to the parents of children dropping into the schools, if such a thing were allowed, and insisting that their children should be taught in such and such a manner, so does the staff at an electrical generating station resent the interference by incompetents in a matter of which they understand neither the technical or commercial points.

Finally, they must remember that even in a Council chamber sometimes "silence is golden," and would prove of more real benefit to the people whom they represent than many idle words spoken in ignorance. Let the Lighting Committee but realise the facts set forth in this article, and we shall be much nearer attaining that progress with municipal electricity undertakings which we should all like to see.

FUEL VALUES—A COMMON BASIS.

Though the value of a fuel is not solely to be stated on the basis of its cost per thermal unit, this is the best basis on which to build an estimate. But fuel values are stated in such different measures that some simple system of translation ought to be arranged as between different fuels. Thus, for solid fuels the calorific capacity is stated in units per lb., and the price is stated in £ per ton. Gaseous fuel is stated as regards calorific capacity in heat units per cb. ft., and its value in shillings per 1,000 cb. ft. Liquid fuel is valued for heat at per lb., and for cost at per ton or per gallon.

For general comparison it would, perhaps, be as well to employ as a datum the cost of 1,000 thermal units of Welsh coal having a calorific value of 15,000 units per lb., and a cost of 20s. per ton. From this may be calculated what ought to be the cost of other fuels for an equal calorific power per 1d.

The ton of Welsh coal contains 33,600,000 units of heat, and costs 240d. Thus, the yield of one penny is 140,000 heat units. Blast furnace gas contains about 100 heat units per cb. ft. How many pence ought 1,000 cb. ft. to cost? The answer is 1·4d. Ordinary illuminating gas possesses 600 to 700 thermal units per cb. ft., and its equivalent price is therefore 8·4d. to 9·8d. per thousand cb. ft. Since the ordinary price of gas is 3s., more or less, the thermal value is poor, for the price is treble what it ought to be, or even four-fold. Gas to be used for heating purposes can only be cheap by reason of its use in a manner much more economical than coal can be used. This may be best done by making use of its smokelessness when burnt through

Bunsen burners to heat a tubular air heater so as to absorb a large proportion of the heat usefully. But ordinarily with usual methods, gas cannot be cheap initially. Its thermal value is only about a fifth that of coke for ordinary prices, and if it is to save money, this can only be done by indirect methods, as by the elimination of labour and of dirt.

Liquid fuel contains, let us say, 20,000 units per pound, or 44,800,000 per ton, which, divided by 140,000, gives 26s. 8d. per ton as the value on a heat basis. Assuming a specific gravity of 0·9, the heat value of the gallon will be 180,000 units, and the value of a gallon of fuel oil nearly 1·3d.

The incidental advantages of oil fuel in an ordinary way add about one-seventh to its value, so that a gallon may be worth nearly 1·5d. as compared with best coal at 20s. per ton.

But for equal nominal heat values, the following may be taken :—

——	Units per pound or per cubic foot.	Equivalent price per ton or per 1,000 cb. ft.	Heat units per penny.
Welsh coal	15,000	20s.	140,000
Blast-furnace gas ...	100	1·4d.	140,000
Lighting gas ...	600	8·4d.	140,000
" " ...	700	9·8d.	140,000
Liquid fuel—			
Paraffin, petrol ...	20,000	26/8	140,000
Producer gas ...	150	2·2	140,000
Liquid fuel... ...	20,000	1·3d per gallon	140,000
Coal	12,000	16s.	140,000

These figures are, of course, only approximate, since gas varies considerably in its calorific value, being as low as 90 units for poor blast-furnace gas and ranging up to 800 units for some of the better illuminating gases.

Coal, again, may drop in heat value to 12,000 units per pound, and its cost may fall to 10s. per ton, though its theoretical value is 16s. per ton on a thermal basis. Thus, given a cheap coal of fair thermal capacity, which can hardly burn on a grate, the engineer may calculate the cost of grinding the coal and, adding this to its price, he then has a fuel which can be burned freely as a gas, that is to say, floating in a stream of air, and if he can assure himself that he can deposit all dust and produce no annoyance he has at hand very cheap thermal units.

Liquid fuel will vary from 19,000 to 22,000 units per pound. An engineer dealing with various fuels should set out their heat values per pound on a vertical ordinate and the value per ton along the horizontal abscissa and draw a diagonal to show the equivalent values per ton with which to compare the actual price. He can thus correct these values to commercial values and know just what advantage he really is obtaining as between one fuel and another.

Thus, alcohol if pure possesses nearly 13,000 heat units per pound, or about two-thirds that of petrol. But it cannot be bought for 0·85d. per gallon, nor can petrol be bought for its equivalent thermal price of 1·3d. Petrol has a value of its own much higher than 1·3d. per gallon because of its peculiar and perfect combustion in the motor engine. But in heavy work, petrol has to compete with paraffin at 3d. per gallon, which, however, has to bear the intermediate process of raising steam in a boiler for use in an engine less efficient than the internal combustion engine.

Alcohol, little better than half the thermal value of petrol, yields almost as much work per pound, and, were it not for the restriction engendered by excise laws, alcohol would soon oust petrol at present prices. Alcohol and petrol are two of the best comparisons to use in showing that the commercial value of a fuel is not necessarily to be fixed by its calorific capacity, but that other conditions step in and must be taken into our calculations. Nobody considers posterity, but posterity will certainly carry on industrial affairs on very different lines from those of to-day. There will be no coal and no mineral oil, and this absence of coal would take effect in 300 years with the present British output. Germany and the United States will be equally devoid of coal and of oil. Oil particularly is a product that bids fair to be quickly exhausted in each area exploited. When this exhaustion of stored fuel takes place, all fuel must be grown. Only wood and alcohol will, so far as we can see, be available. Water-power electricity will, perhaps, serve for metallurgy. These are all we can offer with present day certainty for the comfort of posterity. Unless, therefore, man can tap the promised ether, he will be reduced to growing his fuel, or to living a less strenuous life in what by that time will be the healthy, if hot, tropical parts of the earth.

Fortunately for us we shall not be present to hear the opinions of that day upon the present international rivalry in fuel using.

What, for instance, will then be thought of the American idea of arranging pleasure parks on the Coney Island plan at the end of a tramline, to induce people to take useless journeys at the cost of burning fuel which is not being replaced by nature ?

B

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Strike Trouble.

I have been reading your leading article in the current issue, and as I take it that this represents in the main the official view of the employers (or at least the less enlightened section of them), and also as your paper is of interest to labour as well as capital, I trust you will kindly allow me a little space to state an alternative view of the case.

Obviously, I cannot cover the whole ground traversed by your four-column article, and I, therefore, confine my attention to one or two criticisms on specific points. First, I would point out that in the estimation of those best qualified to judge, the present industrial unrest is not the effect of physiological causes as you appear to suggest, but of something that lies deeper, viz., economic oppression.

There has been a theory held very tenaciously in certain quarters for many generations, *i.e.*, that the only privilege of the worker is to work (when he can get it). Latterly, however, the workers have been evolving a philosophy of their own, and one of the tenets of this philosophy is that liberty is a glorious thing, and that liberty which is not based on complete economic freedom is a sham and a delusion. The implications of that philosophy are very far-reaching, and we are destined to see other manifestations of this phenomenon when Prometheus, in the person of an enlightened democracy, proceeds to his complete emancipation.

You say "Men under the Conciliation Act . . . . are literally cursing this very Act which they forced on the railway companies, &c." You have been misled. The men did not force it on the companies. The men have all along demanded what is their elementary right, viz., recognition of their properly accredited representatives. The companies in response to this just demand have simply put their fingers to their nose. True, the men in deference to Governmental pressure were ill-advised enough (through their leaders) to accept the Conciliation Boards, and have for years in the face of overwhelming irritation and provocation on the part of the companies, loyally and patiently put up with their exasperating methods of working.

The executive of the men's unions found their action in issuing the manifesto and ordering the general strike on "the failure of the railway companies to observe the spirit and letter of the Conciliation Boards Agreement of 1907 . . . ." Now who is guilty of breach of faith ?

You further say "their pay may be small." It is small. It is not only small—it is a disgrace to any civilised community, and such as no self-respecting individual with any glimmering of manhood ought to accept—over 100,000 of them with 20s. a week or less.

You also deplore the fact that "the sympathetic strike is also very much in evidence." . . . "We see factories full of silly girls throwing up their work." I am glad to be able to agree with you on one point : "It seems silly to write of such things" (in such a way). It does.

I wonder whether the people who write thus of the tragedy of our industrial chaos know anything about the lot of the poor

factory girls. No doubt it is a pleasing farce viewed from the editorial chair. It is a hopeless tragedy from the point of view of the hapless victim of our commercial Juggernaut.

There is one more point on which I am whole-heartedly with you. You assume that "Probably much of the trouble arises from sheer economic ignorance." It does.

I think you are in error in attributing the cause of the Midland and North-Western men in Liverpool having gone out with *expressed regret* to "terrorism, mesmerism and lack of manliness." I would rather say that their action was the assertion of manliness—a splendid demonstration of unity, loyalty and SOLIDARITY. I put that word in capitals because it is important, and because it is to be the big word of the future.

The men are learning it from their masters, who sometimes practise it for selfish and ignoble ends in the promotion of the vested interests of a class. As exemplified by labour, however, it will in the near future unify all these industrial disputes, reconcile all the antagonisms that beset our economic life, and promote the highest happiness of every member of the community.

To conclude, I would suggest that what employers as a whole would do well to remember is that "Humanity is vastly more important than property," and that "there is no wealth but life."

Labour.

August 19*th*. 1911.

[The philosophy evolved by the worker a few years ago was "Curse your charity, it is work we want"; to-day the battle cry is "the right to work" for every man, and yet when a body of men go out on strike they take care by "peaceful picketting" that those ready and willing to fill their places shall be effectually denied that right.

Our correspondent appears to be putting his finger to his own nose when he tries to defend the men's attitude towards the Conciliation Boards, which were *forced* upon the railway companies against their will by legislation brought to bear upon them by pressure upon the Government from the men's side.

As for the elementary right of the men, it is scarcely a happy augury for a peaceful and lasting settlement when the only company which has conceded that right is in the anomalous situation of being in the worst plight of all. Since the directors acknowledged the "recognition," they have never been free from labour disturbances for three months together.

It is sheer imbecility to talk about pay being such as no self-respecting individual with any glimmering of manhood ought to accept. Nobody is against any man getting the best wages he legitimately can; in fact, we would gladly see men earning double they are receiving to-day, but it is impossible to take out of an industry more than it can bear, and those who try so to do are only bringing ruin to the country.

And finally, so far as the "sympathy" strikers are concerned, we cannot bring ourselves to look upon their action as an assertion of manliness—a splendid demonstration of unity, loyalty and solidarity—but rather of utter disregard and callousness towards their suffering wives and children, who *should be* their first consideration.

And as for manliness *per se* we rather incline to the manliness of the loyal worker who, in the face of gross intimidation and threats of bodily harm, even at his own home, sticks to his duty.

We agree that liberty is a glorious thing; but with the scenes at Liverpool, Llanelly and elsewhere in mind, we think of the famous invocation of Madame Roland, addressed to a statue of Liberty as she ascended the scaffold:—"O, Liberty, how many crimes are committed in thy name!"—Eds. Elec. Rev.]

Hints to Manufacturers.

Your article by "P. B." on "Hints to Manufacturers" in this week's issue, interested me, but I am not a little surprised to note that he has not become acquainted with one of the leading features of our patent movable fittings.

After quoting the I.E.E. Rule No. 45, which prescribes the connection between flexibles and hard wires may only be effected by screwdown terminals," he says—page 244, right column, eighth line from bottom, "the fittings maker has done nothing." That is, he has done nothing to comply with the above rule.

We can only say we have 50 different kinds of fittings—pendants, standards, brackets and constellums, all with terminals in the base, and these are in widespread use, and are much appreciated.

The need for such a convenient connection was not inspired by any printed rules, but like the movable fittings themselves evolved in a natural way after 24 years' successful experience in contracting for and fixing electric light installations and taking note of the deficiencies of such fittings as were available up to that time.

We have sent for your inspection a fig. 221A by 30-in. bracket, wherein you can see the principle applied.

We also enclose our catalogue, wherein terminals in the base is a common feature.

John Dugdill.

Failsworth, *August* 19*th*, 1911.

Notes on Flexible Pole Line Suspensions.

The Note on this subject, in your issue of this week, appears to be misleading, owing to insufficiently accurate premises.

In the case of a line of poles equally spaced up an incline, the line does not hang in a symmetrical catenary, and therefore the tensions on the two sides of the poles are not equal, nor do they make equal angles with the incline.

F. Thursfield.

Leeds, *August* 21*st*, 1911.

Electric Cooking and Olympia Exhibition.

I have no doubt that the Exhibition will contain several electric cooking exhibits, as Mr. Lundberg states.

As regards the other point—the exhibition caterers not using electricity during the exhibition—I say emphatically that proper steps were *not* taken to induce them to use electricity.

In a matter so vitally important to the industry, the President of the Institution should have been requested to personally see Sir Joseph and use his good offices. Was he so requested? In fact, did anyone see Sir Joseph on the subject?

I am fully aware that no exhibition executive can control the caterers, but there is no necessity for control in such a case; "peaceful persuasion" is all that was wanted, and the proper influences were not brought to bear upon those controlling the caterers' managers. If it can be proved that I am wrong, I will make full apologies.

The attitude of the Executive Committee was feebleness itself when Mr. Cottam raised the question at a meeting of the Honorary Advisory Committee some months ago, and was typical of the apathy which dominates practically every section of the electrical industry.

A. Hugh Seabrook.

London, W., *August* 19*th*, 1911.

Electrical Modesty.

With the spirit of Mr. Seabrook's contribution in your issue of August 11th, it is to be hoped that there are many of us in sympathy. The forthcoming Exhibition at Olympia ought to be an important landmark in the progress of the domestic application of electricity. But if it were merely to be a month's boom in West Kensington, the value of the outlay in time, money and trouble might be questionable. As Mr. Seabrook suggests, electrical men ought to keep up a livelier attack all the time. Theirs ought to be the most aggressive of powerful industries. They have a mission to mankind that ought to keep them at the boiling point of enthusiasm. They are out for revolution, and it would be all the better if there were something more stirring and revolutionary in their methods of impressing the public.

Is it not a fact that, having regard to the large number of clever men engaged in it, the electrical industry affords a miserable return in the shape of material success, notwithstanding that its progress means so much to social advancement, domestic comfort, and more bountiful industrial production? But are we entitled to

claim that this is entirely the fault of an ungrateful and unreceptive public? It is not enough that we should ourselves know what electricity is good for. We have to hammer our case into the somewhat dense and suspicious intelligence of the average man and woman. Is that done with sufficient strenuousness and heartiness, and, above all, with the united force of the whole industry? Nobody would think of asserting that it is. The industry is singularly lacking in aptitude for victorious publicity. We never find the manufacturers and the suppliers in conference, planning campaigns for winning territory from the gas man and the coal merchant.

I have no doubt that the Exhibition will be very impressive, but it is only a quinquennial affair, and it only lasts a month. Could it not at least be made the occasion for considering whether there should not be a continued general movement for pushing electricity in our common interest?

T. C. Elder.

Ventilation and Ozone.

With reference to the article by Mr. Kershaw on "Day Loads for City Electric Light and Power Stations" in your issue of August 4th, and Mr. Grierson's letter appearing the following week, we think it will be of some interest to your readers to learn that so far as the "Elworthy-Kolle" system of ozone generation is concerned, Sir William Ramsay reported: "I find that there is remarkably little rise of temperature due to the very ingenious manner in which the air to be ozonised is made to pass through the ozoniser, and that no oxides of nitrogen are produced."

The beneficial results following the application of ozone generated by the "Elworthy-Kolle" system to the treatment of tuberculosis, asthma and general debility in hospitals abroad, and which have been published from time to time, are sufficient to warrant the statement that when the supply of ozone is regulated to meet the requirements, as may easily be done in connection with the system above mentioned, no ill-effects whatever are felt. The entire absence of nitrous oxides and the possibility of adjustment are outstanding features.

W. H. Walton.

52, Cannon Street, E.C.,
August 16th, 1911.

Direct Trading.

We are in somewhat of a difficulty, and should be glad to hear the views of your readers on the following:—

We recently received an inquiry for a motor from a firm who are not in the trade, and therefore not entitled to trade terms. We quoted them a price which would enable us, should we find that a contracto was entitled to a commission, to reserve him one, but another firm of manufacturers, who were also asked to quote, put their rock bottom price in, with the result that they secured the order. If we had quoted our rock bottom price, we should most certainly have secured this order. We shall be glad if you will kindly let us know what is the usual practice in the trade.

It seems to us that the Contractors' Association should be powerful enough to put a stop to manufacturers selling to retail customers motors at trade prices; but as they seem indifferent in this matter, is it still the duty of manufacturers to see orders passing them on account of their trying to protect a section of the trade who are doing nothing to safeguard their own interest?

Wavering.

August 16th, 1911.

Telephone Charges.—In line six of the letter on this subject, appearing on page 250 of our last issue, the word *wire* should, of course, have been printed *hire*.—Eds. E.R.

The Crumpled Horn.—On July 10th a Newcastle Corporation tramcar ran into the rear of a cow which was walking peacefully along the road, but which suddenly swerved on to the track. The farmer sued the Corporation for the recovery of £16 2s. 5d. Evidence showed that the parts of the cow that were not injured were sold for £7 7s. and the hide for £1 2s. His Honour gave judgment for the plaintiff for the full amount claimed.

PROCEEDINGS OF INSTITUTIONS.

Electric Traction in Switzerland.

By E. Huber-Stockar.

(*Abstract of paper read at the Zurich meeting of the* Institution of Mechanical Engineers, *July*, 1911.)

(*Continued from page* 279.)

Simplon Tunnel.—Shortly before the opening of the tunnel in 1906, proposals were made both on behalf of the Italian Government and of Brown, Boveri with a view to electrifying the tunnel. The Valtellina Railway offered to lend five of its three-phase locomotives, built by Ganz a few years earlier. Two three-phase locomotives in course of construction at that time by Brown, Boveri were also available for the Simplon Tunnel electrification. Through this fortunate coincidence the Federal Railways were persuaded to adopt, on trial for one year, electric traction on this particular section, and a regular service of electric trains was commenced on June 1st, 1906.

Since the opening of the B.T.B. Bergdorf-Thun Railway on the three-phase system, the Valtellina Railway has been electrified, and the Valtellina locomotives appeared, at least in the beginning, perfectly capable of dealing with the trains through the Simplon Tunnel.

These locomotives have since returned to Italy, and have been superseded by two locomotives of the type F. 3/5 and two of the type F. 4/4, all built by Brown, Boveri (the mechanical part by Winterthur).

Technically, the Simplon Tunnel electrification brought, besides important improvements in locomotive construction, nothing very novel, being more or less an exact copy of the systems that had been practically used on the Valtellina Railway for several years. It was not complicated by electric power transmissions, as current could be generated at each end of the tunnel with a voltage to suit the locomotives—3,000 volts, 16 cycles. The contact line in the tunnel consists of two pairs of copper wires, each of 8 mm. diameter, one pair for each of two phases, the third being the rails as in previous cases. The suspension is overhead from cross wires hinged on to hooks in the masonry of the tunnel and in the stations on the top of iron poles. Contact is made by means of articulated bows.

An important departure in three-phase electric locomotive design in connection with the electric traction in the Simplon Tunnel. was their operation by multi-speed induction motors as already described on the B.T.B.

The locomotives and their electric equipments are of the following description:—

	F. 3/5 (1906).	F. 4/4 (1907).
Number of axles, driving	3	4
„ „ other...	2	0
Arrangement of axles...	driving axles parallel, two pony trucks.	Two axles parallel front and rear axle radially adjustable (Klein-Lindner system)
Total weight, tons ...	62	68
Total weight on drivers, tons	44	68
Weight of electric equipment, tons	18	29
Weight on single wheels, tons	4·5-7·5	8·5
System of motors ...	Three-phase multi-speed induction. With intermediate rheostatic speed control	With intermediate voltage-speed control
Voltage of motor ...	550	850
Transformers on locomotive between contact and motors.		
Periodicity of current...	15-16	
Number of motors per locomotive	2	2
Mechanical arrangement	Motors low, rigidly mounted in main frame no gearing, no countershaft, all connecting-rod motion parallel. Central driving axle between motors	Both motors between inner driving axles.

No. of Normal Speeds.	—2—		—4—			
Speed in km. per hour	35	70	26	35	53	70
R.P.M. of motors... ...	113	230	110	150	225	300
Number of poles in motor	13	6	16	12	8	6
Total pull on tread . kgr.	5,800	4,000	11,500	10,000	7,700	6,400
Total H.P., 1-hr. rating...	800	1,100	1,100	1,300	1,500	1,700

Performance according to Specification.

Weight of train in tons without locomotive.	Speed in km. per hour.	On grade in per 1,000.
300	70	2
400	35	7

The piston-like action of the train in the long single-track tunnel absorbs, at a speed of 70 km. per hour, no less than 700 H.P., according to observation; at 35 km. per hour, presumably about 100 H.P. The requisite total pull on the tread is for the fast trains, about 5,700 kgm., for the slow trains about 5,500 kgm. while on open track of like grade these pulls are about 2,700 and 700 kgm. less respectively. From the foregoing table it is see

that the F. 4/4 type has a characteristic which is meeting traction requirements very well at certain intervals. Driving between the distinct normal speeds, often called the (not quite) synchronous speeds, is practicable and, in the case of the F. 4/4 type, with not too great a loss in efficiency and tractive qualities within certain limits.

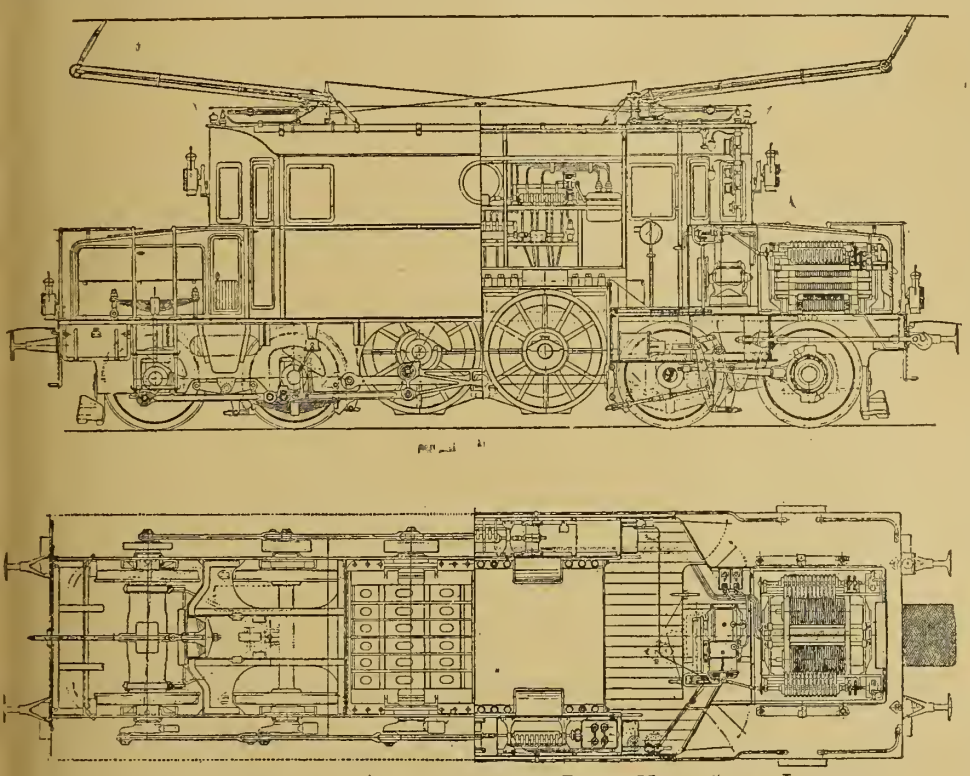


Fig. 4.—Simplon Tunnel 1,100-1,700 h.p. Three-Phase Multi-Speed Locomotive.

Whether this is a feature that could decide the question in the absence of other arguments: "three-phase or single-phase?" practical experience alone, under conditions much less special than those prevailing in the Simplon tunnel, could settle. In this case the working of three-phase current seems to be entirely satisfactory, and will, in connection with other Italian lines electrified (Valtellina, Giovi tunnel) be adopted on the Italian side of the Simplon. The consumption of power has been 37 watt-hours per ton-kilometre.

Seebach-Wettingen Railway. — This electric railway was an experiment, and a technically successful demonstration of a then new method of electric operation of railways. The line on which the experiment was made is one which would be electrified among the very last, if all things were considered; it was chosen because of the proximity of one of its ends to the Oerlikon Works.

As early as the beginning of 1902 it was proposed to use single-phase alternating current for electric traction instead of continuous current or three-phase alternating current.

Single-phase methods overcome the principal limitations of continuous and three-phase methods in their application to railway electrification generally, namely, contact-line voltage with continuous, and complication of contact-line construction with three-phase current. While the latter limitation is evident and simple, the former hides itself behind the great cost of plant for contact conductors, feeders and converter station machinery and buildings, and behind the great expenses for the operation and maintenance of such machinery.

The Seebach-Wettingen experiment was carried out in steps, beginning as early as 1901. First the high voltage of 15,000, five times higher than the highest heretofore adopted for permanent purposes of traction (Berlin-Zossen experiment, 10,000 volts, three-phase), was shown to be practicable and safe. Next came the construction of single-phase traction-motors of considerable power, at that time a problem hardly touched. Then the difficult problem of telegraphic and more particularly of telephonic disturbance had to be solved, because in Switzerland a very great mileage of telegraphs and telephones runs alongside the railways. After that, a regular service of trains on a schedule, as is customary with steam railways, had to be run throughout all the seasons of a year. Lastly, the electric locomotive, and the single-phase one in particular, had to be as powerful, easy of operation and flexible in speed control as a steam locomotive, and capable of taking the place of the steam locomotive.

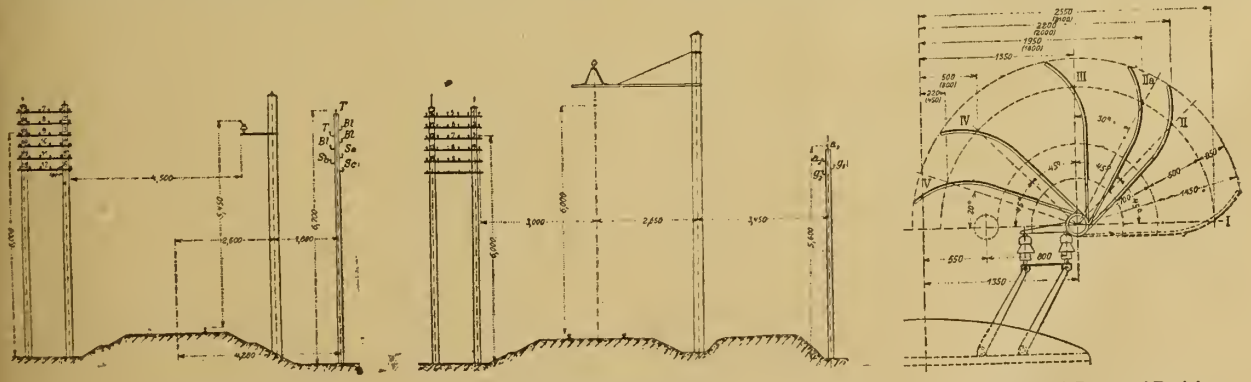
The result has been very satisfactory. The report of the Board of General Managers of the Federal Railways reads as follows (translated):—

"After this year of operation it can be said that the system of traction has justified its trial and that the Oerlikon Co. deserve high recognition of their work. The experiments carried out are of a fundamental character and have much furthered the question of electric traction, as has been shown by the great interest taken in the experiment by railway engineering circles in Switzerland and abroad. It is certainly attributable to a great extent to the work of the Oerlikon Co., that, during recent times, the opinion has gained much ground, that single-phase alternating current of high tension and low periodicity is the obvious form of energy for electric traction purposes on normal gauge and principal railways."

The power consumption per ton-kilometre was very small, though the locomotives were running on light load with the great majority of trains. It amounted to a little over 32 watt-hours per ton-kilometre measured at the high voltage end of the converter station. This is the lowest figure ever obtained in Switzerland in an all-year service.

The performance and general behaviour of the single-phase locomotive motors, were as good as those of the best continuous-current traction motors, and became the basis for the design of the motors of the locomotive for the Lötschberg Railway to be described later.

Though economy in construction of the experimental plant was aimed at, as far as seemed compatible with the success of the experiment, there were installed various types of contact line and special devices for safety and control. There were, for instance, line section switches for telemechanical operation from the station-



Lateral Contact. Catenary Suspension. Contact Rod Range of Positions.

Figs. 5, 6 and 7.—Seebach-Wettingen 15,000-volt Single-Phase Railway.

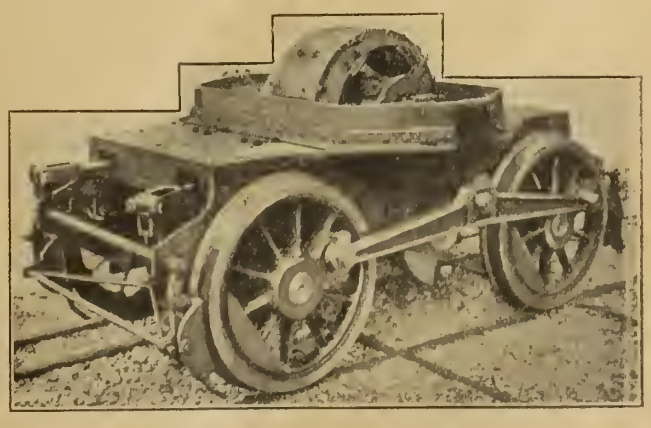


Fig. 8.—Single-Phase Loco. Bogie Truck, Seebach-Wettingen Railway.

master's cabin. Nine km. of the contact line were of a novel description; contact was made by a rod, swivelling about a horizontal axis parallel with and self-adjusting in a plane perpendicular to the direction of travel. The contact wire could therefore be placed on the top of insulators along the side of the track, in a height ranging from 4 to 5 metres, or suspended overhead in the usual way or in any intermediate position by means of more special devices of suspension or support.

This system of contact line has found permanent application on the Locarno-Bignasco (Valle Maggia) Railway, and accounts, among other features inherent to single-phase methods, largely for the low cost of construction of that railway. A feature inherent in this system of contact line is the comparatively low level at which the contact wire must be placed to fully realise the advantages. The tendency being now to place the contact line high (6 to 7 metres) above the top of the rails, that system is not capable of general application.

In 1906 the Siemens-Schuckertwerke joined the Oerlikon Co. in completing the experimental plant, and constructed the western portion of the contact line, about 12 km. on the catenary system and added to the two locomotives, a third of considerable power. The method of battery storage in connection with alternate-current traction was practically tried in co-operation with the Accumulatorenfabrik Oerlikon.

A regular service was performed from December, 1907, for a period of about one year and a half with a few interruptions, for the purpose of making additions. From December, 1907, till December, 1908, approximately 84,000 train-km. were run in regular public service. Before December, 1907, trial runs of different kinds were performed aggregating over 18,000 locomotive-km. and over 27 million ton-km.

The design and appearance of the locomotives of the Seebach-Wettingen electric railway are sufficiently explained by the illustrations and following data :—

	Locomotives I and II.	*Locomotive III.*
Electric equipment by ...	Oerlikon	Siemens
Mechanical part by ...	Winterthur	Borsig, Tegel.
No. of axles, all driving ...	4	4 (6)
Arrangement of axles ...	2 bogies	2 bogies
Total weight, complete, tons	42	68 (75)
Weight of elec. equipm't, tons	21	25 (33)
Max. weight on single wheels, tons	5·25	6·25
System of motors	Single-phase alternating series, voltage control of speeds. No. 1 contactors No. 2 controller	Contactors —
Voltage of motors... ...	300	350
Ratio of transf. voltage ...	15,000 : 300	15,000 : 350
Capacity of transformers KVA.	2 × 250	2 × 500
Periodicity of A.C. ...	15	15
H.P. of motor, 1 hr. rating ...	250	225
Mechanical arrangement ...	motor, high, single reduction gearing, counter crank-shaft below, crank-pin attaching middle of connecting rod	motors low, totally enclosed, single reduction gear, spring suspension as usual on motor-cars
Ratio of gearing	1 : 3·08	1 : 3·72
Motors per locomotive ...	2	4 (6)
Normal total pull on tread, kg.	3,400	5,400 (8,100)
Normal speed per hour, km.	40	45
Max. speed per hour, km.	60	60
Contact	rod and bow	rod and bow
Brakes	Compd. air.	

Locomotive No. I was constructed as early as 1903. With regard to the B.T.B. locomotives, type 1899, the combination of high-level motors, geared to a counter crank shaft below with connecting rods, was not precisely novel in electric locomotive design. In the B.T.B. locomotives, however, the gearing formed an integral part of the speed-control devices. In the locomotives Nos. I and II, Seebach-Wettingen, they were adopted to combine high-speed motors of medium power (economical and cheap) with a low speed of travel, and, at the same time, to relieve the axles from all shocks from masses not entirely spring suspended. The gears of the V-shaped spiral pattern have behaved wonderfully. By that arrangement the advantages of bogies with all wheels driving and evenly loaded, are combined with those of motors accessible and open within the cabin. This arrangement is found again in the type 1910 of locomotive No. III of the B.T.B.

The Seebach-Wettingen experiment proved the practicability of adopting high voltage low-frequency single-phase traction on regular railways in general, also the qualities of the single-phase

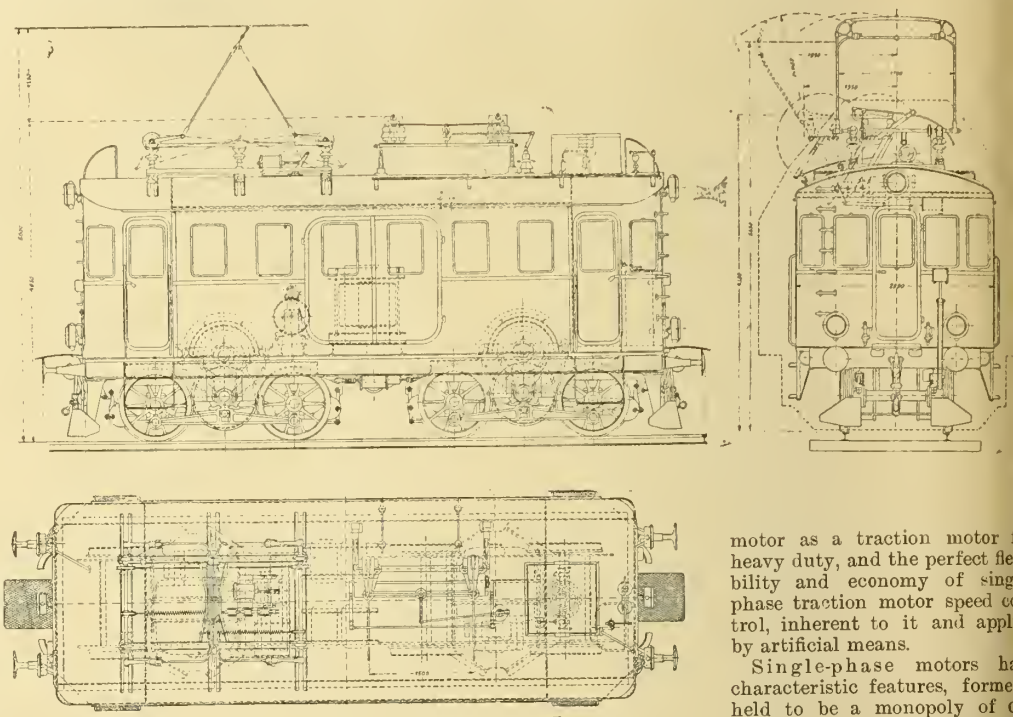


Fig. 9.—Seebach-Wettingen 250-h.p. Single-phase Locomotive.

motor as a traction motor for heavy duty, and the perfect flexibility and economy of single phase traction motor speed control, inherent to it and applied by artificial means.

Single-phase motors have characteristic features, formerly held to be a monopoly of c.c. motors, which make them suitable for traction.

A one-speed induction motor is more attractive to the driver at first sight: it practically relieves him from a good deal of attention in maintaining speed, and prevents the possibility of making up lost time except down hill: it removes a large part of the responsibility from the driver to the central station attendant and the train master. The one-speed, and to a certain extent also the multi-speed induction motor, runs faster up hill and slower on the level, as it might safely and economically do. It runs on a hilly line for a large portion of the time either too fast or too slow and takes either too much or too little power, as is desirable for the best shaping of the load diagram at the power station. A properly designed motor, like the single-phase, though always ready to accelerate, if desired, even above its so-called normal speed, but with an inherent tendency to adjust itself to constant power (by variation in torque inversely to variation in speed), must be beneficial to the shape of the load line, and not disadvantageous to the traffic requirements as a whole.

With cheap power in excess, or with a very great number of light trains running at the same time, the operative and economical importance of the flexibility of motors is greatly reduced; but those conditions do not obtain on railways in Switzerland.

The railways still to be described in this paper, and the majority of electrifications completed recently, or being planned in Switzerland and abroad, are based on single-phase current of high voltage (independent short lines, 5,000; long lines. lines with heavy traffic or lines to be extended into systems, 10,000-15,000 volts), and of low periodicity (mostly 15 on the European Continent, 25 in England and America).

Seethalbahn Railway.—This is a regular normal-gauge railway with a great length constructed on public roads which are used chiefly for agricultural traffic, and it must be considered as a normal-gauge single-phase alternate-current electrification of considerable magnitude. The plant for the entire electrification is by Brown, Boveri.

Power is obtained from the power station at Beznau,* of the Beznau-Löntschwerk, by transmission of, to begin with, 1,000 2,000 H.P. in the shape of three-phase current at 8,000 volts and periodicity of 50. In one sub-station at Beinwil, not far from the middle of the line, this three-phase current is converted into single phase current at 5,000 volts and a periodicity of 25, fed directly into the overhead contact line without any intermediate transformer sub-stations.

The contact line is 5·5-6·0 m. above the rails on sections private to the railway company and 7·0 m. on public roadway.

According to the programme of electrification there will be run in both directions 20 passenger trains of 67 tons (stopping at way side stations) and 74 tons (faster), besides four freight trains of 162 tons total weight. On sections on public roads the speed of passenger trains will be 35, on private tracks 45, and on the maximum grade of 3·7 per cent., 24-31 km. per hour. The speed of

* See page 300 of this issue.

eight trains will be 35 km. throughout, except on the maximum rade, where it will be 17-20 km. per honr. All trains are worked r one motor-car each. Multiple-unit control is, however, provided, id heavier trains thus made practicable.

With the data to hand the author is able to give the following escription of the motor-cars and their equipments (eight passenger, vo freight) (figures approximate) :—

otal weight of motor-cars ...	42-45 tons.
umber of axles	4, in two bogies.
,, motors...	4, single reduction, enclosed usual spring suspension.
ystem of motors	Single-phase, with voltage control of speed (multiple-unit plan).
atio of gearing	1 to 3·68 (passenger), 1 to 4·85 (freight motor-cars).
eriodicity of current	25.
oltage on contact line	5,500-5,000.
,, of motors	200.
o. of transformers on car ...	2.
ower of one motor	100 H.P.
otal power on car	400 H.P.
ectric lighting and heating (voltage 100)	Brakes, compressed air.

The electric service of the Seethalbahn may be considered repre-ntative of the local and suburban service of principal railways. he voltage of 5,000 on the contact line would not be adopted for railway of greater length, but a voltage of 10,000-15,000. In the se of the Seethalbahn, the adoption of 5,500-5,000 volts for the

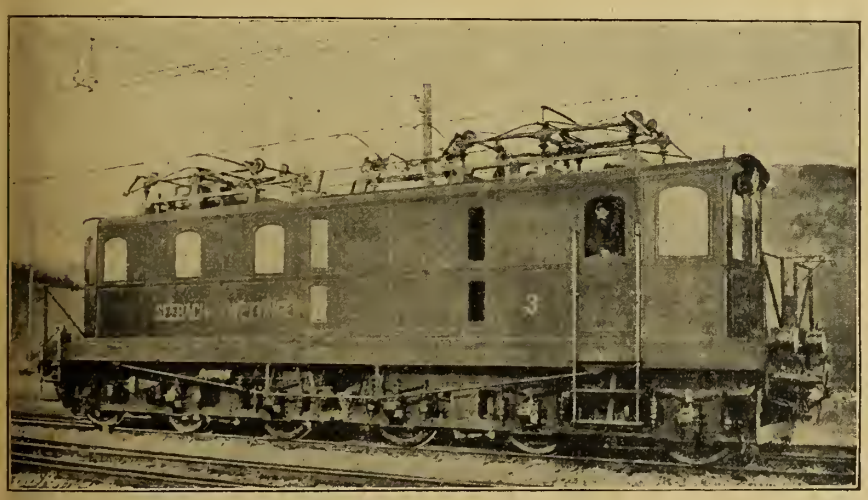
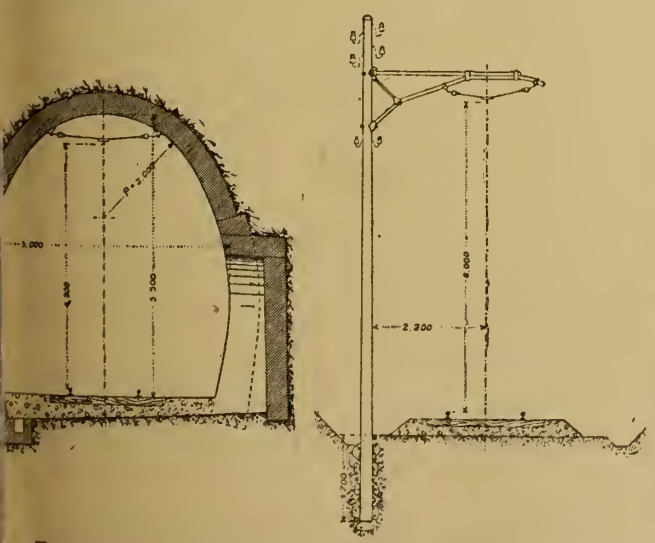


Fig. 11.—Seebach-Wettingen 900-1,300 H.P. Single-Phase Locomotive.

ntact line was economical and convenient at the same time for rticular reasons. If, instead of three-phase current, single-phase rrent of proper periodicity had been obtainable, it is certain that is current would have been conducted to two or three transformer b-stations on the railway line. These would have been cheaper in st of plant and operation than the one station at Beinwil with nverting machinery.



Figs. 12 and 13.—Bow Contact Line Construction, Martigny-Osieres Railway.

This observation will call attention to the desirability of gene-ting alternating current specially for traction pnrposes, and of e unification of periodicity. Radical differences of periodicity nnot be overcome except in an expensive way.

Martigny-Orsières Railway.—This line is similar to the Seethal-hn as far as the general conditions are concerned. The contact ne voltage has been settled at 8,000 volts, a value not very likely to become standard. The periodicity, however, has been fixed at 15, the standard accepted in Switzerland for future electrification. The Martigny-Orsières Railway, branching off at Martigny from the Federal Railways' main line (Lausanne-Simplon-Italy), was requested

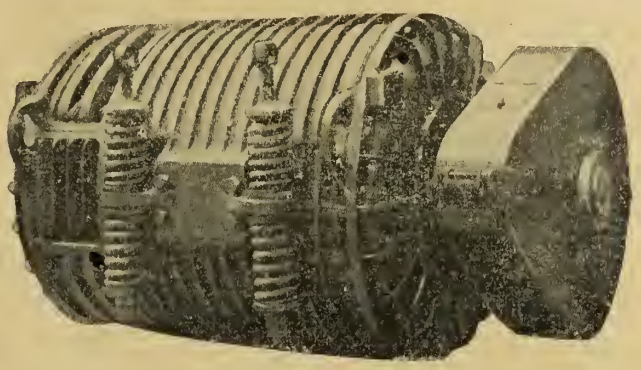


Fig. 10.—90 H.P. Deri Traction Motor, Martigny-Osieres Rly.

by the authorities to adopt a current of a periodicity compatible with that of electric traction on lines in operative connection with it in the near future, namely, the Simplon Tunnel and the Lötschberg services, both with a periodicity of 15. While small differences in periodicity do not prevent transition of locomotives, large discrepancies make it impracticable. Even a large difference in contact-line voltage, though, of course, very inconvenient, can always be dealt with in a suitable manner.

This railway is interesting from the fact that single-phase current has been adopted after a careful investigation of continuous current at 2,400 volts, a voltage still in excess of that on the Bellinzona-Mesocco line ; also on account of the system of motor-speed control adopted.

It has, with reference to the Seebach-Wettingen experiment, been explained that, contrary to multi-speed three-phase motors, single-phase motors permit of speed adjustment with perfect freedom. The means adopted for this control of speed possesses the inherent feature of a step-like action, though, by virtue of the number and pitch of the steps, these are hardly felt as such within the range of speeds usual in driving.

In the case of the Martigny-Orsières railway the speed-control is an absolutely gradual one, free from the feature of steps. It operates on the Deri system perfected by Brown, Boveri, the makers of the entire electric equipment of this railway. The speed-control is obtained by shifting the brushes on the com-

	Passenger.	*Freight.*
Number of motor-cars ...	2	2
Capacity	40 seats, baggage compartment.	10 tons load and 16 seats.
Total weight of car complete, not loaded	40 tons (appr.)	34 tons (appr.)
Weight of electric equipment	17·8 tons.	
Number of axles, all driving	4 (in two bogies).	
Motors per car	4	
Power of 1 motor (1 hr. rating)	90 H.P.	
Normal speed of motor ...	450 R.P.M.	
Periodicity of A.C.	15	
Voltage on contact line ...	8,000	
Ratio of transformers on board car	8,000 : 500	
Capacity of transformers on board car	2 × 130 KVA.	
Motor voltage...	500	
Mechanical arrangement ...	Single reduction gear, spring suspension as usual.	
Gear ratio	1 : 2·53	1 : 3·28
Contact	Pantograph-bow.	
Height of contact	5·500-6·000 m. ; 7·000 m. on stations ; 4·800 m. in tunnels.	
Brakes	Westinghouse.	
Weight of train	66 tons.	126 tons
Speed of trains, km. per hour	30-42	15-35
Number of trains (expected) in both directions	7	3

mutators of the motors ; instead of controller switch-contacts and a certain number of connecting electric conductors, there is, with this type of locomotive-control, a system of spindles, shafts, and bevel or other gears for transmitting motion by hand power from either of the two drivers' cabins to the several motors on the car. In the case of four enclosed motors fitted in two bogie-trucks below the car-body, this will

require considerable skill on the part of the designer, and probably considerable attention in service. In the case of locomotives with high-level motors, open and accessible at any time, even when travelling, and rigidly mounted in the frame of the vehicle, it gives rise to no mechanical troubles.

The contact line is overhead, of substantial character, of the catenary type in stations. The contact is made by pantograph-bows. Electric current is obtained from the power plant of the Société d'Electrochimie in Martigny-Croix, and is generated by a hydro-electric set for the purpose.

The data published on the motor-cars (non-electrical part by Schlieren), their equipment and the weight and speed of trains are given on the preceding page.

(To be continued.)

FINANCIAL CONTROL OF MUNICIPAL ELECTRICITY SUPPLY WORKS.

By "INTERESTED."

Those on the staff of municipal electricity supply works who are placed in the unfortunate position of having part of their work—*i.e.*, the financial part—controlled by the accountant, are to be condoled with. One can only express regret now at the unbusinesslike methods which prevailed in the past, when an important portion of the clerical work necessary to a supply station was allowed to depart from direct control of the engineer or manager. In practice it causes endless petty squabbles and a whole lot of unnecessary duplication of work. This subject would not form a bad basis of a paper for next year's convention of the I.M.E.A., to be read by one of the members of the several committees represented. But I am straying from my path. The fact remains that many such stations are handicapped to a certain extent in the management thereof owing to the accountant having control of some portion of the work; this applies in some districts more than others. Under present circumstances the works staff have to make the best of a bad job, and endeavour to the best of their ability to arrange methods of intercommunication for working which shall be to the mutual benefit of both departments. For the use of readers who are connected directly or indirectly with works managed after this fashion, I give below some forms of books which might be introduced with a view to facilitating a certain amount of duplication.

1. Where the financial part of the business is conducted entirely apart from the works, it is often necessary to obtain from the accountant at short notice full details of any particular consumer's account. In order to enable information to be supplied offhand, the following book will be found useful. A description here will not be necessary, as a glance at the diagram fully explains the intent and meaning :—

Midsummer Quarter.

Deposit account f'lio.	Deposits made. £ s. d.	Arrears brought forward. £ s. d.	Units consumed. at ½d.	at 2d.	at 1d.	at	Current. £ s. d.	Other charges. £ s. d.	Credits. £ s. d.	Depost book folio.	Arrears carried forward. £ s. d.	Amounts irrecoverable. £ s. d.	Name and street.	No. of house.	*Here follow Michaelmas and other quarters.*

2. In the instance of a small station situated in a similar position to that described above, and where the Town Hall is some considerable distance from the works, the following method of dealing with goods accounts might be introduced with advantage :—

a. Each day every invoice received is registered in this book, then passed to the clerk whose duty it is to enter the same in the below-mentioned book, check the quantities with the Stores Received book, and the prices with quotations, tenders, &c. This accomplished, the account is passed on to the engineer for signature, record being made of the "date passed to engineer," likewise the "date received from engineer," for it will be obvious to all that, with the many duties calling for attention on the part of the engineer, a few days will frequently elapse before the accounts receive attention. A record thus obtained enables track to be kept of the position of every invoice received.

Invoice Register.

Date received.	Account No.	Date passed out for checking.	Date received from checking.	Date passed out to Engineer.	Date returned from Engineer.	Details. Quantities.	Description (abridged).	Rate.	Total. £ s. d.

b. All accounts for goods received are entered in detail in this book, after first being recorded in the above-mentioned register, and checked with the quotations, quantities, weights, &c., received, one or more pages being allotted to each contractor according to requirements. Of course, where a loose-leaf book is used, no notice need be paid to the question of how many leaves to allow each contractor, as additional ones can be inserted from time to time quite easily. When the accounts have been duly passed by the engineer, entry is made on the Dr. side, which serves as a record that the same have been duly signed and passed to the accountant's department for the purpose of being presented at the next committee for payment. For want of a more appropriate name, the book is referred to here as a "ledger," although not being just what an accountant would call a ledger.

Name ..... Address .....

Ledger.

Dr.				Cr.					
Date passed to Accountant.	Invoice Nos.	Discount and other deductions. £ s. d.	Totals. £ s. d.	Date.	Account No.	Order No.	Details. Quantities.	Description (full).	Rate.	Total. £ s. d.

With these two books in use a true record is obtained of all invoices received, when passed, and the date forwarded for payment; also, any invoices standing over for any reason can be traced by reference to the register. These books greatly facilitate matters when statements roll in at the beginning of each month. Those referring to invoices already passed are duly endorsed with the date and sent over to the Town Hall as a gentle reminder.

Needless to say, a private telephone-wire between the two departments is a means of saving no inconsiderable amount of time and trouble. An adding machine, also, such as that made by the Burrough Co., will repay its cost, by a saving of time, within a few months. In fact, I venture to say that no electricity works should be without one. Where one or more of these machines are in use, it is remarkable to notice the amount of work found for them to do; for confirmation ask any officer who makes use of one.

The man in the street usually cares little about the inner working of a trading concern, even one connected with his own particular local council, and so long as a few hundred pounds are now and again given as relief to the rates, his interest in this direction seldom carries his mind further than casual observation of work done in the street, or a few high words reported at a council meeting. It is a great pity ratepayers are not taken more into confidence over the business of these trading departments. The local press could do much in this direction by inserting news from time to time as to the progress made by the concerns, the financial position, and what possibilities promise in the future.

Strike at North Woolwich.—A series of strikes of short duration amongst the employés of the Western Electric Co., Ltd., was last week brought to a conclusion. The trouble commenced with the girls, who demanded higher wages. After these had returned to work, the night-workers asked for payment at time and a quarter rate. Next the punch-press boys demanded increased pay. Terms were arranged, and, according to the *Kentish Independent*, everything was running smoothly again on Wednesday night last week.

'HE CITY AND GUILDS ENGINEERING COLLEGE.

The Electrical Equipment.

[by a university lecturer.]

[he Central," which was the name by which the ntral Technical College was known for many years, has come a portion of the Imperial College of Science and chnology. Its official title now is the City and Guilds gineering College. It is proposed to say little of the ministrative aspects of the present situation. Readers of s journal will be more interested in the equipment pro- led for the students in electrical engineering.

We may group the work done in the department under of. T. Mather, F.R.S., in the following manner, viz., ctrical technology, design of electrical machinery, genera- n and transmission of electrical energy, and telegraphy d telephony. In the first year the work seems to be of a ry practical nature. It includes electro-typing, electro- ting, the construction of electric bells, telephones, electric tors, and practical work on heat and light problems. The dent is taught the use of tools. In the second year he es laboratory work, and in the third year he is encouraged do some piece of research.

The Student-in-Charge.—In the department of electrical gineering there are boilers, feed pumps, and heating paratus, and each student is placed in charge of this plant r a week. He has also the same time in charge of steam gines, dynamos and motors. It may be mentioned that the mmercial side of engineering is not altogether neglected, as struction is given in workshop book-keeping and accounts.

A wing of the main building of the College is devoted to e electrical work. In addition to the boiler room, engine d dynamo room, there are a large lecture theatre, labora- ries for telegraphy and telephony, and workshops and oms for research work.

A supply of electrical energy is available from the mains the Kensington and Knightsbridge Co.'s cables. These e laid so that 500 amperes at 400 volts can be taken. urrent is also generated in the laboratory by a Peebles ynamo, which runs at 450 R.P.M. This supplies 200 nperes at 200 volts. There are three batteries of Tudor ccumulators, which are charged by the current from this achine. There is a battery of 30 cells, and two of 0 cells. The accumulators supply current to a main vitchboard, and thence it is distributed to various points in ie building.

Experimental Machines.—The Peebles dynamo, mentioned bove, is driven by a Willans engine. There are also arious other machines which are used only for experimental ork. These include motors of various sizes by firms whose ames are known to all electrical engineers. In the aboratory and workshops there are magnetic clutches which re used for starting and stopping the machine tools. This an extremely interesting and convenient method.

The equipment of the main laboratory includes a Man- nester compound dynamo, a Goolden shunt dynamo, a ngle-phase alternator, a Sayer's scries dynamo and a three- hase generator. The latter is driven by a compound engine y Messrs. Allen & Co., of Bedford.

There is a line of shafting with belt drive. Considerable ariation of speed is obtained by the use of long cone ulleys.

Recent additions to the equipment include a three-phase lternator of 15 KW. capacity, and two three-phase trans- ormers of 30-KW. and 15-KW. output.

There are two crane motors and controllers. One has a apacity of $5\frac{1}{2}$ H.P. and the other $2\frac{3}{4}$ H.P. A small 16-cwt. oist is used in the laboratory. An eddy-current brake is itted to a 3-H.P. interpole shunt motor of quite the most ecent type.

The equipment also includes three extra high-tension ransformers. Two are for 150 to 40,000 volts, and one hree-phase is for 62 to 30,000 volts. There are several irect and alternating-current machines for Hopkinson and ther tests, and a reversible booster is used for charging and ischarging the storage batteries.

Telegraphy Equipment.—The College possesses a large artificial submarine telegraph cable. This has a capacity which exceeds 700 microfarads. It is used to show the electrical properties of the deep-sea cables of the Atlantic or Pacific. Automatic transmitting and receiving instruments, for land and submarine work, are used by the students.

The latest addition to this section of the electrical engi- neering department is a large amount of wireless apparatus. There is a Marconi 10-in. spark-coil, coherer, relay, printer and magnetic detector, also Marconi and Cossor variable condensers, the Duddell-Poulsen arc, &c.

Electric Traction.—An important development of the work of the College has been the special course on railway work ; this includes electric traction, and a portion of the new workshops has been set aside for experimental apparatus in this subject. There are two tramcar trucks fitted with 40-H.P. interpole motors of the most recent type, including brake gear. An installation of a conduit tramway track of the latest L.C.C. pattern is of interest. An inspection pit 28 ft. × 9 ft. has been made in the floor.

Motors similar in design to those used on the L.B. and S.C.Ry. have been installed. These are a 3-H.P. and a 10-H.P. Winter-Eichberg single-phase commutator type.

An example of the equipment used on the Lancaster- Heysham branch of the Midland Railway is supplied. There is a 10-H.P. single-phase commutator motor, with auto- transformer and controller for same, and six full-size railway motor-contactors and master controller for multiple-unit working.

Instruction in Engineering.—It is quite certain that the students who nowadays attend technical colleges realise quite early in their careers the important fact that it is not an easy matter to earn a living in the profession (or trade) of engineering. That is, unfortunately, especially true of the electrical branch. It is all very well to point to Mr. Jones, the consultant or City electrical engineer, and mention his four-figure income. The unromantic fact remains that it is none too easy for any young electrical engineer under 30 to obtain a three-figure annual income, and many who are over 30 would be pleased with the certainty of £100 a year. Consequently the students at the colleges realise, quite early, that the race is to the mentally alert, and the battle to the strong. Of course there are exceptions, and the "wasters" are, unfortunately, in every profession.

One of the methods which ensure that the students work at the City and Guilds Engineering College is the exercise class. The lecture room is so arranged that it is quite an easy matter for the staff to get at each student, and after each lecture examples are given. It is really a most excellent method of supervision. Fine equipment is excel- lent, good research work a great incentive to the brilliant student, but the greatest of all the virtues attached to a college is the really good teacher, and they do *teach* the students at the Central.

It has not been possible to give details of the growing equipment in the civil and mechanical engineering depart- ment. Mention should be made of the fact that the new workshops are electrically driven, and the power absorbed by individual machines can thus be easily measured.

For many years Prof. Unwin did his classical researches in the testing of materials laboratory of the College. The story has often been told how Profs. Unwin, Ayrton, Arm- strong and Heurichi commenced the careers of four depart- ments at the Central, nearly a quarter of a century ago. There were a mere handful of students in the first few years ; there were hundreds when the first to resign (Unwin) left the place. Then Ayrton passed away, and now Armstrong and Heurichi are about to enjoy a well-earned rest from the labour of teaching.

Of the large extensions of other sections of the Imperial College little can be said for want of space. The large Bessemer Memorial laboratory grows apace. The other extensions of the College are apparent to the passer-by, who sees that the vacant ground in the vicinity is being covered with new buildings.

General and Social.—Just behind the Albert Hall is the new Students' Union, a really imposing building. This will be available for all past and present students of the Imperial College. The Officers' Training Corps and the Engineer unit of the Territorial Army are both popular among the students.

There are Association and Rugby football clubs, a rowing club, and also a club for motor-cyclists. There is also a flourishing Old Students' Association, with an employment agency. There are various scholarships at the College. It will be seen, therefore, that an incentive is given to the students to work hard and preserve the old motto "*Mens sana in corpore sano.*" For, after all, in engineering work the man with a strong physique has a valuable asset in the rough and tumble of twentieth century competition.

CO-OPERATIVE POWER PRODUCTION.

Undoubtedly the North-East Coast has shown itself an easy first in the intelligence with which it has put itself into line with modern methods of power production and distribution. With less than 5 per cent. of the population of the United Kingdom, the district produces 20 per cent. of the coal, 36 per cent. of the coke, 40 per cent. of the ironstone, and not far from the same percentage of the pig-iron.

It is essentially an iron and steel area, for its shipbuilding tops the list in tonnage and the Tyne puts both the Clyde and the Logan behind it in the speed of its biggest ship.

The North-East Coast alone has realised the folly of throwing to waste the gases which issue from furnaces and coke-ovens. These gases are one-third combustible, and each unit of this combustible proportion represents more than twice as much heat potential as heat already produced, being carbon monoxide.

Some attempts at power production on a large scale have been made in Cumberland, in the Midlands, and in South Wales. In Cumberland, no serious support could be secured for a scheme to pool the waste gases and supply power. In the Midlands we have seen what has been done at Ocker Hill and Dudley. In both these centres we see freshly mined coal consumed for power purposes within a veritable forest of gas-wasting furnaces, which would furnish the same power 50 times over.

In South Wales, failure followed the same effort to sell power to the mines, using coal again in a country reeking with waste gas.

Yorkshire presents another sample of the want of cohesion and co-operation between its many manufacturing interests, and Lancashire the boasted home of co-operation, seems not to know what that word means.

On the North-East Coast there are no fewer than nine power stations which generate power from waste heat, and put it into the general interconnected system of power mains supplying electrical power to the district. Such is now the condition of affairs that there is said to be practically no coal burned in the ordinary factories. We believe that, though this country is far behind Germany in its total use of waste gases, yet Germany cannot show anything on a par with the co-operative efforts of the North-East Coast. Coke-ovens get all the power they need, and often something considerable in the shape of cash payment for gas values beyond the charge made on them for power. Individual works could doubtless have been their own power producers, and would have had surplus gas to sell. But it has been realised to be wiser to sell all their waste gas to the power companies and take power as a contra account. The widening use of electricity that has been brought about by these co-operative energies has rendered necessary some coal-burning stations. The latest at Dunston, of 50,000 H.P., will supply the many pits in its more immediate locality, but even then it will abolish the many notoriously wasteful boiler plants of these pits, and show an enormous overall economy. Electricity is used for coal winding at many of the principal pits, and at many more it is employed for lighting and general power purposes apart from winding. Its use is rapidly extending in iron works and mills.

The extension of the use of electricity will be more fostered by the co-operative system followed by the men on the North-East Coast than by anything else. There is no reason why equally good results should not have been brought about in the Black Country. The North-East Coast boasts of its population of two millions. Surely Birmingham and an area around it equal to the North-East area could s as many people and a far wider variety of trades. The chief carboniferous outcrops of the area about Birming can be enclosed in an area 40 miles square. This w area is more or less industrial. South Wales is an equ promising area. Though the waste gases are not wh flung away in South Wales, we do not know that they used in any way collectively, but merely at a few w individually, a method that is not likely to compete with system of co-operation.

HIGH PRESSURE CONDUCIVE TO DRYNE OF STEAM.

That dryness is recognised as an attribute of high-press steam was very well shown by the employment in Belleville boiler of pressures much higher than th allowed to reach the engines. The physical facts of ste seem to justify the contention that this should properly the case.

Wetness of steam is due to various causes, but one of worst causes is priming, by which is understood the flus of water which pass from the boiler to the steam pipe. J how priming occurs is not very well understood. It occur in certain states of impurity of the water in a boi and appears to be intensified by viscosity of the water by violent ebullition. Thus a form of priming may con of the pellicle of steam bubbles carried forward by violence of the steam movement; or it may consist of whole or part of the general water surface lifted by steam and swept into the steam pipe. Vortical movem of the steam in a boiler is believed to carry water by a s of cyclonic action as seen at sea in the water-spout, wh sometimes occupies the eye of a violent cyclonic movemen the air. That this is a potent cause may be inferred from fact that the anti-priming pipe will give dryer steam than steam dome with its single opening, the rush of steam fr all points to which causes vortices. The anti-priming pipe pipe several feet in length and several inches in diameter, p forated on its upper half circumference by numerous small h having a united area of not more than about 50 per cent. excess of that of the steam pipe to which they form the approa Vortical action cannot form about a length of several feet pipe. Some engineers have even used double parallel pie of finely perforated copper anti-priming pipe, as much 30 ft. in length, in order quietly to collect steam from ev part of the steam space. It is important that perforatic should not be excessive in area, or otherwise the steam w not be compelled to seek out every perforation. It might enter by a few near the outlet part of the pipe, if these f possessed the requisite area: hence the above limit 50 per cent. excess area only. The pipe is drained at central point by a pipe which dips below the water-level the boiler.

Approximately steam has a bulk inversely as its absol pressure. Thus at 300 lb., its bulk is only about a twentie what it is at atmospheric pressure. Since the weight steam generated in a boiler is practically equal at pressures, it follows that at 300 lb. the steam bubbles whi rise through the water will have a diameter of less than half or a third of those produced at atmospheric pressu And their surface will be a fourth or a fifth only of t surface of the low-pressure bubbles. The smaller bubbl carry with them less of the skin, and the general di turbance of the water is less, and there is more spa between the rising bubbles for any water to fall ba again. Thus in every way the physical condition high-pressure steam is all in favour of dryness as also large steam space and extended water surface from which t rising steam may escape.

That some of the more extraordinary results of stea boiler tests are evidences of priming, rather than of hig efficiency evaporative effect, is the opinion of many reputab engineers, who would, to-day, hesitate to put their names t these high result tests unless they represented combine evaporation and superheat; for only by actual thermometri

rheat can there be any assurance that the so-called oration does not consist largely of hot water lacking the it heat of evaporation.

he day of steam dryness testing by the calorimeter has ed never to return, unless some genius finds a way of ng out of a steam pipe a true representative sample of mixture of steam and water flowing in it.

team superheated and well turned over so that there ot be any unevaporated water present, will show its lition by that reliable instrument, the thermometer. this, at present, is the only instrument that can be d upon for the purpose.

is amusing, to-day, to read bygone boiler tests with r mythical steam dryness factors and enormous iencies. Many useless pages of *Proceedings* are filled the imagery of those times, and their figures are of less e than the baseless fabric of a vision.

GERMAN MONOPOLY.

ERIOD of nearly three years has elapsed since attention first directed to the existence of secret agreements in German electrical engineering industry, which, while ntaining the appearance of open competition, sought to ent orders from being placed with firms not forming ies to the ring of the largest companies. Although ght to be no longer operative, the *Kolnische Zeitung* s that it learns from various sources that such agreeits still exist, but alterations have been made, in the e that written communications are avoided in principle. he case of important customers (electricity works, tram-, iron and steel works, mining companies, &c.) arrangets are now made in such a way that one or the other of nterested large firms is protected by the others in prices, rding to the existing personal or business relations, st keen competition takes place in regard to competitions small contracts. By the adoption of the latter system idea of completely indifferent competition is awakened ng customers in general, and at the same time an mely effective war of destruction is carried on against smaller competitive firms, which, as a rule, cannot be n upon for the submission of offers for large orders. s no fewer than four firms of average standing in the rical engineering industry collapsed in the course of). The time seems to be no longer distant, in the ion of the Cologne newspaper, when the two groups of Siemens-Schuckert Works and the A.E.G. will dictate s to consumers. But it is not only the actual customers electrical machinery who may expect a dangerous time, also certain groups of machinery works which conct pumps, lifts, steam turbines, blowing engines, pressors, &c., and which have also to supply elecl machinery in order to dispose of their own afactures. It is known that the large electrical firms already makers of such machinery, or are in the st relations with a definite and corresponding engineerworks. As soon as the monopolistic efforts in the rical machinery trade have been realised, the Cologne paper contends that all works for the construction of al machinery which, as in the case of those mentioned, to obtain electrical machinery for resale, will be exposed nihilation, as the large electrical firms would have the ol of prices for the whole of the contract. The question e monopoly also forms the subject of a pamphlet by E. H. Geist, of Cologne, the former manager of the . Geist Elektricitäts Aktiengesellschaft, which was comld to go into liquidation some months ago. The author, is consequently an interested party, deals with the mpetition Fight in Electrotechnics and the Secret dicate." Although there is probably little information e pamphlet that is not already known, it may be mend that the Geist Co. had threatened legal proceedings nst one large firm on the alleged ground of illegal petition, but the liquidation of the former has put an to the question. The author summarises the methods he large firms by declaring them to be composed of al power, price underselling, destruction of competition, and the taking over of destroyed works with shares standing at a low book price; the increase in the power of syndicates, the establishment of interests with opposing works by an exchange of shares, the securing of the customers of destroyed competitors, and the dictation of prices. This is, in fact, the way, a Frankfort newspaper remarks, towards the monopoly of large capital in industry—a development—which can be pursued elsewhere than in the electrical industry, although it has made the most progress in this particular trade.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Induction Controllers.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., are placing on the market a novel type of induction controller for slip-ring induction motors, constructed under their own patents.

Instead of direct resistances, there are inserted in the rotor circuits, coils whose apparent resistance depends on their position in space relative to other coils, which have actual resistance in series with them. Thus in the simple case where there is a magnetic core capable of turning, and wound with a coil (the primary), and a frame wound with two coils (secondaries) at 90°

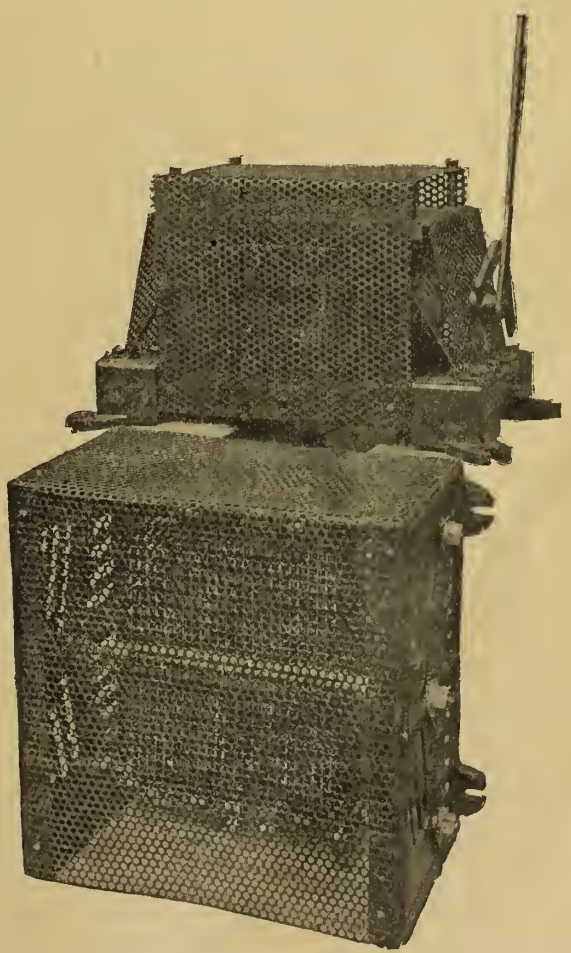


Fig. 1.—E.A.C. Induction Controller, with Resistances.

with one another, if one of these secondaries is closed on itself through a high resistance, and the other through a low one, then when the primary is opposite the first, it has a high apparent resistance (to alternating currents); but when the core is turned so that the primary is opposite the second, it has a low resistance. In intermediate positions the apparent (and effective) resistance has intermediate values.

Hence this apparatus will control an induction motor in exactly the same way as will a variable resistance. A small air-gap is used, so that the apparatus is practically non-inductive.

These controllers have an inherent electrical torque, depending on the load, which tends towards the lowest speed position. In plain controllers this has the important advantage that the operator can actually feel the load on the motor, so that the controller acts as an ammeter; moreover, the motor cannot be overloaded without an *unusual effort* by the operator's hand.

This torque is utilised in the automatic and fool-proof starters in such a way that the motor cannot be subjected to excessive

current in starting, and by it to supply apparatus for automatically regulating the speed and load of induction motors, as is required in rolling mills and many other industrial applications, without the aid of any auxiliary magnets or series transformers whatever.

This simplicity results in great reliability as well as low first cost and maintenance.

At the same time sparking is impossible, and the apparatus can safely be used in mines and other places where risk of fire or explosion may exist.

The apparatus is obviously applicable to a great variety of purposes, and the firm's leaflet H 31 deals with hand-operated speed regulators, plain controllers, fool-proof starters, automatic starters and automatic slip regulators.

Adjustable Fittings Boxes.

The Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., are supplying the "Armorduct" patent adjustable fittings boxes for flush work. The device is introduced to meet the difficulty of fixing conduit junction boxes which are intended to receive outlet fittings, such as switches, plugs, bell-pushes, &c., in alignment with the surrounding plaster, cement or skirtings, in respect of "depth" and "vertical" alignment. The fitting shown is claimed to meet both these difficulties. The accompanying diagrams show that where a box has been let into plaster at an

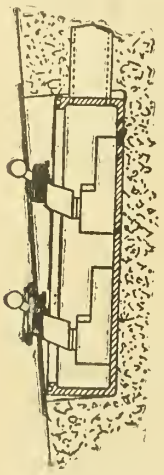


Fig. 2.—A Fittings Box "out of depth."

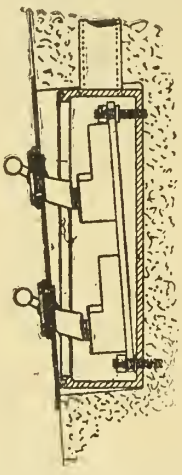


Fig. 3.—The same Box after the necessary adjustment has been given.

uneven depth the necessary alignment can be made without any disturbance to the outlet fittings themselves, by the simple adjustment of the adjustment-cradle screws: similarly, where a box is found out of alignment with surrounding skirtings, the cover may be readily moved so as to bring it within the desired line. Either one or both adjustments may be made with equal facility.

Automatic Cinematograph Resistance.

Mr. F. G. Borland, of 60, Penny Street, Lancaster, is introducing an automatic resistance—a patent for which has been applied for—to use in connection with cinematograph lamps, motor-generators, &c. He sends us the following particulars:

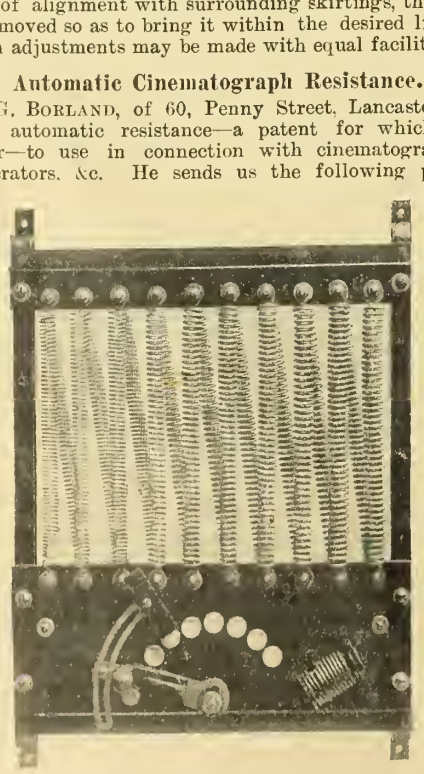


Fig. 4.—Cinematograph Resistance.

The arrangement consists of a rheostat in circuit with the arc, the regulating lever of which is held in the "full on" position by an electromagnet, as long as the lamp is in use.

Should the arc be extinguished, the magnet releases the lever which returns to the striking position inserting extra resistance in the circuit, preparatory for striking up again.

This resistance is intended to be fixed in the operating box as extra in series with the existing one outside; it gives no extra as it is cut out when the lamp is in use. The arrangement is in various sizes to act at any predetermined amperage and prevent the sudden throwing on of heavy loads as at present.

SOME RECENT TRAMWAY CASES.

[From our legal contributor.]

Although those who are interested in electric traction do often figure in the Law Courts except as parties to what termed "running down cases," the law reports for the last yea contain some decisions which are worthy of more than pas notice. When a case is reported at length in these columns, busy man may not have time to read it; and if he does read it, memory of it will soon be crowded out to make room for ot topics. It is, therefore, expedient to refresh the memory glancing at a digest from time to time.

Running down cases usually turn upon particular facts, and therefore, not of much importance or permanent value. We refer, however, to one of these, namely, Leaver *v.* Pontypridd U. (74 J.P. 199). In that case the driver of an electric tramway car an obstruction ahead. Being uncertain as to whether there room to pass it, he went dead slow. After the front of his had safely passed the obstruction, a man who had a better op tunity of judging whether it was safe to proceed, shouted to hi go ahead. In the result the tramcar struck the obstruction, the plaintiff was injured. It was held that there was no evid of negligence to go to the jury.

Disputes constantly arise between tramway companies or l authorities running tramways under statutory powers with re to the rights of parties in relation to the laying of gas mains. Sec. 32 of the Tramways Act, 1870, it is provided as follow "Nothing in this Act shall take away or abridge any powe open or break up any road along or across which any tramwa laid, or any other power vested in the local authority or authority for any of the purposes for which such authorit respectively constituted, or in any company, body, or person, the purpose of laying down, repairing, altering, or removing pipe for the supply of gas or water, or any tube or wires apparatus for telegraphic or other purposes, but in the exercis such power every such local authority, road authority, comp body, or person, shall be subject to the following restriction (2) Before they commence any work whereby the traffic on tramway will be *interrupted*, they shall (except in cases of urg in which cases no notice shall be necessary) give to the promo and lessees, if there be any, notice of their intention to comm such work, specifying the time at which they will begin t so, such notice to be given 18 hours at least before the comme ment of the work. . . . (5) Any company, body, or person, s not execute such work so far as it immediately affects the tram except under the superintendence of the promoters, unless t refuse or neglect to give such superintendence at the t specified in the notice for the commencement of the work discontinue the same during the progress of the work; and t shall execute such work at their own expense, and to reasonable satisfaction of the promoters; provided that *any a tional expense* imposed upon them by reason of the existence of tramway in any road or place where any such mains, pipes, t or wires, or apparatus shall have been laid before the construc of such tramway, shall be borne by the promoters.

In the case of an arbitration between the Bristol Gas Co. and Bristol Tramways and Carriage Co., 74 J.P. 35, it was held tha interruption of the tramway service within the meaning of Sec (2) of the Act of 1870, was caused (1) when the tramway comp for the purpose of enabling the gas company to repair a fract main which was causing a serious escape of gas, were deprive the use of one of their lines, and had to conduct their traffic, up and down on the one line only; (2) when tramcars were slo down or brought to a standstill for a sufficient time to enable w men of the gas company to get out of the trenches under or the tramlines where they were at work on the pipes of the gas c pany. It was also held, in the same case, that the additi expense of the following works was recoverable from the promo under Sec. 32 (5) of the Act of 1870: (*a*) Connecting a new ser pipe laid for the first time since the construction of the tramw such connection being an alteration of the main; (*b*) repair altering or removing a service pipe or a main laid before the tr way was constructed; but that the additional cost of the follow works was not recoverable: (*c*) laying down a new service for the first time since the construction of the tramway; repairing, altering or removing a service pipe laid since the tr way was constructed, the main having been laid before the struction of the tramway: Semble, the proviso to Sec. 32 (5 the Tramways Act, 1870, which provides that additional exp incurred by reason of the existence of the tramway shall be b by the promoters, does not apply if the work claimed for does cause an intreruption of the traffic on the tramway.

When agreements are made under which a local authority le part of its undertaking to a company reserving the right to emp a contractor to do necessary repairs, difficult questions arise a

ability as to injuries sustained in carrying out those repairs. In he case (Birmingham Tramways Co. Law 74 J.P. 355) the Birmingham Corporation leased a certain part of a tramway which hey were entitled to work under statutory powers to the plaintiffs. was a term of the said lease that any repairs which became ecessary to the track should be effected by the Corporation, subct to the licence of the plaintiffs. Pursuant to a licence duly btained, the Corporation employed the defendant to relay a porion of the track which was leased to the plaintiffs. The running f trams was to continue during the operations. In carrying out his work the contractor was guilty of negligence, as a result of hich a tramcar was derailed and overturned, and a number of assengers conveyed by the plaintiffs were injured. The plaintiffs aving compensated the passengers by payment of damages, ought to recover the amounts so paid :—Held, that the acts of the efendant having injuriously affected both the proprietary rights f the plaintiffs as lessees of the tramway, and also their right of assage on the highway, the defendant was liable to indemnify the laintiffs.

With regard to running powers, it is not always easy to determine whether a local authority or other body running trams has power enter into an agreement with a local authority for the purpose f establishing mutual running powers. In one such case (Eccles Corporation *v.* South Lancashire Tramways Co. and Salford Corporation, 4 J.P., 145, 345), the plaintiffs, a local authority, were authorised y a special Act, which incorporated Parts II and III of the Tramways Act, 1870, to construct and maintain certain tramways in heir district and to enter into agreements, subject to the approval f the Board of Trade, with tramway owners of adjacent districts ith respect to the construction, sale, lease, working and manageent by the contracting parties of all or any of their respective ramways. The proposed tramways were adjacent to tramways utside the plaintiffs' district of the defendant company on the est and of the defendant Corporation on the east. Both the efendant company and the defendant Corporation had under their pecial Acts similar powers of entering into working agreements with he tramway owners of adjacent districts, except that the consent f the Board of Trade thereto was not required. The tramways authoised by the plaintiffs' special Act were constructed by the defendant orporation under the terms of an agreement entered into between he plaintiffs and the defendant Corporation, with the approval of he Board of Trade, and the defendant Corporation were entitled hereunder to a lease for a term of years of the exclusive use of uch tramways, but subject to a proviso that they should not ssign, or sub-let, or part with, the benefit of the agreement without he leave of the plaintiffs. During the continuance of the agreeent the defendant Corporation, without the leave of the plaintiffs, nd without the sanction of the Board of Trade, granted to the efendant company a revocable licence to run over a small portion f the plaintiffs' tramways, which adjoined the defendant comany's tramways. It was held that neither under the Tramways ct, 1870, nor under their special Act, had the plaintiffs any power o authorise the defendant company to run cars over their tramway ithout the consent of the Board of Trade, and that their agreeent with the defendant Coporation did not purport to confer on he latter any greater right than that which the plaintiffs had uthority to grant. It was also held, therefore, that the licence ranted to the defendant company was *ultra vires*, and an injuncion was granted to restrain the defendant company from using the laintiffs' tramways.

Another question of general interest was raised in a case where he accuracy of certain electrical meters was considered. We refer o Gravesend and Northfleet Electric Trams, Ltd., *v.* Gravesend orporation, 74 J.P., 156. In that case an agreement was made etween the plaintiffs and the defendants for the supply of elecricity to work the tramways. It was a term of the agreement hat the amount of energy should be ascertained by the average reading of three wattmeters ; that the meters should be calibrated nd fixed by the defendants, and that if, and whenever, any meter should show a difference of more than 3 per cent. from the mean reading of the other two, such meter should, at the option of either party, be removed and recalibrated, or at the option of the defendants, replaced by another meter. It was a further term of the agreement that, on written notice from one party to the other, the three meters should be recalibrated *in situ* by the Board of Trade or by some other approved standardising institution agreed in writing. Subject as aforesaid, the average reading of the meters was to be final and binding between the parties. On several occasions, covering a long period of time, it was found that the meters were inaccurate, and were registering fast, as compared with a standard Aron meter. The plaintiffs contended, upon the facts, that they were entitled to have three meters installed which were capable of measuring the exact amount of energy supplied to them. The defendants contended that the plaintiffs were bound by the wattmeters as and when recalibrated, in accordance with the terms of the contract. It was held (1) that the meters could not be condemned as long as the remedy by recalibration *in situ* remained open to the plaintiffs ; (2) that if the error of any meter could be measured and was constant, and did not arise from any defective adjustment, the necessary rectification of the readings could be made in accordance with ascertained and constant error ; (3) that there could not be held to be any breach of any express or implied term of the agreement until the plaintiffs had applied for recalibration, and it had been refused ; and (4) that the agreement did not amount to a warranty that the instruments installed should measure the amount of energy actually supplied, nor did it impose any express obligation on the defendants to keep the instruments up to the measure of accuracy which could show the energy actually supplied.

BUSINESS NOTES.

Book Notices.—"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XI. 1911. Liége. The Association. Price 8·50 fr.

"The School of Mines Quarterly." Vol. XXXII, No. 4. July, 1911. New York City : Columbia University. Price 50 cents.

Journal of the United States Artillery, with Index to Current Military Literature." Vol. 36, No. 1. July-August, 1911. "Life Hazard and Resuscitation in Electrical Engineering." Fort Monroe, Va. : Coast Artillery School Press.

"Herzogliche Technische Hochschule Carolo-Wilhelmina zu Braunschweig." Programme for 1911-1912. Braunschweig : Vieweg and Son.

"Preliminary Announcements (1 and 2) of the Eighth International Congress of Applied Chemistry, Washington, September, 1912." New York : The Secretary, 22, Broad Street.

Proceedings of the American Institute of Electrical Engineers." Vol. XXX, No. 8. August, 1911. New York : The Institute. Price $1.000.

Bulletin of the Imperial Institute." Vol. IX, No. 2. 1911. London : Eyre & Spottiswoode, Ltd. Price 1s.

"*Proceedings* of the Physical Society of London." Vol. XXIII, Part 5. August 15th, 1911. London : *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"The Testing of Engines, Boilers, and Auxiliary Machines." By W. W. F. Pullen. Second edition. Manchester : The Scientific Publishing Co. Price 12s. 6d.

Admiralty Contracts.—The Walsall Electrical Co., Ltd., have been placed on the Admiralty list for the supply of small switchboards suitable for torpedo-boat destroyers, cranes, accumulators, charging switches up to 100-ampere rating, ammeters up to 1,500 amperes, and voltmeters up to 260 volts.

Catalogues and Lists.—Messrs. Walter Newbold and Co., 10, Arthur Street West, London Bridge, E.C.—List M5 containing illustrated descriptions of a number of lathes.

Messrs. Parmiter, Hope & Sugden, Hulme Electrical Works, Manchester.—Leaflet giving prices and illustrations of Hope's patent Lyon switch fuses, fuse-boxes, &c.

Mr. J. Wolff, Frankfort-on-M. South.—English lists of aerial fuses with bayonet joint, aerial cut-outs, silver wire fuses, and insulators with safety fuses.

British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C. —Illustrated leaflets showing aluminium plant for chemical works, and aluminium trolley heads.

The Hart Accumulator Co., Ltd., has sent us a small envelope of court plaster with a useful calendar down to June, 1912, to carry in the vest pocket.

Messrs. Eastman & Warne, 241-243, Acton Vale, London, W.— Leaflet giving particulars and prices of their hot irons, and the E. & W. convector, also a brief description of a new line—the "Eadisk" cooker.

Mr. F. J. Down, 6-8, Crutched Friars, E.C.—Lists to hand regarding gear shield (lubricant), show that up-to-date 725 traction systems, steel and iron works, mines, &c., have bought this material for stopping wear and noise on gears. By last week's mail from his Transvaal agent, Mr. Down learned that 13 further important gold mines there had just sent first orders. We understand that it is no unusual thing for traction pinions to run 250,000 miles, using this speciality as a lubricating cushion, and that almost double that distance has been recorded.

The Westinghouse Cooper-Hewitt Co., Ltd., 151-2, Great Saffron Hill, London, E.C.—New illustrated catalogues as follows :— No. 17, showing the type "Z 6" 800-c.p. totally-enclosed Silica lamp, 1½ ampere, for 200-250 volts ; and the type "Z 2" 3,000-c.p. Silica lamp 200-250 volts, 3½ amperes, which has been supplied in considerable quantity to many big firms. We understand that a lamp will shortly be put on the market for parallel operation on 500-550 volts, capable of withstanding the heavy fluctuations of pressure experienced on traction circuits. List No. 30 describes the Cooper-Hewitt lamps for A.C. circuits, operation being obtained in conjunction with a special mercury vapour converter. List No. 25 contains particulars of light transforming reflectors by means of which the light from Cooper-Hewitt mercury vapour lamps can now be rectified, so removing objections to the light on account of its colour.

Liquidations.—Canadian Electric Traction Co., Ltd.—This company is winding up voluntarily, with Mr. E. H. R. Trenow, Balfour House, E.C., as liquidator. Creditors must send particulars of debts, &c., to the liquidator by August 29th. A meeting of creditors is called for August 31st.

Fife Electric Power Co., Ltd.—This company resolved, at a meeting held in Edinburgh on July 25th, to wind up voluntarily, with Mr. James Watt, 28, Charlotte Square, Edinburgh, as liquidator. The liquidator is to divide among the members of the company in specie that part of the assets consisting of 10,000 preference and 20,000 ordinary shares of the Fife Tramway, Light and Power Co., Ltd. A meeting of creditors is called for September 1st.

Havana Telephone Securities, Ltd.—A meeting of creditors is to be held at New Broad Street House, E.C., on August 31st. Liquidator, Mr. Geo. Banks.

The A.E.G. in Belgium.—A Belgian newspaper report states that rumours are in circulation on the Liége Bourse, to the effect that the A.E.G., of Berlin, proposes to absorb the Compagnie Internationale d'Electricité, of Liége.

Bankruptcy Proceedings.—Thomas Charles Francis, electrical engineer, 66, Liverpool Road, Stoke-on-Trent.—The adjourned public examination of the above debtor was held at the Town Hall, Stoke-on-Trent, on Tuesday last week, when the statement of affairs showed liabilities amounting to £510, and assets estimated to produce £9. Previous to 1906 the debtor was in partnership with R. H. Wainford and J. H. Froggatt, as electrical engineers, at Stoke-on-Trent. The firm executed a deed of arrangement and paid 1s. in the £ upon liabilities amounting to £1,243. In December of last year the debtor again commenced business with a capital of £10. No further questions were put to the debtor, and the examination was closed.

Middlesbrough Turbine Contracts.—Mr. P. J. Mitchell, of Caxton House, S.W., writes:—"I note in your 'Contracts Closed' section in last week's issue that you make a statement which is slightly contrary to the fact. Under the heading 'Middlesbrough,' you state that Messrs. Fraser & Chalmers have just booked an order for two Rateau turbines of the mixed-pressure type for direct coupling to turbo-blowers of Messrs. Bolckow, Vaughan & Co., Middlesbrough, and that 12 turbines have been supplied by Messrs. Fraser & Chalmers to this company. I would like you to kindly note and state in your journal that I was the main contractor for the following machines:—At South Bank works I have supplied three 1,000-kw. turbo-alterators, with Rateau turbines and Brown, Boveri alternators. There are also six turbo-blowers of the Rateau type. All of the above turbines are of the mixed-pressure type. The complete accumulator plant was designed by me. At Auckland Park Colliery, for the same company, I have installed two Rateau turbo-alternators, the electrical ends being built by Siemens Bros., one of the machines being of the low-pressure type, and the other of the mixed-pressure type. As the main contractor for the whole of this important contract, I think that prominence should be given to my name in view of the fact that the notice which you have inserted would lead to another opinion being formed."

Trade Announcements.—We are informed that Messrs. T. Jacob and E. W. White have taken over part of the business of Messrs. F. A. Glover & Co., Ltd. (in liquidation), including the contract for lighting and power work at the Royal Agricultural Hall, and are carrying on the business in the name of Jacob, White and Co., Ltd. Registered office, King's House, King Street, E.C. Mr. T. Jacob was a director of Messrs. F. A. Glover & Co., Ltd., and Mr. E. W. White was chief engineer to the company for 15 years.

The address of Messrs. Downes & Davies is now 1 to 3, Stanley Street, Liverpool.

LIGHTING and POWER NOTES.

Acton.—At the last meeting of the Council the chairman adversely criticised the action of the Electricity Committee in handing over the work of the undertaking, the use of the stores, and the services of Mr. Blair, chief engineer, to the company, before the lease had been signed. A letter was read from the Metropolitan Electric Supply Co., enclosing deposit receipt for £2,500. The communication went on as follows:—"With regard to your accountant's letter of the 12th inst. enclosing statement of account, showing what in the opinion of the Electricity Committee is the amount refundable to the Council, I am instructed by my board to inform you that they have received a report from their auditors, Messrs. Deloitte, Plender, Griffiths & Co., on this statement, wherein many questions are raised which will require to be dealt with before a settlement can be arrived at. The two most important of these questions are, firstly, in regard to the item of £5,710 18s. 5d. which appears in your Council's balance-sheet of March 31st, 1911, representing the unexpended balance of cash borrowed for capital expenditure, in respect of which it appears clear that unless it is the intention of your Council to undertake the liability for interest and sinking fund charges, this balance should be handed over to the company; and, secondly, to the company being debited with the payment of interest and sinking fund charges accrued prior to the transfer of the undertaking, which my board are unable to entertain. For these reasons my directors are unable to see their way to make any payment on account of this statement at the present time." In conclusion, the letter stated that the proposed rent of £200 per year for the land on which the sub-station is erected was out of all proportion to its value, and unless the Council modified their views on this matter, it would have to be referred to arbitration. The chairman said that the Council had laid down that the company must pay for all the loose stores. The contention of the company now was that as the stores were not bought out of revenue, but out of loan, the company in paying the loan charges and paying for the loose stores, too, would be paying twice over. He again referred to the blunder which had been made in handing over the undertaking and stores before the lease was agreed to and signed. The company had actually got the Council's stock, and were selling it every day, and the price had not yet been fixed. Mr. Schultess-Young said he believed the arrangements would be found to work alright. The company's letter was referred to the Electricity Committee. The accounts for the year ended March 31st last as prepared by the accountant were submitted in abstract. They stated that the result of the 12 months' working was a deficiency, after providing for instalments of loans and interest, of £1,354, against a deficiency of £675 for the previous year. The total income for the year was less by £300 than in the year 1909-10, and the total expenditure was £378 more. The most unsatisfactory feature exhibited by the statement is the decrease in the total number of units sold to consumers. The units supplied for power and heating show an increase over the previous year, but this increase is more than counterbalanced by the falling off in the sales for lighting. This falling off is attributable to the discontinuation of the outside electric lighting by a large percentage of the tradesmen in the principal thoroughfares. The lighting units supplied to private residences show a satisfactory increase. The total number of units sold during the year was 760,696, as compared with 769,813 during 1909-10.

Burnham (Somerset).—The U.D.C. has decided to engage Mr. Trentham at a fee of £5 5s. to advise as to the Council applying for a prov. order for E.L. This step has been taken owing to the intimation that an order is being applied for by a private person.

Continental Notes.—France.—How much the rivers in the French Alpine district are utilised for electric power generating purposes is shown by recently published statistics. All the larger rivers, to the number of 20, besides several small watercourses in the department of the Isère, are laid under contribution. The River Durance heads the list, with a maximum capacity of 93,000 H.P.; the Arc follows with 88,345 H.P.; the Romanche with 59,810 H.P.; the Arve with 54,880 H.P.; and the Rhone with a comparatively modest 22,000 H.P.; the Arly following closely with 20,300 H.P. The Guiers stands for 14,760 H.P., and the Isère for 13,500 H.P., sundry other smaller rivers in the department of the same name aggregating 30,830 H.P. The Brida and the Doron figure for 10,000 and 13,500 H.P. respectively, the remainder are below 10,000, the smallest contributor being the Lez, with 90 H.P. The aggregate capacity of these works is 474,125 H.P.; but this is altogether thrown into the shade by the capacity of the works newly projected, which total over 1,000,000 H.P., viz., those of the Durance, 400,000 H.P.; the Rhone, 300,000 H.P.; the Isère, 200,000 H.P., and the Varo, 85,000 H.P.—*L'Ingegneria Ferroviaria.*

A new company has lately been formed in Tart-le-Bas (Cote d'Or), with a capital of £30,000 and the title La Compagnie Electrique de Bourbogne, to establish and work a central electric lighting station in the district.

Germany.—According to Reuter's representative at Berlin, a fire broke out on August 17th in the main cable tunnel of the Essen-Rhenish-Westphalian Electrical Works, cutting off the current throughout the district supplied by the works. The large mines and works immediately took steps to minimise the inconvenience thus caused by diverting the electric power still available to the points chiefly affected.

Spain.—A co-operative electric lighting company has just been formed at Carabancheles Bajo, with the title La Sociedad Cooperativa Electricidad de los Carabancheles, to establish a central electric lighting station in the town.

Austria.—A scheme for the utilisation of the water power of the Danube has been drafted by the engineering department at Pressburg. The river will be tapped near Theben. A canal will be constructed through the lowlands discharging itself again into the Danube below Pressburg, at which spot the power station will be built with a capacity of 70,000 H.P. The details of the scheme and the quantity of water drawn from the Danube have been so arranged, as to leave unaffected both the navigation of the river and the use of the winter haven. To ensure the sustained capacity of the works it is contemplated to provide a steam reserve. It is also intended to establish an auxiliary accumulator station in the hill country near by. The main power station will generate 300,000,000 KW.-hours yearly, which will be distributed in the region lying between and in the cities of Pressburg, Raab, Buda-Pesth and their immediate environs. For the realisation of the scheme an influential syndicate has been constituted.—*Der Elektrotechniker.*

The firm of Albin Buss & Co. contemplates the construction of a dam across the Drau River above Faal, with a view to the erection of a generating station. It is expected that a fall of 14½ metres will be created, whereby 250,000 H.P. may be produced. This it is proposed to sell to the Steiermark Elektricitäts Gesellschaft, which has come to the end of its resources, also to the electric works at Lebring. Negotiations have also been opened with a view to the establishing of certain branch industries near railways which will need supplies of current.—*Der Elektrotechniker.*

The dual scheme of founding a steelworks and building a hydro-electric station is contemplated by the electrical contracting firm of Jaquet & Rentel, of Salzburg. The waters of the Ache River are to be laid under contribution, whereby an estimated maximum production of 7,500 H.P., and an average production of 2,000 H.P. is anticipated. The station is to be erected at Kitzbühel.—*Der Elektrotechniker.*

Sweden.—According to the *Revue Pratique de l'Electricité*, an attempt of the Swedish Jernkontor, or Association of Swedish Ironmasters, to manufacture steel by means of the electric furnace at Trollhätten Falls Steelworks, has not proved a success. The Association began work seven months ago, and anticipated being able to produce 7,500 tons of ore yearly, or 23 tons per day of 24 hours. No output has yet been made. The United States Consul at Gothenburg, Mr. Fuller, sums up the situation thus:—"The manufacturers seem to be of the opinion that the trials show the process is impracticable. In consequence, they are about establishing new works. It is hoped that by the end of 1911 four electric furnaces at least will be at work, with an output of 30,000 to 35,000 tons a year and a consumption of 12,000 H.P."

(*Continued on page* 303.)

THE B.T.-H. CO.'S TUNGSTEN LAMP WORKS.

n Wednesday, the 16th inst., a special Press visit was ranged to inspect the B.T.-H. Co.'s new lamp works at ugby, and to see the new drawn wire tungsten lamp which at firm intend to make one of the features of general umination during the coming winter. On reaching the orks, small personally conducted parties started on their urs of inspection; the group comprising the representa-es of the technical Press was fortunate in having as its urteous guide, Mr. McNeill, the head of the lamp depart-ent, who took the visitors in detail through the various ocesses of the work.

As to the actual details of glass manipulation in the rious processes of making the stems, securing these to the be, fitting in the supports, sealing the leads and bulbs, tle need be said. Deftly done, these operations are always etty to watch, and we can say without any hesitation that e neat dexterity of the staff of 500 hands in this depart-ent reflects both credit on their training and on their neral receptivity. Of the incidental operations on the ss manipulating side, mention must be made of the neat vice whereby the solution of red phosphorus is supplied to e inside of the sealing tubes. This solution of red phos-

Special attention is given to obtaining a good vacuum, both from the point of view of the subsequent life and efficiency of the lamp, and to save actual waste of filament. To this end the ordinary vacuum test, by connecting up to an induction coil, is made on each group of lamps when nearing exhaustion before switching the current on to the filament. The process of exhausting each lamp bulb takes about 15 minutes. The first or preliminary stage is performed by a main vacuum pump common to the whole of the shop. The second stage is by the rotary vacuum pump, provided for each operator's bench. Finally, another rotary pump, common to each of the three operators forming one group of benches, reinforces the second pump and provides a vacuum within about 1 to $1\frac{1}{2}$ per cent. of the barometric reading at the time.

Very detailed testing and checking at intermediate stages takes place. As the lamps pass from section to section of the works, each individual part is tested.

A drastic over-voltage test, 25 per cent. in excess of the rated voltage, is applied to each lamp to secure the necessary ageing effect.

Mention must be made, too, of the corrugation of the



Interior of the Lamp-Testing Department, B.T.-H. Lamp Works, Rugby.

prus in alcohol is, of course, used to facilitate the removal the final traces of air from the heated bulbs. A small jet the solution is forced from an orifice in a revolving vertical pe into the sealing-tubes which are placed over it in turn.

The point of chief interest, however, is the filament itself. e two copper wires of the upper frame, which are a tinuation of the leading-in wires, have the ends to which filament is joined made of a tubular shape. An exact gth of the tungsten wire is cut off a reel. One end is ced in the tubular recess in one of the leading-in wires ich is squeezed around it: the drawn filament is then ped in succession over the hooks on the supporting frames, d the other end of the filament squeezed into the tubular ess in the other leading-in wire. Intermediate welded nts, necessitated by the short lengths of the ordinary irted filament, are thus entirely obviated. The filament s a much greater natural flexibility apart altogether from fact that these drawn wire filaments possess a tensile ength in tons per square inch approaching that of mild el. The supports are slightly increased in number, 10 nts being used on 200-volt lamps and six points on -volt lamps.

new wire filaments for 200-volt lamps. There are about 25 such to the inch; these save both space in the globe, and probably also will be found to increase the life of the lamp when subjected to concussion or vibration.

Before leaving the lamp rooms, some striking and brilliant examples of over-running were witnessed. First some 205-volt lamps were run up to 300 volts, and then some 115-volt lamps were raised to the same pressure without breakage of filament. On our way to see the plant where hydrogen is produced electrolytically, we were taken through the shops previously used for the manufacture of the pressed or squirted filaments. These were silently eloquent of the pace at which modern industrialism in general, and technical industrialism in particular, now moves. The mixing room in which the powdered tungsten was mixed with its binding agent, the drying room, the powerful presses and huge complication of balances, whereby the short and relatively fragile lengths of squirted filaments were graded, each length separately according to their weight in fractions of a milligramme, all stood idle, and worth not much more than their scrap value. Every advance or each new discovery, and the application of that discovery or advance to manu-

facturing conditions, brings with it its bill in the shape of plant rendered obsolete, and the problem of its application in training labour for fresh operations. This is an obvious truism, no matter whether the problem solved is one whose immediate solution was expected or not. It was with very melancholy pride that Mr. McNeill showed his guests over departments whose interest, so far as the B.T.-H. Co. is concerned, is now historical, yet which some few months ago were not only in full swing but were regarded as secret so far as visitors to the works were concerned.

Carbon filament lamps are an old story—like many threatened industries they seem to have the prolonged life of threatened men. This branch of the works is now more fully occupied than ever in turning out lamps at the rate of over one million per annum. The output capacity of the works in regard to the new tungsten wire lamp is about 30,000 per week. The department, it may be observed, is an example of decentralisation, being self-contained with its own tool room and machine shop.

Packing, too, receives attention. Each lamp after being wrapped in cotton wool is encased in its separate cardboard box. Blocks of 25 or 50 boxes are packed in wooden cases with straw below, above and around each block of 25 cardboard boxes.

The new tungsten wire lamp is to be put on the market in 50 and 60-watt sizes for all voltages from 200 to 260, and all standard sizes from the 10-watt 25-volt lamp to the 60-watt 130-volt lamp.

The 17-watt 100—130-volt lamps, and the 32-watt 200—260-volt lamps, and all other sizes of Mazda lamps will also be made with drawn-wire filaments, but will not be ready for delivery before October 31st, 1911.

THE SWISS TOUR OF THE INSTITUTION OF MECHANICAL ENGINEERS.—III.

By our special commissioner.

We begin this article with a view (fig. 1) of the 20 generators at the Rheinfelden station. These were supplied by the Oerlikon Co., and their dimensions have already been given in Article I in our issue of August 11th, the limits of which did not permit of the insertion of this illustration. They yield a total of of 17,000 h.p.

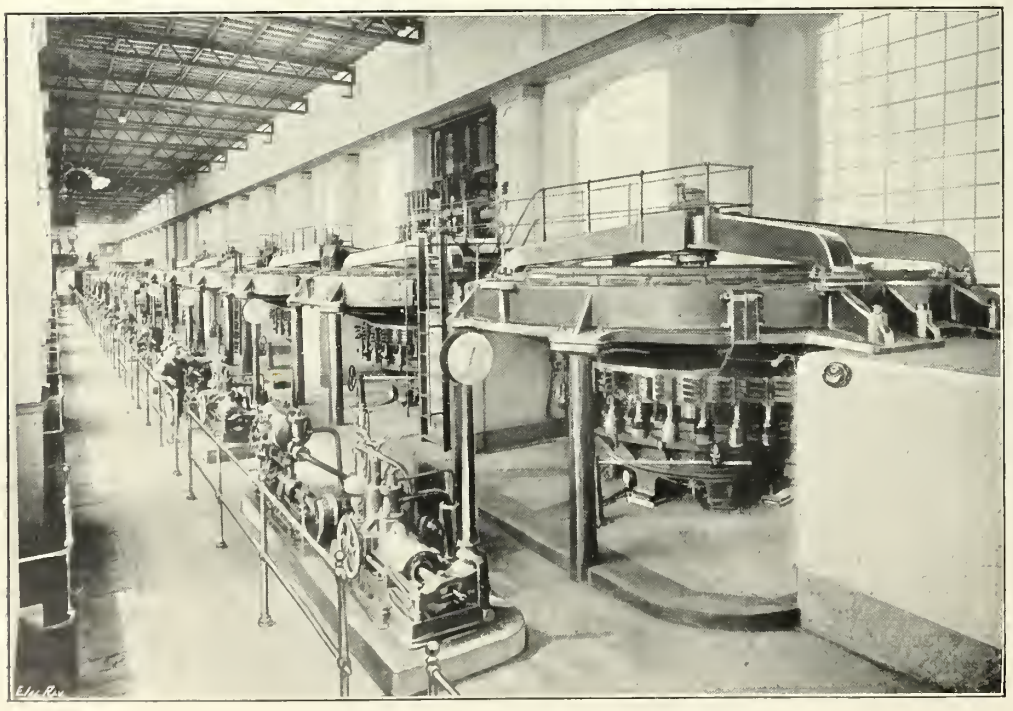


Fig. 1.—Interior of the Rheinfelden Power Station.

The same firm supplied much of the plant at station B of the Schaffhausen Works, described in Article II, publish August 18th, as also the switchboard and exciter sets station C. Fig. 2 is interesting as showing the gener style of control switchboard. It represents the board station B.

This article is devoted to the Beznau Works, visit by a very small party on July 28th, under the guidan of Herr Schenker and Mr. Eborall. Fig. 3 is a photograp of the power house, containing 13 sets of turbines a

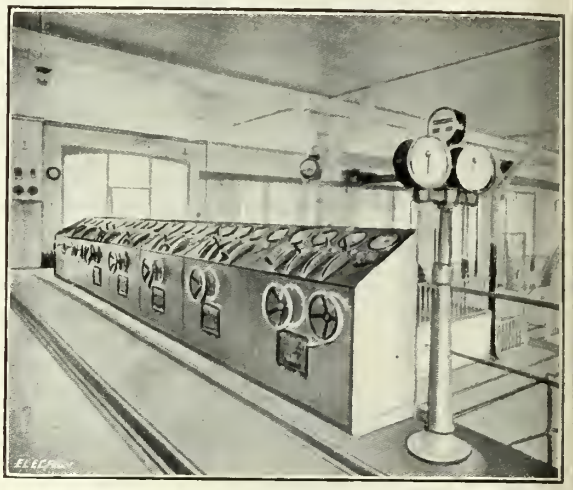


Fig. 2.—General Type of Control Switchboard.

generators. Two of these, seen in the foreground, a exciting machines of 400 h.p. each, running at 85 r.p. and 150 volts. Each is capable of exciting all the ma generators. The other 11 run at 66⅔ r.p.m. and 8,0 volts. They are Brown, Boveri three-phase generators of periodicity and 1,000 h.p. each, driven by Francis turbin built by Th. Bell & Co., of Kriens. There is, agai a steam reserve plant of six Dürr boilers supplyi steam of 180 lb. pressure and 300° C. superheat to t Brown-Boveri-Parsons turbo-generators, each of 2,400 k capacity at 1,500 r.p.m. These generate three-ph current at 8,000 vo and 50 periodici Each has an exci on its own sha overhung beyond t bearing at the ger rator end. The ere tion of the wh plant was complet in November, 1906.

Fig. 4 is a plan this power house. T boilers are at the e treme right in the pa set at an oblique ang to the rest, and t steam turbines lie ne to them. The switc board is at the extrer left, and the conti board overlooks t whole length, cluding the stea turbines. Fig. 5 a section of t switchboard, which of beautifully simp neat and systematica arranged character. will be noticed th the transformers a placed in the basemei There are seven large oil water-cooled transformers 2,000 kva. capacity, raising the pressure from 8,000 27,000 volts. Four other small transformers lower the v tage to 250 for lighting and for crane and sluice motors,

Three of these motors, each of 50 H.P., drive oil-compressing pumps, each of which feeds 600 litres per minute at 450 lb. pressure into the oil accumulator. This supplies pressure oil throughout the works for various purposes, the chief being to drive the servo-motors, which operate the governance of the turbines. The whole weight of the turbine, generator and shaft hangs upon ring bearings in the "umbrella" cover over the generator; and to force oil through these bearings requires a heavy pressure. In ordinary working the oil pressure oscillates between 375 and 420 lb.

The main generators can maintain a 50 per cent. overload when the three phases are equally loaded. Under actual test they gave about 95 per cent. efficiency. The turbines are of two kinds. Those designed mainly for lower falls, which occur with greatest flow and greatest horse-power in the water, are constructed to yield the greatest possible horse-power, namely, from 750 to 1,000, without critical importance being attached to their efficiency, which lies between 60 and 70 per cent., according to the gate opening. There are five of these turbines, whose main lines of construction are shown in fig. 6. They have each three runners, or working blade wheels, the lower two having opposed upward and downward discharges, so that the water pressures upon them are nearly balanced. The topmost runner discharges into the same draught tube as the upper one of the lower pair; and the water pressure upon this topmost one balances a part of the dead-weight of the three wheels and their shaft. These runners have open-tipped blades.

The six high-water turbines are of the type shown in fig. 8. They are designed to utilise the minimum water flow with high efficiency, and on test they gave 72-76 per cent. efficiency. These also have each three runners arranged as in the others; but the lower edges of the blades are here sheathed in, this being necessary for high efficiency with considerable water velocity. In both types the regulation is by a more or less oblique setting of the hinged inlet guide-blades, operated by an oil servomotor started into action by a centrifugal governor.

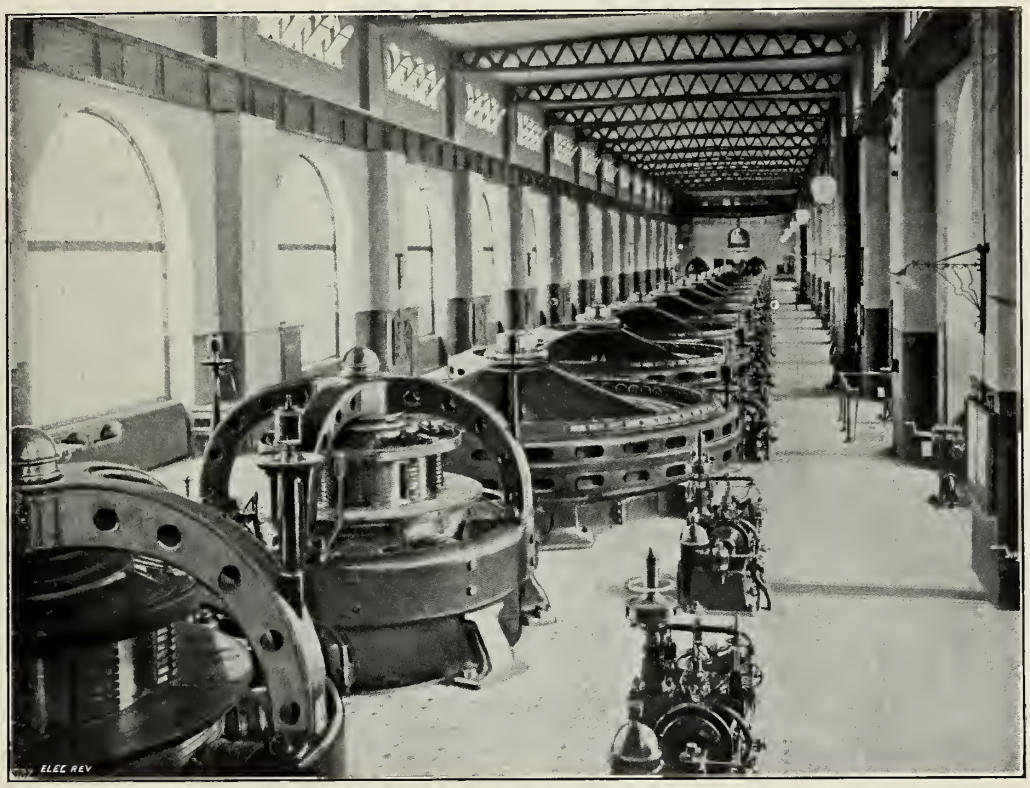


Fig. 3.—The Beznau Power Plant of 20,000 H.P.

Fig. 7 shows one of the 900 KW. three-phase generators built by Brown, Boveri. They have 90 poles on the rotor, with the collecting brushes for the exciting current arranged underneath, but easily accessible from the service floor of the power house. The leads from the stator go straight down through the floor to the galleries underneath, along which are laid the bus-bars, the connections being protected by fuses of liberal dimensions. These generators have 91 per cent. efficiency yielding single-phase current without induction in the circuit; 90½ per cent. with three-phase inductive load and cos ϕ = ·75; and 92½ per cent. with inductionless resistance.

The scheme of electrical connections includes two 8,000 and 25,000-volt ring circuits, with connections to the exciter sets, the 11 main water turbine generators, and the two steam turbo-generators. There are four 25,000-volt outgoing lines to Upper-Seebach, Lenzburg, Lower-Seebach and Rheinfelden; also a 48,000-volt line to Löntsch. There is provision for six 8,000-volt outgoing lines, of which five only are at present in use, namely, to Wehr, Stilli, Döttingen, Baden, Beznau.

The power house is built along the bank of the Aar, the tail-races into the bed of this river being direct and very

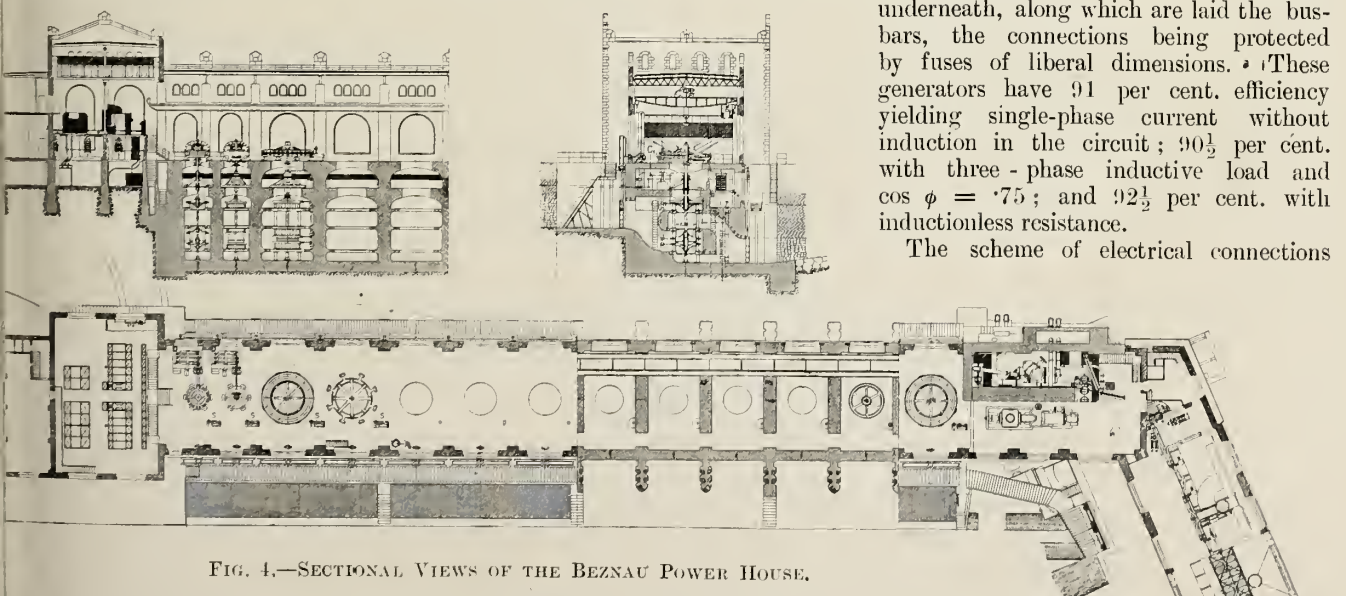


Fig. 4.—Sectional Views of the Beznau Power House.

short. It is the water of the Aar which is used; but the supply canal starts from a very short distance below the junctions of the Limmat, Reuss and Aar, so that it might be more correct to say that this station utilises the water of all these three rivers. The quantity of water taken through the turbines varies from 170 to 310 cb. m. per second.

Across the Aar is built a weir with seven regulating sluice gates each 15 m. wide, at the upper end of a long bend in

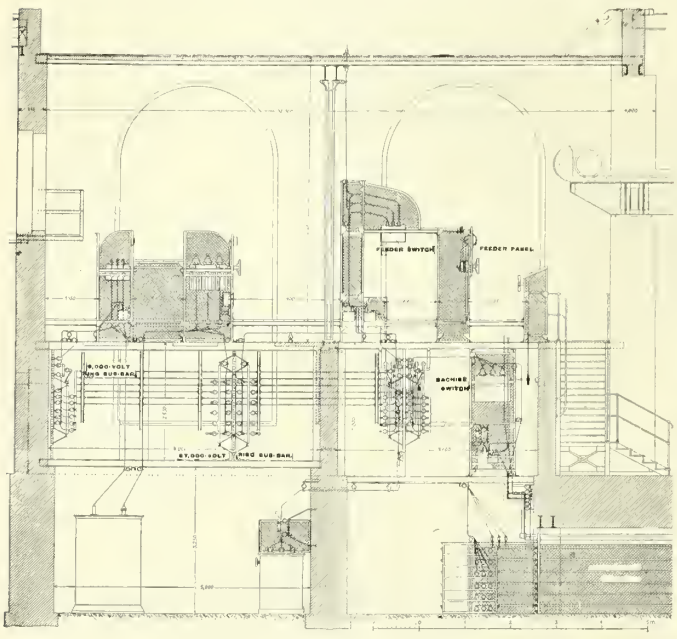


Fig. 5.—Switch Gallery, Beznau.

the river. The supply canal runs in a straight line from this point to the power house, and is 1½ km. long. The inflow into it is controlled by 15 sluice-gates, and at its lower end heavy obliquely-set iron gratings prevent the entrance into

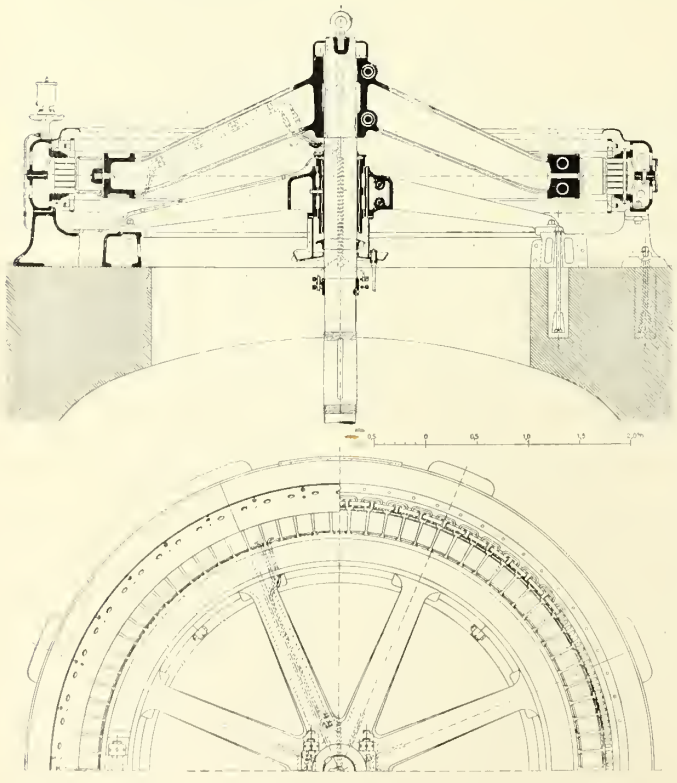


Fig. 7.—Sectional Views of Brown, Boveri Alternator.

the wheel pits of flotsam, ice, &c. The canal has a flat bottom width of 12 m., and has a uniform down gradient of 1 in 66.

Beznau is the centre of a very wide distribution of electrical energy. Towards the west it delivers current as far as Rheinfelden, 32 km. distant, towards the south to Schöftland and Rheinach, a distance of 36 km., and towards the south-east to Zürich, 30 km. away, Winterthur 36 km., Hasli 56 km., Grüningen 50 km., and Glarus 85 km., all these distances being measured on the map as the crow flies. It delivers to no less than 14 distant sub-stations. The demands upon it have been steadily and rapidly increasing, and have long since exceeded the power obtainable from the Aar water.

The steam plant at Beznau has, therefore, for some years been no longer a reserve, but has become an integral part of the normal supply plant. But this also has not sufficed to meet the growing needs of this wide district. For this reason the great scheme of damming the Klönthaler See and so impounding the very irregularly flowing water of the River Löntsch was conceived, and has been most magnificently carried out. These works are in the neighbourhood of Glarus, and for some months past they have been in working connection with Beznau. They will be described and illustrated in our next article.

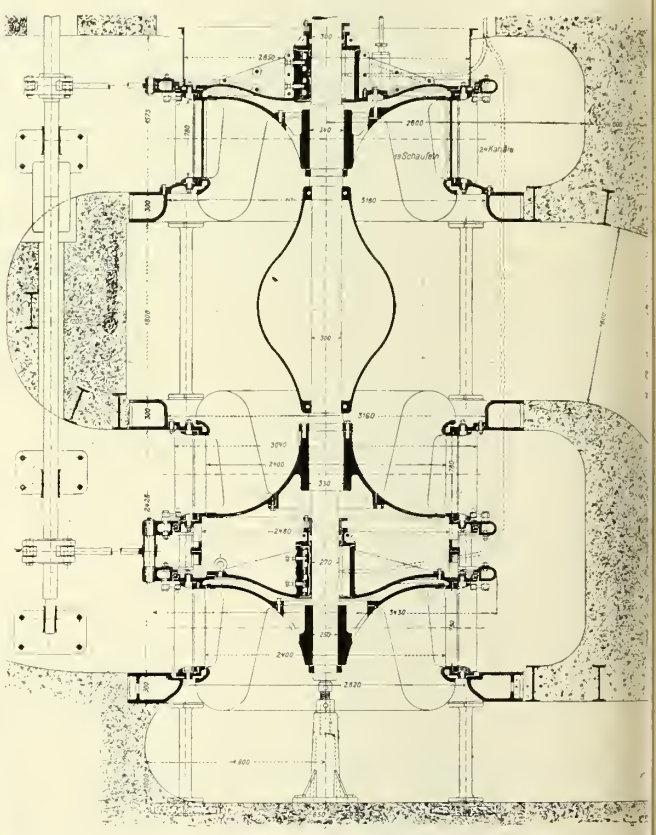


Fig. 6.—Turbine for Low Fall and Great Water Flow.

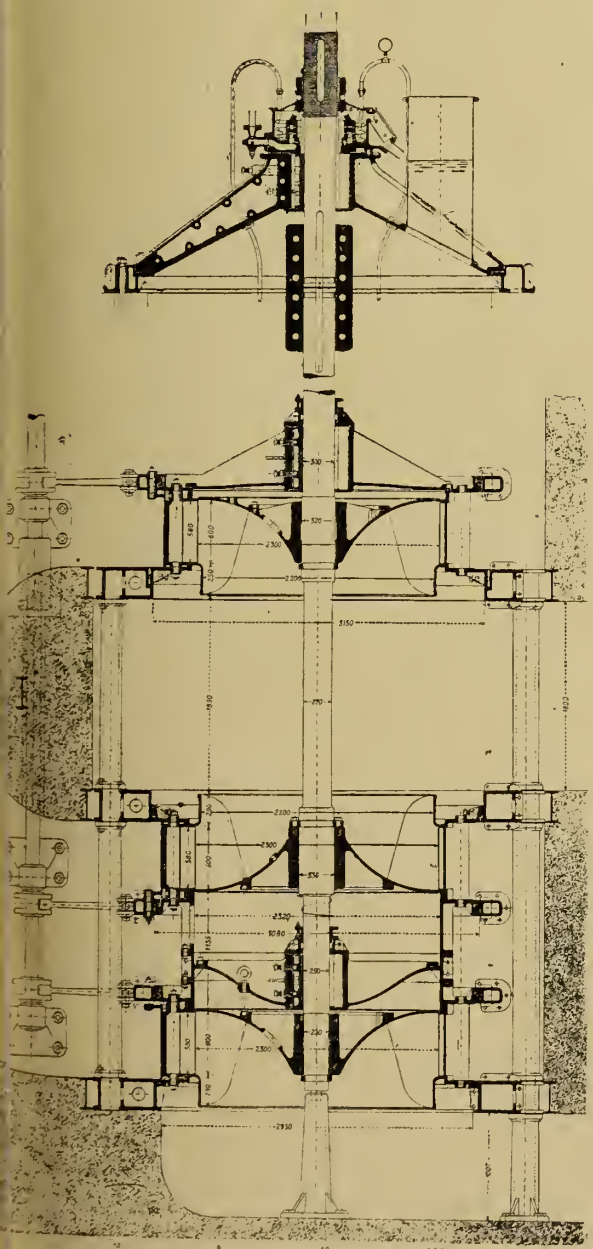
The humming noise from these modern water-turbine electrical sets is very different from that we are familiar with in England from steam turbo-generators. It is much quieter and much more musical. Each machine has its own characteristic song, which can be listened to best with one's ear close down upon the casing. Each operation of the governor is distinctly audible in the sound; the machine groans and wails when it is worried by sudden alteration or fluctuation of load. Experiments have been made upon the cause of the noise. It is proved that it is *not* due to any mechanical beat of solid parts running in contact with each other. It is conclusively proved that it is wholly pneumatic and due to the air currents through the ventilation ducts of the generator. When the outlet ventilation holes in the casing are covered air-tight so as to stop the ventilating currents, the machine runs dead silent. The air passes through the ducts in rhythmic puffs. It may, therefore, be possible in future to so shape these ducts as to eliminate the rhythmic character of the air flow and make it smooth and even. When this is done, the machines will become completely noiseless or practically so.

LIGHTING and POWER NOTES.

(*Continued from page* 298.)

Barnes.—The U.D.C. has decided to extend the mains the Limes Field Estate, where 92 maisonnettes and six blocks of ts are to be built and wired.

Cleethorpes.—The U.D.C., which has arranged to take ctricity in bulk from the Tramway Co., has decided to lay oles from Pelham Road to Park Street along Grimsby Road, at an imated cost of £4,000.



F. 8.—Turbine for High Fall and Small Water Flow.
(See page 301.)

Darwen.—A L.G.B. inquiry was held on the 22nd inst. n an application by the T.C. for sanction to borrow £7,600 in o nection with the electricity undertaking. It was stated that the ication was necessary by reason of the growing power demand. Corporation had entered into an agreement to supply a mini- n of 120,000 units per annum to a new colliery, with a probable e and for 150,000. In addition there were several other concerns e usly considering electrical driving in their works, which, if d ted, would mean the further increase of 100,000 units per n m. A Mr. John Fish opposed the application.

Dublin.—The L.G.B. in sanctioning the portion of the of £128,129 for the purpose of carrying out extensions of the rical works, pointed out that the contracts have been arranged important works in a somewhat loose manner. The Board authorised the raising of £100,000, including the £50,000 already sanctioned, and is of the opinion that before sanctioning the borrowing of any amount beyond that, a clear statement of expenditure and definite proposals, supported by plans and specifications and estimates for any further works should be submitted.

Ford.—Electric lighting is being installed at the village of Ford, and current will be supplied from Lord Joicey's power station at the Castle. A number of houses and the reading room have already been wired.

Harrogate.—The T.C. has applied to the B. of T. for an order to supply current outside the borough to property at Rossett Green belonging to Mr. Norman Rae: to houses being erected on the Firs Estate, Leadhall Lane, for Dr. J. Haslam: and to Crimple House, for Mr. McEwan.

Hindley.—The B. of T. has informed the U.D.C. that the question of revoking the E.L. order has been deferred for a year from July 13th, 1911.

Hoylake.—An inquiry has been held by the L.G.B. relative to the application of the Hoylake and West Kirby U.D.C. for sanction to borrow £2,000 for electric light improvements.

Holmfirth.—The Council recently had a prolonged discussion on a proposal to apply for a prov. order for electric supply for the district. The gas supply is in the hands of a private company, and the proposal is to buy electricity in bulk from the Yorkshire Electric Power Co. It is proposed to take the opinion of the ratepayers on the subject.

Kettering.—The U.D.C. has received from the L.G.B. sanction to raise a loan of £1,057 for electricity purposes.

Launceston.—At a meeting of the T.C., on Monday, correspondence was read from Mr. Purves, on behalf of the Launceston District Electric Supply Co., asking the Council to permit certain alterations in the laying of cables in the town, to enable the company to put overhead wires in Windmill Lane, Northgate Street and Horse Lane, and underground cables in Castle Dyke, and submitting details of steel poles, with arms, as proposed to be used. It was agreed that the Council should meet Mr. Purves.

Liverpool.—In connection with the disturbances in the city last week-end, the stokers at the Lister Drive station struck work, and with a view to keeping a certain amount of street lighting going, the services of volunteer stokers and labourers, consisting largely of professional men, were enlisted, the works being guarded by troops. The effort was fairly successful as regards the street lighting, but the supply for ordinary lighting and power purposes, and to the tramways was much curtailed. An appeal to the captain of the cruiser anchored in the river for the loan of naval stokers was unsuccessful.

Maidstone.—The T.C. has re-arranged its system of public lighting by substituting Osram lamps for arcs. The estimated annual saving is £191 10s.

Portsmouth.—The T.C. has decided to light the road from the Obelisk, London Road, to Ports Bridge, by means of about 20 1,000-c.p. flame arc lamps.

Stockton-on-Tees.—The T.C. has adopted a new scale of charges for current for power, viz.:—Below 150 units per quarter, 2d. per unit; 150 to 500, 1½d.; 500 to 5,000, 1¼d.; 5,000 to 20,000, 1⅛d.; beyond, 1d.

South Africa.—The Cape Town Council is inviting tenders for the erection of a sub-station at Plein Street, Woodstock. This station is intended for the supply of energy to Woodstock Municipality, which at present is supplied direct from the Cape Town central station.

The lighting of Sir Lowry Road is to be improved by replacing the present street lamps of 50 c.p., by lamps of 200 c.p. The new lamps are to be erected along the centre of the roadway suspended on wires stretched between the tramway poles. The annual cost will be increased by about £45.

Cradock, Cape Province.—The T.C. is submitting plans and specifications for the electric lighting of the town, prepared by Mr. Holder, electrical engineer to the Port Elizabeth T.C., to the Government Electrician, Cape Town, for his advice.

Whitworth.—The B. of T. has deferred the question of revoking the E.L. order until November 16th, and has requested the U.D.C. to inform it what arrangements are proposed for carrying out the order.

Yorkshire.—The Yorkshire Electric Power Co. has applied to the B. of T. for consent to use overhead lines for the transmission of energy at a pressure of 10,000 volts. Seven lines are scheduled under the application, the districts affected being the urban areas of Emley, Skelmanthorpe, Clayton West, Dodworth, Penistone and Darton, and the rural area of Penistone.

TRAMWAY and RAILWAY NOTES.

Continental Notes.—Austro-Hungary.—It is reported from Buda-Pesth that the Siemens & Halske Co., of Berlin, has submitted a proposal to the city offering to construct an underground electric railway under the principal streets in Buda-Pesth, and representatives of the firm have already entered into negotiations with the Mayor on the subject. It is further stated that the latter and the general manager of the municipal gas works will shortly proceed to Berlin to confer with the principals of the company on the matter. A similar scheme is also reported from the Hungarian capital, in the sense that the Mayor is declared to have granted a preliminary concession to Herr Michael Kugler, formerly chief engineer to the Hungarian State Railways, for the construction of an underground line to be operated by electricity from Ofen under the Danube to Pesth, and New Pesth, and thence back to Ofen. The preliminary works have already been put in hand by, it is said, the contracting firm of Pethick, Dix & Co., of London. In this connection it has to be remembered that Buda-Pesth was the first city on the European Continent to start an underground line, which was built by the Siemens & Halske Co. in 1895, is over two miles long, and leads from the Gisela Platz, under the Andrassy Strasse, to the Stadtwalachen. The railway serves more for pleasure than for business purposes, and is worked by single cars at comparatively long intervals. It would, however, be possible to extend the line to the railway stations and the populous suburbs, and it is probable that the Siemens & Halske scheme has this object in view.

France.—A new company is in course of formation in the Departement des Doubs, with the object of constructing an electric railway from Nijon, through Trelex, Genollier, Giyrine, Le Murdes, Arzier and Saint Cerque to the French frontier at La Cure, and to work the line La Cure to Morez to be constructed by the Department of the Jura. The commerce, manufacturing industries and the tourist traffic in this region are considered of sufficient importance to justify the scheme, which will have to face no competition; the line for 100 km. from Bellegarde to Pontarlier is the only one crossing the Jura mountain chain, whereas northward of Pontarlier for 100 km. to the German frontier the Jura is crossed by no fewer than four railway lines. The line will be electrically-worked, using single-phase current at 8,000 volts. The estimate based on the surveys allots 4,300,000 fr. for the Swiss line and 1,350,000 fr. for the French line. Subscriptions are now being invited from the communes and others locally interested for the 500,000 preference shares, forming part of the 700,000 total shares of the company set apart for local subscription, and a response is expected of such a nature as to allow of a beginning of the construction works at an early date.—*Revue Pratique de l'Electricité.*

Switzerland.—A meeting of delegates from Upper and Lower Ajoie has been held at Porrentruy with the object of introducing electricity into the district. A scheme prepared by a Berlin firm was laid before the meeting by the engineer representative, and discussed. It is proposed to construct an electric railway between Bressaucourt, Courtedoux, Damvant, Fahy, Buix, and, later on, Cœuve and Bournevesin, and to supply light and power to the places named. A committee, comprising the mayors of six of the places named was appointed to go into the matter, and invite propositions from other sources.—*Revue Pratique de l'Electricité.*

Darwen.—Owing to a shortage of coal at the electricity works, fewer cars were run on Saturday last, and it was expected that several other towns would be similarly affected.

Dublin.—During the disturbances of the night of the 19th inst. a big crowd of roughs assembled and marched in the direction of the electric power station of the Great Northern Railway with the object of wrecking it and destroying the plant. Fortunately, a detachment of soldiers came upon the scene, and the crowd beat a precipitate retreat. Some of them were arrested.

East Lancashire.—The projected East Lancashire light railway scheme has been before the public for many years, but nothing has yet been done. Great Harwood Council considered a letter, on August 12th, from the Light Railway Commission, stating that the powers of the company under the Blackburn, Whalley and Padiham Light Railways (Revival and Extension of Time) Order, 1911, continued in force as regarded the compulsory purchase of lands, for two years, and as regarded the completion of works, for three years, from May 10th, 1911. The clerk was instructed to inquire from the promoters what action was being taken in the matter.

Japan.—The electric tramways of the Tokio Railway Co., in the Japanese capital, were taken over by the municipal authorities of the city of Tokio on the 1st inst., and are now being worked as a municipal undertaking. A thorough investigation is at once to be made with a view to the speedy completion of the unfinished lines and the improvement of all the rolling stock. It is also reported that the municipal authorities propose to abolish some 13 to 14 miles of the existing lines, and to construct a new line to Shinjiku, and also a line from the Central Railway Station in Tokio to Uyeno and Asakusa. Mr. Kodama, chief engineer to the Tokio Railway Co., and the chiefs of various sections of the company, have been appointed as municipal officials.

According to the latest return of the Electric Bureau of the Japanese Department of Communications, the number of companies and private individuals carrying on an electrical business in Japan, including electric traction, at the end of June last, was 367, representing a capital of £45,084,703. Of this number 216 have already actually commenced business, with an aggregate capital of £33,533,563, while 151, with a capital of £11,531,150, have not yet commenced operations.

Korea.—The Korean Gas and Electric Co. has filed an application for a charter for the construction of a light electric railway from Tongnai to Taiku *via* Ulsan and Phohang, a distance of 108 miles.

Liverpool.—Owing to the restricted output of the Corporation power stations under strike conditions, the Corporation tramway service was practically suspended on Friday and Saturday last; the tramway employés remained loyal to the Corporation with the exception of about 250 of the uniformed staff and 350 men at the car works, who left work in sympathy with the strike movement.

No settlement as regards the general strike differences in the city, involving over 60,000 workers, had been arrived at on Wednesday, the bone of contention apparently being the comparatively small section of uniformed tramway employés who left work and have not been reinstated by the Committee. It is understood that the places of these men have been filled, and that the 1,700 tramway men who remained at their posts have, in their turn, threatened to leave work if the strikers are brought back. On Wednesday evening Mr. G. R. Askwith, of the B. of T., took the matter in hand with a view to effecting a settlement.

London.—A mass meeting of the L.C.C. tramway men on Saturday last decided to take a ballot on the question of striking, during the week. The railway strike on Friday and Saturday last did not greatly affect the London electric railway services except in one or two instances, such as the Brighton Co.'s electric lines, on which the electric service was entirely suspended. Otherwise, an ordinary or not unduly restricted service was easily maintained. The Lot's Road power station and many of the railway stations were guarded by police and soldiers.

Morecambe.—The T.C. has obtained the sanction of the B. of T. to loans of £4,617 for the doubling of the tramway track to Bare, and £800 for additional cars.

North-Eastern Electrical Lines.—At the last half-yearly meeting of the North-Eastern Railway Co., the chairman in answer to shareholders, stated that although well satisfied with the Tyneside electrical lines, the directors were not convinced that similar results would follow electrification of the lines south of the Tyne.

Oldham.—On Friday morning last, the tramway men struck work; the alleged grievances have previously been referred to in these columns. The strike dislocated the Manchester and Oldham services, and came at a time when the railway men were also out. The men resumed work on Tuesday again, as a result of certain concessions made by the Tramways Committee, but the decision to resume was only carried by a majority of 24 votes, and great dissatisfaction exists among the minority.

Salford.—In order to coerce non-union men to join their Union, the Salford tramway workers have announced the intention not to work with non-unionists after the 31st inst.

Sheerness.—An extension of the local electric tramway from Sheerness to Minster-on-Sea is under consideration.

Stalybridge.—B. of T. Report.—The report in connection with the tramway accident which occurred on Ditchcroft Hill, on June 5th, has been issued. From this it appears that the car was of the single-truck double-deck type, fitted with the Westinghouse magnetic brake, which latter, as also the hand brake, was in no way defective. In fact, the Inspector comes to the conclusion that the driver too forcibly applied his hand brake at the compulsory stop at the top of the hill, causing the wheels to skid and himself to lose control. It appears highly probable that he then tried to apply the magnetic brake, without releasing the hand brake—and after the accident, the catch was found inserted in the ratchet wheel on the hand-brake spindle, thus holding the brake blocks permanently on the wheels. The accident is attributed to the driver approaching the top of the hill at a higher speed than the regulations allowed and to his lack of skill in manipulating the brake. The Inspector urges that the track brakes should be altered for mechanical as well as electrical application, and that the curve at the bottom of the hill should be reconstructed to not less than 1½-chain radius, and that proper superelevation should be provided by banking up the road. The existing curve is as sharp as 56 chains radius in one point, and the superelevation appears to be a negligible quantity.

Wicklow.—The C.C. has suggested to the Dublin and Blessington Steam Tramway Co. that it should approach the Dublin United Tramways Co. with a view to the latter taking over the line and operating it electrically. The Dublin C.C. has been invited to pass a similar resolution.

TELEGRAPH and TELEPHONE NOTES.

American Telegraphs and Telephones.—We have had sent to us an open letter, dated New York, July 20th, 1911, addressed to the Hon. J. P. Lightfoot, Attorney-General of Texas, Austin, Texas, by the Vice-President of the Postal Telegraph Cable Co., of New York, Mr. O. C. Adams. The 15 printed pages of the letter deal entirely with the conditions of competition between the Postal company and Bell interests in Texas, the latter having apparently for the present successfully stopped the Postal company from dealing directly with the public. The Postal company is now erecting its own lines with the object of again competing with its opponents. It would appear to be a pity that the United States authorities have not yet seen their way to acquiring the telegraphs, and thus prevent the constituting of monopolies. Even with the Postal and Bell interests, monopoly may be said to be created. The United States Government has the power of regulating tariffs with the view of keeping them at a reasonable figure, and not to permit them to act as a deterrent on trade. The British Government has, we are told in speeches, the same desire, but effective progression is negligible, and some of our Colonial possessions still bear the brunt of inaction.

Germany and Colonial Cables.—A Reuter dispatch from Berlin, reports that the establishment of direct cable communication between the Colonies and the Fatherland is to be hastened.

The Telegraphs and the Strike.—Many railway and other telegraph and telephone lines were reported cut during the strikes at the end of last week. One report states that on Saturday south of Matlock, the trunk telephone line to Derby was "destroyed." The secretary to the G.P.O., in a statement issued on Monday, said that the pressure on the telegraph service of the country had been unprecedented. Great numbers of messages which would ordinarily have been sent by post were entrusted to the telegraphs. The staff, both in London and in the chief provincial centres, worked under severe pressure, but responded with the utmost readiness to the calls made upon them. There was delay on most of the lines during Saturday, but the arrears were successfully overtaken. The Postmaster-General visited the Central Telegraph Office on Saturday afternoon and on Sunday morning, and expressed his warm appreciation of the willing efforts made to cope with the immense inflow of work.

The general manager of the Post Office Telephone Department, in an interview with the *Westminster Gazette* on Tuesday, said that the service on the trunk system during the railway strike was phenomenally heavy. Calls poured into London from the seaside resorts and provincial centres from early morning to late evening, and the value of the telephone in such a national crisis had been realised more than ever before. Excepting for the delay necessarily attaching to the heavy demand made on the system, everything worked smoothly.

Wireless Telegraphy in German East Africa.—It was reported some time ago that stations for wireless telegraphy had been opened at Bukoba and Muanza on Lake Victoria at the joint expenditure of the German Imperial Post Office, and the Administration of the Protectorate of German East Africa. It is now announced from Dar es Salam that the stations which were opened in March are working well, and are largely used, and the Muanza Station was even able to communicate in May with a steamer belonging to the East African Line in the harbour of Tanga.

Wireless Telegraph Litigation: Australian Views.—One of the Australian newspapers that has just reached us contains the following from a Melbourne correspondent:—"When the Parker judgment in connection with wireless telegraphic services was made known in Australia, the Federal Ministry communicated with the Admiralty with a view to ascertaining the official opinion as to what effect the judgment would have on systems other than the Marconi. It is understood that a dispatch has been received by the Government in reply to its queries. To-day, in answer to questions, the Acting Prime Minister made a statement on the subject. He said that it appeared that the judgment went to the extent of declaring with a certain amount of hesitancy, and subject to any appeal or further judicial decision which might have the effect of upsetting it, that no known commercial system was outside the scope of the Marconi master patent. He was not prepared to say precisely how that would affect the Federal installation. The Government has felt that the expert opinions which it had obtained from its own officers should be fortified by inquiry from the Imperial authorities. The Admiralty authorities operated under the Lodge patent, which was prior to Marconi, but the Marconi patent could hardly be said to depend in any way on the Lodge patent. He was not going to say for one moment that the position, as it appeared at present, should be accepted as final, for the possibilities of further litigation were imminent. It did not follow that, because the Radio-Telegraphic Co., a comparatively small concern, as to whose operations it was difficult to obtain precise particulars, had failed, that other concerns, perhaps exchanging messages through different media, would necessarily come in the scope of the judgment. It might be possible for some system now in force, or to come into force, to be outside the judgment; otherwise, for the next four years the Marconi patent would hold the field. Dealing with the undertakings already begun for the Commonwealth at Sydney and Fremantle, Mr. Hughes said the position was very clear. The Australasian Wireless, Ltd., who were installing the plant, and were working on the Telefunken patent, guaranteed the Commonwealth against any loss or any actions taken in consequence of infringements of patents. In addition to that, the contractors had to give the Commonwealth an efficient working plant; so that, as far as the existing contracts were concerned, the Federal Government was safeguarded. The difficulty now was that the position, as far as it was known, made it hardly possible for the Commonwealth to proceed along the same lines as formerly. If the Government knew the Marconi patent was being infringed deliberately, that meant that the Port Moresby and Thursday Island installations would be postponed. It was obvious that they could not be hung up indefinitely, but the Government had felt that in view of the gravity of the position, the opinion of the British authorities should be obtained, in addition to the interpretation of the Parker judgment by the Australian Patent Office, and himself, as Attorney-General. Consequently, the opinion had been obtained. It was, of course, a matter for consideration whether the Government, in default of any further testing of the position by others, should sit down under the domination of one company, or whether the company was to straddle the world like a colossus."

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C., (form No. 26). Stores Manager, Aberaman, near Aberdare.

Australia.—Victoria.—September 5th. (*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

Melbourne.—October 3rd.—42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" to-day.

September 26th.—30 miles of paper-insulated telephone cable, also supply of various telephone material. Local representation. Deposit, with tender, 5 per cent. up to £1,000 and 2½ per cent. above. Specification, &c., may be seen at Office of High Commissioner, in London, 72, Victoria Street, S.W.

Belgium.—November 27th. The municipal authorities of Tournai are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town during a period of 30 years. The specification can be obtained at the price of one franc from the Hotel de Ville, Tournai.

September 6th. The Belgian Post and Telegraph Authorities at the Bourse, Brussels, are inviting tenders for the supply of a quantity of material required in connection with the establishment of telephone lines.

Blackpool.—Ornamental electric fittings for the new Central Library and Art Gallery, for the T.C. Borough Electrical Engineer, West Caroline Street.

Brazil.—November 14th. Tenders are invited by the municipal authorities of Pelotas for a 40 years' concession for the supply of electric power and light and the establishment and working of electric tramways in the town. Tenders to Senhor Luiz M. da S. Pennafiel, Secretario, Intendencia Municipal, Pelotas. A deposit of 5,000 milreis (about £330) is required with each tender, to be increased by the successful tenderer to 25,000 milreis (about £1,670). Further particulars (in Portuguese) may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Cleethorpes-with-Thrunscoe.—September 2nd. Vulcanised bitumen distribution and feeder cables, for the U.D.C. See "Official Notices" August 11th.

Dublin.—September 7th. 750 single-phase and 200 three-phase A.C. meters for the Electricity Supply Committee. See "Official Notices" to-day.

London.—September 2nd. Battery boosters and switchboards for the Westminster Electricity Supply Corporation, Ltd. See "Official Notices" August 18th.

Penang.—September 5th. One 500-KW. steam dynamo (engine or turbine), with ejector condensing plant and switchgear, for the Municipality of George Town, Penang. See "Official Notices" August 11th.

Powell-Duffryn.—September 11th. Stores (including electrical fittings) for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

Sheffield.—September 9th. Clothing for the Corporation Tramway Department. General Manager, Tramway Department, Division Street.

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" August 4th.

August 31st.—Electrical fittings for a year, for the B. of G. Thos. Smith, Clerk, Union Road, Leytonstone, N.E.

CLOSED.

Belfast.—Messrs. J. Dowling & Sons have secured the contract for the wiring and fittings of the new Argyle Place Presbyterian Church.

Blackburn.—The Guardians, on Saturday, accepted the tender of Messrs. J. W. Garsden & Co., of Blackburn, at £192 10s., from among several estimates received for the new fire alarm installation at the local workhouse.

Erdington.—The U.D.C. on Monday accepted the tender of Mr. Herbert Holloway, of Wolverhampton, for the construction of the Slade Road tramways, at £24,909. The electrical equipment, to cost £1,356, will be undertaken by the Birmingham T.C.

France.—The French Post and Telegraph Authorities in Paris have just given out contracts as follows :—

La Compagnie Generale d'Eléctricité, of Paris.—60 tons of bronze wire $1\frac{1}{6}$ mm. dia., at 2,740 fr. per ton, 100 tons of high conductivity copper wire $2\frac{2}{3}$ mm. dia. at 2,045 fr. per ton, 100 tons ditto at 2,047½ fr. per ton, 100 tons ditto at 2,050 fr. per ton, 100 tons ditto at 2,052½ fr. per ton, 100 tons ditto at 2,055 fr. per ton.

La Société Grammont, of Pont-de-Cheruy.—60 tons of bronze wire $1\frac{1}{6}$ mm. dia. at 2,740 fr. per ton, 200 tons of high conductivity copper wire, $2\frac{2}{3}$ mm. dia. at 2.055 fr. per ton, and 100 tons ditto at 2,050 fr. per ton.

La Société Francaise des Metaux, of Paris.—60 tons of bronze wire $1\frac{1}{2}$ mm. dia. at 2,750 fr. per ton, and 400 tons of high conductivity copper wire 3 mm. dia. at 2,040 fr. per ton.

La Compagnie Francaise du Bimetal, of Paris.—200 tons of high conductivity copper wire $2\frac{1}{3}$ mm. dia. at 2,030 fr. per ton.

La Société de Pontgibaud.—100 tons of high conductivity copper wire 3 mm. dia. at 2,027½ fr. per ton.

La Société des Trefileries du Havre.—100 tons ditto at 2,035 fr. per ton, and 100 tons ditto 4 mm. dia. at 2,035 fr. per ton.

La Société d'Electro-Metallurgique de Dives.—100 tons ditto at 2,030 fr. per ton.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

India Office Store Department.

Cable.—British Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co.
Dynamos.—British Westinghouse Electric and Mfg. Co.
Motors.—Lancashire Dynamo, &c., Co.

Crown Agents for the Colonies.

Electric light plant and fittings.—Mavor & Coulson, Ltd.
Insulators, &c.—Bullers, Ltd.
Telephone material.—British L. M. Ericsson Mfg. Co.

Office of Works.

Generating set, South Kensington.—Browett, Lindley & Co.

G.P.O. Stores Department.

Telephonic apparatus, cases, trunk, cord, signalling.—British Insulated and Helsby Cables, Ltd.
Coils, loading, and protectors.—Western Electric Co., Ltd.
Generators.—Western Electric Co., Ltd.
House telephone apparatus.—Gent & Co., Ltd.
Jacks.—British Insulated and Helsby Cables, Ltd.
Telephones.—British L. M. Ericsson Mfg. Co., Ltd.; British Insulated and Helsby Cables, Ltd.
Transmitters.—Peel-Conner Telephone Works, Ltd.
Wood arms.—Millars, Karri & Jarrah Co. (1902), Ltd.
Cable, india-rubber and cotton core.—Henley's Telegraph Works Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Casing and cover for electric wiring.—J. Wilesmith & Co.
Earthenware ducts.—G. Skey & Co., Ltd.
Insulator spindles.—Bullers, Ltd.
Copper wire.—F. Smith & Co. (London Electric Wire Co. & Smiths, Ltd.).
Flameproof wire.—C. MacIntosh & Co., Ltd.
Galvanised-iron wire.—R. Johnson & Nephew, Ltd.

G.P.O. Engineering Department.

Telephone (local) exchange extensions at Finchley, Croydon, and Central Exchange, London.—Western Electric Co., Ltd.
Telephone (local) exchange equipment at Blackpool and Worcester.—Peel-Conner Telephone Works, Ltd.
Telephone (local) exchange equipment, Worthing.—British Insulated and Helsby Cables, Ltd.

Commissioners of Works.

Electrical installation, Cumberland Lodge, Windsor Great Park.—Wellman Bros. & Co.

Hyde.—The T.C. has accepted the tender of Mr. W. W. Oldham for a pump and motor.

Southend-on-Sea.—The T.C. has accepted the tender of the Worthington Pump Co. for a pump and motor, at £91.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor.

Tyldesley-with-Shakerley.—The contract for fire alarms, for the U.D.C., has been placed with Mr. T. H. Brett, of Leigh.

NOTES.

Copper.—Mid-monthly returns, from statistics furnished by Messrs. H. R. Merton & Co., show a further decrease in visible supplies of 1,480 tons, being 235 tons less in French ports and 1,220 tons less in English ports. Chile shipments are 125 tons lower, but Australian 100 tons up. Taking the average drop per month in European supplies for the past 12 months as 2,456 tons, this decrease may be called average. In detailed supplies, America to Europe, as a whole, appears heavy, Spain to England is low, Chile shipments below the average, Australian just on. The mid-monthly returns, however, are usually not much indication of supplies over the whole month. Deliveries are brisk at 26,585 tons. American stocks dropped 8,793 tons during July, a large quantity. The world's stocks were down 10,940 tons for that month, whereas the average drop per month since the end of March has been 5,010 tons only. Rotterdam shows an increase of 250 tons, and Hamburg is estimated to hold 10,800 tons, being 400 tons more than for the end of July.

An article in the *Financier* of August 21st gives figures which are useful as indicating the condition of the visible supplies of copper in the United States. The decrease in stocks for the month of July is given as 8,792 tons, the largest decrease since September, when stocks fell off by 8,928 tons. Production also has been considerably curtailed, the quantity 50,074 tons being the smallest yet reported, with the exception of the first two months of 1909. The hot weather is referred to as a contributory cause, it being impracticable to run refineries at full time in such periods. Domestic deliveries were, however, well maintained, at 25,446 tons, being above the year's average deliveries. Exports of 33,482 tons are the largest for the current year. Total stocks in the United States are given at 61,490 tons, or 7,012 tons higher than on January 1st last. Against this increase it is to be noted that European stocks have fallen 12,500 tons.

Finsbury Technical College Old Students' Association.—At the annual general meeting of this Association, held recently, Mr. R. J. Wallis-Jones, M.Inst.C.E., M.I.E.E., was elected president. The following gentlemen were elected to represent the electrical students on the Council of the Association :—As Vice-President, Mr. J. E. Raworth, F.C.I.P.A.; Messrs. W. B. Esson, M.Inst.C.E., M.I.E.E., F. R. C. Rouse, A.M.I.E.E., C. B. Nadaud, A.M.I.E.E., T. H. West and E. W. Moss, and as electrical hon. secretary, Mr. H. W. Gregory.

Parliamentary.—Royal Assent.—The following Acts have received the Royal Assent :—

Dunfermline and District Tramways Order Confirmation Act, 1911.
Edinburgh Suburban Electric Tramways Order Confirmation Act, 1911.
Paisley District Tramways Order Confirmation Act, 1911.
Electric Lighting Orders Confirmation (No. 1) Act, 1911.
Electric Lighting Orders Confirmation (No. 2) Act, 1911.
Electric Lighting Orders Confirmation (No. 3) Act, 1911.
Electric Lighting Orders Confirmation (No. 4) Act, 1911.
Electric Lighting Orders Confirmation (No. 5) Act, 1911.
Tramways Orders Confirmation Act, 1911.
South Lancashire Tramways Act, 1911.
Widnes and Runcorn Bridge (Transfer) Act, 1911.
Winchester Corporation (Electric Supply) Act, 1911.
Sidmouth Gas and Electricity Act, 1911.
Liverpool Overhead Railway Act, 1911.
Metropolitan Railway Act, 1911.
Bristol Tramways Act, 1911.
Central London Railway Act, 1911.
Nottinghamshire and Derbyshire Tramways Act. 1911.
Middlesbrough, Stockton-on-Tees and Thornaby Tramways Act, 1911.
Metropolitan Electric Tramways Act, 1911.
London, Tilbury and Southend Railway Act, 1911.
London County Council (Tramways and Improvements) Act, 1911.
Brighton, Hove and District Railless Traction Act, 1911.
East Kent Electric Power Act, 1911.

The Telephone Transfer Bill.—On August 17th this Bill was read a third time in the Commons, and a first time in the Lords. The Royal assent was notified on August 18th.

Telegraph Construction Bill.—This Bill passed its third reading in the Commons on 17th inst., and its first reading in the Lords on the following day.

Pacific Cable Bill.—This Bill was read a third time in the Commons on 17th inst., and a first time in the Lords on 18th inst.

Victoria Falls Power Supply.—The *South African Mining Journal*, July 22nd, in referring to the Victoria Falls Power Co., says that several mines are still experiencing serious delays in obtaining their requisite supplies, and exaggerated rumours of trouble on various properties arising from this cause have been prevalent. "The fact that the Victoria Falls Co. is about to appoint a new chief mechanical engineer is regarded as confirming these rumours. Undoubtedly, the company has been faced with initial difficulties greater than had been anticipated, and it is likely that questions of contracts unfulfilled, and time limits exceeded, will engage its attention for some time."

Inquiries.—The names of English makers of electrical tempering ovens are wanted; also of makers of electric rivet heating plant. A correspondent requires a process for electrically cleaning steel sheets, preparatory to galvanising.

The British Fire Prevention Committee.—The Special Commission of the British Fire Prevention Committee, which has been spending a week in Paris studying the local fire protective arrangements under the guidance of the French Government, has been much impressed by the precautionary regulations and fire service organisation at Monsieur Lepine's disposal. The latter—who in his capacity as Prefect of Police and head of the fire protective departments of the French capital, accorded the Commission the closest personal attention, is, however, anxious to adopt the methods of the British Committee on the fire preventive side, and gave frequent public expression of his appreciation of the international utility of their work. The Commission, which comprised Mr. E. O. Sachs, chairman ; the Earl of Londesborough, K.C.V.O., member of Council ; Mr. Marsland, honorary secretary ; Mr. Folker, honorary treasurer ; Mr. J. Herbert Dyer, member of the Executive ; with Lieut. Spencer, R.N., and Mr. E. Boyce-Podmore attached, visited all the principal fire stations, saw numerous drills, exhibitions, displays, &c., and inspected a very large number of public buildings and works, including the Opera House, several playhouses, cinematograph theatres, the great electric power houses, water reservoirs, gasometers, &c. A detailed illustrated report of the Commission's visit to Paris will be prepared for the use of the authorities at home, but a number of data on the work of the British Fire Prevention Committee are also being prepared to supplement the particulars already presented for the use of the French authorities as a basis for the proposed organisation of a similar body for France.

The Carlton Hotel Fire.—The Electricity Supply Publicity Committee states that the report that the fire at the Carlton Hotel was due to the fusing of an electric wire is without foundation, as the Electric Supply Co., who supply the hotel, have made a thorough investigation, and give full assurance that there is no evidence whatever to connect the fire with any electrical source.

Strike at Trafford Park.—We read in the *Manchester Courier* that the other day the following notice was posted outside the works of W. T. Glover & Co., Ltd.: "These works will be closed till further notice." The men were locked out last week. as a settlement of differences had not been reached.

The staff of the Hastings Tramway Co. on Friday presented an eight-day chiming clock to Mr. F. B. Holliday, overhead and permanent way engineer, on his departure from the town.

General.—The marriage took place at Saxby Church last week, of Mr. Herbert Huckle, electrician at Brooksby Hall, and Miss M. L. Russell.

Mr. Edgcumbe Brighten, of the firm of Brighten, Malcolm and Co., Ltd., of Shanghai, has just arrived in this country on a visit.

The *Times* states that the German Emperor has nominated Sir William Ramsay, Professor of Chemistry in University College London, and President-elect of the British Association, to the Order "Pour le Mérite," for his services to science.

The second swim of Morecambe Cross Bay Championship has been decided, and R. T. Disley, a Blackburn electrician—who, in May last, swam a distance of seven miles in just over six hours—completed the journey in 4 hours 42 min. 52⅘ sec., and was the winner.

We are informed that Mr. David Smith has now severed h connection with the Foster Engineering Co., Ltd., and will not be making calls on their behalf.

Mr. J. G. Griffin, General Manager of the Delhi Electric Tramways and Lighting Co., left on Wednesday, *via* Marseilles, on his return to India.

Obituary.—We regret to record the death, which occurred at Eastbourne on August 7th, of Mr. Anthony George New. Mr. New was born in 1870. As a lad he studied engineering at Mason's College, Birmingham, and later turned his attention to electricity. In 1890 he came to London, and after spending a tim with a firm of electrical engineers at Lewisham, he, in conjunction with a former fellow-student at Mason's College, established an electrical business under the name of New & Mayne, Ltd., of Woking and Westminster. In 1896 he devoted himself to motor-car engineering, and, after spending 18 months in the States, he became technical editor of the *Automotor Journal*, which position he held until June last. He also edited *Flight*, a paper started by a London firm of publishers in 1909. Mr. New's death occurred quite unexpectedly, owing to a rapid development of a long-standing disease. The *Automotor Journal* refers to the deceased gentleman as "one of the earliest pioneers of the car in England."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Recently, at the office of the borough electrical engineer at Durban, Mr. R. A. Stoker, who has been with the department for upwards of eight years, was the recipient of a silver rose bowl on the occasion of his resigning his post to take up the position of borough electrical engineer of Kroonstad. The presentation was made by Mr. John Roberts, the borough electrical engineer, in a few appropriate words, and Mr. J. T. Smith, station superintendent, proposed the health of Mr. and Mrs. Stoker, to which Mr. Stoker feelingly replied. Mr. Stoker, on his departure to take up his new position at Kroonstad, carried with him the good wishes of all the Durban electrical staff.

Mr. A. E. McKenzie, who has held the position as resident engineer of the Stuart Street Electricity Works of the Manchester Corporation since 1903, was at the last meeting of the City Council appointed chief assistant electrical engineer to the Manchester Electricity Department.

Mr. F. H. Brandreth, assistant engineer at the Grantham E.L. Works of the Urban E.L. Co., has been appointed local manager and engineer to the company at Stamford.

Mr. J. Mordey Lambe, municipal electrical engineer at East London, was recently married to Miss Logan, of East London. The staff presented him with a case of cutlery and a silver table centre on the eve of his marriage.

Mr. Frederick Swarbrick, assistant electrical engineer at the Leigh (Lancashire) Electricity Works, has been appointed chief engineer and manager to the Galway Electric Co., Ltd.

The St. Anne's U.D.C. has increased the salary of the electrical engineer by 18 guineas, this being the amount of his expenses in attending the conference of the Incorporated Municipal Electrical Association. The chairman, in making the announcement of the Committee's decision to the Council, said he was convinced that no authority, however small, could afford not to send its engineer to such conventions, if they expected him to be up to date and fully conversant with the latest information respecting this important branch of municipal enterprise.

Mr. Herbert Stringer, shift engineer at the Hoylake and West Kirby U.D.C. Electricity Works, has been presented with a clock by the staff and employés of the electrical department on the occasion of his marriage to Miss Florence Dutton.

Tramway Officials.—The Bournemouth T.C. has appointed Mr. H. Vickers, assistant tramways engineer, of Wolverhampton, as assistant tramways engineer. Mr. Vickers has been at Wolverhampton for 13 years, and has served in both the electrical and tramway departments there.

NEW COMPANIES REGISTERED.

Skelmorlie Electric Supply Co., Ltd. (7,960).—This company was registered in Edinburgh on August 11th, with a capital of £10,000 in £10 shares, to acquire the business of the Skelmorlie Electrical Supply Co., Skelmorlie, Ayrshire. The subscribers (with one share each) are:—R. V. Farnham, Audley End, Skelmorlie, Ayrshire, mechanical engineer; R. C. Mackenzie, 2, West Regent Street, Glasgow, chartered accountant; J. Pattison, 13, St. James Place, Paisley, writer. Private company. Table "A" mainly applies. Registered by Adam D. Laidlaw, Edinburgh.

Whitfield Fan Co., Ltd. (117,321).—This company was registered on August 18th, with a capital of £2,000 in £1 shares (500 pref.), to carry on the business of electrical, ventilating, mechanical and heating engineers, manufacturers of electric and belt-driven fans, &c., to acquire the business carried on at Dale Street, Shipley, Yorks., as the Whitfield Fan Co., and to adopt an agreement with J. Whitfield. The subscribers (with one share each) are:—J. Whitfield, 10, Merton Street, Shipley, electrical and mechanical engineer; J. Bailey, 32, Beaufort Street, Nelson, joiner. Private company. The number of directors is not to be less than two or more than four; the first are J. Whitfield, J. Bolton and J. Bailey; qualification, £50 remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

CITY NOTES.

Swiss Electrical Companies.

The Bank für Elektrische Unternehmungen, of Zurich, which is the leading electrical investment company in Switzerland, proposes to pay a dividend of 10 per cent. for 1910-11, being the same rate as in the previous year.

The Compagnie de l'Industrie Electrique et Mécanique, of Geneva, reports net profits of £6,400 for 1910-11, as compared with £5,500 in 1909-10. After allocating £3,000 to the redemption fund as in the preceding year, it is proposed to pay a dividend of 4 per cent. on the priority shares as against 3 per cent. in 1909-10, but no distribution is again made on the ordinary shares.

The "Watt" Gesellschaft für Elektrische Unternehmungen, of Glarus, states that its subsidiary companies experienced a progressive development in 1910-11, these being supply works in various parts of Switzerland. As net profits from interest, commissions and investments, the accounts show the sum of £31,400, as contrasted with £21,800 in 1909-10. It is intended to pay 6 per cent. on the ordinary capital of £280,000, as was the case in the preceding year. The loan debt remains unchanged at £280,000, whilst the investments represent £100,000 and the advances made to electricity companies total £590,000.

The report for 1910-11 of Brown, Boveri & Co., of Baden, states that the gross profits on manufacturing did not keep pace with the turnover, which amounted to £2,400,000, and the general expenses, and especially salaries, again experienced an increase, which still further prejudiced the results. If, nevertheless, the net profits were larger, this was due, on the one hand, to the limitation of new plant as far as possible, and the consequential smaller amount needed for depreciation, and, on the other, to an

expansion in the receipts from investments. The results hitherto obtained from the association with the Alioth company had corresponded with expectations, although the actual effect of the arrangement would only show itself after the lapse of time. The decline in the yield from manufacturing was attributed, in the first place, to the depressed situation of the turbine business. The conditions described in the previous year's report continued, and had, in fact, become aggravated. The company was largely affected by them, inasmuch as this department was developed to the utmost in the years 1904 to 1909, and the new plant laid down served, for the greatest part, for the production of turbines. The large profits obtained from the branch in those years had entirely dropped at present, and had partly been converted into losses, and it could not be foreseen up to what degree it would be possible to again make the manufacturing profitable. It was also difficult to immediately provide a substitute. The situation was also complicated by the circumstance that the conditions in the general market for electrical manufacturing were very unfavourable. The main feature of the company's business lay in a comprehensive and uniform manufacture as far as possible, but the small market in Switzerland offered considerable difficulties. Nevertheless, the directors hoped that better results would again be obtained, as they had a number of manufactures which afforded prospects of an increased and regular sale. This hope could be more reasonably entertained, as nothing in the generally favourable position of the company had changed. The works plant at Baden had been completely written off, all the works were abundantly supplied with orders, and the well organised sales organisation extended over nearly all countries. The accounts show the following figures for the past two years :—

	1910-11.	1909-10.
Share capital	£1,120,000	£800,000
Loan capital	400,000	400,000
Gross profits	274,000	256,000
Depreciation provision	21,500	25,000
Net profits and balance forward	92,000	85,600
Dividend, per cent.	7	8

The report proceeds to state that nothing had changed in the details of manufacturing since the previous year's report, the situation in Switzerland in particular having remained the same. At present few power stations of any importance were in course of establishment. The technical question of main line traction could now be regarded as substantially solved, but its adoption on a large scale would only ensue when an important line exclusively worked by electricity had proved its great general advantages. This would be done by the Berne-Lotschberg-Simplon Railway. The Rhatian Railways had ordered seven electric locomotives from the company. Concerning the electric lighting of railway carriages, the report mentions that the work was practically concluded in Switzerland, whilst in France the Compagnie Electro-Mecanique had equipped 900 coaches for the Orleans Railway, and had received an important repeat order. The report concludes by giving particulars of the working results of the company's subsidiary companies, and of the investments held in other undertakings.

Northern Light, Power and Coal Co., Ltd.

THE report for the period to December 31st last, to be submitted to the meeting at Dawson City (Yukon) on 18th prox., states (says the *Financial Times*) that during the period under review the machinery and materials required for the construction of the power house and transmission line at Dawson have been purchased and forwarded to Dawson and there erected. The first portion of the power station was completed in August, 1910, and current was generated and transmitted 40 miles over the company's transmission line to Dawson on August 25th, 1910, in fulfilment of certain contracts entered into with responsible consumers. These contracts were, however, only of a temporary nature and in force during the autumn season. The directors regret that the White Channel Gravel Mining Co. have not taken as yet any portion of the 14,000,000 KW.-hours per annum, the supply of which was to have commenced in August, 1910. The former owner of the properties acquired by the company, Mr. Newman A. Fuller, and Mr. J. Treadwell guaranteed that for ten years the mining company would take this annual amount of power from this company, and steps will be taken to enforce this guarantee in respect of the period from August, 1910, until such time as the mining company actully takes power. The profits from the sale of power, as well as the approximate profits of the three subsidiary companies—namely, the Dawson Electric Light and Power Co., Ltd., the Dawson City Water and Power Co., Ltd., and the Yukon Telephone Syndicate, Ltd.—for the period under review amounted to £24,303, and this sum has been deducted from the expenditure charged to construction account. The development of the coal mine has proceeded satisfactorily, and enough coal has been mined to provide for the requirements of the company's power station and operating the railway and steamer. Coal has also been supplied to the subsidiary companies which this company owns as well as to sundry other consumers in and around Dawson. Various tests of coal are being carried out by possible large consumers, and, if satisfactory, it is anticipated that remunerative contracts will be entered into for the sale of the company's coal. Acting on the advice of the managing director and the company's consulting engineer, the power plant originally provided for was increased and all the buildings and plant were designed and laid out with a view to further increase. In order to complete the work of construction, it became necessary for the directors to obtain certain temporary advances, and with the object of placing the company's finances on a permanent basis, the bondholders have been asked to authorise the creation of $1,000,000 prior lien bonds. Of these bonds it is proposed to issue approximately $700,000, and the balance will be available if required as working capital, or for the purpose of carrying out any extensions to the plant which may be necessary. From advices received from the managing director, who is at present in Dawson, certain temporary power contracts were carried out by the company during the spring of the current year, and according to a cablegram received recently, the profits earned during the six months to June 30th last amounted to approximately $70,000, or, say, £14,400. This profit includes the amount earned by the subsidiary companies and the profits on coal sales and sundry power sales.

Mackay Companies.—The regular quarterly dividends of 1 per cent. on the preferred shares, and 1¼ per cent. on the common shares, will be paid on October 2nd.

Kalgoorlie Electric Tramways, Ltd.—The directors report that the gross receipts for the year 1910 amounted to £43,009 as compared with £45,266 for the previous year, while the net profits earned were £15,199, against £16,573 for 1909. The directors regret to report the decrease in traffic receipts and net profits. The rush to the Bullfinch district, which took a large number of the mining population and considerable money from Kalgoorlie, had its effect on the general trade of the district, and the tramway receipts suffered in consequence. The directors fear that the construction of the trans-Continental railway has now been decided upon, and is likely to be commenced next year. It is hoped that the completion of this line will have a beneficial effect on the prosperity of Kalgoorlie, by opening up the country to the east. Until improved conditions are brought about either by the railway or by the discovery of new mines no increase in traffics can be expected. In the meantime, every possible effort is being used to reduce working expenses. A further amount of £5,300 of "A" debenture stock has been purchased for redemption, making the total stock redeemed to December 31st last £24,722.

Dublin and Lucan Electric Railway Co.—The half-yearly meeting was held on 15th inst., Mr. J. W. Hill presiding. The chairman said that the receipts were £6 less than for the corresponding half of last year. Passenger receipts were £5 better, but goods receipts decreased by £84, owing to one customer adopting motor-lorry traction. Current sold for lighting showed an increase of £5. They now had their battery working satisfactorily, and could give a steady light during the coming winter they hoped to receive an increased income from this source in the future. They had added injectors to the boilers, and renewed the feed pumps, which would enable them to avoid a recurrence of the breakdown of last winter in the water supply. Arrangements had now been completed by the Lucan and Leixlip Railway Co. for the construction by them of a line from the terminus in Lucan to the Spa Hotel. Construction was now in progress, and it was hoped that the line would be running toward the end of the autumn. Resolutions adopting the report, approving of the 5 per cent. preference dividend, and voting an additional £50 to the directors, were passed.

British Continental Electricity Co., Ltd.—The directors' report for the year 1910-11 shows that 179 new installations have been connected, the number of lamps added (8 c.) being 1,545, including motor supply. Towards the end of the year a contract for the public lighting of the village of Poggio was entered into on favourable terms, also a contract to supply power to the San Remo Corporation, and the benefit arising therefrom will be more fully felt during the current year. After writing off £1 depreciation at the usual rates in respect of furniture, tools, meters &c., and £177 depreciation of plant and stock, the balance standing to the credit of revenue account, including the amount brought over from last year, is £2,316, a sum sufficient to pay a substantial dividend on the ordinary shares, after paying in full the preference dividends due to date. As, however, this balance has been temporarily absorbed by further capital expenditure, rendered necessary by the continued growth of the company's business, the directors recommend that it shall be again carried forward pending further issue of capital. A sum of £172 has been carried to a suspense account pending arbitration in respect of a power contract entered into by the company, and the directors anticipate that they will eventually be able to credit revenue account with a substantial award. The sum of £804 has been spent on capital account during the year.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

Consolidated, Gas, Electric Light and Power Co., of Baltimore.—$1,000,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each.

Pennsylvania Water and Power Co.—$7,580,000 first mortgage sinking fund 5 per cent. gold bonds of $1,000 each (Nos. 1 to 7,580).

Liverpool Overhead Railway Co.

HE half-yearly meeting was held at Liverpool on August 15th. SIR WM. FORWOOD, chairman of the company, presided, and in ıoving the adoption of the report (see ELECTRICAL REVIEW, page 25), he said that the report was of a distinctly more encouraging ıaracter. The improvement was due to the increased trade of the port, ɔod weather, and economy in working expenses. These economies ad been small in themselves, but when working a rapid service the ıving of a penny here and a penny there amounted, in the aggre- ate, to a considerable sum. The economies had not been made at ıe cost of efficiency. On the contrary, during the past few years ıey had strengthened their main structure from end to end, and ıe cost of doing so had been paid out of revenue. They had simply ɔne what they thought should have been done when the line was ıilt, and they had rendered it stable and efficient for all time. ıring the past half-year they had carried on the railway and tram- ne 5,393,597 passengers, against 5,090,080 during the same half st year, but the value per passenger had fallen from 1·72d. to 69d. This decrease in value was due to an increased proportion of orkmen's traffic. The effect upon the revenue had been the satis- ıctory increase of £1,968; and they had earned this increased ·venue at a cost of only £382; indeed, if they deducted what they ıd paid for compensation, which was scarcely a working cost, ıeir increased expenses were only £212. Expenditure, as compared ith revenue, worked out at 66·16 per cent., as against 69·84 per nt. in the corresponding period of last year. Taking it per train- ile, their cost had been 12·02d., against 14·2d. on the City and ɔuth London, and 21·51d. on the Mersey Railway. It was only ir to say, however, that these figures were scarcely comparable. he conditions of each railway varied so much. While they had a ıort line with 17 stations and an expensive structure to aintain, the other lines had to pay the expenses of pumping ıd a costly system of passenger lifts. On the other hand, while ıe Liverpool railway carried 4,226,410 passengers, the City and ɔuth London carried 12,413,000, and the Mersey railway 6,027,000. they could only obtain this traffic they would be in a much ıppier position. All they wanted was an increase of traffic. The venue account showed that, including the balance brought ·rward of £4,246, they had £10,841 available for dividend, and ıey recommended a dividend at the rate of 5 per cent. per annum ı the preference capital, and 1 per cent. per annum on the ordinary ıares, leaving a balance of £4,665 to be carried forward. They ıd carried as usual £1,500 to the renewal fund, which now nounted to £42,578, and £200 to the credit of the contingent ınd, which now amounted to £1,100. The State Insurance Bill, hen it became law, would at once increase their expenditure by 300 a year, with a probable further increase in the near future, ıd he quite failed to see that the company would derive the least ·nefit. The Bill in Parliament which the directors promoted for ınsolidating their borrowing powers, and to enable the Mersey ock Board to guarantee the interest on the debenture stock, was ɔw only awaiting the Royal assent. He wished to acknowledge ıe handsome way in which the Dock Board received their over- ıres. It might be quite true that the Dock Board incurred little · no risk, but they might, instead of taking the broad view, which ıey had done, have adhered to the letter of their agreement, which ould have entailed considerable extra cost upon this company in ıaking a new issue, and this expense would have had to be paid ıt of revenue, and would have seriously interfered with their ividends. As to the future, with the improvement in trade their ·venue should continue to increase. The labour unrest should not ·iously affect the company. Their electrical equipment and ılling stock were in good and efficient condition. After acknow- dging the care and ability with which Mr. Neachell and his staff ıd looked after the property,

The CHAIRMAN formally moved the adoption of the report, and R. H. R. ROBERTSON, deputy chairman, seconded. The motion as carried, as was also a motion referring to the payment of the vidends.

Perth Electric Tramways, Ltd.

HE directors' report to December 31st, 1910, states that the gross ceipts for the year amounted to £68,790, as compared with 74,649 for the previous year, while the profit amounted to 26,702, against £30,161. This decrease was entirely due to the rike of motormen and conductors which occurred during July and ugust, and lasted for seven weeks. Up to the date of the strike e receipts showed an increase over the corresponding period of e previous year of more than £3,000. Since the termination of e strike the returns have also been satisfactory, so that under ɔrmal conditions the company would have shown a large increase receipts and profits. The strike was the result of an applica- ɔn to the Arbitration Court by the men at the instance of ·ofessional agitators who, when the award was obtained, put an terpretation upon it which induced the men to make unreason- ɔle claims upon the company, which were resisted; the men again ɔpealed to the Court and not being satisfied with its decision, ected to strike.

The forecasts contained in the last annual report as to the increasing osperity of Perth, consequent upon the immense agricultural developments the State, have to a great extent been realised, and the influx of immigrants ntinues. Since Sir Newton Moore—the ex-Premier—has returned to gland as Agent-General, some 10,000 bookings have been taken for migrants who have been attracted by the agricultural possibilities of the ate. This additional population is adding to the prosperity of Perth, and ust necessarily result in increased traffic returns to the tramways. Perth d Fremantle are now practically one, being almost joined by intermediate burbs. Fremantle has been selected as a naval base of the Western ivision of the Australian Fleet and as the site for the western wireless station for Australia. The construction of a large dry dock is rapidly proceeding, extensive dredging operations are being carried out, and the wharf accommodation is being increased to deal with the growing mercantile shipping trade. The long expected trans-Continental railway is at last to be constructed, and as the population, the land under cultivation, the production of wheat, wool and fruit are all increasing, thus adding to the prosperity of the State, it follows that Perth, the capital city, must increase both in size and importance.

The general opinion seems to be that the progress of the city during the next 10 years will be very much greater than that made during the past 10 years, and people who formerly doubted the ability of the tramways to make profits, now feel confident that within the next few years the profits should amount to at least £50,000 per annum. The question of the purchase of the company's undertaking, either by the City Council or by the State, has been a matter of much local discussion and newspaper correspondence. The board therefore deemed it wise to fortify themselves with the best legal and technical advice on the concessions and agreements, with the result that they are satisfied that the position of the company is a very strong one. The position as between the city and the company is that the citizens demand further extensions and duplications, and the company have explained that in order to meet the wishes of the citizens further capital must be expended. It is indisputable that the City of Perth has increased and is increasing so rapidly that it is advisable to make extensions and duplications and to purchase extra cars, but for the reasons stated below the directors consider that any proposals for increasing the capital at the present time would be premature. Judging from the tone of the Perth newspapers, and from interviews with the Premier and the Mayor of Perth (Mr. T. Anstruther Molloy), and also with many citizens of Perth who have been in London for the Coronation, the feeling in Perth is intense that the tramway undertaking should be acquired either by the City Council or by the State, and the latter view appears to predominate. Many lengthy interviews have taken place with Mr. Molloy on the subject of the purchase on behalf of the city, who asked for an option to purchase; this the directors declined to give, but intimated that they would advise the shareholders to accept a bid of £500,000. This may appear an inadequate price in view of the increasing importance of the city and the fact that it can borrow money at 4 per cent., but the directors feel sure that the shareholders would not wish to hold out for an extreme price or to do anything to block the progress of the city which their enterprise has done so much to promote. From the shareholders' point of view it would of course be better if the company were allowed to work the tramways for the full period of 29 years, and to realise the increasing profits which are certain to accrue and so reward the shareholders for their patience during the past 10 years; in view, however, of the pressure of public opinion, the directors have every reason to believe that a definite offer to purchase will be made in the near future. The directors deemed it advisable to postpone the meeting and the consideration of further capital expenditure referred to above, whilst negotiations were proceeding, but nothing more can now be done until the Mayor has met the City Council or until the policy of the State has been declared, which will probably be in September or October next, when Parliament meets. The amount of first debenture stock redeemed in respect of the year under review is £4,650 at a cost of £4,863. Details of new construction, operation, car-mileage, passengers carried, &c., are given in the manager's report. After payment of interest and sinking fund on the first and second debentures, the balance at the credit of profit and loss account is £8,998, which is carried to profit allocation account. To this has to be added the balance brought forward from last year, viz., £1,056, making £10,054, from which has to be deducted the dividend of £6,000 payable on the preference capital. The directors recommend that the balance of £4,054 on profit allocation account be apportioned as follows:—Dividend on ordinary share capital at the rate of 2½ per cent. £2,500, cash reserve fund £1,000, balance carried forward £554. The directors record their appreciation of the services of Mr. Somerset and his staff during the year, and they announce the death of Mr. E. Graham Price, whose services as a local director in Perth were most valuable.

Mr. Somerset, in his report, says that the loss of receipts consequent upon the strike, the increased price of coal, and the increased wages under the award of the Arbitration Court, have resulted in a decrease of net receipts of £3,656 as compared with the previous year. The following is a complete summary of accounts:—

Year.	Traffic receipts.	Profit.	Debenture interest.	Debenture sinking fund.	Pref. div.	Reserve a/c expended in extensions, &c.	Ordinary dividend.	Invested reserve fund.	3% on receipts to municipalities.
1908..	£73,121	£28,720	£11,628	£5,734	£6,000	—	£2,500	£2,500	£2,068
1909..	74,567	30,161	11,562	5,938	6,000	£4,000	2,500	—	2,075
1910..	68,454*	26,702	11,259	6,241	6,000	—	2,500	1.000	1,914

* Strike of motormen and conductors.

Jandus Arc Lamp and Electric Co., Ltd.—The *Manchester Guardian* states that the annual meeting of this company was held in Manchester on Tuesday last week, Mr. Edward N. Galloway, the chairman, presiding. The report, which was unanimously adopted, recommended the payment of a dividend for the year of 10 per cent. on the paid-up capital, the transfer of £2,500 to reserve fund, and the carrying forward of the balance of £3,289 subject to deduction of directors' remuneration. Mr. E. N. Galloway was re-elected a director, and Messrs. Ferguson and Hamer were reappointed auditors.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Aug. 16	3,569	+ 230	11	18,421	+ 1,361	..	..
Ayr	„ 19	1,101	+ 21	14	6,141	+ 35	8	..
Bath	„ 19	2,479	+ 378	33	27,808	+ 1,681	..	..
Belfast	„ 18	9,406	+1,200	20	92,646	+11,474	40	3
Birkenhead	„ 20	2,477	+ 166	20	23,825	+ 979	13·7	..
Birmingham Corp.	„ 12	18,231	+4,955	19	151,502	+21,764	56·5	..
Blackburn	..	..	..	..	..	..	..	..
†Blackpool Corp.	„ 10	4,146	+ 456	..	29,694	+ 2,959	..	..
Blackpool-Fleetw'd	„ 19	5,753	+1,536	7	12,578	+ 884	..	..
Bolton	„ 20	5,644	+3,291	21	53,345	+ 4,133	26	..
Bournemouth	„ 16	5,602	+ 689	20	37,941	— 1,838	21·9	..
Bradford	„ 12	11,638	+ 531	19	109,456	+ 8,865	56	1·2
Brighton	„ 20	3,189	+ 105	20	23,418	+ 1,566	9·5	..
Bristol	„ 18	15,900	+3,432	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 11	432	+ 5	32	6,918	+ 41	3·65	..
Barnsley	„ 11	382	— 11	„	5,778	+ 327	..	..
Barrow	„ 11	995	+ 202	„	9,345	+ 771	5·37	..
Devonport	„ 11	1,864	+ 247	„	15,597	+ 2,211	8·85	..
Gateshead	„ 11	2,290	+ 184	„	38,180	+ 1,840	11·25	..
Gravesend	„ 11	585	+ 96	„	6,779	+ 192	6·5	..
Greenock	„ 11	1,743	+ 217	„	22,752	+ 2,879	7·25	..
Hartlepool	„ 11	8.9	+ 88	„	8,462	+ 755	6·72	..
Kidderminster	„ 11	498	+ 2	„	3,810	+ 257	..	..
‡Leamington	„ 11	665	+ 173	„	5,695	+ 358	..	..
Merthyr	„ 11	524	+ 4	„	6,689	+ 116	2·9	..
Metropolitan	„ 11	20,747	+2,975	„	280,699	+44,770	22	..
Middleton	„ 11	789	+ 38	„	10,779	+ 726	8·5	..
Mid. Joint Com'tee	„ 11	10,182	—3,146	„	182,174	— 959	..	..
Oldham—Ashton	„ 11	1,246	+ 73	„	18,121	+ 858	9·13	..
Peterborough	„ 11	332	+ 15	„	4,058	+ 406	5·31	..
Potteries	„ 11	4,154	+ 649	„	61,746	+ 6,803	29	..
Rothesay	„ 11	1,213	— 11	„	6,760	— 203	2·75	..
Southport	„ 11	884	— 43	„	9,752	+ 326	8·17	..
S. Metropolitan	„ 11	2,315	+ 101	„	27,672	+ 1,522	..	..
Swansea	„ 11	3,016	+ 4	„	36,493	+ 2,246	12·5	..
Tynemouth	„ 11	1,275	+ 51	„	8,466	+ 287	3·75	..
Weston-s-Mare	„ 11	1,183	+ 53	„	5,070	+ 496	3	..
‡Worcester	„ 11	873	+ 38	„	9,435	+ 492	5·75	..
Wrexham	„ 11	254	+ 23	„	3,200	+ 124	..	..
Yorks. Wool. Dist.	„ 11	2,235	+ 129	„	33,535	+ 2,374	17	..
Miscellaneous	„ 11	649	+ 14	„	8,228	+ 369	..	..
Burnley	„ 19	2,801	+ 432	..	..	..	11·7	1
Burton-on-Trent	„ 20	714	+ 148	20	6,116	+ 789	6·6	..
Bury	„ 20	3,241	+ 884	20	27,824	+ 2,862	22·5	..
Cardiff	July 29	5,422	+ 766	17	44,064	+ 4,786	..	..
Chatham and Dist.	Aug. 17	2,247	+ 278	33	28,113	+ 340	15	..
Cork	„ 17	1,184	+ 89	33	16,818	+ 439	9·9	..
Croydon	„ 4	3,806	— 56	18	31,238	+ 2,700	..	..
†Darlington	„ 12	241	+ 31	20	4,452	+ 483	..	..
Darwen	„ 18	578	+ 39	20	5,513	+ 476	4·36	..
Dover	„ 12	778	+ 111	19	5,267	+ 893	4·75	..
Dublin	„ 18	13,668	+1,477	..	52,343	+ 9,970	54·2	..
Dundee	„ 2	2,446	— 42	11⅔	13,970	— 126	15	..
East Ham	„ 19	3,776	— 304	20	22,519	+ 1,312	15·25	..
Exeter	„ 18	868	+ 106	20	7,456	+ 657	5·5	..
Glasgow	„ 19	82,549	—3,138	..	212,824	+12,428	98	·75
Hastings	„ 17	3,804	+ 451	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 19	5,779	+ 354	20	57,813	+ 2,877	14·5	..
Ilkeston	„ 17	298	+ 48	20	2,729	+ 126	..	..
Ipswich	..	..	..	..	..	..	10·5	..
Kilmarnock	„ 19	320	+ 23	14	2,835	+ 291	4·5	..
Lancashire United	„ 16	3,169	+ 288	33	44,318	+ 1,557	39	..
Leeds	„ 12	15,250	+ 470	19	147,306	+10,275	108	..
Leicester	..	..	..	..	..	..	..	..
†Leith	July 29	751	+ 98	10⅔	7,738	+ 679	8·72	..
Liverpool	Aug. 12	25,230	+1,890	32	370,420	+15,466	116	2·5
†L.C.C.	„ 9	89,561	+3,350	..	850,985	+58,607	141·5	5·5
London United	„ 19	17,142	+2,400	..	220,136	+ 9,476	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
Manchester	„ 19	34,078	+3,574	21	332,408	+19,884	183	..
Newcastle	„ 19	8,508	+ 813	..	87,643	+ 5,933	14·5	..
Newport	July 29	1,456	+ 80	17	12,742	+ 935	14·5	..
Oldham	Aug. 13	4,098	+ 332	20	40,491	+ 2,543	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	„ 16	1,528	— 102	20	16,083	+ 1,191	..	..
Salford	„ 14	9,872	+ 319	19⅔	96,992	+ 5,162	..	..
Sheffield	„ 22	12,988	+1,157	..	136,310	+ 9,470	40	..
Southampton	„ 16	3,172	+ 642	20	25,737	+ 3,372	..	..
Southend-on-Sea	„ 16	3,845	+ 714	20	15,306	+ 2,201	..	..
South Shields	„ 19	1,540	+ 238	20	18,409	+ 1,734	..	..
Swindon	„ 16	408	+ 63	20	3,248	+ 390	..	..
Tyneside	„ 16	1,192	+ 102	..	3,888	+ 218	..	..
Wallasey	„ 19	2,885	+ 674	20½	23,957	+ 3,876	..	..
Walthamstow	„ 19	1,891	+ 334	20	16,679	+ 1,526	11	..
†West Ham	„ 10	3,040	+ 601	19	53,288	+ 5,606	15·25	..
Wolverhampton	„ 16	2,189	+ 182	20	20,388	+ 1,348	25	..
Cen. London Rly.	„ 19	7,670	—1,789	7	80,862	— 6,328	6·32	..
City & S. Lon. Rly.	„ 20	5,623	— 354	7	21,199	— 348	7·26	..
Dublin-Lucan Rly.	„ 18	£95	— 80	7	1,239	— 20	7	..
G.N. and City Rly.	„ 19	2,574	+ 48	7	9,502	+ 289	3·5	..
L'pool Overh'd Rly.	„ 15	3,400	+ 120	..	9,881	+ 748	6·8	4·3
Llandudno-Col. Bay	„ 11	1,622	+ 88	36½	9,544	+ 809	..	..
London Elec. Ry. Co.	„ 19	20,720	+ 125	7	82,995	+ 1,480	21·25	..
Mersey Railway	„ 19	3,151	— 657	7	12,651	— 1,104	4·5	..
Metropolitan Rly.	„ 20	28,448	—2,896	7	113,595	— 2,467	24·5	..
Met. District Rly.	„ 19	18,883	+ 648	7	74,880	+ 3,615	24	..
Anglo-Argentine	„ 19	97,579	+9,595	..	1,608,677	+152,997	..	..
§Auckland	July	16,199	+1,452	..	..	..	23·3	·6
Bombay (B.E.T.)	„ 21	5,602	+ 302	29	82,708	+ 4,919	..	..
Brisbane	May	21,099	+2,609	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 19	7,081	+ 626	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	July	3,320	..	..	23,784	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Aug. 15	1,508	+ 144	..	22,040	+ 1,861	..	..
§Montevideo	July	22,012	+1,848	..	226,247	+12,894	..	..
Perth (W.A.)	Aug. 18	3,036	..	..	63,117	+ 8,792	22	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

With the partial settlement of the railway strike, Stock Exchang markets adopted a firmer tone. The effect was moral as well a direct, and had considerable influence all round the House Unhappily, the favourable influence thus produced came to b marred by the recrudescence of the Moroccan imbroglio. Thi threw another damper over prices, while the effect of the strik settlement was modified to some extent by the news that th North-Eastern men had not come in, and that some of the Midlan workers also refused to be pacified.

City and South London Ordinary stock remained at 30, in spite o the partial cessation of the system last week-end. Central Londo Deferred shed another point, but the Ordinary stock is a trifl better, allowing for the dividend deduction, while the Preferre shows no change. One of the first stocks to recover after th differences had been arranged was Metropolitan Consolidated, whic put on a point to 45¾, to lose half of it afterwards. Districts ar also ½ higher, though the 4½ per cent. Preference did not recove the fall of nearly 2 which occurred while the strike epidemic wa at its height. Underground Electric Bonds, both 4½ per cents. an incomes, eased off upon apprehensions of the men coming out at th power house; and although this calamity was averted, the fall i the price of the 4½ per cent. issue was not regained.

British Electric Traction Ordinary and Preference have gon back, and the Second Debenture shows a small loss upon th criticism of the directors' scheme. Other movements amongst th domestic stocks are insignificant, and there is not much going o in the foreign and colonial group. Rio Trams are ½ down, bu the 5 per cent. First Mortgage bonds improved to a slight exten Mexico Trams are also easier, although the news from the country has lately been of a negative character and therefo regarded as good.

In the Manufacturing list Callenders have risen ⅛, and Babcock are $\frac{3}{16}$ better, these being the only fluctuations on the week. The is more doing in Rubber shares, and the tone of the market distinctly healthier; at the same time, business is on quite a reta scale. It is thought, however, by those who are in a position know, that there should be some revival in Rubber shares withi the next month or so; but it must be frankly confessed that e pectation has been disappointed so often in regard to a promise rise in this market that it is as well not to prophesy until th knowledge is available.

Movements in the catalogue of English Electricity Supply shar are mostly confined to the deductions caused by *ex*-dividend mar ings. For example, amongst those thus quoted are Brompto Ordinary and Preference, Charing Cross Ordinary and Preferenc Metropolitan Ordinary, and Westminster Ordinary.

Business is very quiet, and the slight buying of the leadi shares which started last month appears to be satisfied for the tim being.

Dramatic movements in the price of Northern Light and Pow 5 per cent. Bonds have given rise to considerable comment durin the last few days. The price, of course, has been falling steadil for weeks past, although the drop had been temporarily arreste about a fortnight ago. Last Friday, however, it was put dow 15 points in one day, being officially quoted at 25-30, and busine was done in between those figures. On the following Monday—*i.* the next Stock Exchange business day—it was restored to 40-4 and a bargain was done at 41. It looks as though somebody too a huge "turn" out of the transaction, and the man who sold th bonds on the Friday was possibly induced to do so by consideration the authority obtained at last week's meeting to place a prior lie issue in front of these bonds. The company requires money, but is not at all surprising that proprietors of the existing bonds shoul resent the suggestion to create a senior security ranking befo their own.

It has frequently been contended here that not a few of the s called bond issues which are made to-day have for their security very flimsy base. A company starts operations in Canada America, and by making an issue of what it calls "bonds," th public subscribe, although the security for the issue may be a rai way line which is not yet constructed, farm lands that are not y irrigated, or a power house still unbuilt. These details are, course, set out in the prospectus, but there is a magic attached the word "bonds" every bit as blessed from the promoter's point view as the word "mesopotamia" was to the old lady, and it seem to us high time for some kind of check to be placed on the loo manner in which the former is so freely utilised.

Aberdeen Suburban Tramways Co.—The directo report that the profits earned on the half-year amounts to £1,4 and that there is a balance of £3,333 at the credit of the profit a loss account. The directors propose adding to the amount at th credit of the renewal and depreciation account, which will the stand at £8,000, £1,800; a dividend at 2½ per cent. for the pa year on the paid-up capital, £180; directors' fees, £42; leaving be carried forward, £710

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations August 22nd.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	7⅜ — 8⅜ xd	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼ xd	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½ xd	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7⅜ — 8½ xd	..	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅜ — 7⅝ xd	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3½ — 4¼ xd	..	5 19 2
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5 xd	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12¼ — 12⅝	..	5 9 10
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅛ — ⅜	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 2⅝	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5½	6	4⅛ — 5	+ ¼	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	8½	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6⅞ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	+ 1	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞ — 4¼ xd	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜ — 3⅞	..	5 3 3
Do. 5 % Pref., Non. Cum.	5	5	5	3⅞ — 4⅜	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7½	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅞ — 9⅛	— ⅛	5 8 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7½ — 8 xd	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	109 —114	—1	6 2 10
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	88 — 90	+1	5 11 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	..
Do. 6 % Pref.	1	6	6	13/16 — 7/8	..	8 6 8
Laministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2¾ — 3¼	+ ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½ — 90½	..	5 10 6
Mexican Lt. & Power, Common	$100	4	4	88 — 90	— 1	4 8 11
Do. 7 % Cum. Pref.	$100	7	7	110 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97 — 98	..	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	— ½	5 9 11
Montreal, Lt., H. and Power	$100	6	7	165 —170	..	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	40 — 42	—3	11 18 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	115 —117	—1½	3 8 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	29/32 — 31/32	— 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅞ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98½ —100½	..	4 19 6
American Telep. & Teleg., Cap.	$100	8	8	137 —139	..	5 15 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3¾	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111½ —112½	..	5 6 8
Do. Def.	Do.	25/-	30/-	25⅝ — 25⅞	— ⅛	5 17 1
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101½ —103½	..	4 16 7
Chili Telephone	5	8	7	6 15/16 — 7 3/16	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87⅛ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10¼ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17¼ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4¼	4½	8 — 8½	..	5 5 11
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102 —104	..	3 16 11
Eastern Extension	10	7	7	13⅜ — 13⅞	..	5 0 11
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10¾ — 11¼	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13⅜	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	86 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	74 — 77	+2½	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2 7/16 — 2 7/16	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 13 2
Do. Def.	Do.	6	6	117½ —120½	..	4 19 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10¾	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/16 — 5 1/16	..	4 7 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do.	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1 7/8 — 1 15/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 1/4	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5	8⅝ — 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131½ —134½	..	4 9 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 5/16 — 7 7/16 xd	..	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅜ — 2⅝	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10⅜	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¼ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜ — 14½	..	4 18 3
Do. 4 % Deb.	Stock	4	4	100½ —102½	+ ½	3 18 1
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	+1	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 22nd.	Rise + or Fall —	Present Yield £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— ⅝	.	Nil
Do. 5 % Pref.	1	5	5	½— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	⅞— 1⅛	— ⅛	Nil
Do. 6 % Pref.	10	1½	1½	3⅜— 4	— ⅛	3 15 0
Do. 5 % Deb.	100	5	5	94 — 97	.	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	1	5 13 11
Central London Railway, Ord.	100	3	3	67 — 69 xd	+ ⅛	4 6 11
Do. Pref.	100	4	4	85 — 87 xd	..	4 12 0
Do. Def.	100	2	2	48 — 50	1	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	29½—31½	..	4 18 4
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13 xd	..	4 12 4
Great Northern & City, Prf. Ord	10	Nil	Nil	⅞— 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼— 2⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3¼— 3⅝	..	Nil
Do. 4 % Deb.	100	4	4	73 — 76	..	5 5 3

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910	Closing Quotations August 22nd.	Rise + or Fall —	Present Yield £ s.
Metropolitan Railway Consol.	100	1	1⅛	45½— 45¾	+ ½	3 0
Do. Surplus Lands	100	2⅜	2⅜	66 — 68	..	4 4
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14
Do. 3½ % Pref.	100	3½	3½	88 — 90	..	3 17
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	..	3 18
Metropolitan District Ord.	100	Nil	Nil	26¼— 26¾	+ ⅛	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3½	86 — 88	—1⅜	3 13
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 9
Metropolitan Elec. Trams, Ord.	1	5	5½	33/32— 1 1/32	..	5 6
Do. Def.	1	Nil	Nil	⅛— 7/32	..	Nil
Do. 5 % Pref.	1	5	5	¼— 1 xd	..	5 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15
Potteries, Ord.	1	2	2	7/32— 11/32	..	..
Do. 5 % Pref.	1	5	5	1/32— 3/32 xd	..	7 12
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18
South Metro. Trams, 6 % Pref.	1	3	6	13/32— 19/32	..	10 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15
Underground Elec. Railways 5 % Prior Lien	..	5	5	100⅜—101½	..	4 18
Do. 4½ % Bonds	100	4½	4½	98 —100	—1	4 10
Do. 6 % Income	100	Nil	1	59 — 61	—2	1 12
Do. Power House Debs.	100	..	4	101 —103	..	3 17
Yorkshire (West Riding), Ord.	5	Nil	Nil	¼— 3/8	..	Ni
Do. 6 % Pref.	5	Nil	Nil	2⅜— 2⅝	..	Ni
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16— 5 5/16	..	5 3 6
Do. 2nd Pref.	5	5	5	4¾— 5	..	5 0 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102·—105	..	4 16· 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96⅜— 98⅝	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6½— 7	..	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	139 —143	..	5 11 11
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102⅜—104½	..	4 6 2
Calcutta Trams, Ord.	5	4½	6	5⅜— 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16— 9/32	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 9/16— 5 13/16 xd	..	4 12 6
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	5/16— 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92⅜— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf,	1	6	6	1 5/16— 1 1/16	..	5 1
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	..	5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97½— 99½ xd	..	5
Mexico Trams Com.	$100	7	7	120 —122	— ½	5 1
Do. Gen. Con. 5 % Bonds	..	5	5	99½—100½	..	4 19
Do. 6 % Bonds	100	6	6	99 —101	..	5 18
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛— 7⅝	..	6 1
Do. 6 % Pref.	5	6	6	5¼— 5⅝	..	5
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 19
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	5/32— 7/32	..	
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 19
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜— 5⅝	..	5
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4
Rio de Janeiro Trams	$100	1	4½	115½—116½	— ½	3 17
Do. 1st Mort. 5 % Bonds	..	5	5	101¼—102½	+ ¼	4 19
Do. 5 % Mort. Bonds	100	5	5	97 — 98¾	..	5
Sao Paulo Tram, Lt. and P.	$100	10	10	178 —181	..	5 1
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 1
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98	..	5
Un. Elec. Trams Monte Video	5	5	6	5½— 6	..	5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 11
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	3/32— 3/32	..	Nil
Do. 6 % Pref.	1	12	9	1½— 1⅝	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜— 5⅝	+ 3/16	4 12 6
Do. Pref.	1	6	6	1⅜— 1⅝	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅜— 7⅜	..	6 15 7
Do. Pref.	5	6	6	5¾— 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1½— 15/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/·	..	Nil
Do. Pref.	1	Nil	Nil	5/·—6/·	..	Nil
Brush, Ord.	2	Nil	Nil	7/16— ½	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛— ⅜	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	..	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9½— 9⅝	+ ⅛	7 15 11
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	33½— 35	..	4 17 0
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅜— 7/16	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2

Dick, Kerr	1	6	5	13/16— 15/16	..	5
Do. Pref.	1	6	6	1 5/32— 1 7/32	..	5
Do. Deb.	100	4½	4½	95 — 98	..	4 1
Edison & Swan, A, £3 paid	5	Nil	Nil	9/16— 11/16	..	Nil
Do. fully paid	5	Nil	Nil	1 5/16— 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6
Electric Construction	2	Nil	2½	11/16— 13/16	..	6
Do. Pref.	2	7	7	1 1/16— 1 1/8	..	7
Greenwood & Batley, Pref.	10	7	7	7¾— 8½	..	8
Do. Deb.	100	5	5	94 — 96	..	5
General Electric, Pref.	10	5	5	8½— 9	..	5 1
Do. Deb.	100	4	4	88 — 93	..	4
Henley's, Ord.	5	15	15	12⅜— 12⅞	..	5 1
Do. Pref.	5	4½	4½	4 15/16— 5 1/16	..	4
Do. Deb.	100	4½	4½	106½—108½	..	4
India-Rubber, G. & T.	10	10	10	11½— 13½	..	7
Do. Pref.	10	5	5	9⅞— 10⅝	..	4 1
Telegraph Construction	12	17½	20	34½— 36½	..	6 1
Do. Deb.	100	4	4	100 —102	..	3 1
Willans & Robinson	1	Nil	Nil	1/32— 5/32	..	
Do. Pref.	5	1½	Nil	½— 1	..	
Do. Deb.	100	4	4	55 — 65	..	6

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

THE LAW RELATING TO THE ESCAPE OF ELECTRICITY.

[FROM OUR LEGAL CONTRIBUTOR.]

Amongst the legal problems to which the use of electricity has given rise, perhaps there is none of greater interest than the question whether persons or companies supplying or generating electricity can be held liable for the damage caused by an escaping current. The solution of the question is by no means free from complexity, and it may therefore be profitable to discuss, in so far as it is possible to do so within the scope of a short article, the principles which appear to have been adopted in the Courts. Reference may be usefully made to American decisions, inasmuch as the legal principles which are applicable seem to be the same on both sides of the Atlantic. Having reviewed the cases which have arisen in relation to the escape of powerful currents of electricity, we shall discuss the questions which are likely to arise in connection with the transmission of wireless messages.

A current of electricity which is travelling along the mains of a supply company, or returning through earth, may do mischief in one of two ways, *e.g.*, by induction, as in the case where it affects the working of telegraphic apparatus, or by setting up electrolytic action, by which iron pipes beneath the soil belonging to gas or water companies are sometimes corroded. If damage is caused in either of these ways, it is necessary to see whether the person who has generated the escaping current can be held responsible in any and what degree. It is proposed to approach this question, in the first instance, without regard to the statutory protection express or implied, which is so often conferred upon a company or municipality who are carrying out a public work for the public benefit.

It was long ago declared that any man who brings anything on to his land which may escape and do damage to his neighbours' property, must keep it there at his peril, and the very fact of its escaping is *prima facie* evidence of negligence. This principle was settled in relation to water in the case of Fletcher *v.* Rylands (1868. L.R. 3 H.L.C. 330). There the defendant had made an artificial lake on his estate. The water broke through and flooded certain shafts in a mine belonging to the plaintiff. The defendant was held liable. Mr. Justice Blackburn stated the principle to be that anyone who brings on to his property something which is not naturally there, harmless to others so long as it is confined to his own property, but which he knows to be mischievous, if it gets on his neighbour's land, must keep it at his peril "and ought to be obliged to make good the damage which ensues if he does not succeed in confining it to his own property." It was of the very essence of this decision that the plaintiff was injured through no fault of his own. Quoting Mr. Justice Blackburn, Lord Cairns, in giving judgment in the highest legal tribunal in England—the House of Lords—said at page 340 of the report :—"The person whose grass or corn is eaten down by the escaping cattle of his neighbour, or whose mine is flooded by the water from his neighbour's reservoir, or whose cellar is invaded by the filth from his neighbour's privy, or whose habitation is made unhealthy by the fumes and noisome vapours of his neighbour's alkali works, is damnified without any fault of his own."

The principle of Fletcher *v.* Rylands, modified, as we shall endeavour to show, in a very material particular, has been applied to electricity ; and it was so applied for the first time in America, where the doctrine of Fletcher *v.* Rylands,with an important modification, was accepted. In Pixley *v.* Clarke (32 Barbours' New York reports), the Court held that :—"Individuals owning the bed of a stream, and each bank thereof, have a right to build a dam and embankment, and to raise the water of the stream as high as they please, subject only to restriction resting upon all, so to enjoy their own property as not to injure that of another person, with the qualifications and limitations incident to that right of property. And if in the exercise of that right they build with due care an embankment to prevent the water when raised by their dam above the natural banks of the stream, from overflowing the lands of adjacent owners, and in consequence of raising their dam the water finds its way through their own natural soil, and below the surface thereof, by filtration, percolation or otherwise to the land of an adjacent proprietor, the owners of such dam or embankment are not, in the absence of any unskilfulness, negligence or malice, liable to such adjacent proprietor for any damage he may sustain thereby, the injury being *damnum absque injuria*."

In the case of Cumberland Telephone and Telegraph Co. *v.* United Electric Railway Co. (1890) 42 Fed. Rep. 273, the head note was as follows : "In the present state of electrical science a telephone company cannot maintain a Bill for an injunction against the operation of an electric railway to prevent damages incidentally sustained by the escape of electricity from its rails." The facts of this case may be thus epitomised :—

The plaintiff telephone company had obtained legislative authority to construct and maintain telegraphs and telephones or other lines necessary for the speedy transmission of intelligence along and over certain highways. The defendants were five street railways, all operated by electricity under the Sprague and Thomson-Houston systems, and using a trolley or overhead wire. By an Act approved March 21st, 1887, amending the general incorporation laws, all street railways thereafter organised under the general laws of the State were authorised to propel their cars by electricity. By another Act, approved February 28th, 1899, all street railway companies which before that time had operated cars by animal power, were empowered to operate the same by electricity, provided the city gave its assent. Acting under this supposed authority, one of the defendants, the McGavock and Mount Vernon Co., proceeded to equip a portion of its road with electricity. Thereupon and on April 17th, 1889, the complainant filed a Bill in the Chancery Court to restrain it from so doing. Before the cause was heard, the parties entered into an agreement by which the telephone company agreed to dismiss its Bill ; to elevate all its wires, which might interfere with the operation of the road : to use all means to prevent their wires coming into contact with the trolley wires of the road, and not to interfere further with the operation of the road, the railroad company agreeing, upon its part, to construct at its own expense a return metallic circuit, for the use of the telephone company, "whenever it is ascertained that its service is being injured by electricity generated by the railway company, and to use all necessary precautions to prevent the telephone wires from coming into contact with its own wires." In January, 1890, a similar agreement was made between the telephone company and the City Electric Railways, with a proviso that if, upon a fair trial, the return wire should not protect the telephone company from substantial injury, the parties should be remitted without prejudice to their legal rights and remedies as they existed before the agreement was made. The action was brought to determine the nature of these legal rights. It was alleged that the metallic circuit had not given the relief anticipated, and that the complainant was not estopped by the agreement. It was asserted that the electricity passing through the earth reached the wires of the telephone company through various agencies, and that this current produced loud noises and greatly interfered with the working of the instruments.

It was also averred that the service was interfered with by induction, where a varying current of electricity, conveyed on a conducting wire, will produce in a parallel wire other amounts of electricity. The defendants, among other pleas, urged that the complainants were not entitled to a monopoly of the earth for the return circuit, and insisted that they should make use either of a complete metallic circuit or of a device known as the "McCluer device" for the return circuit.

After a lengthy review of cases bearing upon the point, Brown, J., said : "The substance of all the cases we have met with in our examination of this question is that where a person is making lawful use of his own property or of a public franchise in such a manner as to occasion injury to another, the question of his liability will depend upon whether he has made use of the means which, in the progress of science and improvement, have been shown by experience to be the best ; but he is not bound to experiment with new inven-

tions, not generally known, or to adopt expensive devices, when it is within the power of the person injured to himself make use of an effective and inexpensive method of prevention. If, in the case under consideration, it were shown that the double trolley would obviate the injury to the complainant without exposing the defendants or the public to any great inconvenience or a large expense, we think it would be their duty to make use of it, and should have no doubt of our power to aid the complainant by an injunction; but, as the proofs show that a more effectual and less objectionable and expensive remedy is open to the complainant, we think the obligation is upon the telephone company to adopt it, and that the defendants are not bound to indemnify the complainant; in other words, that the damage incidentally done to the complainant is not such as is justly chargeable to the defendants. Unless we are to hold that the telephone company has the monopoly of the use of the earth within the city of Nashville for its feeble current, not only as against the defendants, but as against all forms of electrical energy which in the progress of science and invention, may hereafter require its use, we do not see how this Bill can be maintained." In the event the injunction was refused. It is conceived, however, that the result might have been otherwise if a telephone company had been unable to effect an improvement by a comparatively slight modification of their plant.

The English Courts appear to have arrived at the same conclusion. The point was first raised in the case of National Telephone Co. *v.* Baker (1893) 2 Ch. 186. There a tramway company acting under statutory authority and using what was said to be the best known system of electrical traction (*i.e.*, overhead wires and return through insulated rails), caused electrical disturbance in the wires of the telephone company. These disturbances prevented the telephone being used. It was proved at the trial that the use of a second wire by the plaintiffs would have completely cured the disturbances complained of, but it was also proved that nearly the whole of the plaintiff company's telephone business throughout the country was carried out by means of the single-wire system. An action having been brought by the plaintiffs, the defendants pleaded that an alteration of the plaintiffs' system would have minimised the nuisance. With regard to this plea, the judge said that inasmuch as the plaintiffs were carrying on their business lawfully, he could not put them to the expense of altering it merely for the purpose of enabling the defendants to run their trams without creating a nuisance. As events turned out this opinion became a mere *obiter dictum*; that is to say, an expression of opinion which was not material to the issue, as the case was decided in favour of the defendants, because they were expressly authorised by statute to use electrical power, and the learned judge held that the Legislature must, therefore, have condoned by anticipation any mischief arising from the reasonable use of such power.

In 1902 the case of the Eastern and South African Telegraph Co., Ltd., *v.* the Cape Town Tramways Co., Ltd. (1902, A.C. 381), came before the Judicial Committee of the Privy Council, on appeal from the Supreme Court at the Cape. There the defendant company owned certain tramways worked on the overhead system, and having uninsulated returns which ran along the sea front at Cape Town and its suburbs. Part of the line was worked under statutory protection, and part of it was worked without statutory authority. The plaintiff company owned a submarine cable, which runs out to sea through Table Bay.

It was found that at some point in Table Bay electricity having escaped and being at large, was attracted to the telegraphic cable. Entering the sheathing, it found its way back to the tramway central station, and so completed the circuit. While travelling along the sheathing the intensity of the current varied frequently at irregular intervals, and gave rise to such induced currents in the core of the cable as to render it practically useless for the transmission of messages. In these circumstances the plaintiff company were put to great expense to effect a remedy, and in the event it was found that by laying a second cable parallel to the first all through the sphere of influence, the mischief was abated. They sought by action to restrain the tramway from so carrying on their business as to be a nuisance, and incidentally to recover, by way of damages, the expenses to which they had been put in making experiments and laying the necessary protecting cable. Owing to the fact that section of the tramway was worked otherwise than statutory power, the question of the company's liability law was distinctly raised.

The Court below having found in favour of the defendants, the telegraph company appealed to the Privy Council. At the hearing, the American case of Cumberland Telegraph and Telephone Co. *v.* United Electric Railway Co. (*supra*) was referred to. The plaintiffs, however, relied upon the simple doctrine of Fletcher *v.* Rylands to give them cause of action. In giving judgment, Lord Robertson said:- "If regard be had solely to the action of the respondents storing electricity on their lands, it must be allowed that the analogy is very close to the illustrations given Rylands *v.* Fletcher of the kind of things which an owner can only do at his own peril. Electricity is capable, when uncontrolled, of doing injury to life and limb, and to property; and in the present instance it was artificially created or generated in such quantity that it escaped from the respondents' premises and control. So far as the respondents are concerned, it appears to their Lordships that given resulting injury such as is postulated in Rylands *v.* Fletcher and the principle would apply. But this is only half the question, and it remains to be seen if the injury postulated is present. The true comparison is with things used the ordinary enjoyment of property, and this cable differs from such things in its peculiar liability to be affected even minute currents of electricity. Having regard to the appellants' argument, it seems necessary to point out that the appellants, as licensees to lay their cable in the sea, and owners of the premises in Cape Town, where the signals are received, cannot claim higher privileges than other owners land, and cannot create for themselves, by reason of the peculiarity of their trade apparatus, a higher right to limit the operations of their labours than belongs to ordinary owners of land who do not trade with telegraphic cables.

"If the apparatus of such concerns require special protection against the operations of their neighbours they must be found in legislation, the remedy at present invoked is an appeal to a common law principle which applies much more usual and less special conditions. A man cannot increase the liability of his neighbours by applying his own property to special uses, whether for business or pleasure. Nor need the law be regarded as showing a want of adaptability to modern circumstances if this be true view, for the liability thus limited is of insurance."

Hitherto we have considered the question of liability independent of statute. Consideration of the authorities seems to warrant the conclusion that the fact that electricity is being used under statutory power, will excuse the company from liability. Liabilities on this head are usually only imposed where there is some evidence of negligence. In the Cape Town case, for instance, the company specially undertook, by an agreement which was incorporated with and formed part of the statutory power under which they worked the greater part of the tramway, that, in the event of any electric leak taking place and doing injury by electrolysis or otherwise, they would make good the loss. In the opinion of the Privy Council, however, the injury done to the return current in the submarine cable was not the result of a leak. "It was," to use Lord Robertson's words, "on the contrary, a natural incident of the operations legalised under the statutes."

Thus has the law been settled, and its settlement has been a matter of far-reaching importance to electrical companies of all kinds. It has compelled telephone companies to adopt the two-wire system and to adopt every other kind of improvement which is capable of rendering the service immune from injury which might be sustained owing to the vicinity of heavy current mains. Nor has the above declaration of the law been without its effect on subsequent legislation within the British Empire. By a statute recently passed in Natal, a tramway authority were specially enjoined not so to conduct their business as to cause any interference with a neighbouring submarine cable.

With regard to electrolysis caused by escaping electricity it will be at once appreciated that injury from this source can only be caused by the negligent laying or up-keep of mains; and it is conceived that no Legislature would ever

use an electric supply from the consequence of such ligence.

n England, however, the Legislature has considered it edient upon one or two occasions to expressly reserve s liability to the tramway company. Thus, Sec. 46 of City of Birmingham Tramways Act, 1901, provides t :—"If it be proved that any injury or damage to any or water pipes, or other metallic pipes belonging to the poration, shall have resulted from fusion or electrolytic ion caused by any currents generated or used by the npany for the purpose of electric traction under this Act, hing in this Act shall relieve the company from any bility to make compensation for any such injury or nage, which would not have existed but for the passing his Act."

Passing on to the question of wireless telegraphy, it is ceivable that the messages from a transmitter belonging one person might affect and seriously incommode the rking of a receiver belonging to someone else. In the nt of the above statement of the law of escaping elec-ity, could any redress be sought?

It is thought not. It may be true that in sending ssages broadcast from a transmitter a man is discharging nething (if such a word is appropriate) from his own perty, which may be a source of inconvenience to his ghbour; but it is conceived that if any neighbour makes of a receiver he must either be content to submit to erference with his messages or else take such precautions ether by "tuning" his transmitter, or otherwise, as to vent his instrument being affected. Such, it is conceived, he principle of law applicable to wireless telegraphy. In ng a receiver a man uses a highly delicate instrument, d if his neighbour's messages reach him he has no redress law. There remains a question of greater nicety. ppose the owner of a receiver of wireless messages records message sent from a transmitter belonging to someone e, can he be restrained from making use of that message? ease in relation to telegraphs has arisen in England ich is likely to give any clue to the solution of a problem this kind. This is probably because the telegraph has so g been a Government monopoly that no one has ventured tamper with it. Further, an Act of Imperial Parliament ich was passed in the year 1904 to bring the use of eless telegraphy under State control, is silent with regard the question under discussion. It may be that in the rse of a few years we shall have to report some interesting ision on the subject.

REVIEWS.

inciples of Electrical Engineering. By H. Pender, Ph.D. London: Hill Publishing Co. Price 17s. net.

It is worth while to quote in full one paragraph from the roduction of the book which we are about to consider, ce it states clearly the aim which the author has had in w during its preparation. The author says:—

"The acquisition of knowledge in any technical subject quires first of all an analytical mind, that is, a mind pable of following out in detail the relation between cause d effect. The performance of various kinds of electric paratus and various magnetic and electrical effects that ne under the observation of the electrical engineer, can all explained in terms of a comparatively few fundamental nciples or natural laws. First of all, the student must come thoroughly familiar with these fundamental laws of ture. He must then learn to interpret individual electric d magnetic phenomena in terms of these laws, or *vice rsâ*, from his knowledge of these fundamental principles predict what effect will take place under given conditions."

Having noted the author's special object, to develop the ole of his subject from a few fundamental laws, we may ceed to summarise his treatment.

Chapter I deals with the fundamental units and defini-ns of momentum, force, energy, &c. Vectors are also scussed, and the same term is made to include both localised vectors," or rotors, as they are more strictly called, and the true vectors, which have a significance which is independent of their position in space. The next chapter deals with magnetism; beginning with a description of para-magnetic and diamagnetic substances, it proceeds to define units of magnetic strength of poles and field from the definitions of force already derived. Later we learn to detect and to measure an electric current from observing the magnetic field surrounding a wire which joins the opposite poles of a battery. Incidentally, we find the following logi-cally deduced definitions of conductors and insulators:—"Any substance which, when connected to the poles of an electric battery, has a magnetic field produced around it, as long as it remains in contact with these poles, is called a conductor of electricity; if no magnetic field is established around the substance, it is called an insulator or dielectric."

After an investigation of the field due to electric currents, we are able to deduce the unit of quantity of electricity. The next definition is that of unit of resistance from the rate at which heat is developed by the current. From the difference in the energy possessed by the current at different points in the circuit, follows the definition of the unit of potential difference. Next comes Ohm's law, and then various applications of the laws of Kirchhoff. The chain of reasoning based on the energy of the electric current leads further through the phenomena and applications of electromagnetic induction. Similar, step by step, reasoning takes us through further chapters on electrostatics, variable currents and alternating currents. A special chapter is devoted to the symbolic method of Steinmetz, and another to the considera-tion of three-phase alternating currents.

The main characteristic which distinguishes the author's treatment from that given in other text-books which cover much the same ground, is the continuous chain of reasoning which seeks to lead the student on deductively from the fundamental laws of mechanics to the various principles of electromagnetism in succession. For the manner in which Prof. Pender has carried out his plan, we have little to offer but praise, except perhaps that we have found his style here and there a little laboured and cumbersome.

The question whether Prof. Pender's plan is the one best suited to a student's text-book, must be a matter of personal opinion. If the reviewer gives his reasons for differing from the author on this point, he must not be thought to condemn a method of treatment which may be valuable in the hands of teachers whose experience has been different from his own.

In the reviewer's opinion, then, the successive deduction of so many principles by logical reasoning alone, from one or two fundamental laws, practically without reference to actual observations or experiments, is unnatural and unlikely to give the student concrete ideas of the phenomena about which he is reasoning. For the advanced student, who is already familiar with the phenomena, the chain of reasoning would form an instructive exercise. That the book is not primarily intended for advanced students, appears from the large amount of comparatively elementary matter which it contains. The definition given of conductors and insulators has already been quoted. This definition is perfectly logical; but can any definition be conceived which would be less likely to convey a concrete idea of the nature or use of conducting and insulating substances to the learner?

Again, is not a purely deductive treatment of natural phenomena likely to make the study of them dreadfully uninteresting? Can any enthusiasm be worked up on learning that the factor M in the equation—

$$W = \tfrac{1}{2} L_1 I_1^2 + M I_1 I_2 + \tfrac{1}{2} L_2 I_2^2,$$

is called the "coefficient of mutual induction"? And yet this is the way in which this important constant is intro-duced to, and defined for, the student (see page 181).

Lastly, a text-book produced on this plan is little adapted for reference. Definitions and explanations depend so largely on their place in the chain of reasoning, that it is difficult to make use of them apart from their context.

A list of errata is given at the beginning of the book, but there are other misprints—*e.g.*, on page 7, "vector quan-tities" should read "vectors"; also, on page 245, we find: "The average value of an alternating current is defined as the numerical value of its instantaneous values between successive zero values."

We may, perhaps, quote one passage to illustrate the author's rather cumbersome style, to which a reference has already been made. On page 84 we read:—"The properties possessed by free space, or any space occupied by a dielectric, are found to be analogous to the properties which would be possessed by this space were the incompressible fluid in this space enclosed in minute cells with elastic walls, forming a cellular or honeycomb structure with continuous walls, completely filling this space; while the properties possessed by a conductor are analogous to the properties possessed by a space in which the walls of the cells are completely destroyed."

In concluding this notice, the reviewer does not think that Prof. Pender's book is at all likely to displace the many excellent text-books on the principles of electricity and magnetism which are at present in use in this country, in which theory and experiment are developed side by side to the advantage of both aspects of science. At the same time, he can cordially recommend a perusal of the book to the more advanced student who finds a special interest in the abstract, rather than the experimental, side of physics.

A Handbook of Wireless Telegraphy. By J. Erskine-Murray, D.Sc. Third Edition. London: Crosby Lockwood & Son. Price 10s. 6d.

This work has again been considerably revised. Much new matter has been added and certain parts deleted. The alterations have undoubtedly added to the value of the book.

The frontispiece gives a reproduction of trans-Atlantic signals recorded on photographic tape, and indicates one direction in which much valuable progress may yet be made in radiotelegraphy.

Water Wireless Telegraphy. By Habibur Rahman Khan, Deputy Superintendent of Telegraphs, Allahabad.

An illustrated pamphlet containing an account of experiments made in India on utilising water courses to convey interrupted currents from point to point. The river or water course is made to take the place of the overhead telegraph line. With interrupted currents the author claims to have succeeded in establishing communication by this means over distances considerably exceeding previous efforts. The author is, however, much too sanguine in his deductions as to the future scope and utility of the method.

Telegraphen und Fernsprechkabelanlagen. By C. Stille. Braunschweig: Friedr. Vieweg & Sohn. Price 13 marks.

A manual of German practice in the manufacture of telegraph and telephone cables, with descriptions of cabling machinery and methods of construction of gutta-percha and paper-covered cables. Details of laying and jointing underground cables, terminating appliances used and methods adopted for leading-in, are fully explained. The book forms a good *résumé* of modern methods, and is copiously illustrated throughout.

The Modern Bioscope. London: Gane's, Ltd. Price 3s. 9d.

Many electrical engineers and contractors are unaware of the amount of business which is to be obtained in connection with the "moving picture" industry. Special electrical regulations have been drawn up and are being enforced in regard to the electrical equipment of buildings which are used for bioscope entertainments. The necessity for electrical knowledge on the part of the operator is apparently only realised in this country by the proprietors of cinematograph theatres and the technical Press of the industry; and it is therefore interesting to note that a considerable section of the second edition of the "Modern Bioscope Operator" has been devoted to the subject.

Electric light is now almost always employed for bioscope work, not only because a more brilliant light can be obtained than by any other illuminant, but also on account of the great intensity and smallness of the illuminant area that can be obtained when it is employed—two important factors in the obtaining of high-class results. As it is necessary, therefore, that the operator should be conversant with the nature and use of both continuous and alternating currents, the first part of the section is devoted to explaining in a lucid and not too highly technical manner, the characteristics of the two systems.

A number of wiring hints are then given, which are certain to be of value to the reader. Taken in all, these are carefully written. The transformer is dealt with at some length, and the question of no-load losses is discussed. It is the general opinion that alternating current is unsuitable for cinematograph work, and the writer of the chapter is to be commended for advising the use of a motor-generator in cinematograph theatres on alternating circuits. Rotary and auto-converters also come in for attention, and a good many convincing examples of the economics effected by the use of such appliances are worked out in detail.

Engines and dynamos are briefly dealt with, and, in connection with generating sets, the writer advises users of metal-filament lamps always to run them off a storage battery, as, although the extra cost of such a battery is "rather high," any sum so spent will be more than saved by the longer life obtained from the lamps. Electrical contractors as a body will probably be quite prepared to endorse this statement as to the advisability of laying down a set of cells. At the same time it may be mentioned that electrical lamp makers will not agree with the statement that metal filament lamps are "very fragile and extremely susceptible to variations of voltage."

The necessity for care in looking after the generating plant is emphasised, and the points which should be possessed by high-class switches are enumerated.

The rest of the book deals with the film, the projecting apparatus, and the care necessary with it, a good deal of information being given as to operating, detailing the pitfalls that are to be avoided, and the work concludes with the various regulations affecting cinematograph theatres in the United Kingdom, these being given in full. Altogether, it is a book which can be confidently recommended to the operator, as well as to those who desire to become operators and one which will not be without interest to the electrical contractor who has his eye on the wiring of buildings which are to be used for bioscope work.

Elektrotechnische Winke für Architekten und Hausbesitzer. By Dr. L. Block and R. Zaudy. Berlin: Julius Springer. Price M. 2 80 pf.

Although numerous books on the purely electrical side of wiring are available, there is still an opening for a book like the present one, dealing in a somewhat less technical manner with the question of electrical installations from the architect and builder's point of view.

As the writers point out, the cheapness of such installations is greatly dependent on the care and skill of the architect who plans the building, and this cheapness can be attained without in any way increasing the general cost of construction, provided that a few simple rules, such as are discussed in this book in non-technical language, are kept in mind.

Chapter I deals with general installation work, starting with the entrance of the mains into the consumers' premises and containing sections on the preparation of wiring diagrams, cable supports, methods of running the leads, distribution boxes, joint boxes and switches, installations in old buildings, the lighting of business premises, &c.

Chapter II describes the various kinds of electric lamps and discusses their suitability for various purposes. Useful and complete tables are given of the necessary candle-power per square metre of floor space, and the watts per candle power, with the various lamps. There are also some notes on show-window and general advertising illumination.

Chapter III is on electric cooking and heating problems and Chapter IV deals with the applications of electric power to various other household purposes, such as lifts, fans, pumps, vacuum cleaners, accumulator charging, cold storage, &c.

Chapter V contains an interesting description of numerous ctrically-driven tools and machines, which are gradually ning into more general use in connection with building erations.

In conclusion, a reprint of a set of simple rules drawn up the Verband Deutscher Elektrotechniker for the use of hitects, is given.

The book is well illustrated, and, although small, con- us a very useful amount of information which would be ite as valuable to English architects as to those to whom is more particularly addressed.

THE ECONOMIC DEVELOPMENT OF ALUMINIUM.

MONOGRAPH on the economic development of the aluminium lustry has been published for Dr. Wilfried Kossmann by the assburger Druckerei, which, among other matters, throws fresh ht on the activity of the former international syndicate in this nch. It is stated in the first instance, that the world's production the metal only amounted to 175 metrical tons in 1890. In 1900 output reached 7,300 metrical tons, and the consumption was same quantity; in 1905, the figures were 11,500 tons and 500 tons respectively; in 1909, 24,200 tons and 30,800 ns; and in 1910, 34,000 tons and 33,500 tons respectively. The rk sets forth the following companies as the producers of minium at the present time, together with their individual out- t in 1910 :—

Companies.	Situation of works.	Production in metrical tons in 1910.
uminium Industrie Gesell- chaft, Neuhausen	Switzerland, Austria and Germany	6,000
ciété Electro-Metallurgique Francaise, Froges	France	6,000
mpagnie des Produits Chimi- ques d'Alais et de la Camarque, Salindres	France	2,500
itish Aluminium Co.	Scotland	4,000 to 5,000
uminium Co. of America	United States	12,000
rthern Aluminium Co.	Canada	
ciété des Forces Motrices et Usines de l'Arve	France	600
ciété des Produits Electro- Chimiques et Métallurgiques des Pyrenées	France	500
ciété Electro-Métallurgique du Sud-Est	France	300
ciéte d'Electrochemie	France	300
bruder Giulini, Ludwigshaven	Switzerland	400
cietà Italiana per la Fabbrica- zione dell' Aluminio	Italy	600
glo-Norwegian Aluminium Co.	Norway	500

The first five companies produce nine-tenths of the world's tput, the remaining one-tenth being divided among the other rks. As to the amount of the production, it will be seen that ance and the United States, including Canada, occupy the ding position. Only one works is located in Germany, namely, at at Rheinfelden, Baden, which belongs to the Neuhausen Co. is considered that the existence of water power has played a uch greater part in the selection of the site of the works than e geographical situation of the bauxite fields which contain the w material alumina. The development of prices has been an portant factor in the extension in the use of aluminium. The ice is declared to have amounted to as much as £50 per kilo- amme in 1855. In 1890 the quotation was 27s. 6d.; 2s. in 1900, 3d. to 3s. 9d. in 1905, 1s. 3d. to 1s. 6d. in 1909, and 3¾d. to 1s. 7½d. per kilogramme in 1910. Down to 01, when the price averaged 2s. 2½d., a large down- ard movement took place. But in the course of that year syndicate was formed by the Neuhausen Co., the French orks at Froges and Salindres and the English and American mpanies. The syndicate played a determining part in the urse of prices in the succeeding years; and both prices and pro- uction experienced an increase. It is possible that the advance the output was mostly due to natural conditions as the ndicate concerned itself very little with the creation of new heres of use for the metal. but the price movement is solely plained by the action of the combination. The early years of e syndicate's activity proved to be extremely favourable; the oduction developed in proportion to the demand, and the ndicate was able to raise the price temporarily in 1907 to 4s. r kilogramme. Owing to the advance in price, the remunera- veness of the companies largely increased, and raised the hope at it would be of a lasting character. All the works were tended, and when the Héroult patents expired in 1905, new mpanies were formed, and their plant was mostly completed in 907. The productive capacity was thereby largely increased, and he works outside the syndicate began to place aluminium on the arket below the convention prices. During 1908 the management of the syndicate was compelled to reduce the price several times without attaining the desired results, and the syndicate was dissolved at the close of September in that year, when the price further declined in consequence of the competition for orders. Contracts were even concluded at the close of 1908 at 1s. 1¼d. per kilogramme, a rate which is declared not to have covered the prime costs of most producers.

The author, in referring to the history of the syndicate, states that its activity extended to the fixing of prices and to the division of the total quantity to be offered for sale among the members according to a percentage basis, whilst, at the same time, specified markets were allotted to the companies individually. The relation of the Pittsburg Reduction Co. (the former name of the Aluminium Co. of America) to the syndicate, was very slack from the beginning. The fact that this company erected works in Canada, which was subsequently made an independent undertaking, and which was exclusively built for export purposes, shows that strong interests, as the author remarks, existed in opposition to the German producers. The management of the syndicate was not exercised jointly by members, but lay in the hands of the Neuhausen Co., which almost fixed the price independently and assigned the orders to the constituents in accordance with the percentage of their allotments. The company owed this position to its great experience and success and to the circumstance that it was the largest producer in Europe at that time; the company's output was almost one-third of the world's production, whilst the two French companies were responsible for 20 per cent., and the English company for 8 per cent. But this proportion completely changed with the lapse of time, and although the Neuhausen Co. increased its capacity the extensions were no longer limited to the output of aluminium, but were applied to other branches. At the same time the French company at Froges largely expanded its production, and has reached the level of the Neuhausen Co. at present in regard to aluminium, if it has not surpassed it. The advent of other companies further reduced the importance of the Swiss company in the aluminium market, and the displacement of power in this respect is assumed to be one of the reasons for the collapse of the syndicate, although a defect from the beginning was to be found in the lack of a binding agreement. The dissolution of the syndicate was hastened by the crisis in the United States in 1909, which was very perceptible in the automobile industry, in which a large quantity of aluminium is used.

The efforts made to revive the syndicate in the second half of 1909 led to an improvement in prices, but the negotiations were unsuccessful. Nevertheless, an important step in this direction is recorded in the combination, which the French producers formed in November, 1910, under the heading of the Frankfort Metall Gesellschaft, but it is considered to be an open question whether the French organisation will lead to the constitution of a fresh syndicate to control the trade of the world.

THE WORK OF THE UNITED STATES BUREAU OF MINES IN CONNECTION WITH THE TESTING OF AMERICAN FUELS.

(*Abstracted.*)

AN illustrated article by H. M. Wilson (C.E.), which appeared in the April issue of *Cassier's Magazine*, gives a good account of the many-sided work carried out by the United States Bureau of Mines, since the inauguration of a fuel-testing station at the Louisiana Exhibition of 1904. The author is in charge of the Government Laboratory for Fuel-Testing at Pittsburg, Pa., and the article is published by the express permission of Dr. Holmes, Director of the U.S.A. Bureau of Mines.

Referring to his introduction to the arguments for some change in the principles which govern coal purchase in the United States, the author remarks :—

"The purchaser is afraid to buy from any but such dealers as he knows and trusts, because, although each dealer claims that his coal is equal in quality to that of others, yet if it prove unsatisfactory, there is no standard for settlement or for cancellation of the contract. Many thousands of dollars' worth of coal are bought each year in this manner, but the purchasers would consider it ridiculous if they were asked to contract for a building, with no specifications, and simply on the agreement that it should be of a certain size and well constructed. Never would they buy gold, silver, or even copper and iron ores on the mere information that they were mined at certain localities. All products of mines are now purchased, to a great extent, on the basis of their value as shown by chemical analysis. This is true of coal in only a small degree, but the number of contracts made on this basis is increasing every year."

Bulletin XI of the United States Bureau of Mines gives details of these new methods of coal purchase, and the author's comment upon them is worthy of reproduction here. "He who buys coal under a specification, fixing the number of British thermal units as the basis thereof, *gets what he pays for and pays for what he gets.*"

Turning now to the details given relating to the special work of the Bureau of Mines, the author gives the following account of its inauguration and later developments :—

"The first definite step towards scientific coal testing taken in the United States, aside from the few scattered fuel tests made by a few of the larger and more intelligent coal consumers, and at a few of the Universities, was the provision by Congress in 1904 for an exhibition (at the Louisiana Purchase Exposition, St. Louis, Mo.) of fuel testing. This has been followed up by annual appropriations for fuel testing under the Department of the Interior, which work is being conducted as one of the principal energies of the Bureau of Mines. In the course of these studies, proximate chemical analyses with calorimetric determinations of heat-value (supplemented, in many cases, by ultimate chemical analyses) have been made of more than 5,000 separate mine samples of coal, the origin and history of which are authenticated. These samples have been collected by the mining engineers of the bureau and by geologists of the Geological Survey, and samples have been tested of the coal as mined, as loaded on the cars, as unloaded at the testing station, and as fired. A bulletin is in course of preparation setting forth the coalfield, coal seam or bed, location within the mine, analytical data, and other pertinent facts concerning these samples, and, when published, may be had on application to the Director of the Bureau of Mines. With this information, it will be possible for the Government purchasers and users of coal, and for commercial consumers, to predict the character of the coal which may be furnished to them from any mine in the United States. Through medium of the ultimate analysis, it is possible to determine whether coal specified by the name of a coalfield or colliery, as, for example, Pocahontas No. 3, actually comes from that seam or some other seam carrying a less high-grade coal, though drawn from the same shaft through the same tipple.

"For the most intelligent use of these data, as a basis upon which to distinguish the relative fuel values of the various coals, these chemical data must be studied in the light of authentic steaming, gas producer, briquetting and coking tests. The Geological Survey and its successor, the Bureau of Mines, have conducted and have published, or have in the course of publication, the results of steaming tests made under boilers of standard type and capacity, upon over 600 separate coals, mined in every portion of the United States from Virginia to Washington, and including coals from the Philippine Islands, Alaska and the Argentine Republic. In like manner producer gas tests have been made on car-load quantities of over 200 of the representative coals, lignites and peats of the United States. About an equal number of briquetting tests have been made of all of these fuels, to determine the methods of briquetting, pressures necessary, binder (if any), weathering and combustion qualities of these coals when compressed into briquets. About 160 washery and coking tests have been made on the various American coals, preliminary examination of which has indicated the possibility of their furnishing coke of a metallurgical quality. About 70 tests have been made under similar conditions to determine the relative value of such coals for producing illuminating gas."

The value of these tests to individual fuel users, and to the community, is set forth in the following paragraph, which incidentally gives the reason why Government tests have an advantage over those supplied by private and independent observers:—

"In considering the value of all these fuel tests, it must be borne in mind that they have been conducted by the highest impartial authority in America, the Government of the United States. They have been primarily to furnish accurate information for the guidance of the several hundred purchasing officers of the various Government bureaus and public buildings, in order that they may be enabled to provide that fuel which will give the most efficient results upon the installation available. These results are then made public in Bulletins published by the Bureau of Mines. It is evident that results of such tests can have no bias and reflect no influence of commercial interests, to which doubts tests made by coal producers, or coal consumers, or, in some cases, University representatives, may be subjected—divorced, also, as are the Government tests from the influence of variations in types of apparatus and of *personnel*."

The titles of the official bulletins containing the records of these tests are given by the author in the course of his article, and for the convenience of our readers, we have reproduced these at the end of this abstract.

Referring finally to the further development of the work now in contemplation, the author states:—

"With fixed appropriations and the permanency of the work better assured, the Bureau of Mines has, since its organisation in July last, procured the equipment, and commenced investigations of a more fundamental nature, based upon these preliminary tests. An exaggerated furnace, named a long combustion chamber, has been perfected and put in operation. This is nearly 45 ft. in length from the fire door to the boiler tube, and approximately 3 ft. in rectangular inside cross-section. The inner lining is of firebrick. At every 5 ft. of its length are peep-holes and work-holes, where the appearance of the flames may be observed, and temperature measured and gas samples taken from any part of the cross-section. In all, 36 simultaneous gas samples may be taken in different parts of the furnace.

"In this appliance coals are burned under fixed conditions of firing and draught, and it is believed that many of the fundamentals of fuel combustion will here be better developed. It should be possible to determine just what length of furnace is necessary to procure the most efficient mixture and highest temperature in the fuel gases from any coal, and that necessary for the emission of the least smoke. These first investigations will be followed by others, in which different arrangements of baffling, or different cross-sections, will be given the combustion chamber."

Bulletin 366, "Tests of Coal and Briquets as Fuel for House heating Boilers," by D. T. Randall; No. 325, "A Study of Fou Hundred Steaming Tests," by L. P. Breckenridge; No. 373, "Th Smokeless Combustion of Coal in Boiler Plants," by D. T. Randal and H. W. Weeks; No. 367, "Significance of Draft in Steam Boiler Practice, by W. T. Ray and Henry Kreisinger; No. 8, "Th Flow of Heat or Heat Transfer," by W. T. Ray and Henr Kreisinger; No. 48, "Report on the Operations of the Coal-Testing Plant of the United States Geological Survey," by E. W. Parker J. A. Holmes and M. R. Campbell; No. 363, "Comparative Tests o Run-of-Mine Coal on Locomotives, including Torpedo Boats," by W. F. M. Goss; No. 403, "Comparative Test of Run-of-Min and Briqueted Coal on the Torpedo Boat *Biddle*," by W. T Ray and Henry Kreisinger; No. 402, "The Utilisation of Fuel in Locomotive Practice," by W. F. M. Goss; No. 412 "Tests of Run-of-Mine and Briqueted Coal in a Loco motive Boiler," by W. T. Ray and Henry Kreisinger; No. 332 "Report of the United States Fuel-Testing Plant at St. Louis," b J. A. Holmes; No. 416, "Recent Development of the Produce Gas-Power Plant in the United States," by R. H. Fernald; No. 393 "Incidental Problems in Gas-Producer Tests," by R. H. Fernald C. D. Smith, J. K. Clement and H. A. Grine; No. 7, "Formation o Producer Gas," by J. K. Clement and others; No. 13, "Gas Producer Tests," by R. H. Fernald and C. D. Smith; No. 343 "Binders for Coal Briquettes," by J. E. Mills; No. 385 "Briquetting Test at the United States Fuel-Testing Plant," by C. L. Wright, and a forthcoming bulletin, No. 14, "Briquetting Lignite," by C. L. Wright.

All the above-named bulletins can be had from the Director o the Bureau of Mines in Washington.

ELECTRICITY FROM A DRAINAGE CANAL

THE drainage canal of the sanitary district of Chicago is a artificial channel 30 miles long connecting the south branch of th Chicago River with the Desplaines River at a point below Lock port, and designed to discharge 840,000 cb. ft. of Lake Michiga water per minute into the Desplaines River, and so into the Illinoi River, from which it finds its way through the Mississippi into th Gulf of Mexico. The water has a fall of 34 ft. at the Desplaine end of the canal, the electrical power derived from which is trans mitted back to Chicago, and used for municipal and commercia lighting and power purposes.

At the south-western terminus of the drainage canal are th Lockport controlling works, designed to keep the rate of flow through the canal constant, in accordance with the official limit placed on the amount of water which may be diverted from Lak Michigan. These controlling works comprise seven sluice gates an a bear-trap dam. The sluice gates are 30 ft. wide, and have vertical travel of 20 ft., while the dam has an opening of 160 f wide, and can oscillate through a range of 12 ft. vertically. Th great hinged barrier is opened by hydraulic pressure, the sluic gates being operated by electric motors.

The hydro-electric generating station is a concrete structur 385 ft. long × 70 ft. wide and 47 ft. high. The red tile roof i supported by a steel truss without interior supports, the interior o the station being lined throughout with white enamelled brick.

The station has been designed for eight 4,000-KW. water-whee driven A.C. generator units, of which six have been already installe and are in operation.

The turbine shafts of four of the sets are 12 in. in diamete and 71½ ft. long, and are in three sections, of open hearth, nicke and annealed steel respectively, corresponding to the increasing torque as the shaft nears the generator. The whole of the sets run at a rated speed of 163 R.P.M. At 80 per cent. gate opening they each use 10,000 cb. ft. of water per minute, and develop 5,360 H.P. Th draught tubes are moulded in the concrete of the power house foundations, and discharge the water with a minimum of disturb ance or loss of suction head.

The alternator rotor diameters are 18 ft., and the machines are direct coupled to the turbine shafts. Four of the machines have their armature conductors built of bar sections inserted in the partly open slots, while the other two have had this construction replaced by former wound coils.

Three 350-KW., 250-volt, D.C. exciter generators are provided, and are driven by 600-H.P. turbines. These exciter sets are mounted on the main generator floor midway between the two 4-unit sections of the main A.C. equipment.

The 6,000-H.P. turbines have their speed automatically controlled by Lombard oil governors, which are being installed to replace the mechanical governors at first used. The exciter turbines are regulated by mechanical governors.

The electrical equipment in the power house is ranged on three floors—the main generator floor and two balconies. On the first floor, beside the generating units, are the 6,600-44,000 step-up transformers and the 6,600-volt transfer bus-bars. The first balcony carries the remote control benchboard and switchgear, the high-tension transformer switches, and at the east end the 44,000-volt electrolytic lightning arresters. On the second gallery are the main bus-bars and the out-going line bus-bars, the high-tension tie switches and also the generator rheostats.

Throughout the whole of the plant no special and untried apparatus or unnecessary complications of any kind were permitted.

Each water-wheel, generator and transformer bank is treated as a unit straight through to the high-tension bus-bars. From the

enerators the 6,600-volt circuits are taken to the hinge clips of 50 ampere double throw hook switches protected by oil breaks, aking it possible to feed from the generators directly into the 600-volt bus-bars, or the step-up transformers, or both. From the 600-volt bus-bars through hand operated oil switches, four 6,600-olt circuits are taken off for the purpose of transmitting energy to veral adjacent industrial concerns. The 6,600-volt bus-bars are rried the whole length of the station in marble slab channels ounted on enamelled brick partitions behind which the trans-rmers are installed. The high-tension leads from the oil insu-ted, water-cooled, transformers are carried through the ceiling to ro motor-operated oil switches on the first balcony. These trans-rmer switches are connected in series and serve as a double break r disconnecting the high-tension bus-bars from the transformers. he oil switches are enclosed in enamelled brick compartments, the alls of which are extended to protect the connecting bus-bars and ok switches. From the transformer switches the lines again cend to the main bus-bars on the second balcony. These are ade of rod conductors carried on petticoat insulators between ngle course barriers of enamelled brick, 2 ft. 6 in. high, erected on ie concrete floor.

The control of the operating units is effected, and all switching erations are performed from a remote-control benchboard on the rst balcony which commands a view of the entire generator room. his marble board comprises six generator panels with ammeters, wer factor meters, indicating wattmeters and voltmeters, and so totalising kilowatt-hour meters. At the right hand side are ie three exciter panels, and at the other side is a swinging bracket rrying a synchroscope, two frequency indicators and a voltmeter, ll of which can be applied through plug connections to any circuit n the board.

Behind the switchboard, on an enamelled brick pedestal, are the lenoid operated exciter switches, and another pedestal carries the otor-operated generator field switches.

A 250-125-volt, 10-KW. balancer set is provided for the station ghting.

The principal output of the station is of course transmitted to hicago on steel tower transmission lines, parallel to the drainage anal, but several 6.600-volt circuits are run to neighbouring indus-rial establishments and also for city lighting at Joliet and Lock-ort, respectively two and three miles distant.

These circuits are protected by star connected electrolytic light-ing arresters, comprising three separate piles of aluminium disks nclosed in a single enveloping tank, and having the neutral or ottom point earthed.

The generator floor of the station is served by a 40-ton crane, nd a narrow gauge railway track runs the length of the station ehind the transformer banks.

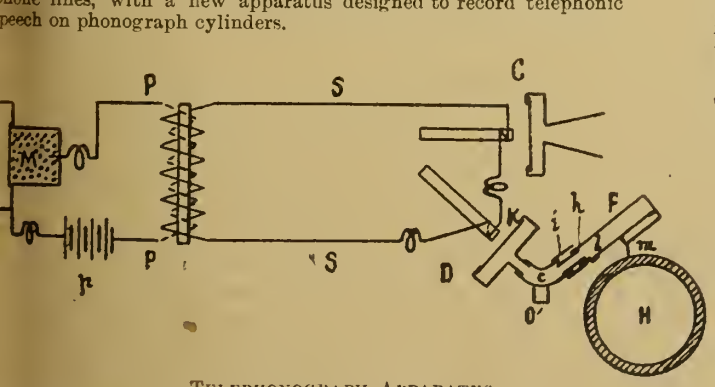
According to the New York *Electrical World*, the total cost of he power house, dams and lock was £160,000, exclusive of elec-rical machinery.

The station is run by a staff of 18 men, including the superin-endent, on the eight-hour shift system.

(To be concluded.)

TELEPHONOGRAPHY.

A RECENT issue of *L'Elettricista* announced the conclusion of some xperiments by Prof. Pierluigi Perotti, on the Italian State tele-hone lines, with a new apparatus designed to record telephonic peech on phonograph cylinders.



TELEPHONOGRAPH APPARATUS.

The arrangement employed is represented diagrammatically in he attached sketch. The sending station contains the usual type f telephone transformer, to the primary P of which a high sensi-ivity granule-microphone M, is connected in series with a four-cell hree pint) primary battery *p*.

The secondary of the transformer is connected to the metallic ircuit line and, at the receiving station, the incoming lines are onnected to two loud speaking receivers C, D in series. The receiver is used in the ordinary manner, but the second receiver D com-unicates with the recording membrane F of a Pathé phonograph, hrough the elbow tube *c*, which is coupled to the sound box F by he rubber sleeve *i*.

The membranes *k*, *l* are thus connected by a small enclosed olume of air. The vibrations of *k* are transmitted to and repeated y *l*, and are thence recorded by the sapphire style *m* on the wax ylinder H. The tube *c* is attached to the traversing carriage O f the phonograph, the receiver D and sound box F moving as one iece, this being permitted by the use of slack flexible leads to D.

It is advisable to speak somewhat louder than usual into the transmitting microphone M, and to provide a rather higher battery voltage in the sending circuit than is usual in telephone practice.

It is not compulsory to use the recorders D, F; but the simple turning of a locking screw enables any or all of a message to be recorded at will. The record obtained can be subsequently repro-duced at any time or place, and an imperfectly heard message can be repeated as often as desired, thus avoiding delay and all risk of error.

All the trials so far carried out show the present apparatus to be sensitive and accurate; applicable to any telephone line; cheap in first and operating costs and quite satisfactory in the hands of ordinary subscribers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIAN COMMONWEALTH.—The following decisions, as to the duties to be levied on certain electrical and similar goods imported into Australia, have recently been issued by the Commonwealth Customs Authorities:—

Brasswork and Gun-metal work:

Tariff Item 172, under which duty is leviable on "Brasswork and gun-metal work for general engineering and plumbing and other trades" at the rate of 25 per cent. ad val. for British goods, is to be interpreted as covering only the various *stock* pieces, fittings and accessories which are suitable for general application in the various trades.

It does not apply to brass or gun-metal parts made specifically for a special purpose and not suitable for general use in any trade.

It does not include stamped, rolled or spun brass or gun-metal, but is limited to brass or gun-metal castings which are machine or hand worked.

Combination articles of brass or gun-metal and other material are not to be charged under Item 172 unless the brass or gun-metal portion is largely in preponderance.

The above is to take effect on and from May 1st, 1911, and will affect the decisions on the undermentioned goods when of brass or gun-metal. The amended classification is shown where necessary.

	Duties now leviable.
Electrical appliances, &c.:	
Adaptors, "Porcelain and brass in combination," electric bells, automatic arc lamp couplings, lampholders, Morse telegraph instruments, ceiling roses, &c., rosettes	10 per cent.
Rosettes, if suitable only for telephones ...	Free
Wall plugs	10 per cent.
" if suitable only for telephones ...	Free
Lamps and lampware:	
Gallery, shade, &c.	15 per cent.
Reflectors and burners (being separable):	
Burners	10 "
Shade carriers, &c.	15 "
Meggers, for measuring electrical resistances.	Free
Brush Rockers, when suitable for use on dynamos coming under Item 177 (A) and also on dynamos coming under Item 177 (B) ...	20 per cent.
Testers—"Dionic" Water Tester, for measuring the electric conductivity of water	Free

NOTE.—The duties quoted above are in all cases those leviable under the British Preferential Tariffs.

The Australian Customs Authorities have also decided that in the case of goods wholly produced or manufactured in the United Kingdom there is no objection to manufacturers eliminating paragraphs 3 (*a*) and (*b*) and 4 from the declaration in the certificate of origin and altering paragraph 2 to read:

"That every article manufactured in the said invoice has been wholly produced or manufactured in the United Kingdom."

In cases where goods are put up in bottles or jars, paragraph 5 of the present declaration must be included, and would then become paragraph 3.

In the case of manufacturers who do not deal in goods put up in bottles or jars there is no objection to their eliminating paragraphs 5 (*a*) and (*b*), and the footnote from the declaration printed on the invoices.

NOTE.—The full text of the Form of Certificate prescribed for entry of goods under the United Kingdom Preferential Tariff has already been given in the ELECTRICAL REVIEW.

JAPAN.—The Japanese Customs Authorities have decided that from October 1st, 1911, all invoices for goods exported to Japan must be signed by the "seller" in the country of production. The term "seller" is to be understood to mean the "last seller" or "supplier," and does not include the London house of an importer.

Press copies of invoices will not be accepted by the Japanese authorities.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,957. "Devices for use in tying or connecting the ends of wires, stranded cables and the like." W. L. Bullows. August 8th.

17,978. "Receiving apparatus for electric transmission of signals." H. A. Schepeler. (Convention date, August 5th, 1910, Germany.) August 8th. (Complete.)

17,998. "Machine for winding wire or the like upon hose pipes, insulation upon cables, and for analogous purposes." W. Firstenberg. August 8th.

18,051. "Electric power transmission devices." H. Kleinschmidt. August 9th. (Complete.)

18,078. "Electric insulation material." Meirowsky & Co. Akt-Ges. (Convention date, April 18th, 1911, Germany.) August 9th. (Complete.)

18,080. "Telephones." B. Gwozdz. (Addition to 11,234/11. Convention date, April 26th, 1911, Germany.) August 9th. (Complete.)

18,082. "Device for starting combustion motors having a magneto ignition." R. Bosch (Firm of). (Convention date, October 1st, 1910, Germany.) August 9th. (Complete.)

18,083. "Interrupter for the electric ignition of internal combustion engines." R. Bosch (Firm of). (Convention date, April 10th, 1911, Germany.) August 9th. (Complete.)

18,099. "Controller for pit hoxes, corves, trams and the like." W. Eastwood. August 10th. (Complete.)

18,114. "Printing telegraphs." H. R. Tayler. August 10th.

18,115. "Automatic switch for telephone circuits." H. F. Tayler. August 10th.

18,131. "Wiring of electric installations." H. W. Handcock. August 10th.

18,132. "Windings for dynamo-electric machines." B. G. Lamme. (Convention date, September 6th, 1910, United States.) August 10th. (Complete.)

18,160. "Reflector fittings for electric lamps." B. J. Grigsby. August 10th. (Complete.)

18,175. "Automatic electric switchgears." L. H. King. August 11th.

18,201. "Aluminium magneto cover for motor cycle." W. Andrews. August 11th.

18,203. "Electrical brushes or collectors." R. H. Barbour. August 11th.

18,204. "Homopolar electric generators and motors." R. H. Barbour. August 11th.

18,212. "Protecting coverings for electric conductors or cables." W. C. Blackett and W. C. Mountain. August 11th.

18,230. "Arc lamp projector for stage lighting and other purposes." W. P. Thompson. (Schwave & Co., Germany.) August 11th. (Complete.)

18,231. "Electric oscillation circuits and their connections." W. P. Thompson. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) August 11th. (Complete.)

18,235. "Telephones." B. Gwozdz. (Convention date, June 2nd, 1911, Germany. Addition to 11,234, 1911.) August 11th. (Complete.)

18,265. "Electrically-operated signs and the like." J. S. Hecht and A. T. Dowdell. August 12th.

18,271. "Transmitter for wireless telegraphy." W. T. Ditcham. August 12th.

18,280. "Arrangement for automatic voltage regulation of alternators, decreasing the current in case of short circuit." T. Lehmann. August 12th. (Complete.)

18,284. "Improvements in wireless telephony, applicable also to wireless telegraphy." H. G. Matthews. August 12th. (Addition to 29,242/1910.)

18,293. "Circuit arrangements for railways, points and signals." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 12th. (Complete.)

18,310. "Locking attachments for overhead railway cables." E. Peter. August 12th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Arc Lamps. H. J. Booker, A. Ogilvy-Webb and Reinecke. 9,191. April 15th. (Cognate application, No. 24,041 of 1910.)

Alternating-Current Power Measurement and Instruments for the same. R. Arno. 9,580. April 20th.

Alternating-Current and Alternating and Direct-Current Machines. L. Klein. 16,763. July 13th.

Switch Devices for Electric Circuits. S. Lichtenfeld. 16,904. July 15th.

Starting Devices for Electric Motors. Adams Manufacturing Co. (Cutler-Hammer Mfg. Co.) 17,166. July 19th.

Wireless Signalling Apparatus. J. Bonhomme. 17,172. July 19th. (July 19th, 1909.)

Device for Grinding the Contact Surfaces of Carbon Brushes for Dynamos or other purposes. A. Watkins. 17,236. July 20th.

Means for Electrically Driving Machines at Variable Speeds, particularly applicable to Printing Machines and the like. H. V. James. 17,247. July 20th.

Manufacture of Filaments for Incandescing Electric Lamps. F. Eisner. 17,469. July 22nd.

Telegraph Relays. W. Judd and A. R. Hardie. 17,523. July 23rd.

Resistance for Electric Heating Apparatus. R. F. Venner. 17,684. July 26th.

Ignition Systems for Internal-Combustion Engines. B. R. Raggett, A. D. Maclean and C. Murray. 20,531. September 3rd.

Electrical Switches. J. H. Tucker. 20,900. September 8th. (Cognate application, No. 22,163 of 1910.)

Motor, more especially designed for use in Driving Blowers, Rolling Mills, and Electric Generators for Smelting Works. F. W. Rogler. 21,235. September 12th.

Intercommunication Telephone Systems. H. G. White. 22,289. September 26th.

Process and Device for Transmitting and Registering Verbal Communications by means of the Telephone. P. Perotti. 24,347. October 20th.

Incandescent Electric Lamp. R. Bacci. 27,240. November 23rd.

Wooden Propellers for Aeroplanes, and the like with an Electrically Deposited Metal Coating. H. C. Barber. 28,783. December 10th.

Sparking Plugs. J. C. Anderson. 29,489. December 19th.

Means for Producing High-Tension Electric Discharges and Electric Oscillations. T. J. Murphy. 29,802. December 22nd.

1911.

Electric Accumulator Boxes. Pritchett. 4,524. February 22nd. (Addition to No. 15,425/10.)

Current Graduation Devices or Resistances applicable for Electric Lighting or Heating. W. Sumner. 5,521. March 16th.

Apparatus for Manufacturing Conduits for Underground Cables. C. Hu[illegible]man. 5,813. March 8th. (April 9th, 1910.)

Ventilation of Dynamo-Electric Machines. Siemens Bros. Dynamo Work[illegible] Ltd., and C.A.B.D. Koettgen. 5,392. April 4th.

Non-Interchangeable Electric Fuses. Siemens Bros. Dynamo Works, Lt[illegible] (Siemens-Schuckertwerke Ges.) 10,113. April 25th.

Systems of Electric Motor Control. British Thomson-Houston Co. (Gener[illegible] Electric Co.) 177. January 3rd.

Electricity Motor Meters of the Mercury Type. Compagnie pour la Fabr[illegible]cation des Compteurs et Materiel d'Usines a Gaz. 559. January 9t[illegible] (Addition to No. 30,297/1910.)

Method and Apparatus for Extinguishing Fires in Electric Cables an[illegible] Electric Circuits, especially in Teleograph, Telephone and simil[illegible] installations. G. Gautsch. 2,226. January 28th.

Water-Tight Telephonic Apparatus. F. A. Graham. 2,501. January 31st.

Systems and Mechanism for Transmitting Electric Impulses. G. A. Can[illegible]well. 3,086. February 7th.

Controlling Gear for or Connected with Electrically-Driven Hydraul[illegible] Pumps. Hathorn, Davey & Co., J. A. Towler. 8,890. April 10th.

Subscribers' Instruments for Automatic Telephones. Siemens Bros & C[illegible] (Siemens Halske Akt.-Ges.) 10,341. April 28th.

Systems of Electric Motor Control. Allgemeine Elektricitäts Ges. 12,92[illegible] May 29th. (May 27th, 1910.)

Method of Supplying Electric Furnaces with Triphase Currents. Soci[illegible] Anonyme Electrometallurgique. (Procédés Paul Girod.) 13,731. June 15t[illegible] (June 9th, 1910.)

Thermo-Electric Temperature-Measuring Apparatus. F. Stroude an[illegible] F. Josephs. 1,100. January 16th.

Line Circuits for the Transmission of Electrical Signals. G. A. Campbe[illegible] and T. Shaw. 3,422. February 10th. (February 12th, 1910.)

Line Circuits for the Transmission of Electrical Signals. T. Shaw. 3,42[illegible] February 10th. (February 12th, 1910.)

Electrical Measuring Instruments. E. Weston. 5,267. March 2nd. (Divide[illegible] application on No. 17,091 of 1910, July 18th.)

Electric Current Detectors or Apparatus for Detecting the Presenc[illegible] and Direction of Electric Current. W. Frisby. 7,569. March 27th.

Rheostats. E. Schattner. 7,736. March 28th.

Selective Electric Signalling Over a Number of Conductors. G. H[illegible] Crook. 8,233. April 3rd.

Method of and Means for Receiving Electric Waves in Wireless Tele[illegible]graphy and Telephony. R. Goldschmidt. 8,387. April 4th. (April 4th[illegible] 1910.)

Electric Furnace. E. Stassano. 8,901. April 10th.

Cooling of the Commutators of Dynamo-Electric Machines. M. J. Railin[illegible] and A. T. Bartlett. 9,201. April 13th.

Electrical Heating Apparatus. L. Frosali and L. Visconti. 10,767. May 8t[illegible]

Electrical Measuring Instruments of the Dynamometer Type. Siemen[illegible] Bros. & Co. (Siemens & Halse Akt.-Ges.) 13,707. June 8th.

Le Corrosanti.—This is the name of a mixture o[illegible] graphite, vegetable oil and coal-tar products from which acid[illegible] and harmful ammoniacal salts have been discharged. Its purpose i[illegible] the painting of boiler plates with the object of preventing scale fro[illegible] adhering. We recently had an opportunity of inspecting a boile[illegible] at the Hotel Metropole, which had been treated three months befo[illegible] with this compound. Otherwise, no difference had been made i[illegible] its manner of treatment. We found that the scale which ha[illegible] accumulated in the surfaces in that period was so loose and so[illegible] that its removal was quite easy. A single stroke of the scrape[illegible] cleared down to the plate. Indeed, it could be moved with a wir[illegible] brush. On the side of the boiler the scale had moved itself i[illegible] sheets. We observed that the surface of the broken sheets showe[illegible] a graphitic layer next the plate, and it is clearly to the graphit[illegible] that the easy removal of the scale is due, though it appears certain[illegible] that much depends also on the mixture employed with th[illegible] graphite. Perhaps the success of the mixture depends upon th[illegible] adherence of the graphite to the plate, which the special mixtur[illegible] ensures, as well also to the removal of the coal-tar constituent[illegible] which are harmful to the plates. The effect at least is good. W[illegible] have long known that certain coal-tar products have proved thei[illegible] efficacy in softening boiler scale, but we have not before seen th[illegible] combination with graphite. The composition is the patent of Mr Adolph Schror, of the Corrosanti Co., of 37, Essex Street, W.C.

Accidents on German Electric Tramways.—The Association of German Tramways and Secondary Railway Administration has published statistics of accidents on electric tramways in that country. It appears that out of a total length of 2,480 miles of tramway track, 2,402 miles were operated by electricity, and of this mileage 2,338 miles refer to tramways which are in the possession of members of the Association. The largest contingent of accidents has devolved not upon passengers but upon passers-by, and the risk to the former is less than that appertaining to the latter. For instance, in the case of passengers only one accident in 100 has had a fatal result, whereas six persons were killed per 100 accidents to passers-by. The following figures are given by the Association for the years from 1905 to 1909 :—

	No. of tramways.	No. of passengers carried.	No. of persons injured. Slightly.	Severely.	Fatally.	Total.
1905 ...	123	1,430,298,593	4,229	602	128	4,959
1906 ...	130	1,580,733,246	4,675	690	150	5,525
1907 ...	140	1,750,266,590	4,876	756	190	5,822
1908 ...	150	1,846,750,324	4,747	834	209	5,790
1909 ...	158	1,949,621,269	4,803	793	181	5,777

The report of the Association adds that the number of passengers injured formed 2.996 of the total persons affected in 1909, these figures apparently contradicting, for that year at least, the statement previously made in regard to the respective risk of passengers and other persons.

THE

ELECTRICAL REVIEW.

VOL. LXIX. SEPTEMBER 1, 1911. No. 1,762.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

All Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. RONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: TVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter n Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to . H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C

THE WORKING OF THE EIGHT HOURS ACT IN MINES.

IN a recent article dealing with the railway strike, we referred incidentally to the serious consequences resulting from State interference with, or regulation of, particular industries, and if any proof were needed we have only to turn to the reports of H.M. Inspectors of Mines for the year 1910, which have recently been issued, to see the effect of the working of the Eight Hours Act; an Act, by the way, which was forced on the industry at the instigation of the men's leaders, in face of the determined opposition of the coal owners, and many of the workmen themselves, and all the allied industries which depend more or less for an existence upon a cheap and sufficient coal supply.

The total production of coal for last year was 264,433,028 tons, being an increase of 658,716 tons over the previous year. The increase, however, was not common to the whole eight inspection districts, four showing increases, viz., Yorkshire and North Midland 2,896,148 tons; Scotland, 1,556,767 tons; Midland and Southern, 839,429 tons; and Liverpool and North Wales, 83,307 tons; while four showed decreases, viz., Durham, 1,690,020 tons; South Wales, 1,663,955 tons; Newcastle, 1,145,996 tons; Manchester and Ireland, 226,964 tons. The increase in the Yorkshire district was in all probability due to the development of the new East Yorkshire coalfield, whilst the decrease in Durham, Newcastle, and South Wales districts was to some extent caused by strikes, which in the case of the two former were due solely to the introduction of the Act.

At first sight it would appear that if there is an increased production, no great harm can have resulted from the reduction of the hours of labour, but when we note that there is an increase in the number of persons employed to the extent of 35,409, and of these no fewer than 30,000 are employed below ground, and, further, that in point of production the output is 12 tons *less* per person employed than it was in 1909, we begin to appreciate the importance of its actual effect. The following table which shows the average output of mineral (including fireclay, shales, &c.) per person employed below ground is interesting :—

	Output per person employed. 1910. Tons.	1909. Tons.	Increase or decrease.
Scotland	412	407	+ 5
Newcastle	301	335	— 34
Durham	366	408	— 42
Yorkshire and North Midland	349	344	+ 5
Manchester and Ireland ...	284	297	— 13
Liverpool and North Wales ...	291	291	—
South Wales	270	289	— 19
Midland and Southern ...	336	333	+ 3
Average	328	340	— 12

With regard to Scotland, it is important to note that the increased production is due to a considerable extent to the introduction of coal-cutting machines, the increase in the

number of these being no less than 82, and the increased production of machine-mined coal over the year 1909 being 1,403,491 tons. The increase in the number of persons employed below ground is 3,130. Of the total number of coal-cutting machines (581), 425 were driven by electricity and 156 by compressed air.

The Inspector in his report for the Newcastle district says: "There are 7,119 more persons employed in 1910 than in the preceding year, principally due to the *increased number of transit hands* rendered necessary by the Eight-Hours Act." (The italics are ours.) "As might have been anticipated, owing to stoppages consequent upon the Eight-Hours Act coming into operation, the output per person has fallen considerably." Again, in the Durham district, the Inspector reports: "The large decrease in the quantity of mineral raised per person employed is due to the reduction in the total output caused by several large collieries not being at work during the first three months." As is well known, these stoppages were purely due to the Act.

Mr. Pickering, however, deals very thoroughly with the economic aspect of the working of the Act in his district, viz., Yorkshire and North Midland, the direct effect of which he says has been "to increase the number of persons for a given output; to reduce the average weekly earnings, and to increase the cost per ton." In many "favoured" mines the increased cost is very small, but in others both the increase in cost per ton and the reduction in weekly earnings is "very serious." It is also worth noticing that it is the person who is willing to work who is hit the hardest, as Mr. Pickering says, "The reduction in wages is most severely felt by those men who were accustomed to work overtime"; and Mr. Nicholson (Durham district) practically says the same thing, as "The Act has made an appreciable difference in the weekly wages of stonemen, deputies and other off-hand persons; these classes of labour prior to the commencement of the Act having had a varying amount of overtime."

Mr. Pickering, however, gives actual facts and figures which are so interesting that they will bear quoting in full. He says: "At a large group of mines having an aggregate output of *15,000 tons per day* (the italics are ours), the Act caused the following changes:—(*a*) The number of coal-getters was increased by 9·5 per cent.; (*b*) the working costs were increased by 3d. per ton; (*c*) the number of tons obtained per man decreased 7 per cent.; (*d*) the stallman's wages decreased by 6d. per day; and (*e*) the output increased by 2 per cent. At one large mine the following changes were made to meet the new conditions. New boilers increasing the steam pressure from 50 lb. to 100 lb. were provided, the winding engines were fitted with larger cylinders, cages of four decks were substituted for those of two decks, more pit room was provided, and the number of underground workers increased by 11 per cent. The result was that, though the output was increased by 16 per cent., the working cost per ton *increased* by 2·5 per cent. . . . The changes at two large mines are given in the following table:—

Reduction in output per man per shift	10 per cent.	7 per cent.
Stallmen's wages reduced per shift ...	2s.	2s. 8d.
Increased wages costs	1·5d.	0·02d.

And as the tonnage got at each mine is about the same for each year, the large decrease in the wages of the stallmen is due to there now being four stallmen in each working place, compared with three in 1908. The wages of the miners have been more equally distributed." At six other collieries each having a large output, the working costs have increased and wages have been reduced according to the following table:—

Working cost increased per ton	1d.	1d.	3d.	½d.	3d.
Stallmen's wages reduced per shift	11d.	11d.	9d.	11d.	2d.

The figures clearly show, as Mr. Pickering says, that it is not possible to get the same amount of work done in eight hours as in a longer period, and prove, if proof were ever needed, that however much truth there may be in the statement that the workman "loafs" in other industries the miner was doing his "level best." It is especially interesting to note the efforts of the owners to maintain, if not actually to increase, the outputs of their respective collieries, and it is undoubtedly due to this that the general public have not been called upon to pay a greatly enhanced price for this staple product. Mr. Pickering also reports an increase of 71 coal-cutting machines, which resulted in an increased production of 542,889 tons of machine-cut coal.

Mr. Johnstone, for the Midland and Southern district, reports similarly, inasmuch as coalowners state that the effect of the Act has been to reduce considerably the output of mineral and increase the cost of production; "but as the output has been sufficient to meet the requirements of consumers, there has been no corresponding advance in selling prices."

With regard to accidents, it is also important to note that last year the total number of deaths was the highest recorded in any one year, and further that the number of deaths from "falls of ground" is also the highest on record, and whilst we admit it was a most disastrous year for explosions, there is some reason to think that the number of accidents due to "falls of ground," &c., would not have been so many were it not for the undoubted "speeding up" of the workmen in their honest endeavour to maintain their wages.

The application of the Act, however, is not without its lessons, the chief of which is that it clearly shows that no industry can be much, if at all, improved by State regulation, that the hours of labour and rate of wages can never, so long as the law of supply and demand remains, be regulated by Act of Parliament; and that it is hopeless to attempt to fix a standard rate of wages, together with the exact number of hours which one is to work to earn them. We trust, however, that at least the Act will teach the miner that no one can look after his interests so well as *himself*.

Olympia Electrical Exhibition.

It is impossible for those who are not behind the scenes, or who have no experience in such matters, to understand what an enormous amount of work is entailed in the organising of an exhibition such as is to be opened at Olympia during the present month. That work becomes harder when those who could lighten it put off their action until the last minute. We are in a position to know that very real efforts have been made to secure a fine demonstration of electric cooking and heating apparatus, and it will be in the memory of our readers that the committee went so far as to offer free space and free supply of energy to firms who would, by a suitable exhibition and demonstration help to make this feature a most impressive one. A number of firms have thrown themselves into the matter with zest and a good showing is assured; but there are others who ought to have made up their minds to be there, but have not as yet done so. To such we would suggest that immediate action on their part will greatly assist. There is no time to lose. Three weeks to-morrow the exhibition opening ceremony will take place. We believe, also, that there is room for a little more enthusiasm on the part of those who propose to purchase tickets for distribution among prospective consumers of electricity and apparatus, whose attendance they are anxious to secure. The earlier the tickets are in circulation, the more the public will talk about the coming event, and that is one of the chief things required in order to secure a full popularity for this exhibition by the time of its opening. We suggest that electricity supply engineers and their committees buy their tickets and distribute them at once.

HE SWISS TOUR OF THE INSTITUTION OF MECHANICAL ENGINEERS.—IV.

By our special commissioner.

r our last article we saw over what a very large area, exnding 70 miles from east to west, electrical energy is disibuted from Beznau, and how, for several years past, the mands made upon this station became excessive and beyond e capacity of its natural resources. On the other hand, e water of the Löntsch river has been utilised in the mills Netsal, near Glarus, for several generations back; but ly to a small percentage of the total annual rainfall over gathering ground, which has an area of nearly 32,000 . miles, or 82,000 sq. km. A large part of this is high d rugged mountain land with many extensive glaciers, which the snowfall is heavy. This melts in the springne, and comes down in torrents, lasting between two and ree months. It was stored in some small degree in the tural lake Klönthalersee, but most of it ran waste. Ever ice 1896 various schemes have been proposed for utilising is great bulk of water. A remarkable and instructive storical fact is that each new scheme was more ambitious an its predecessor, and that effective financial support as not obtained until the project was designed the total storage and electrical development of e whole annual available water-power. This was dertaken in 1904 by the "Motor" Aktiengesellschaft, Baden, who are the proprietors of the Beznau Works. ne two stations, 85 km. apart, are now connected and tually support each other throughout the year, the Löntsch orks adding a steady supply of from 36,000 to),000 E.H.P. to the combination. This linking up is the ore profitable, because the Klönthalersee lies at the extreme uth-east end of the district supplied from Beznau, while eznau is only 32 km. from its extreme western end.

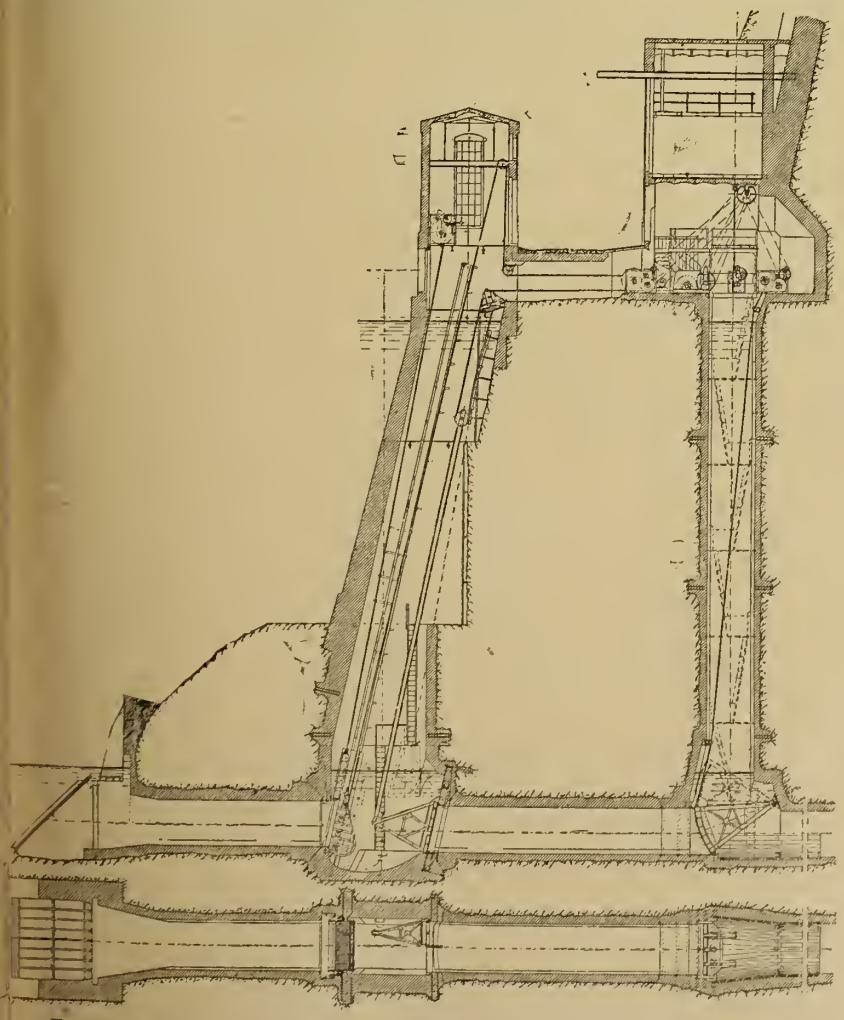


Fig. 2.—Shafts and Sluice Gates at Entrance to Supply Tunnel.

The Klönthalersee was formed in a narrow valley by very ient "mountain-slides" which broke down parts of the ggis and Glärnisch ranges and blocked up the valley. e natural barrier so formed has now been improved by the building of a dam 21 m. high above the natural surface. Its rammed clay-puddle core goes 6 m. further down in an excavated trench, and is 10 m. thick at ground level and 230 m. long across the valley. It was necessary to run

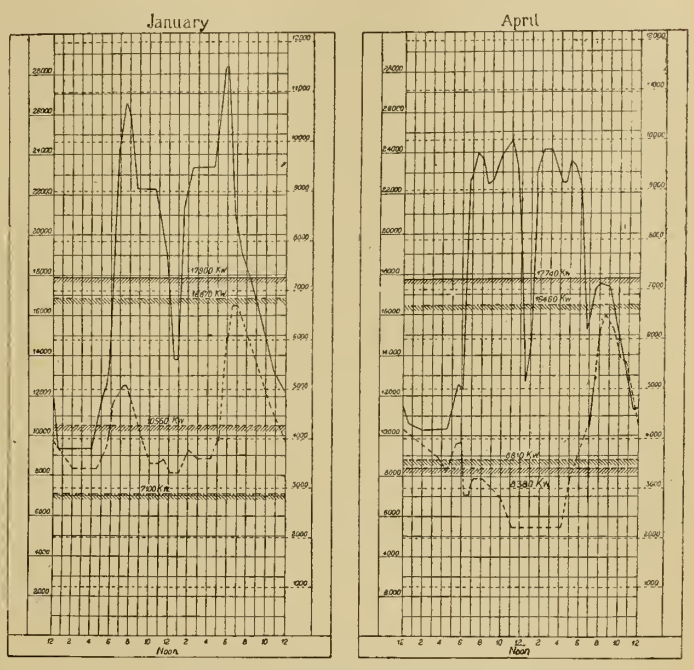


Fig. 1.—Curves showing Combined Working of the Löntsch and Beznau Stations.

this a considerable distance up the south shore of the lake to ensure absolute water-tightness and safety. The width of the base of the dam within outside surfaces varies from 80 to 120 m., the normal being 103 m. This dam contains no less than 110,000 cb. m. of built-in material, of which 25,000 cb. m. are in the watertight core.

The overflow from the lake is in the form of a round vertical tower of 7 m. internal diameter, and whose outer top edge has a diameter of 10 m., and therefore an overflow circular periphery of 31·4 m. This edge stands at 850 m. above sea level, while the lowest water level is 820 m.; so that a 30 m. variation of depth is available, and this corresponds to a storage of 50 million cb. m. of water. When full the water surface has an area of 3·2 sq. km.; so that a variation of 1 m. depth at top level means over 3 million cb. m. storage. This is probably the largest artificial storage reservoir yet constructed in Europe.

Although the power house is designed to use practically the whole of the water supply throughout the year, it is, of course, essentially impossible to keep the lake level constant, and there follows also the physical impossibility of keeping the working head at the turbines quite constant; and again, there results from this an unavoidable variation in the quantity of water flowing per second.

In possible torrential seasons the lake level will rise about ½ m. above the edge of the overflow tower, the section of this tower and of the tunnel leading from its base being sufficient to carry off the flow due to this head. When the Institution party visited the place, there was an overflow with a head of 5 or 6 in. over the edge, and this produced a singularly beautiful conical cascade down the interior of the tower, the waters meeting in the centre at a depth of some 10 or 12 m. below the top.

D

Fig. 1 gives some curves for the months January and April, showing the effect of working the Löntsch and Beznau power houses together, each diagram being for one day of 24 hours. The upper full line is the load curve at Beznau plotted to the right-hand vertical scale; in April this rises to about 10,000 KW., and in January to about 11,500. The similar dotted line is the load curve for a holiday. Owing to want of water storage at Beznau, these works by themselves have been able to utilise only about

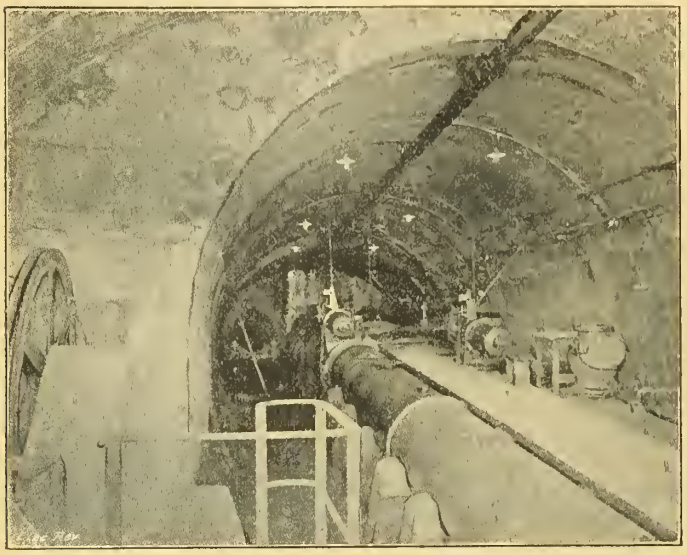
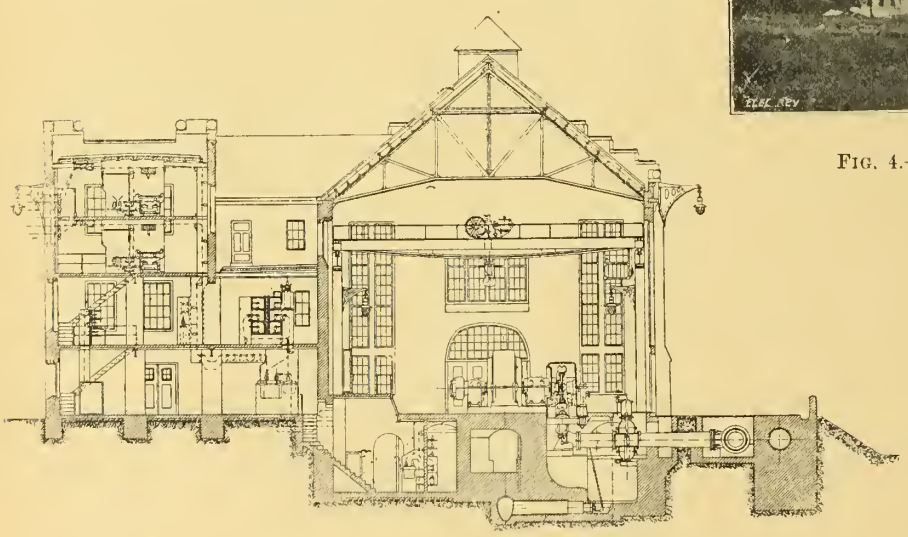


Fig. 3.—Junction of Rock Tunnel and Steel Flume Tubes.



Fig. 4.—Löntsch Power House and Flume.



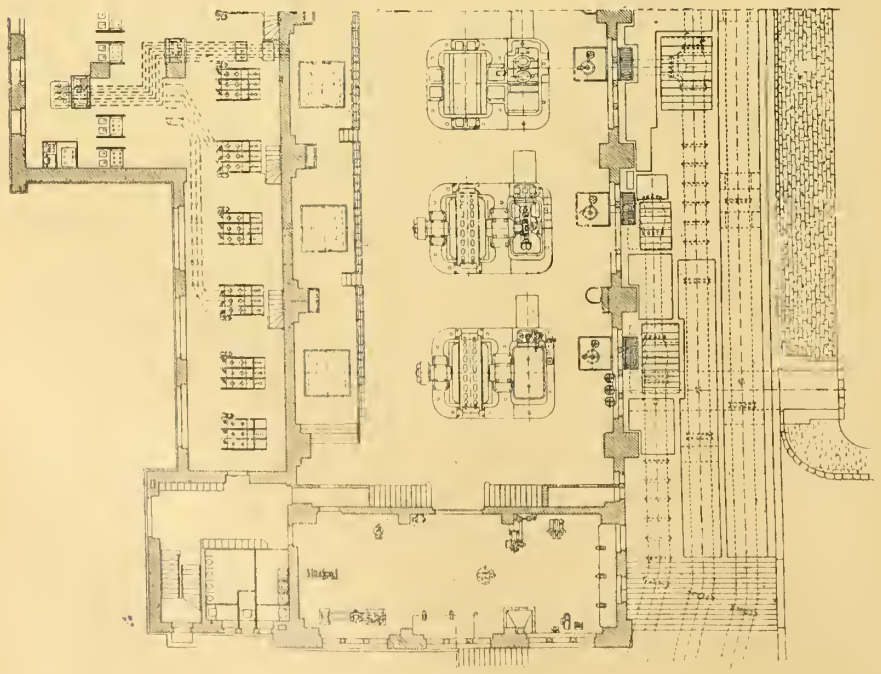


Fig. 5.—Half Plan and Section, Elevation of the Löntsch Power House, 36,000—40,000 H.P.

half the energy available in their wat supply. Combined with Löntsch th percentage is raised to about 90 p cent. The left-hand scale in fig. 1 reduced from the right-hand scale, that when, from the sum of the mea load at Beznau and the mean pow required at Löntsch independently Beznau there is substracted the mea water-power available at Beznau, the remains a load equal to the mea

available water-power at Löntsc The 24-hour mean consumption Beznau is now 17,900 KW. on a wor ing day in January and 10,550 K on a holiday. Of this the Bezn turbines supply 7,100 KW. The me consumption taken over a week, calc lated for six working days and c holiday, is 16,870 KW. in Janua The difference, 16,870 − 7,100 = 9,7 KW., is supplied from Löntsch as

n. But to the left-hand scale the load curve goes up 28,100. and the excess of this over 7,100, namely, 000 kw., is the maximum supply from Löntsch to nau. This was the fundamental calculation on which quantities for the Löntsch construction were estimated. supposition was that the load curve would retain the e form when the supply was nearly doubled—a supposi- which is evidently not quite accurate, but the error of

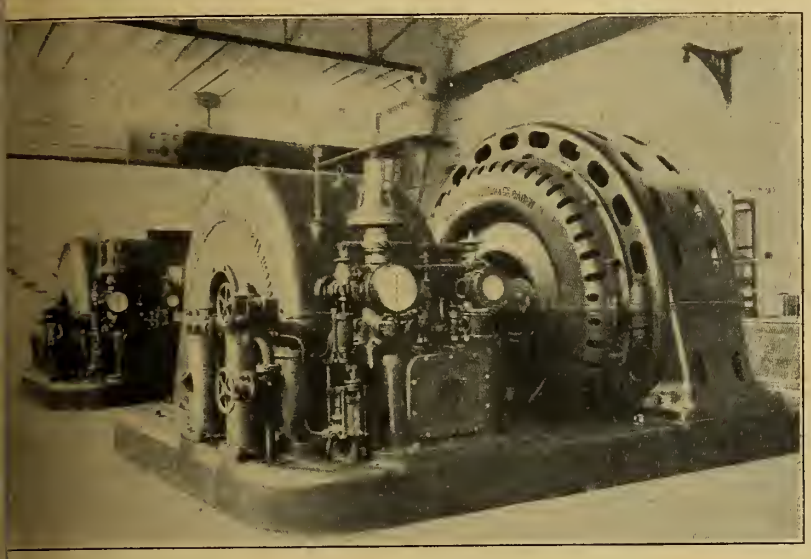


Fig. 6.—Pelton Wheels and Generators, Löntsch Station.

ch could not be calculated beforehand and obviously lay n the safe side.

he constructive work at the reservoir, and between it and power house, is of very great and special interest, and of icularly high quality both in design and in execution ; it is not the class of work in which our readers are onally interested, and we will, therefore, not describe it letail, but will only mention its leading features and ensions.

o make certain of the strength and stability of the dam, level of the lake was raised in a series of 5 or 6 m. steps onsiderable time intervals. This necessitated ample ns of drawing off excess water independent of the flow over the top ne tower, and such ns were also per- ently desirable in of future need of ning or repairing face of the dam. overflow tower therefore, com- d with a low-level e tunnel through base of the dam ; a low-level entrance is tunnel from the was built, con ng of two flumes, closed by a heavy rally - hinged cir- r valve of 1·4 m. eter.

he supply to power house taken from a ot on the north e of the lake, a distance of 0·7 from the dam. The level of the centre of the nel is 25 m. below the overflow edge of the waste weir r. Its section is $4\frac{3}{4}$ sq. m., and its gradient of 2·17 per 0 is dimensioned for a maximum flow of 10 cb. m. per nd, corresponding to a horse-power of 36,000. The ance from the lake is commanded by a series of three e gates, one behind the other, and placed at the bottoms of shafts. The first is of immensely strong build, and no

great care is taken to make it perfectly watertight. It is intended as an absolute protection against full water pressure under the maximum head of 25 m. ; and it can only be raised when relieved of this pressure by the opening of a small door inserted in it. At the tops of the two shafts are two small guard houses containing winch gear, whereby the sluice gates are raised and lowered by rods and steel ropes. Behind this first gate comes an iron fence in the form of a sack, which catches all flotsam that may have passed the outside grating, and which can be raised through the shaft to the surface for emptying and cleaning. At the foot of the same shaft, 5 m. beyond this first gate, comes a second hinged valve built in two independently movable side-by-side halves. Behind this, at a distance of 13 m., and at the bottom of the second shaft, is a third gate, also hinged. These two last are of different constructions, the last having for its object the exact regulation of the flow desired at any time, and being therefore movable with great facility and balanced so far as water pressure is concerned, while the main duty of the former is to keep the tunnel free of water for inspection and repairs, for which purpose it is kept close to its seat by the water pressure. Fig. 2 is a section of the guard houses, the two shafts, the three valves and the beginning of the tunnel.

This tunnel is cut through the solid rock of the precipitous south face of the Wiggis mountain for a length of 4·1 km. Where it emerges it makes a watertight concrete joint with three welded steel flume pipes, which descend rapidly to the power house. A guard-house, or "Wasserschloss," is built at this issuing point, which is accessible only by means of a rope railway built up the precipice. Here are installed a continuous autographic water meter, as also other valves, one in each pipe, which can be operated electrically from the power house below. There is also constructed what may be called a gigantic relief valve.

This consists of two long galleries cut in the rock, one at a level of 3 m. above the tunnel and the other about 32 m. higher. These two act as water tanks. The lower

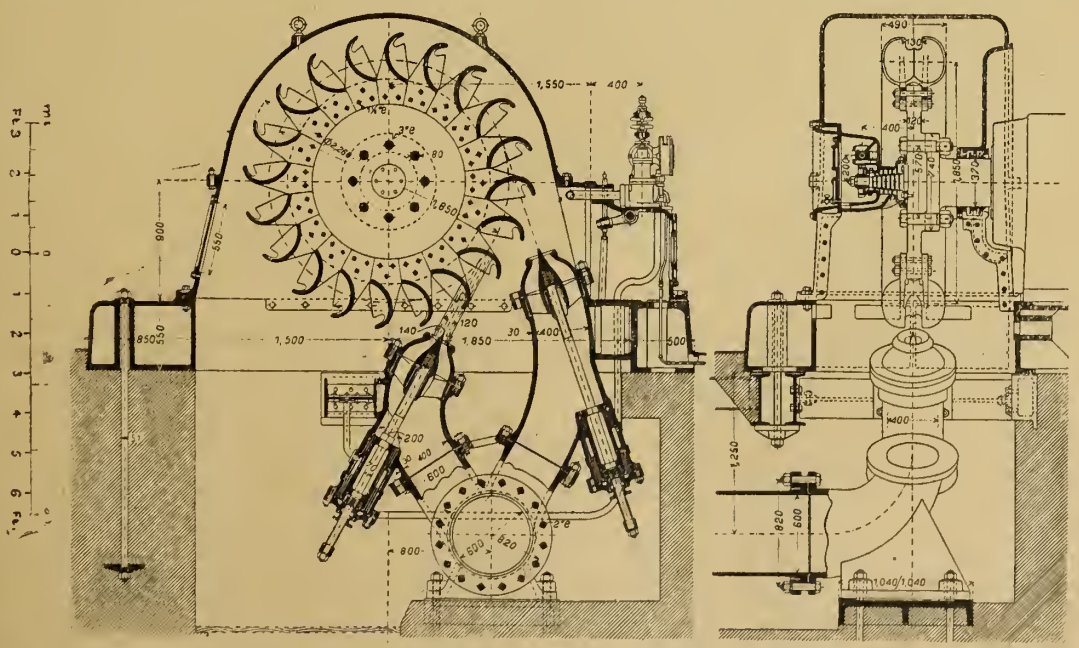


Fig. 7.—Sectional Views, 6,000-h.p. Wheel at Löntsch.

one is normally full and is occasionally emptied by its yielding a small temporary extra supply due to quick action of the turbine governors. The free water level in this gallery, or immediately above it, is determined by the flow through the principal tunnel, this flow being due to the gravity difference between this level and that of the surface of the lake. An oblique gallery is cut through the rock to connect the lower and the upper gallery, and the water

level rises in this when the flow to the turbines is quickly stopped or largely decreased. Thus serious pressure arising from the stoppage of momentum in the enormous mass of water flowing in the long tunnel is prevented. This flow is slowly stopped by the gradual decrease of the head producing it, this decrease being due to the rise of the water in the passage leading to the upper gallery. The upper gallery opens to the atmosphere over a lip or small waste weir at the level of its roof. This arrangement of two water tanks formed as two long galleries cut out in solid rock, the upper gallery having a top outlet to the atmosphere, thus acts as an air vessel or a buffer in which the elastic increase of pressure is due, not to air compression, but to a rising head of water.

Fig. 3 is a view of the interior of this Wasserschloss where tunnel and steel tubes join, taken before the third tube was laid.

In the 4 km. length of the tunnel there are cut two adits or cross galleries running out to the mountain face. These were cut for the purpose of carrying on the work of tunnelling from these two intermediate points as well as from the two ends, as also for the purpose of draining the tunnel during its construction. One of these is maintained permanently as a means of emptying the tunnel for inspection. From its mouth a welded steel flume tube descends the face of the cliff to the bed of the river Löntsch ; and alongside of this tube there is built a permanent service staircase.

Fig. 4 shows the power house, the Wasserschloss, and the three high-pressure flume tubes. These pipes are 1¼ km. long, and are very heavily anchored in section lengths to the rock. Below each anchorage there is a brass-lined and rubber composition-packed expansion joint. In spite of the scorching summer sun, and the great cold in winter, there is little variation of temperature in the metal of these pipes, the temperature being wholly governed by the waterflow, and hardly at all by the external exposure to sun and frost. But the water is, of course, cold in winter and warm in summer, and the result is that there is a maximum actual movement of nearly 5 mm. in these expansion joints. If the pipes are emptied in hot summer weather, the movement will be much more than this ; but this has not yet been necessary. The first three lengths of piping are very steep, the gradients being 986, 817 and 764 per 1,000 ; the lengths are each about 120 m., and the diameters 1,350, 1,275 and 1,200 mm. Beyond these the gradients of the two remaining much longer sections are 116 and 124 per 1,000, the diameters being 1,125 and 1,050 mm. The metal thickness varies from 8 mm. at the top to 28 mm. near the power house.

The fall from the Wasserschloss to the turbines is 325 m. The bed of the river Löntsch is immediately in front of the power house, as seen in fig. 4. The flume tubes are carried round the end, and along the front of the house before they enter it. Thus, if one of the pipes bursts, the power house would not be flooded ; the waste water would flow direct with the tail-races into the river bed.

Fig. 5 gives a half-plan and a cross section of the power house. The arrangement is eminently simple, and the whole installation is beautiful in its compactness, quietness and cleanliness. There are six units ranged in a straight line along the main hall, each being nominally of 6,000 H.P. The master control switchboard stretches across the east end of this hall 5 m. above the main floor, and commands a full view of every part of the machinery. The main switchboard and bus-bars extend along the full length of the north side, in an outbuilding from the main hall. They are, therefo placed well out of the way in complete security fr risk of any flooding due to possible burst pipes or turb casings. The lightning protection is erected in the roof a central further extension of the building. The tra formers are ranged in a row in the basement inside t along the north wall of the main hall. Each of three great flume tubes feeds two turbines by branch pi entering from the south : and the common tail-race for

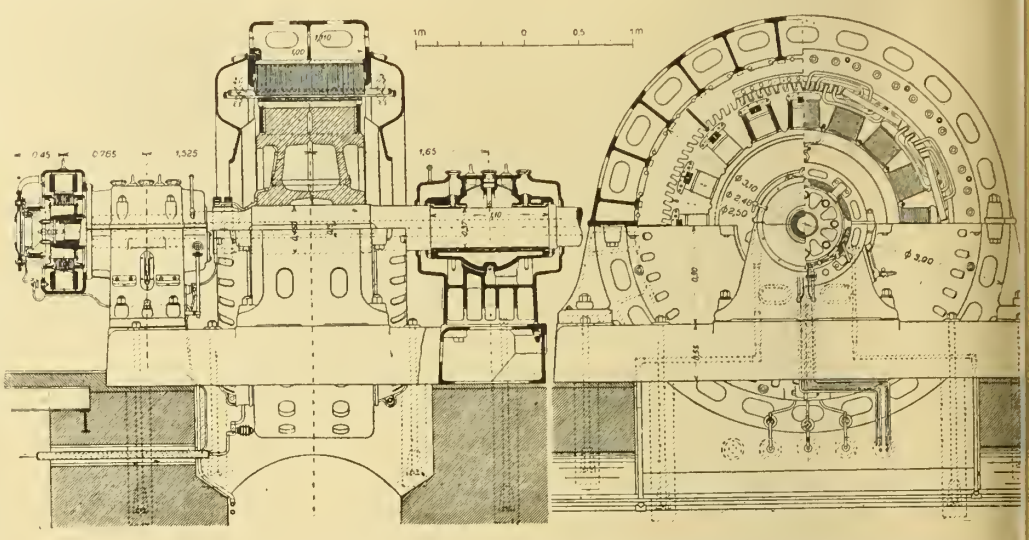


Fig. 8.—Brown, Boveri 5,250 k.v.a. Three-phase Generator, Löntsch Station.

the turbines runs along the south side of the building in the great hall. The dimensions of this hall are only 1 wide by 54 m. long, and from its unencumbered appear one is tempted to think that it has more free floor s than space occupied by machinery.

Fig. 6 is a photographic view showing fully one unit a part of a second unit. The turbines are 6,000 H.P. P wheels built by Th. Bell & Co., of Kriens. Two sectio this machine are shown in fig. 7. Each wheel is acte by two jets, and takes 1,700 litres per second when runni 375 R.P.M. They are governed by the central diminuti the cross section of the jet through the thrusting forwa the "needle," this being operated by an oil-pressure s motor fitted directly round the end of the "needle" sp The governing mechanism is so arranged that it ope upon one jet one or two seconds before it acts upon other. This is a recent improvement, which has raised

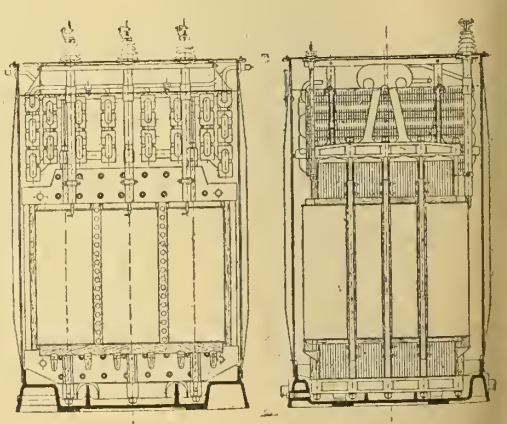


Fig. 9.—4,600 k.v.a. Transformer for 8,000/27,000 Vo

considerably the mean efficiency of these wheels. Th servomotors are started into action by a centrifuga governor. At the same instant that they commence m the needle, a large by-pass valve is opened by another motor, which permits part of the water flow to pass sti to the tail-race. This prevents resurgent waves of pr up the mains caused by too sudden stoppage of the and the use of this by-pass has raised in a very degree the possible quick governing of these large w

ıe by-pass valve is closed a few instants after opening, t gradually, by the action of a cataract, whose speed can easily regulated in the ordinary well-known manner.

These turbines maintain over 80 per cent. efficiency from 200 to 7,000 H.P., and attain a maximum efficiency of per cent.

All the other regulating valves and mechanisms are roughout moved by oil servomotors, and a special set of pumps gives a copious supply, through an accumulator, of at pressures of from 375 to 450 lb. per sq. in.

The generators, built by Brown, Boveri & Co., are three-ase. Their output is 5,250 K.V.A. at 8,000 volts and periodicity, the speed being 375 R.P.M. Their general ıstruction is shown in fig. 8. They have 16 cast-steel or poles, cast on the core, with 2,480 mm. diameter er the pole faces. The rotor is in two symmetrical halves. er the poles are placed 96 windings, held fast by laminated le-shoes. The external casing diameter is 3,900 mm. ıe main bearing is 370 mm. diameter by 1,100 mm. ıgth. As calculated the generator losses are as follows :—

Full load	$\cos\phi = 0{\cdot}8$	$\cos\phi = 1$
Stator iron	87·0 KW.	84·0 KW.
Stator copper	24·5 „	15·7 „
Field copper	36·5 „	14·3 „
Bearing friction and ventilation	30·0 „	30·0 „
	178·0 KW.	144·0 KW.

Efficiency $\frac{178}{4{,}200 + 178} = {\cdot}958$. With $\cos\phi = 0{\cdot}8$

„ $\frac{144}{4{,}200 + 144} = {\cdot}966$. „ $= 1$

They have 20 ventilation radial passages, each 10 mm. de. The 96 stator teeth are open, and so formed that the ndings are easily laid in place. These are so designed that e tension in all three phases remains equal. The formers the windings are made of copper sheet and are tened in place by wooden wedges. Each consists of six pper sheet windings of 145 sq. mm. cross-section, and the rrent density is 2·62 amperes per sq. mm.

The exciter is mounted overhung upon the end of the aft. It has eight poles and generates 225 amperes at 0 volts.

There are two sets of transformers. One of these, shown fig. 9, raises the 8,000 volts of the generator to ,000 volts, and is of 4,600 K.V.A. capacity.

The other, seen in fig. 10, raises it to 48,500 volts, and is 5,250 K.V.A. capacity. These transformers were also pplied by Brown, Boveri & Co.

They are oil insulated with water cooling. The smaller e is built of 0·3 mm. thick sheets ; the larger of 0·4 mm. ick sheets of special soft quality. Both are star connected. the high-tension transformer the pressure between con-uous windings is limited to 450 volts. The weights of ese transformers are as follows :—

	4,600 kva.	5,250 kva.
Transformers	18,500 kg.	12,280 kg.
Casing	3,300 „	2,470 „
Oil	4,500 „	4,400 „
	26,300 kg.	19,150 kg.

Their energy efficiencies and voltage losses are as llows :—

	4,600 kva.	5,250 kva.
Full load efficiency	98·56 %	98·95 %
Half „ „	97·80 %	98·85 %
Voltage drop $\cos\phi = 1$ ...	0·43 %	0·62 %
„ „ „ $= {\cdot}8$ ...	1·29 %	3·0 %

The rise of temperature above that of the cooling water from 45° to 50° C.

The 27,000-volt system is fed from the first three gene-tors, and has two outgoing lines. The 48,000-volt stem is fed from generators Nos. 4, 5 and 6, and has three tgoing lines. There is also an 8,000-volt network, usually d by generator No. 3, with five outgoing lines. Each of ıe high-tension bus-bars consists of two bars coloured white" and "black," and these can be used either inde-endently or connected as a ring.

Each portion of the high-tension systems is protected by automatic high-tension oil switches, two-poled in front of the bus-bars and three-poled in front of the out-going lines, with maximum relays. The bus-bars are so divided that each generating unit can be connected direct to the neighbouring out-going line without connection to any other part of the whole system. All the outgoing lines are carried to the roof where they are protected by horn and induction coil lightning apparatus.

Each of the six generators can be disconnected from its transformer and coupled direct to the 8,000-volt bus-bar ; but in ordinary working this bus-bar is disconnected and lies dead. This bar is used for testing the units separately, when they work upon a water resistance suspended in the tail-race of the turbines. The arrangement thus also permits the 8,000-volt network to be fed from any one of the generators other than No. 3, which is its usual source of energy.

The Löntsch and the Beznau generators are usually

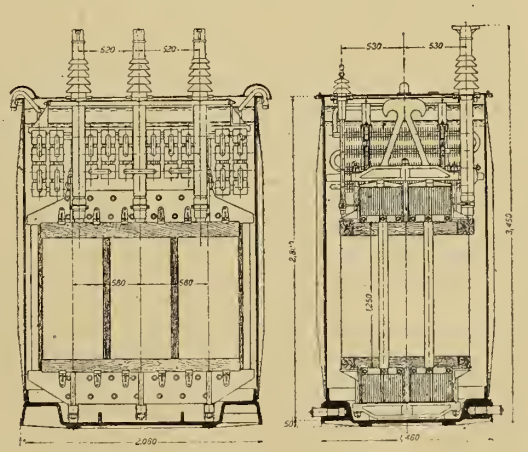


FIG. 10.—5,250-K.V.A. TRANSFORMER. FOR 8,000/48,500 VOLTS.

worked in parallel, and this without difficulty. If the connection between the two stations is accidentally broken, the parallel working can be re-established in a very short time. Also at night time, when the load is small, the whole area can be fed from either station while the other lies idle.

Again, a great part of the total load at any moment can be transferred from one to the other station almost instantaneously. The stations have been frequently tested in this respect. For example, in one test 3,500 KW. was thrown from the Löntsch works on to the Beznau station within two minutes and without the consumers becoming aware that anything had happened.

The whole scheme of this extremely fine work and of its linking up with Beznau, so as to increase the output from this last centre by 80 per cent., is due to Engineer A. Nizzola, director of the "Motor" A.G. The details were worked out by Engineers Dübendorfer, Brodawski, and Ehrensperger.

The technical world owes to these engineers one of the most beautiful examples of completely safe and highly economic hydro-electric engineering, worked out under physical conditions which for 20 years were considered such as to preclude the possibility of any useful result.

Cable Manufacture in Hungary.—As previously announced, the development of the demand for cables in Hungary has induced the directors of the Ganz Electricity Co. to decide upon the erection in Budapesth of a new cable factory in which the Siemens-Schuckert Works will also be prominently interested. The establishment of the factory is to be commenced in the near future, as it is hoped to participate in the supply of cables for the new electricity works to be erected in Budapesth. The new undertaking will be a competitor of the Pressburg Cable Works Co. and the Felten and Guilleaume Co. The Pressburg Co. recently increased its share capital from £100,000 to £200,000, and the Felten and Guilleaume Co. has resolved to raise its share capital from £62,500 to £83,000 in order to meet the threatened rivalry, additional shares having been taken over by a syndicate headed by the Pesth Hungarian Commercial Bank.

THE BRITISH ASSOCIATION.

On Wednesday evening, in the Town Hall at Portsmouth, the British Association for the Advancement of Science commenced its 81st annual meeting. This is the Association's first visit to Portsmouth. The Connaught Drill Hall has been fitted up as the reception room and for general committee rooms, &c. Sections "A" (Mathematical and Physical Science), and "G" (Engineering), are meeting only a few steps away, in the Municipal College.

After the customary preliminaries had been performed on Wednesday, Sir Wm. Ramsay delivered his presidential address, to which, as well as to that of the Chairman of the Chemical Section, delivered yesterday (Thursday) morning, we allude below. Prof. J. H. Biles, LL.D., D.Sc., M.Inst.C.E., in his opening address to the Engineering Section, dealt with the rolling of ships, and accidents to ships at sea, the causes of which it may be are never fully revealed. The varied programme of papers in the Engineering Section suggests that the proceedings of the Section may be more interesting than has sometimes been the case.

Sir William Ramsay prefaces his address with a few reminiscences of earlier scientific bodies. The Royal Society, founded under the name of the "Invisible, or Philosophical College," about 1645, was the first of these, and later there separated off from it many others, such as the Linnæan Society, 1788; the Geological Society, 1807; and, later, the Society of Antiquaries, the Chemical, the Zoological, the Physical, the Mathematical, and many other Societies were founded. The foundation of the Royal Society was commemorated by a poem, one verse of which Sir William Ramsay quotes, though we shall refrain from reproducing it.

The first meeting of the British Association took place 80 years ago, at York, and Earl Fitzwilliam was the President. At that time there were but few workers in scientific subjects, but as the opportunities for discussion and exchange of thought between them increased, so also progress was made. Lord Playfair said, in 1885, at Aberdeen, that it seemed as if human progress and scientific thought were alternative terms in the history of civilisation. This is, as Sir William Ramsay describes it, an echo through the ages of Roger Bacon's utterance in 1250 in praise of experimental science.

Experimental science was in disfavour after Bacon's day, however. It was considered degrading for a philosopher to do more than reason out his theories. Whether it was that resort to experiment was considered to throw doubt upon his mental ability we do not know, but such was undoubtedly the case.

Engineering has now made such strides that the question, "Is it possible?" has been replaced by "Will it pay to do it?"

Sir William Ramsay then deals with scientific education. He laments the fact that in England this has been made a local and not an Imperial question. Instead of half-a-dozen first-rate institutions of University rank, there are half-a-hundred, in which the departments are necessarily understaffed, the staffs are mostly overworked and underpaid, and the training given is not that for captains of industry, but for workmen and foremen. "Efficient captains cannot be replaced by a large number of fairly good corporals." The quotation marks are Sir William Ramsay's. With the last remark we think no one will fail to agree, but we are quite sure that there are in the United Kingdom the desired half-dozen institutions of University rank. And in scientific working the captain of industry must work up to his position, and must have a knowledge of the work not only of the corporals, but of the more humble troopers. This, of course, is not the case in the military profession, and it is time that scientists got rid of the silly habit of borrowing terms from a profession so dissimilar to their own as that of arms.

Sir William Ramsay next gives his views on scholarships, and we shall indicate what these are by quoting his words:—

"To induce scholars to enter these institutions [the hal hundred before referred to] they are bribed by scholarship a form of pauperisation practically unknown in every countr but our own; and to crown the edifice, we test results b examinations of a kind not adapted to gauge originality an character (if, indeed, these can ever be tested by examina tion), instead of, as on the Continent and in Americ trusting the teachers to form an honest estimate of th capacity and ability of each student, and awarding honou accordingly.

"The remedy lies in our own hands. Let me suggest tha we exact from all gainers of University scholarships a undertaking that, if and when circumstances permit, th will repay the sum which they have received as a schola ship, bursary, or fellowship. It would then be possible f an insurance company to advance a sum representing th capital value, viz., £7,464,931, of the scholarship reserving, say, 20 per cent. for non-payment, the result mishap or death. In this way a sum of over six millio pounds, of which the interest is now expended on schola ships, would be available for University purposes. This about one-fourth of the sum of twenty-four millions stat by Sir Norman Lockyer at the Southport meeting as nece sary to place our University education on a satisfactory basi A large part of this sum should be spent in increasing th emoluments of the chairs; for, unless the income of a pr fessor is made in some degree commensurate with the ear ings of a professional man who has succeeded in his professio it is idle to suppose that the best brains will be attracted the teaching profession."

We presume that all remuneration should be a reward labour, application and diligence. A scholarship is u doubtedly the reward of labour, and certainly ranks earned money. Fellowships have been in existence at Oxfo and Cambridge for centuries, and the pecuniary reward learning is a well established principle where the wealth classes are concerned. But the scholars, to whom the financi assistance is absolutely necessary if the "captains of industry so desired by Sir William Ramsay are to be produced, are pay the money back again, so that the professors, who a already more highly paid than in many continental countri may have it. Capitalise the scholarships, says Sir Willia build and staff real universities, and then—and then wha Why, nobody will be able to go into them, and they will white elephants. Many pessimists are to be found w deplore the building of universities in our great provinci cities, though some are richly endowed. The reason is th there are no students, or too few. And there is no room f doubt at all that a university education is a costly thin and Sir William Ramsay is barbarically out of date in calli the endowment of the student whose financial position is n strong, "pauperisation."

Examinations are certainly imperfect as a method awarding honours. Yet who is it that has a great deal do with the alteration of the mathematical requirements the subsidiary papers at London lately, in some cases again the advice and recommendations of the examiners in t honours subjects? None other than Sir William Ramsa Surely a man occupying his highly influential position shou be able to start us on the road which shall lead away fro the examination system. Yet the trend of modern English qua fication is examinations, examinations, and more examinatio until even our own Institution contemplates the starting an examination system; and without examinations, what to become of the external student, who, in his own time an at his own expense, works up his abilities to degree standard Destructive criticism is easy; what is wanted is a defini constructive policy.

Having expounded his views on educational policy, S William Ramsay reviews the losses of the Association duri the year; some noted names have been removed from rolls by death. Among those to whom he refers we m mention Sir Francis Galton; Prof. Story Maskelyne; J Johnstone Stoney; Prof. Van 't Hoff, of Berlin; and Pr Cannizzaro, of Rome.

Sir William then proceeds to the consideration of ancie and modern views regarding the chemical elements. Th interesting theme leads him to the subject of radium and products, the question of transmutation and of allotropy, to which many diverse views exist in the chemical wor

he energy of disintegration of radium and its products takes im to important reflections on the matter of our own coal upply, and it is interesting to find that Sir William amsay's views coincide with those of the leaders of hought in the electrical world, as to the building of orks at the pit mouth, and transmission of energy by ectrical means.

He thinks we should start a permanent Commission to ake stock of our coal annually, as is done in America, and his Commission should keep abreast with the diminution f the stores of natural energy, and take steps to lessen its ate. He suggests penal legislation to prevent waste, and elpful legislation for suggesting and financing improved ethods.

The conclusion comes with an appeal for the study of ure science, without regard to its applications. While emembering the world-wide utility of this course, we should ot fail to bear in mind that it is our duty first of all "to trive for all which makes for the permanence of the British ommonweal."

Prof. Walker, who, as our readers may be aware, is the rofessor of chemistry at University College, Dundee, has hosen as the theme of his address to Section B (Chemistry) he subject of Theories of Solutions.

In opening the address, he refers to the discussion on the ature of solutions which took place at Leeds 21 years ago, he meeting at which this occurred having constituted Prof. Valker's first experience of a British Association meeting. His use of the epithets "great" and "lively" in speaking f the discussion shows that it impressed him keenly, and he ow indicates the position of the question at the present ime.

He considers this procedure the more appropriate, as an 't Hoff, the great founder of the modern theory of solu- ions, died this year. Twenty-one years ago his theory was nly four years old, and he had hoped to attend the present neeting as he did that one which contained the seed of nspiration which has now blossomed into Prof. Walker's ddress. Although his wish was not permitted to be ulfilled, his ideas are included in the scientific equipment of hemists of to-day, and the quantitative idea of osmotic ressure will always be to the theory of solution what the uantitative idea of the atom is to chemical composition and roperties. Emphasising the fact that chemistry is a quan- itative science, Prof. Walker quotes the well-known words of Lord Kelvin, to the effect that unless you can measure what you are speaking about, and express it in numbers, you re only at the beginning of knowledge, but have not yet eached science.

A general theory of solutions must be applicable to all olutions—to those in which the solvent and the solute are nerely intermixed, as mixtures of saturated hydrocarbons, or of inert gases in the liquid form, as well as to those in which chemical combination occurs, as in the case of water and sulphuric acid.

For the purpose of illustrating the effect of solvents on a issolved substance, Prof. Walker gives a series of interest- ing observations on the solution of iodine in a number of colourless solvents. The vapour of iodine is violet in colour, and if unaffected by the solvent, we might reasonably expect the solution to have the same colour as the vapour at equal concentration. The solution of iodine in carbon disulphide is violet-hued, but the solution in water is brown. In the indifferent hydrocarbons, and in chloroform, the colour is violet, but in methyl or ethyl alcohol it is brown. The rough conclusion to be drawn from these facts is that in the case of saturated hydrocarbons, chloroform, carbon tetrachloride, and carbon disulphide, there is little effect of the solvent upon the iodine, whereas in the case of water and the alcohols, there is considerable effect, probably of the nature of combination, since in all the solvents two atoms of iodine seem to be associated in the molecule. In dilute solution in glacial acetic acid, in the cold, the colour is brown. At boiling point the colour changes to pink, indicating dissociation at 100° C. of the compound stable at low temperatures.

Van 't Hoff's osmotic pressure theory is applicable to all cases, including mixtures of gases, mixtures of inert liquids, and mixtures such as that of sulphuric acid and water. Moreover, so long as the solutions considered are dilute, simple relations connect the osmotic pressure with other easily measurable properties. It has been unfortunately the custom to oppose the osmotic pressure theory of solution to the hydrate or solvate theory. The solvate theory, Prof. Walker says, is not a general theory, and is, further, per- fectly compatible with the osmotic pressure theory. The solvate theory stands, in fact, upon the same plane as the electrolytic dissociation theory of Arrhenius, with regard to a general theory of solutions. The former can tell us nothing about solutions in which one or both of the components are inactive, just as the latter can tell us nothing about non-conducting solutions.

There has of late been a tendency to belittle the importance of the conception of osmotic pressure in some thermodynamical quarters. Admitting that it may be dispensed with from the mathematical thermodynamic point of view, Prof. Walker questions whether the cultivators of the thermodynamic method would ever have arrived at Van 't Hoff's results. His conceptions have given a great stimulus to thermodynamics in relation to chemistry.

It is open to an investigator to choose whatever method of working is most suitable to himself. The teacher is obliged to choose that method which is most clearly intelli- gible to students, and which contains the least likelihood of giving rise to misconceptions. Thus, though the thermo- dynamic method is mathematically more elegant and in a way simpler, it affords less opportunity than the osmotic pressure method for the student to submit his methods to any practical check or test, and would lead frequently to error and confusion. Prof. Walker is careful to say that this is in no way due to mathematical incapacity on the part of the student. The excellent opportunities now offered to students in connection with mathematics have obviated that. It is in critically scrutinising the conditions under which each equation used is applicable that the difficulty lies.

Of the mechanism of osmotic pressure, nothing is yet known, but great advances have been made in the practical measurement of osmotic pressure in recent years. Though experimental difficulties are enormous, Morse and Fraser have carried on, and are carrying on, in America, admirable work in this direction. America has also produced H. C. Jones, A. A. Noyes, and Van Laar, all of whom have done valuable work in experimental and theoretical directions. They have shown how many substances may be made amenable to mathematical treatment, even when the state of dilution is not so great as in the simple cases taken by Van 't Hoff.

The outstanding problem in the domain of electrolytic solutions is to show why strong electrolytes are not governed by the same laws as weak electrolytes. The formula known as Ostwald's dilution law is strictly applicable to solutions of feeble electrolytes, but to solutions of strong electrolytes it is altogether without application. To the law of mass action there are many exceptions. The enumeration of them invariably occupies several lectures in any course upon physical chemistry.

Explanations have been attempted. Efforts have been made to show why the difference should exist. These have in general been based upon consideration of the behaviour of the ions in the solution. Prof. Walker wishes to draw attention to a point of view which has not, so far as he is aware, been fully considered. Is it the ions in the solution which are abnormal, or is it the non-ionised substance? The view which he proceeds to deduce reasons to support, and which has been reached by Noyes and others, is that it is the non-ionised portion of the electrolyte which exhibits abnormal behaviour.

It is natural to attribute everything to the ions, because they are in general the active constituents of an electrolyte. Prof. Walker goes on to show that ionisation may in some cases be normal, while the recombination is abnormal. In other examples, the reverse may be the case.

If it were possible to measure directly the velocity of either operation, it would at once be easy to select the proper equilibrium formula. These velocities are, however, unfor- tunately so high as to be beyond our powers of measurement.

The assumption may, Prof. Walker thinks, be justified

that if in a given solution a substance has normal activity with regard to one reaction, it has normal activity with regard to all reactions in which it can take part in that solution, while if its activity is abnormal in one case, it is abnormal in all.

Ammonium cyanate can be transformed into urea in aqueous and aqueous-alcoholic solutions at rates which can be easily measured. Prof. Walker has himself experimented on this reaction, and he finds very strong evidence that in the case of the abnormal electrolyte, ammonium cyanate, the abnormality of the ionisation equilibrium is entirely due to the non-ionised portion. Since ammonium cyanate is no different in regard to its electrolytic conductivity from the hundreds of other abnormal binary electrolytes with univalent ions, he is disposed to conclude that it is to the non-ionised portion in general of these electrolytes that the abnormality is to be attributed.

He remarks that the conclusion is not new, but has not been sufficiently emphasised. Nernst's principle of the constant ionic solubility product tends to show that the ions act normally in solution. Summing up, Prof. Walker says that in the equilibrium between electrolytes agreement will be obtained between theory and experiment whether we use the mass-action law, or an empirical law such as van 't Hoff's dilution formula, provided only that we attribute the abnormality to the non-ionised portion of the electrolyte. The problem of *why* certain electrolytes should be normal, and others abnormal, is matter for further investigation and research.

The theory of solutions ought to provide a suitable basis for the general calculation of hydrates. That hydrates exist in some aqueous solutions is undoubted, but no general rule or method exists for determining what the hydrates are, and in what proportions they exist. The ionic theory does not indicate, save in aqueous solutions, what the ions are, and how great is the degree of ionisation. Clausius enunciated the theory of electrolytic dissociation, or free ions, in 1857, but until Arrhenius introduced measurable quantities into the doctrine, it was barren. As soon as a simple quantitative principle is developed for hydrates in solution, that doctrine will become fertile.

Prof. Walker draws to a close by pleading that the irrelevant and intemperate things said and written by whole-hearted upholders of the osmotic pressure and electrolytic dissociation theories on the one hand, and of the hydrate theory on the other, should be forgotten. Those who remember the discussion between Sir J. J. Thomson and Prof. Armstrong last year will realise that there must, of course, be much in each of these views. The plain man's conclusion is, naturally, that the truth must lie in a combination of both, and it is satisfactory to find that this is also the conclusion arrived at by the learned President of the Section.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Oil Engine Fuel.

We have read with interest the paragraph upon oil engine fuel, appearing in the issue of August 4th of the ELECTRICAL REVIEW.

While there are, unquestionably, difficulties in handling oil having an asphaltic base, still there are engines on the market which are built to deal with it effectively. The alternative system of retaining some 20 per cent. of the heavier or tarry portion of the above fuel in an external vaporiser cannot be considered a satisfactory solution, for it is very evident that, unless great care is taken to maintain the correct vaporiser temperature, a portion of the heavier constituents of the oil will enter the cylinder, and "gumming" will ensue sooner or later. The only practicable way to deal with tar oil is to consume the whole of it within the cylinder; and with an engine of suitable design, this would offer no difficulty. In support of this statement, we should like to bring to your notice the Ruston patent complete combustion oil engine, which has been sold in large number within the last two years, and has worked so successfully with residue oils of all kinds, including in a number of cases those having an asphaltic base, that we have had many repeat orders. This engine works with great economy and reliability, and will run for long periods with the minimum of attention, and, what is of salient importance, without cleaning; while its economy is effected without the aid of an air compressor with its attendant complications or a very high compression pressure.

We have long recognised the demand for this type of engine: and in placing the complete combustion engine on the market, we are offering one which is able to handle, in an efficient manner, cheap fuels which are unworkable with the large majority of engines.

Ruston, Proctor & Co., Ltd.

Lincoln, *August 24th*, 1911.

Metal Lamp Patents.

Our attention has been called to a statement under the above heading appearing in your journal of the 18th inst. addressed to you by the Osram Lamp Works, Ltd., to which is appended a notice of an order made in reference to an action brought by that company against the British Tungsten Lamp Co., Ltd.

As one of the various manufacturers referred to in that letter, against whom litigation has been commenced, we desire to call your attention to the fact that the order referred to was made with the consent of the defendants who took no steps to defend the action.

The business of the British Tungsten Lamp Co., Ltd. was in the hands of a Receiver for the debenture-holders who did not feel justified in contesting the proceedings. The point is material, as your correspondent's letter might convey the impression that the order was the outcome of an investigation by the Court.

We may add that the proceedings instituted against us are being defended, and we are content to await the decision of the Court.

"Z" Electric Lamp Manufacturing Co., Ltd.
KILBURN BROWN & CO., *Managers.*

London, E.C., *August 23rd*, 1911.

Insulating Properties of Leatheroid and Presspahn.

In your issue of the 18th Mr. Sack throws doubts on the deductions that I drew as the result of my experiments. I think that it is quite clear that I was comparing the two substances as they exist, *i.e.*, under normal conditions and after being exposed to damp atmosphere. Thus, under these conditions presspahn is undoubtedly superior to leatheroid.

After treating with insulating compound I found, as Mr. Sack seems to have found also, that leatheroid has the higher puncturing voltage. This is clearly indicated by my figures.

If Mr. Sack's deductions are drawn after treating both materials, then his experiment and mine are on quite different lines.

Without treating, presspahn is superior; that is what I wished to convey.

D. H. Ogley.

August 24th, 1911.

Cost of Electric and Acetylene Lighting.

I have received a booklet which apparently has been widely circulated by a firm of acetylene contractors.

In dealing with the fuel costs of various illuminants, the following statements appear amongst others of similar purport. I only quote the most glaring:—

"*Electricity.*—Six 16-C.P. lamps use in eight hours 3 B. of T. units, which at 5d. per unit = 1s. 3d.

"*Acetylene.*—Six 16-C.P. burners use in eight hours 16 C.F. or 3½ lb. of carbide, which at 1½d. per lb. = 5¼d."

These statements are obviously misleading, and are not

in my opinion, fair trading. Can anything be done to check this sort of thing?

As the booklet deals almost entirely with country house lighting, it is only fair to compare with electricity on the same basis, and taking the commonest case of a paraffin engine, small dynamo and storage battery, the figures appended hereto are, I think, very moderate, and bring out a very different result to the aforementioned statements.

Further comments might be made, but they are, I think, needless.

Six 16-c.p. low-voltage metallic-filament lamps at 18 watts for 8 hours = 864 watts, say, ·9 B.O.T. unit = 1·2 H.P.-hours.

Taking battery efficiency = 60 per cent., and dynamo efficiency = 75 per cent., it gives B.H.P.-hours required from engine = 2·67.

Taking engine consumption at 1 pint per B.H.P.-hour, and paraffin at 6d. per gallon, gives

Fuel cost of six 16-c.p. lamps for 8 hours = 2d.

Even comparing with a town supply at 5d. per unit, the cost comes out at 4½d., instead of 1s. 3d., as stated.

Scottish Contractor.

August 24th, 1911.

Tests of Lamp Shades and Reflectors.

With reference to our article on "Distribution and Efficiency Tests on Lamp Shades and Reflectors," published in your issues of July 7th and 14th, Messrs. Holophane, Ltd., have written to us pointing out that some readers have assumed, from the figures given, that the Holophane shade possesses no advantage over the ordinary opal type.

As we took every precaution to avoid photometric errors, we are confident that our results are correct within 1, or at most 2, per cent., but we do not wish these to be considered as in any way depreciating the excellent qualities of the Holophane shade.

The choice of designs available giving various definite polar distributions, the excellent screening and high efficiency of these shades, together with the uniform illumination produced even when used singly, render them, in our opinion, one of the most perfect forms of shade that has yet been introduced.

The object of the article was, as stated therein, to give information concerning the shades in common use, and this we have attempted to fulfil without unduly favouring any particular type.

Leonard Murphy.
H. L. Morgan.

London, E.C.

Representatives Abroad.

The excellent leading article on the above subject which appeared in your issue for July 14th, though primarily directed to a consideration of the needs of our Colonial markets, contains much that is equally pertinent to the question of representation here, in India.

In an article which appeared in the Electrical Review, Vol. LXVII, page 474, I touched on the subject of the qualifications required for successful personal representation in India, and it is interesting to note that your article endorses the general propositions which I then ventured to put forward.

It is gratifying to note that you lay special stress on the necessity for thorough technical knowledge on the part of the engineering representative. It might be thought that it is superfluous to labour a point which is almost self-evident, were it not for the fact that, even now, it is possible to find as representatives of engineering firms gentlemen who are "salesmen" and nothing more.

In England, where salesmen are always within easy touch of the technical department of their principals, such men may show satisfactory results. Here the sales engineer has no such assistance.

It must, however, be freely acknowledged that the great majority of electrical manufacturing firms who have adopted direct representation in India, have laid the above lesson to heart, with the result that our electrical engineering representatives here are, with few exceptions, gentlemen of not inconsiderable technical qualifications and professional standing. Indeed, on this point British enterprise compares very favourably with that of Continental firms, and there are several of our British manufacturers who deserve much credit for the complete and adequate manner in which they have dealt with the problem of Indian representation. It is to be regretted that the harvest is not always proportionate to the labour which has been expended.

Speaking generally, I venture to think that here in India the usual complaint of inferiority to Continental firms in the art of representation cannot be fairly laid to the charge of our manufacturers of "heavy" electrical supplies as far as the *quality* of their representatives is concerned.

In my opinion, unsatisfactory results are often due, not to the sales organisation in Indian itself, but to failure, on the part of the head office of works at home, to fully support and assist the Indian branch. There is often, as pointed out in your leading article, a regrettable reluctance on the part of those at *Home* to carry out suggestions from those *Abroad*. If success is to be attained, it is essential for the head office at home to realise that it is the "man on the spot" who *knows*, and that his opinions and his suggestions *must* be attended to, however much they may be at variance with the preconceived ideas of those at home.

Furthermore, it is essential that the Indian representative should have far wider powers than those accorded to a branch manager at home. He must not be tied by standard instructions which would be good and proper for the latter. He must practically have a free hand to do what he thinks best in the interest of his principals. Often the latter, not unnaturally, shrink from entrusting to a not very senior member of their staff powers little less than those of a director at home.

Further consideration will show that this risk must be faced. Time seldom permits of referring questions home and awaiting replies. Hence the representative must be able to strike a bargain on his own authority.

To firms who are used to a rigid system of centralised control over their sales organisation such freedom will seem repugnant, and even subversive of sound business principles. It is, however, unavoidable. The representative who is under instructions to refer home every question, technical or financial, which is out of the ordinary run of business, will do no good either to himself or to the firm he represents.

Just as in the process of "empire building," the responsibility placed upon officials in distant lands is far greater than those officials would be entrusted with were they at home: so must commerce trust large issues to her pioneers, and, if the right men are selected, that trust will be as well sustained in the latter case as history has proved it to be in the former.

G. E. Wright, M.I.E.E.,
Electrical Engineer, North-Western Railway, India (Lahore).

Lahore, *August 9th*, 1911.

Labour Troubles.

As a reader of the Electrical Review for over 21 years, I protest against your leader of August 18th on the strike, it being unworthy of the *Daily Mail* and unfit for an electrical paper read by all classes of workers. Adam Smith, over a century ago, stated that "all wealth is produced by labour." The generally accepted definition of capital is "that part of wealth that is used to produce more wealth." You state that the strikers are reinforced by every blackguard hooligan, who never has or never will try to do a good day's work. This is wonderfully like the legal definition of a gentleman: "One who lives without working." Legally, a doctor or engineer cannot be a gentleman until they retire from work.

The secretary of the railway workers, four years ago, had instructions for either a strike or recognition of trades unions. He accepted the Conciliation Boards instead of either, and is now a Government official. Workers are free to work or starve. What have men starving a wife and family on 16s. 10d. per week to conciliate about? Your remarks about the community striking against the Guardians are very apt. It costs the Guardians 1s. so that a pauper will

benefit to the extent of 3d., and the strikers not being paupers, and living in houses and paying rates, would benefit 6d. or 1s. per week if they withheld their poor rates.

The Conciliation Act, which was forced on the workers by the Government, works like this. The first important award was given by Lord MacDoncll in November, 1909, two years after the establishment of scheme. Disputes followed as to its interpretation, and for a long time the companies refused to ask the arbitrator to elucidate his decision. When, in December, 1910, the managers were finally forced to consult Lord MacDonnell, he declared that the men had been correct all through in their reading of the award. Your statement that the docker gets £3 in a comparatively short time means that, if the docker worked usual office hours, from 9 a.m. till 6 p.m. on five days and on Saturday from 9 a.m. till 3 p.m., with an hour for lunch each day, he would be two weeks earning £3. He would probably have to wait about the same number of hours in order to get the job, and be picked out, like butchers pick beasts, by the amount of beef and muscular energy he appeared to possess. Then you say, "silly girls striking out of sympathy." I have no sympathy with average wages of 7s. to 10s. per week when I know that 100 families per week in Christian England consecrate a daughter to a life of shame.

Tipping, as you say, is a disgrace, and is indulged in by those who aspire to be considered legal gentlemen. The worker should be paid such a wage that he can keep a wife and family without having to bow, beg and scrape to every blackguard hooligan who offers him twopence. This only creates flunkies and more parasites for the workers to feed. The position of the gentleman (legal) and the worker reminds me of big fleas have little fleas on their backs for to bite 'em, and little fleas have lesser fleas, and so on *ad infinitum*. I consider betting on horses or stocks and futures as dishonest as accepting premiums from pupils in the electrical trade, and, as a manager to a supply company, I always refused premium pupils.

Premium.

August 28th, 1911.

[We would suggest, in all seriousness, that our correspondent should carefully read "The Economics of Strikes," by Mr. Harold Cox, published in the September issue of "The Financial Review of Reviews." If this does not give him a clearer conception of the subject on which he holds such irrational, inconsiderate and uninstructed views, then nothing will bring him to a fuller appreciation of ultimate economic facts.—Eds. Elec. Rev.]

I was somewhat interested in "Labour's" article under the above heading in your issue of August 25th. While my sympathies are with "Labour" and the cause he espouses, it appears to me that he is indulging in random firing, and is in reality injuring the cause he wishes to uphold.

Liberty! what is liberty? Liberty in many instances becomes oppression; at the present time a man who is in receipt of good wages is at liberty to spend them practically as he likes: he is at liberty to marry and have a family; he can play the fool, neglect his family, ruin and undermine his constitution, until he becomes chargeable to the rates. But what are the liberties of the men who pay the rates? They are not at liberty to say whether or no they will pay their rates; they are compelled to do that. If this were not so, by sheer stress of economic forces the man who wasted his income would have to mend his ways, *i.e.*, curtail his so-called liberties, or go to the wall, where want and privation would be his ultimate reward.

We prate of the rights of man and individual liberty, very often overlooking the fact that the rights of the ne'er-do-well in many many instances infringe on the rights of the well-doer.

Let me give a quotation from an article that I have before me:—"Germany has a law that provides that if it can be proved that a man is earning a sufficient wage to support those dependent on them, but that he is dissipating that wage by vicious habits, he can be declared a minor, and he is then treated as a child. His employer is told that the wage must be paid, not to the man, but to a guardian appointed by the magistrate of the district in which he lives, who uses it for the support of the wife and children. In England a man who could not get his wage might refuse to work; in Germany the police would see that he did. The District Captains are expected to report at the head office all cases that should be thus dealt with."

This practically has the effect of protecting the liberty of the well-doer, while restricting the liberties of the ne'er-do-well. Comment, I think, is superfluous.

"Labour" must also remember that many men are victims of their own folly. Now, with respect to this, let me touch on "Mental Capacity of the Individual." Between mental capacity and incapacity there is no broad line of demarcation, it is a question of degree. There is no degree, however, of control; it is either absolute freedom or absolute control (lunatic asylum); now, it seems to me that partial supervision and watching of the interests of Nature's weaklings would be beneficial to the nation generally.

In handling problems of this description, it is wise to view things from the stern realities of life, not from the land of dreams and ideals: if you preach false doctrines to the unenlightened multitude, the time comes when the disappointed multitude turns on its would-be protectors and leaders, and rends them limb from limb; at least, this is the teaching of history.

There are times in the lives of each one of us when we compare the dark present with the bright past, and think the majority of other people's jobs are easier than our own.

Whilst not ignoring the valuable services rendered to the general public by the vast body of railway workers, we must not overlook the fact that "over 100,000 of them with 20s. a week or less," include many lads—lad clerks and junior porters, &c., that have to start at something the same as the rest of us: many of them are employed in the country, where conditions are vastly different to those in towns. I have worked in London, also in the country and on railways, and can speak from experience. Space, however, does not permit me to dwell on this as fully as I could, although for the purposes of this article there is no reason why I should. This remark also applies to the question of the "silly girls."

I hold no brief for employers or capitalists; I wish to be impartial. But supposing one Monday an employer called his employés, numbering 500, together, and told them that, owing to better trade, he was going to distribute about an extra £1,000 between them per annum in wages, what would be the feelings of the individual after a week's anticipation and speculation, when they found out that it only meant an increase of 9d. per head per week? I guess many would feel disappointed, and it would take some convincing to make them satisfied and feel that they were being fairly treated, and yet on a capital of £40,000 the same sum would represent 2½ per cent. dividend. We talk glibly of capital, capitalists, dividend and interest; yet how many men in works will borrow money and pay interest of 1d. or 2d. per 1s. per week (? how much per cent. per annum), most probably to put it on a horse or spend in some other useless manner, and yet begrudge a fair interest to the men who find the necessary money so that tools and equipment can be acquired, so that they can be usefully and efficiently occupied to their own advantage.

Again, say a mechanic is paid 9d. per hour, and his employer advances him to 9½d., at the same time the employer, from philanthropic, I will not say business motives, advances his labourer from 6d. to 9½d. per hour—would the mechanic turn round and congratulate and shake hands with the labourer on his good luck? "I don't think." Not while human nature is what it is, and human nature is really at the bottom of the social question; although I believe, as a nation, we are becoming more altruistic, and in that fact lies hope.

SOLIDARITY—capital letters, please. While one or few men may receive an increase in salary and relatively be in a better position than the remainder—when applied to the whole, and that, I take it, is what "Labour" means—relatively speaking, everyone would be in the same position as previously, unless there were a corresponding increase in production. Wages act on cost of manufacture, and anything which acts on cost of manufacture is reflected in the selling price, or, in other words, we should, relatively speak

ing, have to pay more for the goods we purchased, and this would have the effect of defeating any other advantage we might have gained.

Referring to "Labour's" concluding paragraph: "Humanity is vastly more important than property," and "there is no wealth but life;" are employers alone to blame in this respect? Are all rich people devils, and are all poor people saints? I think not. Do we all direct our energies to the best advantage, or, in other words, spend our money as we should? I think not. I admit that as you saunter through the West End of London you see evidence around you of luxury, idleness and waste, but on the other hand, if you go into the East End of London, you see evidence of economic waste in many ways, and even idleness and luxury of a degraded type. I admit this is the extreme, but take the mean. You see money spent on dress and finery by all classes that would far better be spent on good food and nutriment; the drawing room, dining room and parlour furnished elaborately, while the kitchen, larder, library, or book-case is neglected, and the quiet pastoral pursuits of the country-side are neglected and spurned for the bitter apples of modern town life; and what applies to the individual life applies to the national life.

Oliver Goldsmith, when writing his "Deserted Village," in 1770, plainly foresaw the cause of a great deal of our present-day troubles; let me give a quotation:—

> Ill fares the land, to hastening ills a prey,
> Where wealth accumulates and men decay;
> Princes and lords may flourish or may fade,
> A breath can make them, as a breath has made;
> But a bold peasantry, their country's pride,
> When once destroyed, can never be supplied.

"Labour" says: "You assume that probably much of the trouble arises from sheer economic ignorance," and he remarks, "It does"; but waving aloft the flaming torch of class hatred and enmity will not improve the position; and are any of us past masters in the art of economic laws? Is there not room for improvement in us all?

My views and opinions may not be "Labour's"; I, however, submit them for his consideration, and for the consideration of anyone, either employer or employé, who is interested in one of the most pressing problems of present-day life; and I hope that many are so interested.

A. W. Wyatt.

P.S.—I would also refer "Labour" to my letter under "The Sphere of Government Influence," in the issue of August 18th.

In the recent articles in the Electrical Review regarding the present labour troubles, statements appear to have been made without due consideration from some points of view. The leading article in the issue of August 11th contains the following quotation from John Stuart Mill:—

> When a Government provides means for fulfilling a certain end, leaving individuals free to avail themselves of different means if in their opinion preferable, there is no infringement of liberty, no irksome or degrading restraint.

It is surely obvious that whatever truth or merit this statement may possess, will depend upon the statement at all times and in all respects of a reasonable equity in the relations that exist among the individuals concerned. If there had never been unfairness in the relations between employer and employed, there would probably not have been any occasion for restrictive Government control. Quoting further:—"Those relations—at one time free, or practically free, from Government control—are now hedged about with all kinds of restrictions. The parties are not free to contract one with the other."

Inequitably, no: for that would be still worse restriction. I think it must be admitted that the prevalence of bad conditions, and of injustice, has been largely the cause of Government interposition in these matters.

Again:—"A may not run a factory unless it is open to the view of a Government inspector." Is not this really to protect the liberty of A's employés? What is that in which A is restricted and which he dare not let a Government inspector see?

"B may not employ able-bodied pitmen for nine hours at a stretch in his coal mine."

Is it not rather the pitman who would never have been free from the slavery of the one time 12 and 14 hours' day, had there been no legislation?

"C may not agree with D, for whom he works, that he will take no advantage of the Compensation Act if he meet with an accident in the course of his employment. Are not all these 'infringements of liberty' or 'degrading restraint'"? Can anything more degrading be imagined than that D should desire C to forego compensation for an accident he has met with while in his employ?

Then follows a taking picture of the "humane employer of 15 years ago" sending poor sick Tom his wages. Is it implied that this was the general practice? How many employers of this type were there, and what proportion of the total workers did they employ? Did he likewise for Dick and Harry and others, as well as Tom? It is not on his account that there is a Compensation Act, so much as the other kind of employer whose name is legion.

I was engaged in the office of an industrial undertaking employing over a thousand hands, more than 15 years ago, and in many cases of sickness I do not remember one instance of a workman's wages being sent him during the time he was compelled to be away from duty.

With regard to the statement concerning the National Insurance Bill, that:—"Its only result may be to enable the employer to save that which he would otherwise spend," if this is so, what reason is there to complain from the employer's point of view?

It is easy to say, as we all do, that labour troubles can and should be settled without recourse to strikes and their deplorable accompaniments, but the pitiful feature of the whole matter lies in the fact that conditions that constitute admitted grievances do not get remedied without. It is not the *possibility* of improvement by peaceable means that is in question, but the *actual undelayed accomplishment*. If the nation dallies with reform, then the nation cannot hope to have anything other than revolution as a consequence.

Scrutineer.

Olympia Exhibition.

In my last letter I said I would make full apologies if I were proved to be wrong in my statements as to electric cooking by the Exhibition caterers.

Mr. Butler has since informed me as to the steps that were taken, which probably were not so active as they would have been had the committee been composed of electric cooking manufacturers only, and were not the steps referred to in my letter, but undoubtedly a strong line *was* taken, with, unfortunately, no success, so the committee are entitled to my withdrawal of my criticism of their action.

I do think, however, that the next Electrical Exhibition should be "all electric," though by that time there will be a sufficient number of large electric cooking plants in London to make resistance such as the Exhibition Executive have experienced very difficult.

A. Hugh Seabrook.

London, W., *August 26th*, 1911.

Direct Trading.

Re letter in your issue of August 8th, signed "Wavering," your correspondent is certainly in an untenable position, and must accept one of the two ways out of the difficulty. The first method would be to remain loyal to the trade and respect all its ordinances. The second way would be to supply all and sundry on trade terms, and become "an outsider." The first way should prove the more beneficial, as a feeling exists (in the electrical world) to support firms who study the welfare of the trade. "Trade terms to the trade only," this fact should be widely advertised, and (providing goods and prices are competitive) there is no doubt the trade will support a firm carrying out this policy. The second way is a despicable method of doing business, it is generally stigmatised by the trade and has a train of disadvantages attached to it; on summation we find—the business done outside the trade (motors) is very limited—the orders do not repeat—the mistakes are numerous (through lack of technical knowledge), which cause loss of

time and expense which a trade quotation does not cover. Subject to circumstances, there are exceptions to the above trade acceptances. Regarding the Contractors' Association's line of action, I have no doubt, if your correspondent forwards the name of the offending firm to the Association, they will send the customary letter, "Telum imbelle sine ictu," await the customary reply, and having received same, await the millennium.

Percy Collins.

August 28th, 1911.

Who Pays?

It has occurred to me during troubles in the coal trade that, if I were a foreigner, I should much like to see the colliery owners try the policy of conceding all the men's demands, and putting up their prices correspondingly. They would no doubt, in order to secure the same profit, have to add more to their prices than the exact extra to which the concessions amounted, because the increased cost of coal would reduce the consumption, particularly the exported portion. Still, I should think it might be done; and it would prove a very instructive lesson. Of course, it would do considerable harm to the country, and I, therefore, do not advocate the policy. My reason for mentioning the coal trade particularly is that it is probably the only one in which the experiment would not certainly prove disastrous to the employers. No doubt we should start by congratulating the men on obtaining their "rights," then we should hold up our hands in alarm at the cost of coal, and curse the owners for their cupidity; and then we should nationalise the mines, though Heaven only knows what good that would do.

I should, however, like to know what objections there are in the case of a strike of municipal tramway employés to taking a poll of the ratepayers to decide whether the demands shall be conceded, and, if so, whether the extra cost should be put on the fares or be borne by the rates, information as to what these would amount to being, of course, given. I think the advantages of this procedure are obvious, but, not being a tramwayman, there may be disadvantages of which I am not aware. Of course it would be useless for a tramway company to adopt this method, even if they could, as the decision would be to concede the demands, the shareholders to bear the cost.

J. S.

August 26th, 1911.

A Question of Trade Practice.

May we ask those of your readers who are in the rubber, cable and electrical material trades to inform us, and your readers generally, whether it is the recognised practice of the trade, when selling pure rubber tape, to include in the weight charged for, the roll of paper that interleaves the layers of rubber? Very much to our surprise we find that it is a very general practice among a certain section of dealers.

If this is general practice, we fancy it will come as a surprise to many of your readers, who, like us, will fail to see the humour in buying wrapping paper at 8s. a lb.

We should also be much interested to know whether such a practice, even if general, is legal.

Importers.

Electric Heating and Cooking Apparatus.

As one actively engaged in selling electrically-heated apparatus, I am much interested in the discussion that is appearing in your columns on the above subject. It is a difficult matter to get this class of apparatus into the hands of people who would really be pleased to use it, and would realise its advantages when once the prejudice against its first cost had been worn off.

The manufacturer cannot do much more than he now does. He has to make and sell the goods at a figure which will stand comparison with similar apparatus using gas. He is expected, by many people, to send out goods on sale or return—to lie in the show room or even in a corner at the back of the storeroom and to remain there indefinitely. He is expected to supply unlimited quantities of expensive advertising matter. He is expected to give long credit, and risk bad debts in a trade that is notoriously worse managed than the average. If this apparatus sold as freely as pills or sauce, and bore the same margin of profit, he might, perhaps, do a little more than he now does.

The contractor cannot afford to devote much energy to this portion of his business. Repeated experience has proved that the cost of actually selling most forms of cookers or heaters is, in the present stage of the industry, considerably greater than the amount of profit that is obtained directly from the sale. He cannot really be blamed if he is content with handing the goods over the counter in response to a made demand in exactly the same manner as a grocer or any other tradesman. Some few contractors are wide awake and active enough to sell a fair quantity, and, where they are able to obtain orders for heating circuits at the same time, they are usually well repaid.

The supply authority is, in most cases, the only possible organisation that can sell this class of apparatus at a profit to itself. Every good iron, cooker or heater is a steady source of profit—profit from the sale of a by-product—a daylight load. At present less than 10 per cent. of the stations in this country appear to be in any way aggressive in developing the use of electricity for heating or cooking purposes, and 10 units per head of population appears to be about the average consumption per year. The contractors really have no cause to complain if the supply authorities relieve them of the responsibility incurred in selling motors, cookers or the like. Hire or hire-purchase arrangements are usually made necessary by the action of the gas companies, and, so long as the contractor has the wiring and the installing to do, he is better off than if he has to sell the complete installation at a cut price and uses the cheapest apparatus obtainable.

Some few authorities have progressed so far as to open a free museum of apparatus, stocked largely at the expense of the hopeful manufacturers. A stronger effort is needed.

Why is it that so many supply authorities do nothing at all to develop the use of electricity? Has any authority lost money through being aggressive?

Manufacturer—Ex-Contractor.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Leather-Faced Insulating Gloves.

Our attention has been drawn to the excellent leather-faced insulating gloves which the St. Helens Cable and Rubber Co., Ltd., of Warrington, have now been supplying for the last two years, and which we have had the opportunity of inspecting.



Fig. 1.—Leather-faced Insulating Gloves.

The ordinary rubber insulating glove is naturally liable to abrasion in ordinary use, and puncture by contact with sharp projections; the knowledge of this tends to restrain the average man

rom using the gloves, except on what appear to be the most angerous jobs, and this leads to accidents. With the St. Helens o.'s arrangement of leather facings over the palm of the hand nd faces of the fingers, both the wear on the glove and the chance f dangerous punctures are enormously reduced, especially when the love has been in use for a time. The leather covering also shields ne rubber from the effect of exposure to atmospheric changes, and reserves it.

Every glove is tested at either 2,500, 5,000 or 10,000 volts, and abelled to that effect, together with the company's name, and a eather tab is provided to prevent ripping in case the glove is pulled n hurriedly. Both gloves and gauntlets are supplied, in 8, 9 and 0 sizes, and the firm offer to test and inspect, free of charge, loves of their own manufacture, if sent to them carriage paid.

We understand that several hundred pairs of these gloves have een ordered by the Admiralty, and that during the two years they ove been on the market, no complaint has been received regarding hem.

"Tubead" System of Electric Heating.

Messrs. F. A. Wilkinson and Partners, Ltd., of Harpenden, Herts., have recently introduced a patented system of electric heating known as the "Tubead." We illustrate in fig. 2 a 1,000-watt heater on this system, consisting of a seamless steel tube, 7 ft. 6 in. long and 1 in. diameter, in the interior of which is run the heating element, of special type. The tube is complete with connection box and supports, and three degrees of heat can be provided in the single length of tube, if desired. Naturally the first cost of such a heater is very small in comparison with steam or hot water systems, and its convenience, where an electric supply exists, is obviously much greater.

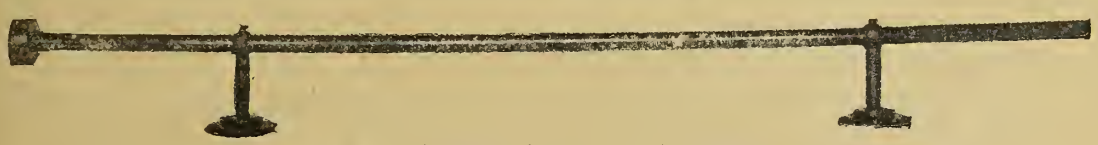


Fig. 2.—"Tubead" 1,000-watt Heater.

New "Graphic" Instruments.

Messrs. Everett, Edgcumbe & Co., Ltd., of Hendon, N.W., have just introduced a "recorder" possessing numerous novel features, and owing to the very great confusion which has so often arisen in the past between, say, a "watt-hour meter" and a "recording wattmeter" (owing to the latter expression being loosely applied to both instruments), they have decided as far as possible to abandon the term "recording," and to speak of a "graphic" ammeter, wattmeter, &c. By this means it is felt that all possible confusion will be obviated.

As showing the very wide range of usefulness covered by these new instruments, it may be said that they could be supplied for practically every purpose, including voltmeters and ammeters for continuous and alternating currents, wattmeters for continuous, single-phase and polyphase circuits, whether balanced or unbalanced, speed and frequency indicators, pyrometers, pressure and vacuum gauges, and, in fact, for any and every purpose for which a graphic record may be required.

Fig. 3 shows the general appearance of a recording voltmeter. It has an exceptionally large glass window through which a long length of record can be clearly seen, and a special spring fastening which affords an absolutely dust-tight joint, and yet, at the same time, is instantly opened with one hand. It is, moreover, so arranged that a padlock or seal can be employed, if thought desirable.

Fig. 4 shows the internal appearance of a moving-coil graphic ammeter. Covering the permanent magnet, and shielding it from stray magnetic fields, is a detachable hood B, which is seen as a "ghost" in the figure. As will be gathered from the illustration, a roll of chart is inserted between spring centres H, above the clock, and passes down under two springs and a toothed guiding-wheel in the centre. Under this latter lies the driving wheel of the clock mechanism. The arrangement is such that the chart cannot possibly slip, and the guiding is so perfect that all tendency to creep to one side or the other is avoided.

Below the clock is a roller L, on which the chart can be made to wind itself up, if required, as it is passed through the recorder. On the right-hand side will be noticed the winding lever D, which owing to the construction of the case, is thoroughly accessible and very conveniently placed. Below this lever are the change wheels K, whereby any desired paper speed can be provided. These wheels are readily accessible, so that any subsequent change in the chart speed can be carried out in a few moments and without the necessity of returning the recorder to the factory. Further, by means of a simple gear-changing device, two or more speeds can be provided on a single instrument, so that the same recorder can be used for widely different purposes. For example, a speed of 1" per hour can be provided for ordinary work, and this can instantly be altered to, say, 1" per minute for use in connection with machine-tool driving.

A special feature is made of a hinged pen-arm, which can be instantly removed for cleaning or replacement. The simplicity of the operation is well shown in fig. 5, which indicates the method of removing it by merely pressing together the two arms of the spring fork G between the finger and thumb. Amongst the advantages claimed for this construction of pen are, besides ease of removal, a constant and readily adjustable pressure on the paper, and the maintenance of a very high insulation resistance between the electrical winding and the pen, which last is a most important point, particularly in connection with traction and other earthed systems.

It may be mentioned in passing that the surface of the chart over which the pen moves is a perfectly flat one, in contradistinction to the curved surface provided in the case of drum and many other recorders.

The pen itself takes different forms, according to the purpose for which it is to be used—that is, according to whether the paper speed is high or low, and the load a steady or variable one, and so forth. Again, the damping, which is provided by means of an oil bath, is adjustable, so that any required amount of dead-beatness can be obtained.

It need hardly be said that special care has been devoted to the construction of the clock, so as to provide ample working forces and to enable it to withstand the none too gentle treatment so



Fig. 3.

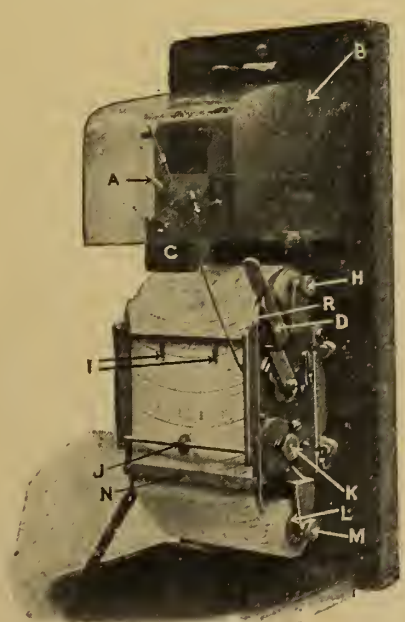


Fig. 4.

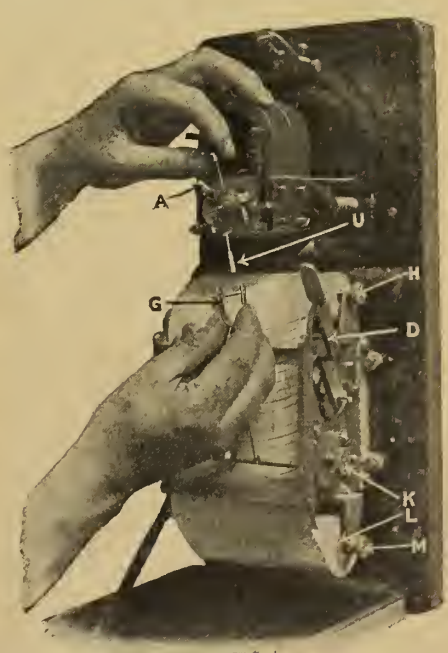


Fig. 5.

Everett, Edgcumbe "Graphic" Instruments.

often meted out to a "graphic" instrument. In this respect the long experience of Messrs. Everett, Edgcumbe & Co. in the design of such instruments has stood them in good stead.

Back-Geared Screw Limit Switch.

Amongst the many "Igranic" switch specialities of the Adams Manufacturing Co., Ltd., of Bedford, is a back-geared screw limit switch for valve control and for use with lifts or machine tools, shown in fig. 6.

It is not always convenient or desirable to install limit switches of the tappet-operated type in the well of a lift or hoist, and in such a case it is necessary to employ limit switches of the travelling-

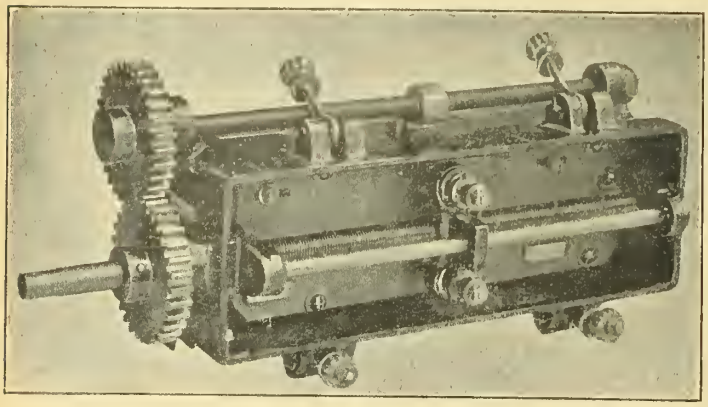


Fig. 6.—Back-Geared Screw Limit Switch.

nut or equivalent type. The Adams Igranic screw limit switches are adapted to be driven directly from a lift or valve mechanism, either by means of back gear, sprocket wheel and chain, or other positive drive.

Protecting covers, or completely enclosed or watertight cases and covers, can be provided as required.

If for use in connection with electrically-controlled motor-driven valves or slow-moving reciprocating machine tools, similar screw-actuated limit switches can be supplied fitted with contacts opening with a snap action.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Fire" writes:—We shall be glad if you or any of your readers can give us any information on the following point, for which we thank you in anticipation. Suppose a contractor estimates for the electric lighting of a house, the value of the work to be done being, say, £150, and his offer is accepted, there being no specification, or if such, there being no clause in same regarding the insurance of the work. After work to the value of, say, £50 has been completed, a fire breaks out in the house, which is completely destroyed. Is the contractor liable for the re-execution of the work which was done prior to the fire, without being paid for it? Has he any claim on the proprietor for the amount?

*** Upon the facts above stated, it appears that the contractor is clearly entitled to be paid. No mention is made of there being any necessity for a certificate of approval; but as no certificate is required, the contractor is entitled to be paid when the work is done. For what happens afterwards he is not responsible.

TRADE WITH CHINA.

The Acting Commercial Attaché at Pekin reports that the total value of machinery, railway plant and materials, electrical materials and fittings imported into China in 1910 amounted to £3,122,000. In commenting on these figures he states:—

"I desire to draw the particular attention of British manufacturers and merchants to these figures, not so much because they constitute a record import but because they illustrate the fact that China, after some years of hesitation, has definitely entered the world's markets as a purchaser of machinery. The Chinese people have at last come to realise that railways are an indispensable factor in the development of their country's natural resources, and that the vast stores of mineral wealth that lie dormant all over the empire are of no use to them unless exploited by scientific methods. They have, moreover, awakened to the fact that with practically unlimited supplies of raw materials and cheap labour there is no reason why they should not manufacture themselves many of the articles they have hitherto imported from abroad. So railways are being constructed and projected in every province, coal and other mines are being opened and factories are springing up in all directions.

"Having called attention to the demand that exists, I would point out that owing to the increasing keenness of competition among European and American manufacturers, the tendency of the day is towards industrial and financial combines who are prepared, through their representatives stationed at Pekin, Shanghai and other important centres, to finance Chinese industrial undertakings and supply them with all the machinery and expert assistance they require. In these branches of the trade where such combination is not feasible or desirable, manufacturers are beginning to send their own agents out to China, in order to get into personal touch with the native purchasers, who belong, in a majority of cases, to the official class; or they entrust their interests to some local firm of merchants who, by means of branches in different parts of the country and through their Chinese connections, have special facilities for pushing their business. The reputation of British machinery is second to none in China, and as there is good reason to believe that our manufacturers are fully alive to the great possibilities now opening out in this part of the world, and are prepared to take a more active part than they have done hitherto in making their products known, giving, perhaps, a shade more liberal treatment to local merchants in the matter of credit and financial support, we may, I think, look forward with confidence to the United Kingdom maintaining the dominant position she now holds in the Chinese machinery market.

"The view is held by some, whose opinions are entitled to respect, that the machinery best suited to the Chinese market, at any rate for some years to come, will be of so cheap and common a description, that British manufacturers stand little chance of successful competition with Continental and Japanese makes. My experience does not altogether bear out this view. The Chinese are, I think, learning by bitter experience that to purchase cheap materials for railways, factories, &c., does not pay in the long run, and as money becomes cheaper, as it must when currency reform is firmly established, they will be in a better position than they are at present to fit out their various industrial undertakings with good and durable plant. I am informed, moreover, on good authority, that the prevailing impression regarding the costliness of British machinery is somewhat exaggerated, and that in certain branches of the trade, such as the supply of railway materials, British makers are able to tender as cheaply, if not more cheaply, than their Continental rivals. Chinese factories will be unable for some time to come to turn out any but low grade articles, which will only compete with Japanese productions of a similar class.

"Another factor which militates against the success of native industrial undertakings is their unreasonable dislike of employing foreign managers and engineers. In factories where up-to-date plant of complicated and delicate machinery has been fitted up, they dispense with the foreign expert almost as soon as the machines have started working, leaving them to the tender mercies of native engineers who are helpless as soon as anything goes wrong.

"As in the technical so in the commercial side of the undertaking, the Chinese are not yet capable of conducting large commercial enterprises, such as steamship companies, ironworks, &c., on sound business lines. The great majority of Chinese industrial companies, if not in financial difficulties, are, at any rate, earning far less than they ought, owing to inefficient management. Yet their promoters deliberately refuse to avail themselves of foreign business knowledge and experience. It should be added that the more enlightened among Chinese officials and business men are beginning to realise, in some cases as a result of bitter experience, that something more than capital, machinery and labour is necessary to make great industrial and commercial undertakings a success and are inviting foreign co-operation in the management of their companies. There is as yet no code of company laws in China, and therefore no legal obligation on so-called Chinese companies to furnish properly-audited accounts. Most of the companies now being formed to establish waterworks, electric light, telephone and tramway systems, &c., consist of groups of officials and merchants who have obtained a concession or permit from the Government. The only thing they can offer as security for a loan is a mortgage on their property, and as this involves expert valuation and investigation of titles, not to mention the necessity in the case of landed property of obtaining the Government's sanction to the mortgage, all matters requiring careful handling by an experienced man on the spot.

"It is hardly necessary to remind British manufacturers of the advantages to be derived from judicious and systematic advertising, but attention may be drawn to the facilities afforded by the rapidly increasing circulation of Chinese newspapers, copies of which are carefully scanned each morning by millions of readers all over the country, and to the growing number of foreign journals published in the Far Eastern parts in which commercial affairs are made a leading feature. The spread of railways in parts where foreign goods are still practically unknown, offers an almost unlimited field for pictorial advertisement, which would be especially appreciated in railway stations where the Chinese travelling public, as yet unaccustomed to the use of time-tables, are in the habit of assembling some hours before the departure of their train.

"The commendable practice of marking foreign goods with Chinese characters, or accompanying the package with description of contents, has now become fairly established; and in the large trade centres it is becoming the rule, especially in the case of machinery for foreign firms, to bring their goods to the notice of Chinese buyers by well-ordered displays and exhibitions of their wares."

BUSINESS NOTES.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Eight-page finely-illustrated pamphlet briefly describing and giving prices of "Eco" electrically-wound, self-contained clocks which are made for connection to either continuous or alternating current supply, or which may be driven by their own battery. We understand that the cost of operation is about one-sixth of one unit per annum.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, London, E.C.—Illustrated price lists, also copy of a Charlottenburg test of "Graetzin" metal-filament lamps.

Messrs. Wiley & Russell Manufacturing Co., Greenfield, Mass., U.S.A.—224-page catalogue, illustrated and priced, relating to their screw plates, taps, reamers, drilling and other machines.

The Mica and Standard Insulation Co., 16 and 17, Devonshire Square, London, E.C.—Several leaflets (B. C. and D.) giving prices of standard micanite sheet insulation; round and "pure" micanite and "Landol" insulating tubes, also mica and micanite washers.

Messrs. James McMillan & Co., Clun House, Surrey Street, London, W.C.—48-page catalogue giving illustrated particulars and prices of wet and dry batteries, carbon brushes, carbon contact pieces, carbons for telegraphs and telephones—all of which are made by Messrs. Rylander & Rudolph's Fabriks Aktiebolag, Henriksdal, Sweden, for whom they are sole agents in Great Britain.

C. W. Hunt Co., New York.—Catalogue No. 11-5, describing storage battery and combined battery and trolley locomotives, crude-oil electric locomotives, &c.

The Coronation Durbar Plant at Delhi.—An Indian engineering paper contains an advertisement in which the electrical engineer-in-charge of the Royal Durbar Works, Delhi, offers for sale in January, 1912, the Coronation Durbar plant, consisting of a complete electrical power station equipment, including water-tube boilers, high-speed engines direct coupled to dynamos capable of giving an output of 1,800 kw. continuous-current at 440 volts, and 600 kw. three-phase current at 220 volts 50 cycles, with transformers and switchboards; also a very large quantity of electric fittings, materials, and lamps for interior and exterior lighting.

New Electro-Chemical Works.—It is stated that the Continentale Gesellschaft für Angewandte Elektrizitat, of Glarus, which has a share capital of £120,000, has convened an extraordinary general meeting at Basle to consider a resolution proposed by the directors with regard to the erection in England of a branch of the Poissy (Paris) works and the raising of the loan capital for the purpose.

Strike Settled.—The strike at Messrs. W. T. Glover and Co.'s cable works at Trafford Park was settled by the men returning to work on August 24th. The strike was brought about owing to the management declining to grant an immediate increase of 2s. per week all round.

Stoker Contracts.—Among stoker contracts received by the Underfeed Stoker Co., Ltd., recently for installations at electrical stations are the following:—

St. Helen's Corporation, 1 E.; Metropolitan Borough of Bermondsey, 3 E.; Hull Corporation, 4 E. and 4 Air Heaters; Hereford Corporation, 4 B. and Air Heater; Stoke-on-Trent Corporation, 3 A.; Lincoln, 1 E.; Lacroze Tramways, Buenos Aires, 4 E.; Alemana Transatlantico, Buenos Aires, 12 E.

The company has of course booked many other contracts for general installations.

Bankruptcy Proceedings. — Frederick Vickers (trading as Frederick Vickers & Co.), electrical engineer, 286, Oxford Road, Manchester, Lancaster.—The first meeting of creditors was fixed for Thursday in last week at the offices of the Official Receiver, Byron Street, Manchester, but only one creditor attended, and the matter, therefore, remains in the hands of the Official Receiver. At the Manchester Bankruptcy Court, on August 25th, the bankrupt came up for examination. He began business at 413, Oxford Road, Manchester, in November, 1908, without capital and without liabilities, after having been in business with various firms for 21 years; but one creditor had given him credit to the extent of £250. His work was general electrical installation. About 18 months ago he removed to 286, Oxford Road. Previously he had done the estimating and most of the work himself, but after the removal he took over more contracts than he could estimate for, and afterwards the estimates given by his foreman proved to have been too low, and he lost a considerable amount of money on those contracts. He also incurred business expenses heavier than the increase in cash sales warranted. He estimated his unsecured liabilities at £455 and his assets at £58. The Registrar (Mr. Atkinson) closed the examination.

W. H. Ridpath (Ridpath & Wells), electrical engineer, Ilkeston.—September 9th last day for receipt of proofs for intended dividend by the trustee. Mr. E. W. Humphreys, 5, Victoria Buildings, London Road, Derby.

Dissolutions and Liquidations.—Havana Telephone Securities Co., Ltd.—This company is winding up voluntarily with Mr. George Banks, New Broad Street House, E.C., as liquidator.

The Starlight Electric Co., 38, Alexandra Street, Southend-on-Sea.—Messrs. A. A. Kerridge and H. Sloman have dissolved partnership. Mr. A. A. Kerridge will attend to debts and continue the business.

Book Notices.—*Calendar* of the Glasgow and West of Scotland Technical College, 1911-1912. Glasgow: The College.

"Il Nuovo Cimento." August 18th, 1911. Pisa: Tipo. Toscano.

"Technical Papers, Nos. 3 and 4," and "Miners' Circular, 4." 1911. Washington: Government Printing Office.

"Boletin de la Sociedad de Fomento Fabril." July 1st, 1911. Santiago de Chile: The Society.

"Revue d'Electricité." Vol. XXVIII, No. 7. July, 1911. Brussels: Société Belge d'Electriciens. Price 1 fr. 75.

"The Physical Review." Vol. XXXIII, No. 1. July, 1911. Lancaster, Pa.: The "Review" Offices. Price 65 c.

Trade Announcements.—The Standard Cable Manufacturing Co., Ltd., of Queenhithe, E.C., advise us that they have opened a contract office at 198A, St. Vincent Street, Glasgow, from which they can submit estimates for the complete installation of all descriptions of electric cables in towns, mills, docks, collieries, exhibitions, &c.

The business of Messrs. Hall & Mathews, electrical engineers, of Ecclesall Road and West Street, Sheffield, has been transferred to Messrs. Renton, Holdsworth & Co., Ltd., of Norfolk Street, Sheffield.

Mr. Joyce, electrical engineer, has opened business premises at Oxted (Surrey).

The British Thomson-Houston Co.'s Manchester office, at present at 30, Cross Street, is being removed on September 7th to National Buildings, St. Mary's Parsonage. Their new telephone number will be 6366 Central (three lines). The new premises include commodious stores, and a large stock will be carried of "Mazda" metal-filament lamps, B.T.-H.-Edison carbon lamps, holophane glassware, &c.

LIGHTING and POWER NOTES.

Abercarn.—With a view to improving the lighting in the neighbourhood of the Crumlin Navigation Colliery, the U.D.C. has decided to co-operate with the colliery company in the matter of introducing electricity for illuminating the streets.

Aldeburgh.—The T.C. on Friday decided to lease land for the erection of a generating station to the Electric Supply Co., Ltd., who are to supply energy for public lighting.

Arnside.—There is a probability of the public lighting at Arnside being converted from oil to electricity. Mr. Thos. Wilkinson, a local resident, has installed a complete plant at his residence, and utilises electricity for lighting, cooking and laundry work, and he has arranged to wire and supply Earnseat Schools, for Mr. J. W. Bland. It is hoped that the authorities will supersede the present oil lamps for public lighting with electric lamps.

Australia.—The Electric Lighting Committee of the Sydney (N.S.W.) Council agreed on July 25th to recommend the expenditure of large sums of money for the extension of the electric supply to various portions of the city and suburbs. It was explained that arrangements for the supply of Alexandria must be completed before the end of the year, the estimated cost being £5,235. In this connection it was agreed to purchase a site for a sub-station at a cost of £100, and to erect the sub-station at an additional outlay of £375. A temporary structure is to be erected at Botany, whilst a sum of £1,800 is to be expended in the erection of poles and cables to Botany. The erection of poles and cables to Erskineville will absorb another £3,700, materials for further extensions approximating £800. The electrical engineer was instructed to obtain options for sub-station sites in the various municipalities. Work is proceeding rapidly with the mains reticulation of Darling Point and Woollahra, the service being partly overhead and partly underground. With the Balmains Electric Supply Corporation and the Sydney Municipal Council both competing for supply in the various suburban municipalities, the local authorities are enabled to make fairly good bargains with their street lighting. The Sydney Municipal Council has just arranged to take over the lighting of the municipality of Redfern, which has had its own plant for some years.

Bangor.—A L.G.B. inquiry was held on August 24th relative to the application of the T.C. for a loan of £2,000 for the provision of additional plant at the E.L. works. There was no opposition.

Chipping Norton.—The T.C. has accepted the tender of Mr. W. A. Schultz for public lighting by electricity from August 14th to May 14th, at £150.

Barnsley.—An inquiry has been held by the L.G.B. in reference to the application of the Corporation for sanction to borrow £16,100 for purposes of electricity extensions in the borough. The details of the scheme, as supplied by Mr. Barker, the borough electrical engineer, are as follows:—500-kw. turbo-generator complete with condensing plant, £3,500; excavating, foundations, &c., £370; cooling tower (as per accepted tender), £795; excavating and foundations for same, £650; water-tube boiler (as per accepted tender), £1,200; brickwork and extension to main flue, £280; borewell (as per accepted tender), £650; extensions to switchboard, £200; cables and connections, £210; water meter, £75; steam.

water, and circulating pipes and valves, £250; extension buildings (one bay), £500; contingencies, £35; making a total of £8,715, less an outstanding loan on existing tower to be superseded and met out of revenue, £415, reducing the amount to £8,300; prospective mains and services, £6,700; new lamp columns and fittings, £1,100, bringing the amount asked for to £16,100.—Mr. Barker referred to the increase in the use of electricity within the borough, and anticipated developments, and mentioned that the Committee proposed to substitute electric lighting for 500 remaining street gas lamps. No opposition was raised to the scheme.

Continental Notes.—Austria.—The city of Innsbruck intends to acquire Lake Achen, with a view to setting up a new electric light and power station. The purchase price amounts to about 4,000,000 k. In view of this new scheme, the project to obtain 75,000 H.P. from the Gerloch and Ziller becks will be left over for private industrial users. Messrs. Dykerhoff, of Nürnberg, who have the whole scheme in hand, will be open to arrange contracts with parties interested up to the end of the year.

Dukinfield-Mossley.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has applied to the B. of T. for consent to the placing of transmission wires above ground along various routes in Dukinfield and Mossley for the purposes of supply under the Act of 1901.

Halesowen.—The Halesowen and Stourbridge Hospital Committee has decided to light the Hospital at Hayley Green by electricity. The Committee proposes to install its own plant.

Hastings.—The B. of G. has received an order from the L.G.B. sanctioning the installation of the E.L. at the workhouse.

Hebden Bridge.—The U.D.C. has under consideration an application from Messrs. Pickles & Sons, machinists, for an estimated supply of 20,000 units per annum and a maximum of 40,000 units. It is proposed to enter into a five years' agreement, and a new scale of discounts has been adopted in view of this and similar cases, varying from 15 per cent. for 2,000-2,600 units per quarter to 37½ per cent. for over 5,000 units per quarter.

Heckmondwike.—The U.D.C. has resolved that a strongly-worded request be sent to the L.G.B. for an answer to the Council's application for sanction to borrow money for the erection of new condensing plant at the electricity works. It was stated at the meeting that other councils whose inquiries were held later than that of Heckmondwike had already received sanction, and that the delay was causing the town to lose money week by week.

India.—According to the *Times of India*, the directors of the Tata Hydro-electric Power Co., Bombay, have received and considered applications for the supply of power from 24 mills, aggregating about 27,000 H.P.

The municipal authorities of Chittagong have granted a licence to the agents of the A. E. G. Lahmeyer Co. for the supply of electrical energy for lighting and power purposes in the town.

Llandudno.—On the Electricity Committee's recommendation, application is being made to the L.G.B. for sanction to borrow a further sum of £500 to cover the estimated cost of laying additional mains during the next two years.

Llangollen.—The U.D.C. has appointed a Committee to go into the E.L. question, over which a difficulty has arisen. The Council is legally informed that its action in obtaining a prov. order, and then transferring the powers to the E.L. company, who repaid £200 spent in obtaining the order, is illegal, and is advised to acquire the undertaking from the company and supply the town, or to apply for an amending order enabling the Council to legally transfer the prov. order obtained to the company, who at present are not the legally appointed agents of the Council.

Moseley.—Preparations are being made by the electric supply department of the Birmingham T.C. to extend the mains to Moseley, and current will be available before the coming winter.

New Malden.—The L.G.B. has forwarded its sanction for the supply of current in the urban district by the Wimbledon T.C., and the laying of mains will be proceeded with forthwith.

Pittington (Co. Durham).—The local Co-operative Society has installed an E.L. plant, at a cost of £500. The work has been carried out by Messrs. T. G. Usher & Co., of Newcastle-on-Tyne.

Pontardawe.—Messrs. Gilbertson & Co., who have been given permission to erect poles and overhead lines for the conveyance of current, have asked the U.D.C. whether it will take over some portion of the installation if the Council at any time obtains powers to supply current throughout the district, as without some such understanding they would hesitate to go to the expense, which would amount to from £300 to £500. The Council, on August 24th, referred the matter to a committee.

Rawtenstall.—A L.G.B. inquiry was held on August 23rd relative to the application of the T.C. for a loan of £2,000 for public lighting by electricity. The distance to be covered is 13 miles, and the lamps number about 500. By substituting electricity the Council anticipates a yearly saving of £322 10s. Gas is charged for at 3s. per 1,000 cub. ft., less 3½ per cent. There was no opposition.

Rugby.—The U.D.C. has obtained an important consumer of current in Rugby School, which has hitherto had its own installation. This has now been shut down, and the whole of the school and boarding-house premises have been connected with the town supply, while the entire wiring installation has been overhauled.

Sidmouth.—The Sidmouth Gas and Electricity Bill, promoted by the Sidmouth Gas Co., has now received the Royal assent, and the company now possesses powers to supply electricity. It is stated, however, that nothing will be done for 12 months or so, pending the deliberations of the District Council, and the decision of that body whether or not it shall acquire and carry on the business of supplying Sidmouth with gas and electricity.

Stockton Heath (near Runcorn).—The Parochial Committee has decided to ask the Runcorn R.D.C. to keep the requirements of Stockton Heath in view when powers to supply current in the district are granted to the Mersey Power Co.

Stockton-on-Tees.—During the 12 months ended March 31st last, 1,018,372 units were generated and 920,256 units sold for lighting and power by the Corporation Electricity Department. The maximum load on the feeders was 644 KW. The capacity of the plant at present installed at Stockton is 1,050 K.W., which allows 400 KW. as spare in case of breakdown. As the load on the station is continually increasing, a decision was recently arrived at to increase the generating plant to deal with next winter's load, and to install a 400-KW. mixed pressure D.C. turbo-generator, together with the necessary switchgear. The cooling tower is to be extended so as to increase the efficiency of the present turbine, and the existing boilers are to be fitted with superheaters. The contract for a mixed pressure turbine, combined with a Siemens D.C. 400 to 500-KW. generator, has been let to Messrs. Richardsons, Westgarth & Co. The switchgear will be supplied by Messrs. Drake and Gorham, a cooling tower by the Klein Engineering Co., and a feed water meter and superheaters by Messrs. T. Sugden. When the extensions enumerated above have been brought into use, it is estimated that there will be a saving in fuel consumption of about 20 per cent.

Stoke-upon-Trent.—The L.G.B. has sanctioned the borrowing by the R.D.C. of £300 for the public lighting of Bucknall and a portion of Eaves Lane. The loan is repayable in ten years.

TRAMWAY and RAILWAY NOTES.

Accrington.—Another stage in the tramways assessment dispute between Accrington Corporation and Haslingden Union was reached during last week. At a meeting of Haslingden Assessment Committee, on August 23rd, it was agreed to join Accrington in a request to the umpire to submit the detailed valuation showing how the gross estimated rental and rateable value were arrived at. After the electrification of the Accrington tramways, the Haslingden Union valuer provisionally fixed the rateable value of the undertaking within the Accrington borough boundry at £1,650. As this was a considerable increase on the old figures, the Corporation proposed to appeal to Quarter Sessions. Following an exchange of views, it was agreed to accept £825 as the amount of the rateable value, or exactly half the sum. The Corporation thought that £650 should be the limit, and this led to arbitration proceedings. Mr. Wainwright, of Liverpool, officiated in this capacity, and his award has led to the present agitation.

Ashton.—The employés of the Stalybridge Joint Tramways Board, Ashton Corporation Tramways, and the Oldham, Ashton and Hyde Tramways Co. have sent in claims to the authorities for improved conditions of labour. Their grievances relate to hours, meal times and wages. Following a meeting of the representatives of the joint authorities, the Ashton Tramways Committee is calling a special meeting for the consideration of the various questions in dispute.

Australia.—Victorian Railway Electrification.—In responding to a toast at the Commercial Travellers' Club dinner the Acting Premier said that the Premier (the Hon. J. Murray) had been making inquiries in England on the question of the electrification of the railways. Information had come to hand by letter and by cable message from the Premier that the Government would have a policy to announce within two months in respect to the conversion almost immediately to electrical working of the suburban railway service.

Milnrow.—The Rochdale Corporation has commenced the long-expected extension of the tramway system to the adjoining township of Milnrow, this week. Preliminary work has been in progress some time.

Wigan.—On August 22nd the Tramways Committee passed a resolution that the wages of the motormen, conductors and shedmen connected with the local tramways, be increased by a farthing per hour. The men had been agitating some time for increased remuneration.

(*Continued on page* 343.)

THE METAL-FILAMENT LAMP FACTORY OF PHILIPS & SON, EINDHOVEN.

HEN it is taken into consideration how recently the metal-ament lamp has come into use, it says much for the terprise of manufacturers, that they have at once taken ps to meet the universal demand which has arisen, and in ing so have not hesitated to expend thought and money putting up adequate factories, machinery and laboratories, d in training and looking after the welfare of the large mber of employés engaged.

One of the most important lamp factories is that of ssrs. Philips & Son, Eindhoven, Holland, which we had the asure of inspecting, under the guidance of Mr. Antony ilips, who, with his brother, has been responsible for the ction of a works exclusively devoted to the manufacture lamps, which is the largest in Holland, and the second gest in Europe. Over 3,000 hands are employed, a mber which is almost incredible, when it is remembered t in 1891 there were only 30 hands employed in the ginal factory established for the manufacture of carbon ips; everything pertaining to the lamp is manu-tured on the spot, with the exception of the metal caps d the bulbs.

Some idea of the rapid growth of the works may be hered from the following figures:—In 1891, 30 workers re employed, 600 in 1903, 1,200 in 1909, 2,000 in 1910, l in 1911, 3,250, at the date of our visit. The greatest reases, as will be noted, have occurred since the metal-ment lamp factory was started.

Of the 3,250 hands, 300 are employed in a machine shop large dimensions, fitted with machine tools of the latest tern, which is exclusively occupied in the making and intenance of the plant employed in the factory: we were ured that this machine shop is self-supporting, besides sessing advantages in the matter of secrecy and prompti-le of delivery of machines specially required.

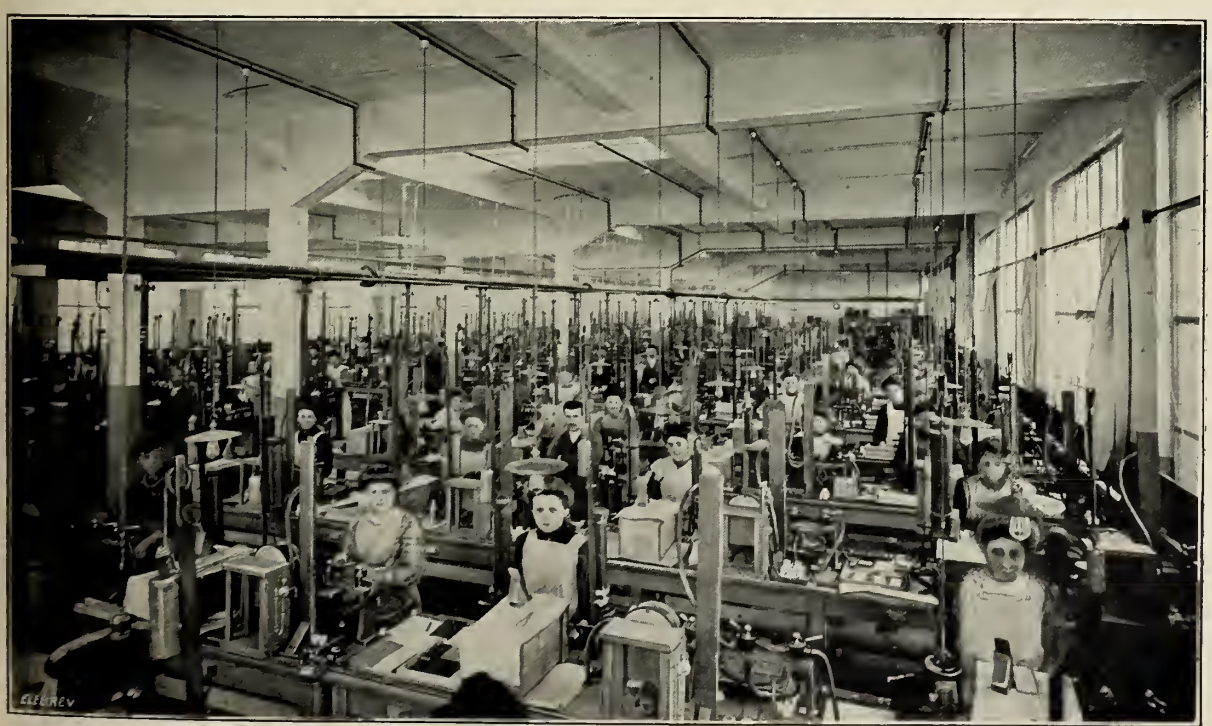
new buildings, one of which is reserved exclusively for offices and administration, and includes an estate agency, architect's drawing offices and building department in connection with the village, to which we shall refer later. The most noteworthy feature in this building is the spaciousness of the rooms and the amount of light in every part, while



The Philips Metal Lamp Works, East Side, 1910.

heating and ventilation are provided on a scale, and with a thoroughness that is seldom seen in the offices of manufacturing concerns.

The main factory building, six storeys high, is impressive from its size alone, and here, too, lighting, ventilation and heating have been thoroughly considered.



The Philips Lamp Works: Grading the Filaments.

The works power station is capable of an output of 8[illegible] H.P., and on the occasion of our visit the boilers were being erected to supply steam to a further 400-H.P. Bliss engine, which will be delivered immediately.

The principal interest, however, lies in the two enormous

On the sixth floor accommodation is provided for the technical staff, and spacious laboratories were being fitted up and furnished to take the place of the old laboratory, which itself was of no mean description. Here a highly-trained technical staff is constantly engaged in research work, and it

is largely due to this department that the lamp as now manufactured possesses such a strong filament. On this same floor the filaments are flashed in hydrogen.

Proceeding to the fifth floor, we were shown the processes of baking and drawing the filaments, the preparation of the mixture, and the manufacture of the dies, including the boring of the diamonds. On the fourth floor, the squirting of the filaments through the dies, and the measuring and



The Philips Works, West Side, 1911.

classification of the filaments was shown, this being the only process in which it is necessary to send the filaments upstairs again, the work beginning at the top of the building and gradually passing down to the basement, with this exception, rendered necessary on account of the flashing process having to take place on the top floor.

Our attention was particularly called to the increasing tenacity and elasticity of the filament as it approached completion, the filament before enclosure in the bulb being like fine steel wire, capable of bending into a loop without breaking.

Thus far we have dealt with the manufacture of the filament; and it is now necessary to turn briefly to the process of glass-blowing. Bench after bench is occupied by girls or boys with nimble fingers carrying out one or other operation, with the assistance of ingenious time-saving machinery. A glass tube, cut off to a precise length, is put into a machine and submitted to an oxy-hydrogen flame; a few deft touches and the upper part of a bulb is evolved; this goes to another bench, where leading-in wires are inserted, and a pair of jaws rise up and pinch the glowing glass to the shape so well known. Further on boys insert the supporting hooks in glass rods. These are welded into place, the filaments are fitted, the whole enclosed in the bulb, which has just been provided with an exhausting tube, and then passes to the exhaust pumps, preparatory to a visit to the test room to be classified for voltage, wattage and candle-power. From the test room lamps go at the rate of 25,000 per day to the packing rooms, where they are dispatched to every quarter of th world.

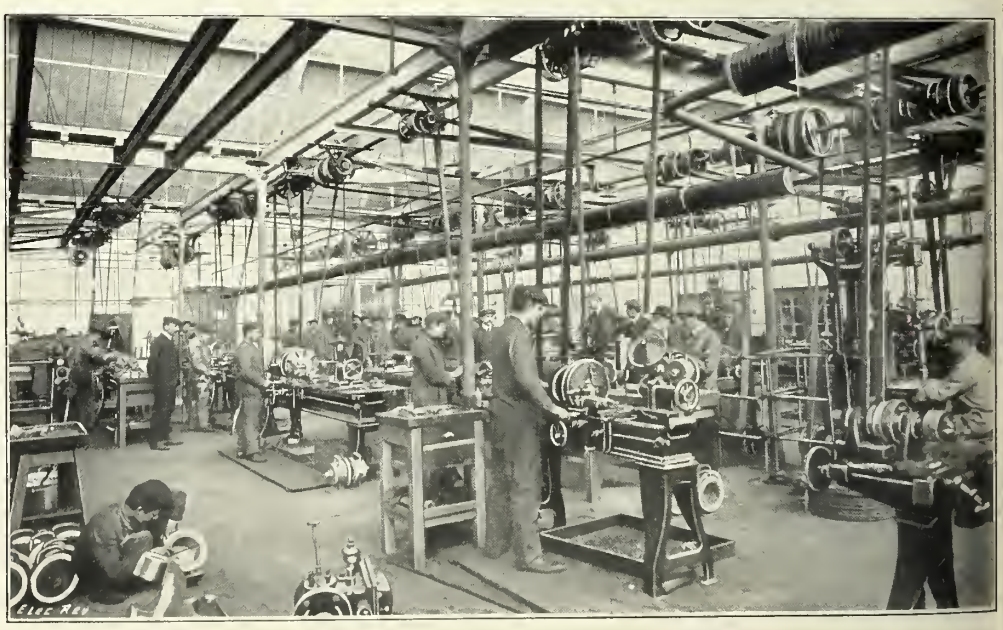
Throughout these six floors there are extractors to remov foul air and gases, while a powerful fan injects fresh ai passed through a filter and through cooling coils in summe and heating coils in winter.

The well-being of the worker has received special atten tion; spacious lavatories are provided on every floo with abundant accommodation, s that cleanliness is a distinguishin feature.

On the third floor there is a surger and operating room, with nurses con stantly, and a doctor at specified hour in attendance. There, accidents ar treated and illness prescribed for, show ing an important saving to the firm in time, which would otherwise be los by an employé going to a hospital o local doctor, with the further gai that a trivial accident, properly treate only causes a worker to lose a fe minutes and the wound heals quickl whereas delay may, and has rendere even trivial hurts serious.

As Eindhoven itself does not pro vide sufficient labour, workers t the number of 800 come in by speci trains from the outlying districts, an for their accommodation a restaurar is provided, where coffee is supplie free, the girls bringing their own food it is intended, if practicable, to provide a hot meal winter at a nominal charge.

Mention has been made of the village. To provid accommodation for the workmen within easy distance of th factory, Messrs. Philips purchased several large tracts ground, and have transformed them into quite a model villag called Philips Dorp, where a house with garden can be rente at from 4s. to 6s. per week. The houses at 6s. have abou 60 ft. of garden, are well built and decorated, and have fiv or six rooms with outhouse and all conveniences. These ar intended for employés earning about £2 per week, while th cheaper houses are intended for workers with families. W



The Works Machine-Shop.

saw one family of eight, most of whom will in time b drafted into the works, and like the boys who fix the wi supports, be gradually advanced to more responsible work.

The Philips lamp is so well known under various names this country that comment on our part is quite unnecessary

We were shown certificates from the various testi authorities, which indicated a steady improvement

and candle-power, and a reduction in current cost: we derstand that it was a Philips lamp under the name Metalik," which came out on top in the Westminster ts.

The following is a translation of a letter from the muni-al power station in Utrecht, dated September 15th, 1910, c. Beetsstr. 3 :—

n connection with our letter dated July 29th of this year, o. II, 1,664, we beg to inform you that the test made up to the sent with the metal-filament lamps sent us has given the lowing results :—

amp	...	...	806 hours	1 lamp	...	...	3,136 hours
,,	...	...	838 ,,	1 ,,	...	...	2,064 ,,
,,	...	...	1,000 ,,	1 ,,	...	...	3,136 ,,
,,	...	...	2,915 ,,	1 ,,	...	...	3,304 ,,
,,	...	...	3,136 ,,	1 ,,	...	...	3,496 ,,
,,	...	...	3,472 ,,	1 ,,	...	...	1,693 ,,
,,	...	...	2,800 ,,	1 ,,	...	...	2,443 ,,

The lamp burning 3,496 hours continued to burn after the test s finished. We have made a photometric observation of this C.P. lamp and have ascertained that its strength of light was l about 28 C.P., and that the consumption in energy was about 5 watt per C P.

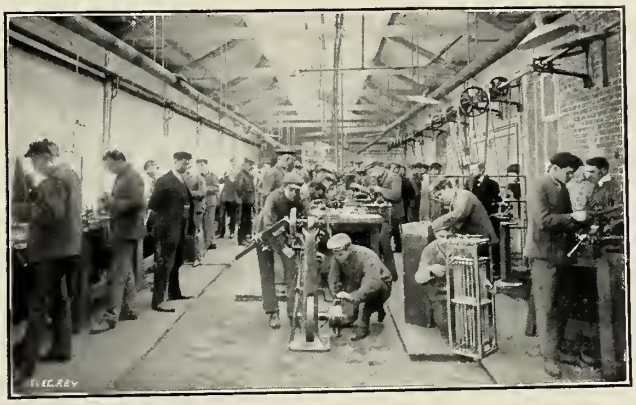
The average length of burning of each of the lamps sent amounted 2,445 hours.

The dominant ideas throughout the whole place are nomy and efficiency, but these ideas have been so intelli-ntly carried out, that economy has not meant stinginess, l apparent extravagance has been amply justified by reased efficiency and ultimate lower costs of manufacture. In conclusion, our thanks are due to Mr. Antony and Mr. rald Philips for their courtesy and kindness, and for the portunity of witnessing the complete process of manu-cture, and having it explained in a most interesting nner.

AN ELECTRICALLY-DRIVEN SHIP.

The last few years have seen many attempts to upset the hodox methods of the marine engineer in regard to ship pulsion. The turbine, by itself or in conjunction with oil engine is on its trial, and even the gas engine is being experimented with.

Perhaps the most radical change which the long-suffering "chief" may expect to find in a ship is the introduction of an electrical transmission between engine and propeller, such



The Works Fitting Shop; Philips Lamp Works.

as has been tried by Messrs. Mavor & Coulson, Ltd., on the *Electric Arc*, a 50-ft. passenger boat, of 12 ft. beam, built by Messrs. Maclaren Bros., of Dumbarton.

A demonstration of this ship took place on the Gareloch about two months ago, when a mean speed of 7¼ knots was obtained over the measured mile. The electrical part of the equipment consists of a generator capable of furnishing two alternating currents of different periodicities, and of a motor coupled direct to the propeller, and having two independent windings, the number of poles being so chosen that two different speeds may be obtained on the boat by suitably connecting the two motor windings to the supply of the appropriate periodicity. During the run the volts and amperes in one circuit were 380 and 10·5 respectively, and in the second circuit 410 and 25·5. The propeller revolutions were 415 per minute. Taking into account the power factor of the motor, these figures indicated about 25 B.H.P. delivered to the propeller shaft in order to obtain the speed of 7¼ knots. The boat was taken to the head of



The Philips Lamp Works, showing the Flashing Benches.

e reciprocating engine, has firmly established itself in rtain directions, while the geared turbine appears to be a ture competitor.

Internal-combustion engines, so popular in small craft, are tting a footing in the merchant service, where the Diesel

the loch, where a demonstration was given of the ease with which it could be manœuvred. Two switches only are in use for controlling the propelling machinery, and both these switches are controlled from the bridge by means of an ordinary Chadburn telegraph instrument. This is arranged

so that, instead of merely signalling to the engine room, it actually throws over into the proper positions, the two switches which make the necessary alterations in the electrical connections. The order of operations is as follows :—

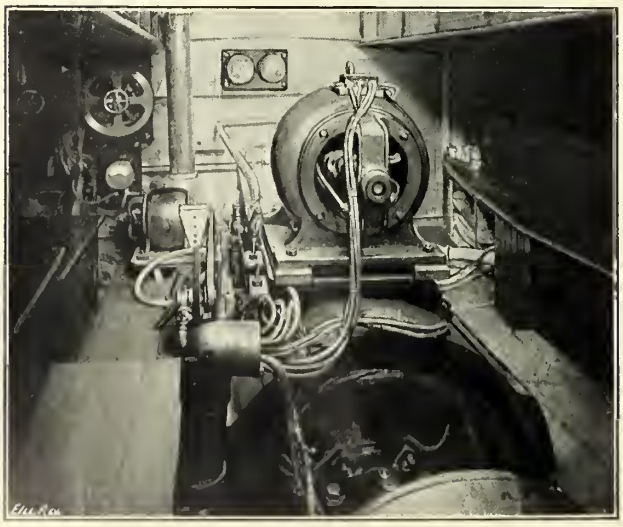
1. The exciter circuit is broken by throwing over one handle of the telegraph instrument from the "on" to the



The "Electric Arc."

"off" position, the electrical circuits being thus made dead, the other handle of the telegraph instrument is put in any desired position—"full ahead," "full astern," or "half ahead," "half astern."

2. The excitation is restored by bringing back the first handle from the "off" to the "on" position. The alternator then gradually comes up, and currents are established in the proper circuits. The actual throwing over of the switches can be done as quickly as the operator wishes, and the handles are interlocked, so that it is impossible to move the main switch except when the exciter switch is at the "off" position, thus ensuring that no currents can be broken on the main switches. By means of this apparatus the boat was repeatedly reversed from "ahead" to "astern," or *vice versa*, and carried out all the evolutions required in a most satisfactory manner. It was also demonstrated that the switch handle could be thrown over from "full ahead" to "full astern" without any danger of injury to any part of the apparatus. This would not be necessary in practice,



Interior of Engine Room, looking forward.

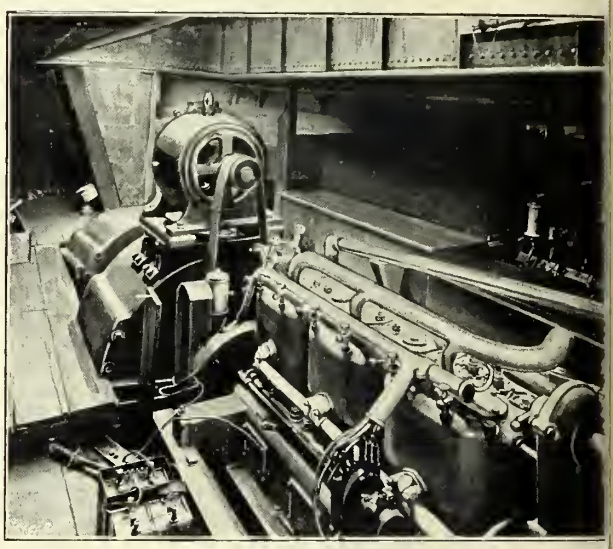
as no time is saved by omitting the "half ahead" and "half astern" positions. It is, nevertheless, a good test of the electrical parts of the machinery, as it shows the largest possible currents which can be put through any of the windings of the machines or through any of the leads and connections.

Needless to add, the *Electric Arc* has been built f demonstration purposes, with the idea of providing a suitab and flexible electrical coupling between the prime mover a propeller, each of which, under these conditions, can built and operated with a view to obtaining its maximu efficiency.

PERSONAL PUBLICITY.

[communicated.]

For two reasons it has recently become more than ev necessary for supply authorities to turn their minds to th increase of the output of electrical energy for domest purposes. The first, and simplest of these, is that the wi lamp has decreased the consumption of those consume already on the mains, and has also placed electricity in more advantageous position to compete with gas lightir from the point of view of cost. The second reason is that a those to whom electricity is of such obvious advantage th it required no exertion to induce them to become consumer have been connected, while the electrical manufactur provides a large and efficient body of men to seek o the power user, and to induce him to install a electrical system in place of whatever obsolete method h may be employing. Hence it has become necessary to ta lower and lower strata of revenue-earning material, and



Interior of Engine Room, "Electric Arc."

most districts there is a—more or less—Publicity Departmer which, by the distribution of "popular" literature, and h house-to-house canvassing, endeavours to attract the eye the householder to the advantage of a safe system of "clea cool cookery" and lighting.

Unfortunately, the supply authorities did not at fir recognise the importance of this department, and desir to run it inexpensively ; consequently, the majority of m engaged in this work were technically uneducated. Wh at last the value of the department was made manifes efforts were made to secure technical men, and son such have recently entered the field. They ha not yet, however, overcome the influence of th predecessors, and have even to some extent adopt their methods. It is rightly assumed that the be way to induce the householder to use electricity is educate him, and with this intention many pamphlets ha been issued explaining electrical matters in popular languag The popular language adopted is, unfortunately, that of t earlier workers in these departments, and so the impressi arises that because the subject has to be treated elementari it must also be treated in a style in which no educated m would write on ordinary subjects. It seems to be on t principle on which elderly people address small children—i language more infantile than that used by the childr themselves.

Whatever the cause, it is undeniable that whenever

s up one of these treatises, there is some glaring offence inst literary style which turns the attention of the ler away from the subject, the study of which is not erally resumed on that occasion. Undoubtedly, these ks are effective in some quarters, or they would not be oduced; but there is a large class of possible consumers are otherwise cultured, but who are ignorant on nical matters. Such a class is rarely touched, except by personal efforts of engineers among their friends, and method is bound to be slow in producing large results, cannot possibly be sufficiently extensive in its action. haps the time may come when some work will be pro- ed on electrical matters which, although elementary, not justly be termed a " work of vulgarisation " in every se of the term.

t is fortunate that men in these departments realise the essity of some special knowledge, in addition to the usual lifications of an engineer. As an example, mention might nade of one highly-placed central station engineer who poses to take lessons in cookery. It is proposed also employ ladies for this work, as they would be more on al terms with the consumer, and this idea has many nts in its favour. But recently, the opinion of a lady asked on this subject, and she stated most emphatically ; she infinitely preferred a man to deal with ; and she her stated that she did not want any lady canvassers ing round to teach her cookery. What she did require a man to tell her how long, and how much electricity, pok to boil a given quantity of water, and to explain the thod of adjusting the heating. Given that information, own knowledge of cookery would be sufficient to devise thods of employing the advantages of the system. A canvasser would be sure to have her own ideas on domestic tters, which might clash with those of the consumer's e.

Similarly with regard to lighting, it was suggested some e ago that a lady would be more effective, as she would ble to point out the advantage of " pink shaded lights on piano," and generally, by the exercise of her own know- ge and taste, to assist in the arrangement of the installa- , so rendering a valuable service both to consumer and plier. However, there are dangers in this. The whole tter is one of taste, and though we know the Latin pro- b, we also know that nothing is more fatal than to disagree h another on a matter of taste. In such a case as the above, whole of the negotiations might be broken off at once, all the advice would be tainted by one piece of what is, the eyes of the possible consumer, " bad taste." It is far ter for one to go who will avoid the decision of matters of kind, but who will at the same time be able to appreciate taste of the consumer, and bring forward whatever will cceptable ; and this can only be done impartially by one does not personally take the responsibility of such isions in other cases.—R. S. T. V.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 338.)

Blackpool.—The Tramways Committee spent considerable e on August 24th hearing the reply of the general manager, Mr. Furness, to the grievances set forth by the motormen and con- tors respecting their hours of duty. After an exhaustive in- tigation, the Committee instructed the town clerk to reply "That Committee cannot see their way to accept the suggested schedule mitted by Mr. J. R. Clynes, M.P., which, on the advice of the eral manager, is considered unworkable." Mr. Furness said the ion were suggesting hours which medical experts of the Amal- nated Association of Tramway and Vehicle Workers were eavouring to stop as being injurious to health. The tramway had only a spread-over of 16 hours, therefore a double ft of men in lieu of present split-shift system, which commonly in vogue in 60 municipal tramway under- kings, would only give a week of 48 hours. He felt e the majority of traffic employés would not consider uble shift" a satisfactory alternative if any wage reduction ulted from the change. In every seven weeks the motormen conductors' duties rotated completely round, thus giving each ployé one rest day per week. Under the present "split shift" tem, 56 men were required to work 16 service cars in the winter. Under the "double shift" system suggested by Mr. Clynes' Union, 70 men would be required, equivalent to an increase of 25 per cent. in wages. The bulk of the men affected by the proposed alteration had not been consulted or considered, and they would not agree to the conditions the proposed rearrangement of hours would entail. Double shifts were chiefly in operation in cities and large industrial centres where the tramway day extended over 18 hours, thus making it easy for nine-hour shifts to be satisfactorily worked. It was quite feasible to introduce a double shift in Blackpool during the winter months, but it would have to be on a 48 hours weekly basis, and the majority of the men would not be prepared to accept same with a corresponding reduction in wages. The present rates and hours of labour compared most favourably with other towns, and Mr. Furness could not recommend any alteration of the split shift system. In nine towns men worked over 60 hours per week, 52 towns worked 60 hours per week, 10 worked from 55¼ to 58½ hours per week, and 14 under 54 hours per week.

Burry Port and Gwendreath.—The Light Railway Commissioners have granted an order authorising the reconstruction and working as a light railway of a further portion of the lines of the Burry Port and Gwendreath Valley Railway Co.

Continental Notes.—Spain.—A concession has recently been granted by the Spanish Ministry of Public Works for the construction and working of an electric tramway between Porriro and Vigo.

France.—Steady progress is being made with the electrification of the Pyrenean network of the Chemin de Fer du Midi. The first portion of its programme comprises 12 sections of an aggregate extent of 532 km., 52 km. of which is a metre gauge line from Castelnau to Tarbes. At the beginning current will be supplied by three generating stations, two of them being situated respectively at Pierrefitte-Nectatas and Eaux Chandes, on Lake Sousoneou. It is intended to use single-phase current at 15 cycles, delivered at a pressure of 55,000 volts. Stepped down to 10,000 volts at the transformer sub-stations, it will be distributed by trolleys over the working lines to the trains themselves at 285 volts. The locomotives will be of two kinds—the 4-motor single-phase type of 125 h.p. each, weighing about 56 tons, to carry 50 passengers and their baggage will work the express and heavy goods service. The stations will utilise, when they come into working, the waters of several of the beautiful lakes and pools in the Pyrenees. The dam across the natural basin at Bouillouses has already been constructed 15 metres high, and the Cassagur station already draws its power from this reservoir to feed the Villefranche-Bourg Madane line. The station equipment is of 5,000 h.p., and supplies current at 800 volts in the immediate district.

Greece.—A general strike of the employés of the Athens and Piræus tramways extended over two days last week. The strike was due to the resignation of the manager, who the men demanded should remain at his post. The Government intervened to require, in conformity with agreement, that the headquarters of the company, which are at present in Brussels, should be transferred to Athens.

Halifax.—In order to bring about a better timing of the cars, the Tramways Committee has decided to have a master clock erected in Commercial Street. Every morning at 10 o'clock it will be set according to Greenwich time, and will control the working of the clocks at the Cow Green, Union Street, and Waterhouse Street termini.

Liverpool.—As the outcome of the intervention of the B. of T., the Corporation Tramways Committee eventually agreed to reinstate, on certain specified conditions, the drivers and conductors who left their work during the recent strike. The decision raised a protest from the local Shipowners' Association, which had locked out its own men.

London.—In connection with our note last week respecting the effect of the recent railway strike on the London electrically-worked railways, the Brighton Railway authorities inform us that, contrary to our information last week, their South London and Crystal Palace lines were working quite as usual (one or two stations only being closed). The company, in fact, rather prided itself on the above circumstance, and we can only add our congratulations.

A special meeting of the Highways Committee of the L.C.C. met, on Friday last week, a deputation of the tramway men, when it was agreed that certain matters should be settled the next day by the manager, and that a Conciliation Board should meet on or before October 9th, if desired by the men.

New Zealand.—According to the *Times*, the Government has made its first move towards exercising the unlimited powers of regulation of tramways that it recently obtained by the passing of an amending Tramway Act. The new law enables the Minister of Public Works to impose regulations, even to the extent of overriding authorising orders, without reference to any one; but the first batch proposed have been referred to the municipal tramway authorities for their suggestions. Included are stringent provisions as to overcrowding, carrying passengers beyond the seating capacity of cars, and many traffic details, while car construction must be brought into conformity with the provisions now laid down. Very small scope is left to authorities in their future choice of plant, almost every item being placed on a compulsory list. One regulation stipulates that the gap on the car lightning arresters shall be $\frac{1}{32}$ in., and minute directions for valves, details of sanding gear, &c., are laid down. The publication of these regulations has roused a storm of protest, ridicule, and even defiance. The engineer of the Wellington tramways has advised

his Council that it will cost that system £75,000 to comply with the regulations, that the additional annual cost will amount to £40,000, and that fares will have to be increased about 50 per cent. to meet the outlay.

Southend-on-Sea.—The Light Railway Commissioners have granted an order authorising the extension of the tramways in the town by the T.C.

TELEGRAPH and TELEPHONE NOTES.

Madeira Telephones.—A correspondent writing from Funchal, Madeira, under date August 18th, says:—"Allow me to correct a slight error in your issue of August 11th in the paragraph under Madeira, referring to the proposed telephone service. The project for the installation of a telephone service in Madeira is far from being abandoned, for the installation is now nearly completed. The lines have been run, and the instruments are now being erected, and within a few weeks the service will probably be commenced. The work is being carried out by the Portuguese Government under the Post Office and Telegraph Department, and the service when completed will be run by this department."

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (form No. 26). Stores Manager, Aberaman, near Aberdare.

Australia.—Victoria.—September 5th. (*a*) 10,000 protectors, and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

Melbourne.—October 3rd.—42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" August 25th.

September 26th.—30 miles of paper-insulated telephone cable, also supply of various telephone material. Local representation. Deposit, with tender, 5 per cent. up to £1,000 and 2½ per cent. above. Specification, &c., may be seen at Office of High Commissioner, in London, 72, Victoria Street, S.W.

South Australia.—October 25th. Cable and paper sleeves for the P.M.G. See "Official Notices" to-day.

Tasmania.—October 2nd. Porcelain insulators for the P.M.G. See "Official Notices" to-day.

Austria.—September 29th. International tenders are invited for the supply of a new electric station equipment at Budapest, comprising two turbo-generators of 5,000 kw. each, boilers up to a capacity of 5,000 kw., piping, central transformer station plant, crane for engine house, and coal-conveyor plant. Particulars to Dr. Johann Buzath, Präsidial Section des Magistrats, Városház-ucka II St. 1, Budapest. Guarantee, 50,000 marks.

Belgium.—November 27th. The municipal authorities of Tournai are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town during a period of 30 years. The specification can be obtained at the price of one franc from the Hotel de Ville, Tournai.

October 3rd.—La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the contract for the overhead equipment of the Salzinnes-Malonne section of the Onoz-Profondeville light electric railway.

October 4th. Tenders are invited by the same society for the installation of electric traction on the Brussels to Halcht suburban line. The works comprise overhead equipment, sub-transformer station, electric locomotives, &c.

September 13th.—Tenders are also invited by the same society for the overhead equipment of the extensions of the Charleroi-Jumet line.

Brazil.—November 14th. Tenders are invited by the municipal authorities of Pelotas for a 40 years' concession for the supply of electric power and light, and the establishment and working of electric tramways in the town. Tenders to Senhor Luiz M. da S. Pennafiel, Secretario, Intendencia Municipal, Pelotas. A deposit of 5,000 milreis (about £330) is required with each tender, to be increased by the successful tenderer to 25,000 milreis (about £1,670). Further particulars (in Portuguese) may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal*

Cleethorpes-with-Thrunscoe.—September 2nd. canised bitumen distribution and feeder cables, for the U.D.C "Official Notices" August 11th.

Denmark.—September 4th. Danish State Ra Administration. 936 accumulators for electric train lig Tenders, marked "Tilbud paa 936 Stk. Akkumulatorer til el Togbelysning," to "Direktören for Maskinafdelingen, Gl. Ko 1 D, 3 Sal," Copenhagen B. A specification, &c., (in Danish) drawing, may be seen at the Commercial Intelligence Bra the Board of Trade, 73, Basinghall Street, E.C.

Dublin.—September 7th. 750 single-phase and three-phase A.C. meters for the Electricity Supply Committe "Official Notices" August 25th.

Eccles.—September 12th. High-tension single alternating-current switchboard, consisting of three generat five feeder panels, for the T.C. H. W. Angus, electrical en Cawdor Street, Patricroft; returnable deposit of £1 1s.

Haslingden.—September 9th. Electric light instal for various public buildings, for the Corporation. See " Notices" to-day.

London.—September 2nd. Battery boosters and s boards for the Westminster Electricity Supply Corporatio See "Official Notices" August 18th.

Ostend.—September 18th. Tenders will be recei to September 18th (instead of August 11th) for the sup erection of electric lighting apparatus in the port of Particulars, Bureau des Adjudicatures, Rue des Augustins, P

Penang.—September 5th. One 500-kw. steam (engine or turbine), with ejector condensing plant and swit for the Municipality of George Town, Penang. See " Notices" August 11th.

Pontypridd.—September 12th. Water-tube boi Foster superheater for the U.D.C. See "Official Notices" t

Roumania.—November 6th. The municipal aut of Tulcea are inviting tenders for the concession for the lighting of the town.

Russia.—October 1st. The T.C. of Syzrane is p to accord a concession for the establishment of electric tr and public lighting, or for the lighting separately. The city is situated on the Volga, has a population of 45,000, and t way from Siberia-Moscow-Irkutsh makes a junction there line to Viarma. Tenders must be addressed to the " Municipame" at Syzrane.—*Revue Pratique de l'Electricité*

Tenders are invited by the T.C. of Omsk for a concession and work an electric tramway and lighting service.

Sheffield.—September 9th. Clothing for the Cor Tramway Department. General Manager, Tramway Dep Division Street.

Swinton and Pendlebury.—September 9th. cables, joint boxes, compound, &c., for the U.D.C. See Notices" to-day.

Wishaw.—September 11th. Carbons for Orifla lamps for the T.C. See "Official Notices" to-day.

CLOSED.

Aldeburgh.—The T.C. has arranged with Christy to instal and maintain the necessary electric m driving the pumps at the sewage and water works, at £348. by 12 quarterly instalments of £29.

Birkenhead.—The Electrical Power Storage received the Corporation contract for supplying a new Batte cells, 1,500 ampere hours capacity, at £1,771, and mainten 10 years.

Bispham.—The D.C., on August 24th, sett following contracts in connection with the electric undertaking:—

Engines and dynamos.—National Gas Engine Co.
Switchboard, balancers, and boosters.—Messrs. Kelvin & James W
Storage battery.—Premier Accumulator Co., Ltd.
Mains.—British Insulated & Helsby Cables, Ltd.
Erection of station buildings, &c.—Chadwick Bros.
Making approach roads to the station, cable trenches, &c.—Mes Bros. (Burnley) Ltd.

Devonport.—The Corporation has placed with t trical Power Storage Co., Ltd., the contract for renewing of the lighting battery having a capacity of 670 ampere h renewing part of the traction battery, each cell having a ca 2,000 ampere hours (£1,024), also maintenance of same for

Farnham.—The tender of Messrs. Goddard & Farnham, has been accepted for the erection of the g station for the Farnham Gas and Electricity Co. The elec works are expected to be in operation by February next.

Haslingden.—The Education Committee has accepted tender of Messrs. Siemens Bros. & Co., Ltd., for 10 motors to the looms in the weaving shed.

Huddersfield.—The T.C. has accepted the tender of the ed Electric Car Co., Ltd., for 10 new car bodies, and of Messrs. Kerr & Co., Ltd., for the electrical equipments.

Keighley.—The T.C. has accepted the offer of the or Accumulator Co., Ltd., to cancel the contract for the maintenance of the storage battery at £118 per annum, to double the city of the battery, supplying suitable switchgear and booster operating the gear, and to enter into a fresh 10 years' purchase maintenance contract for the enlarged battery, the Council to £302 per annum.

Walsall.—The T.C. has accepted the tender of Messrs. ey & Sons, Ltd., for two sets of condensing plant, at £1,163.

FORTHCOMING EVENTS.

ial Electrical Manufacturers' Association (Inc.), Balfour House, Finsbury avement, E.C.—Thursday, September 7th. At 2.30 p.m. Meeting of Council.

NOTES.

The Electrical Exports of Germany.—Although the es of employment of electricity in Germany have been greatly ned and large schemes have been carried out during the current . abroad Germany's exports have only found a restricted market, the expansion of last year has been followed by a swift tion. Notwithstanding that the quantity of electrotechnical ucts exported has been noteworthily larger than in the previous . the value has proved appreciably inferior. This is strikingly n by a comparison of the exports in the first half of the last years :—

	Quantity. Double centner.	Value in 1,000 Marks.
1907	301,440	71,089
1908	381,812	88,760
1909	370,867	81,862
1910	418,428	101,551
1911	457,518	97,978

ntrasted with the quantities exported last year, which show ncrease of 9·4 per cent., the values for the same period indicate cline of 3·5 per cent. In fact, the double centner (q.) only yielded lne of 214 Marks, as against 243 Marks in the previous year. ough this price is purely arithmetical, the downward tendency fficiently attested. Contrasted on a similar basis, the down- l tendency of values in the past five years is shown to be st continuous :—

1907.	1908.	1909.	1910.	1911.
235	233	221	243	214

is year's figures are thus by far the lowest, and sensibly less those of last year.

ne question arises, what export products of the electrotechnical stries are specially responsible for this alteration. A single ce shows that of all the products those of cables for electrical mission have undergone the most unfavourable development. export quantities have, it is true, largely exceeded the ages; this year they totalled 184,033 q., against 159,101 q. ne first half of 1910, or nearly 16 per cent. increase; but the e has gone down from 23,060,000 marks to 18,917,000 marks, or er cent. The cable exports are indeed a record this year, but values have never been so low in any of the previously cited s. This is shown by a comparison of the leading export article n over the past five years :—

	Quantity (double centner).	Value (1,000 Marks).
1907	135,395	23,694
1908	152,585	26,702
1909	169,672	24,602
1910	159,001	23,055
1911	184,033	18,969

ne average value of the double centner, which figured for 175 ks in 1907 and 1908, sank this year to 103 Marks.

ne export of complete armatures and commutators betrayed the e tendency. There were exported this half-year 22,246 q. against 69 q. last year, showing expansion at the rate of 17·3 per cent. ues, however, remained practically unaltered, being 4,743,000 ks against 4,742,000 marks last year. The increase, which is n, pl. crab'. vs consequently no relation to the increase dis- ed by the quantities. Comparing, moreover, the figures with e of 1907, while the quantities exported have nearly doubled, values show a falling off of about 40 per cent.

The export of dynamos in the first half of this year was to the extent of 139,851 q., against 136,958 q. in the previous year, with a value of 20,400,000 marks, against 17,690,000 marks. Although, however, in comparison with the previous period, the advance in the values is greater than in the quantities, the relations to the foregoing years disclose the same drift as with the other products named. This is clearly shown by the following figures :—

	1907.	1908.	1909.	1910.	1911.
Quantity ...	88,020	134,608	104,573	136,985	139,851
Value	14,956	22,090	13,341	17,691	20,399

The increase in the exports from 1907 to 1911 amounted to 59 per cent., while that of the values was only 36 per cent. This variation between quantities and values is repeated in a whole series of articles, as, for example, light reflectors, dispersers, &c., whose volume in the current year was only 8 per cent. behind that of its predecessor, while the value was as much as 48 per cent. lower than in 1910.

More important, however, is the contrast which the participation of various lands in Germany's export trade shows. A single fact stands out clearly—namely, that those lands which hitherto have loomed largest in the export trade—viz., British South Africa, Belgium, Argentina, Italy and the Netherlands—have appreciably reduced their purchases. This is demonstrated by the following statistics :—

	1910.	1911.	*Decrease.*
British South Africa ...	48,392	21,468	27,464
Belgium	36,572	29,108	7,464
Argentina	36,237	33,875	2,362
Italy	27,693	26,644	1,049
Netherlands	26,557	24,461	1,996

Very pronounced, it will be seen, is the fall in the exports to British South Africa, mainly on account of the decline in the number of dynamos exported thither. Observably lesser shipments of dynamos to Belgium have also occurred. The countries taking fewer exports are not, however, exhausted by the list given, and the following record tangible reductions in their purchases :—

	1910.	1911.	*Decrease.*
France	16,065	9,752	6,313
Spain	8,917	8,728	189
Brazil	7,260	7,202	58
Switzerland ...	7,133	5,612	1,521
Mexico	5,897	4,494	1,403
Chile	4,525	4,398	167

France, in particular, shows a noteworthy retrogression, not only in her imports of dynamos, but of complete armatures, arc lamps, glow lamps, &c. Switzerland's and Mexico's declines are principally in large dynamos, glow lamps, &c.

The countries to which Germany's exports disclose noteworthy increases are not very numerous. Japan takes the first place, then follow Great Britain and Norway. The Japanese market shows a quite unusual power of absorption, for while last year only 21,701 q. of electrical goods were shipped there, this year more than double were dispatched, viz., 65,002 q. Of dynamos alone Japan took as much as 18,361 q., against 3,945 q. in the previous year; of cables, she took 32,866 against 13,863 q.; of electric accumulators 8,393 q., compared with 3,405 q., and electric light fittings 4,551 q., against 498 q. The exports to these several countries grouped in order of the importance of the shipments were as follows (double centner) :—

	1910.	1911.	*Increase.*
Japan	21,701	65,002	44,301
Great Britain ...	21,525	26,532	5,007
Sweden	20,609	22,263	1,654
Austria-Hungary ...	18,691	20,683	1,992
European Russia ...	15,340	16,963	1,623
Norway	9,612	13,064	3,442

Norway's heaviest imports this year were dynamos; those of Great Britain were dynamos and complete armatures and cable equipments.—*Elektrotechnik und Maschinenbau.*

Cricket.—The "Tantalum" Athletic Cricket Club was on Saturday engaged in a match against the "Brimsdown" Imperial Lamp Works Cricket Club. The match was played on the "Tantalum" ground at Stamford Hill, and the visiting team batted first, making a total of 30 runs, 20 of which were actually scored off the bat, the remaining 10 being extras. In reply the "Tantalums" made a score of 128 for five wickets, thus handsomely winning the game.

Tramcar Accident Claim.—At the Court of Session, Edinburgh, on August 23rd, before Lord Johnston, the case Fife *v.* Musselburgh and District Electric Light and Traction Co., Ltd., was mentioned. Intimation was made of the settlement of the action. Plaintiff had claimed £750 damages in respect of personal injuries. The action was settled by a payment of £100 and expenses to the pursuer.

A French Experimental Furnace.—According to the *Revue Pratique de l'Electricité*, the Creusot Works have relinquished the trials—which were never seriously prosecuted—with the Saladin induction furnace in order to build a 1,000-H.P. arc furnace of a special type, with suspended electrodes

Installation Monopoly in Germany.—An example of the manner in which a monopoly of installation work is still sought to be established in Germany, notwithstanding the Prussian Ministerial order issued a year ago instructing Government officials to oppose any open or other attempt to secure a monopoly in installation work or the supply of apparatus or materials in connection with installations of prospective consumers has just occurred in Silesia. The local authorities of Schweidnitz, Reichenbach, Neumarkt, Jauer and Striegau have formed themselves into a company to establish the Central Silesian Overland Central Station, which is to purchase a supply in bulk and is to be leased to an electrical manufacturing firm. A notice has just been published in a Striegau local newspaper under the signature of an administrative official, stating that when the scheme for the distributing network has been settled, the names will be announced of the installation firms who will be permitted, in addition to the manufacturing company in question, to undertake house installations for connection with the mains of the overland station. The persons interested are warned before the particular firms are mentioned not to enter into negotiations with firms other than the manufacturing company or to conclude any contracts of any kind, as their validity might be placed in question by the decisions to be arrived at by the company owning the station. The Association of Electrotechnical Special Works, in drawing attention to this instance, submits that all the remunerative contracts will devolve upon the manufacturing company, leaving scarcely any profitable business when other installation firms are permitted to enter the arena after the network scheme has been settled. The question of the monopolistic tendency in the electrical industry has also engaged the attention of the Strassburg Guild, which has adopted a resolution setting forth the conditions under which freedom of competition should be allowed to installation firms in the execution of work and the supply of materials in connection with overland central stations, and formulating the methods under which tests should be carried out. It has been decided to refer the question to a committee with a view to a suggestion being made in official circles that Imperial legislation should be enacted on the lines of the resolution, so as to be able to maintain the independence of installation contractors and their workmen.

Extensions at the Quarry Street Station, Chicago.—Important extensions have been recently effected in this central station, being necessitated by the rapid increase in the maximum load on the bus-bars. Thus, in 1908 the maximum load was 117,000 KW., a figure which rose, in 1910, to 182,000 KW. The present extensions comprise six machines, each of 14,000-KW. capacity. The output of the neighbouring Fisk Street station is 120,000 KW., and in north-west Chicago there is a station of equal capacity in course of erection, with units of 20,000-KW. capacity. The total output of the latter station is ultimately to be doubled.

The main building of the Quarry Street station is 495 ft. long, 200 ft. wide and 80 ft. high. The rooms for fuel storage and handling, boilers, turbines and switchgear are arranged along the building. Electric locomotives are used for fuel handling. Water-tube boilers are employed, arranged in two rows of eight; each unit has 4,850 sq. ft. heating surface, is provided with chain-grate stoker, and supplies steam at 240 lb. per sq. in. and 144° F. superheat.

Five-stage vertical Curtis turbines are used, running at 720-750 R.P.M. and direct coupled to three-phase, 9,000-volt 25-cycle and 12,000-volt 60-cycle alternators respectively. A vertical 5,000-KW. frequency transformer (25 to 60 cycles) enables either set of generators to help the other in case of need.

The switch room has three levels and a central switch gallery. On the ground level are the high-tension cables, the battery room and the exciter bus-bars; the central level contains the high-tension and distribution bus-bars, and on top are placed the generator lines and the group switches. The high-tension switchgear is built on the cellular system, and is divided into two groups of 300 amperes and 1,200 amperes capacity respectively.

Excitation is provided by two 150-KW. motor-generator sets, three steam turbine sets and two 125-volt auxiliary batteries. The exciter switchboards are placed in niches above the turbine room.

For operating purposes, the whole plant is divided into three sections, each of 60,000-KW. capacity, which are paralleled as required by the demand at various times of the day.

The western end of the switch house contains a sub-station with two 500-KW. rotary transformers. A 220-volt D.C. cable connects this sub-station with Fisk Street.

German Electric Trusts in Turkey.—The *Standard* correspondent in Berlin says:—"German financiers and industrial men are making strenuous efforts to secure a firm foothold for German enterprise in the new field offered by the regenerated Turkish Empire. The latest development is the formation of an electric trust among the German companies at present operating in Turkey and several of the leading German banks, the negotiations for which are now approaching completion. The new trust will have a capital of £2,500,000, and its chief component companies will be the Deutsche-Orient Bank, with its subsidiary companies, the Dresdner Bank and the National Bank, the Deutsche Bank, the Constantinople Electric Tramway Co., the Metropolitan Tunnel Co., and the Electric Light and Gas Co. in Constantinople."

Lock-out on the Continent.—A Reuter dispatch, dated August 26th, in the *Times* states that the negotiations in the metal trades conflict at Dresden have been broken off. The masters carried out their threat and locked out 60 per cent. of their employés at Dresden and Chemnitz.

A Miniature Electromotor.—The miniature ele motor recently constructed by M. G. Trevet, at Bellevue, Fr works most satisfactorily in spite of its marvellously dimensions, and has, therefore, been presented by M. Carpent the French Academy of Seiences. This motor is a shunt-ex machine with Gramme ring, the height of the field-magnet 14·5 mm., width of base 14 mm., and length of shaft 15 mm. field magnet coil comprises 600 turns of wire, 0·05 mm. in t ness. The magnet iron is 15 mm. in cross-section and 33 m average length. The armature, which is 6·2 mm. in dian has 12 teeth; its windings are subdivided into six sections, with 288 turns, have a useful length of 1·67 metres. The mutator comprises six plates kept together by two ivory cone insulated by six ebonite plates, the whole being screwed w hexagonal nut on a brass tube forced upon the shaft. The are connected to minute terminals, the commutator diameter only 2·8 mm. Each of the brushes consists of two plates together by three riveted cross stays and pressed against the mutator by a ring, screw and spring. A piece of silve place of the carbon used in actual practice—serves to effec contact. The brushes are 3 mm. long, 1 mm. wide, and 0·7 thick. The brush-holders are adjustable, connection with being made by perforated screws. The steel shaft is 0·8 mm the bearings only 0·4 mm. in diameter. The motor in full ope takes 0·2 ampere at 3·5 volts, that is, 0·7 watt. Its total wei only 7 grammes.

Electric Pumping in Tin Mines.—At the half-y meeting of the Dolcoath Mine, Ltd., on Saturday, Mr. Harvey presiding, Mr. R. S. Hosken (Penryn) inquired i management were satisfied that electric pumps were going to the object for which they were being installed, bearing in min electrical pumping at Wheal Vor caused a good deal of trou one time. Mr. Arthur E. Collins asked if the manager thou would pay Dolcoath to have its own generating station. Re Mr. Arthur Thomas said that at the present price of tin they working stuff which could not be worked if the price wer much lower. As regarded Mr. Hosken's question, they guarantees from the makers as to the efficiency of the e pumps. They were of a type entirely different from the first at Wheal Vor, and, he thought, would prove absolutely reliab efficient. Having an agreement more or less of a private na was inadvisable for him to mention the price Dolcoath was for electrical energy. The matter of a generating station f mine had been gone into very carefully, and the decision a at—which he thought to be a very sound one—was that it we better to keep in the locker the capital of £20,000 to £ necessary for the laying down of such a station, and developments.

Bridge Strengthening.—Tramway engineers may times be called on to strengthen a bridge without stoppi traffic over it. They might take a note of the bridge strengt that has just been carried out on the Chatham and Dover R near Walworth. There an old plate girder bridge has bee tically made into a new and much stronger structure witho disturbance of the traffic. To effect this a horizontal-built b top boom was erected 10 ft. or so above each bridge girder an ported on the ends of these by sloping junction colum diagonals, and then the old plate girders and the new upper were connected by a system of web members. In thi there are now a pair of truss girders, the upper chords of wh new and the lower chords are the old plate girders, whi amply strong to carry the tensile load of what are now the members of deep trusses, and are also well supported by th diagonal bracing in carrying the floor beam load. The whol appears to be a cheap and efficient means of getting over a di with a minimum of inconvenience, and is worth noting, for ma and shallow plate-girder bridges could thus be treated. It r a very weak plate girder indeed which is not fit for the ser tension member in a bridge of double its own depth.

Wiremen's Agitation in Berlin.—An agitati improved conditions is proceeding among the wiremen in and is being conducted by the German Metal Workers' Uni form of contract which the union asks that the installatio shall observe in relation to the wiremen and assistants em by them was recently submitted to the contracting firms fo ture, and it was intimated that a strike was in prospect in refusal. Some of the contractors belong to the Syndi Electrotechnical Installation Firms, but quite a number, in the large manufacturing firms, are not connected with it stated that some firms have now signed the proposed agreem to working conditions, but others have not done so, an comprise to some extent the more important contractors. theless, it is said that from the course of the negotiations d the present time there is no need to fear the occurrence of a strike.

Accidents.—It is reported in the papers th Saturday last two of the Glasgow Corporation electricit employés, a hoistman (David Roxburgh) and a motor-ca (W. Donelly), met with an accident while out in one of the ment's motor-cars. Some distance outside Glasgow the car downhill and collided with a tree, Roxburgh being ki Donelly injured.

Inquiry.—A wholesale supply firm requires na manufacturers of Presspahn and Leatheroid. Makers "Pragnell" electric adapter are asked for.

Electric Power in Textile Mills.—In view of the at interest which has been aroused with regard to the applica- of electric power to the driving of textile machinery, as lenced among other things by the very complete inquiry which ow being made into the subject by representatives both of the tex- and the electrical engineering industry, it may be worth while nention briefly an experience of technical interest which occurred onnection with a textile factory. This was equipped electrically installing a number of direct-current motors, but a difficulty e owing to the fact that, in the particular operation carried on he factory, it was absolutely essential that the machines should at constant speed. The motors which had been installed were he shunt-wound type, and it was observed that after these had n at work for some time, the speed gradually increased, in some s by as much as 5 or 10 per cent. This speed increase was, of rse, due to the warming up of the field circuit winding and the sequent weakening of the magnetic field. It was judged inex- ient to add any shunt regulating resistances in order to correct speed variation, inasmuch as it was not thought desirable to power to the operatives to vary the speed of the motors by d, so it was decided to use instead an alternating-current supply ch was available, and to install induction motors, which, as the on the machines was approximately constant, maintained their d constant within very narrow limits.

Soldering with Acid Flux.—A rather curious source rror which occurred in a central station testing department in nection with bridge measurements may be of interest to other ion men, in order to keep them on their guard against a similar rrence. The testing engineer, while using a form of Wheat- e bridge, found that there was a fluctuation in the currents ch upset his balances, and for which he could not account. He ctually, however, traced the fault to a terminal of the bridge, terminal, to which one wire was attached, being fixed on top of a marble base. On the under side of this base e two other wires and also a metal strip, all of these g connected to the terminal by means of a brass bolt which wed into the terminal for about ½ in. In order to secure ient connection between the various circuits, the head of the , the wires, and the copper strip had all been soldered together. bridge had been in use for some years, and the terminal on al inspection appeared to be quite sound. On closer examination, ever, it was discovered that an acid flux which had been used he sweating had crept up the thread of the brass bolt, and had ctually eaten it away to such an extent that it only made an rmittent contact with the terminal, thus throwing the readings confusion. It was, of course, a fault which was easily set it, but it is well to remember that acid is not a good thing se in soldering electric circuits. That which could occur on a suring instrument might also happen on a power circuit, with leasant results.

Water Polo.—A water polo match took place at Great th Baths last Tuesday between the London Electrical Engineers the City of Westminster Swimming Club. A good game ulted in a win for the latter by 5 goals to 2.

Appointment Vacant.—Works superintendent for the lish Electric Works, Preston, Lancs. See our advertisement es to-day.

Institution and Lecture Notes.—Institution of nicipal Engineers (Southern District).—This Institution l meet at Lewes and Seaford on Friday, September 8th, mencing at 11 a.m. with an inspection of the engineering and l construction departments at the Phœnix Ironworks, Lewes.

Institution of Mining Engineers.—The annual general ting will be held at Cardiff on September 13th. Among the ers to be read is one by Mr. Sam Mavor, on "The Reduction, trol and Collection of Coal-dust in Mines," and one by Mr. W. rice, on "A Rope-driven Coal-cutter." Various interesting ts have been arranged, including several electrical installations, ich figure prominently in the programme.

Educational Notices.—Crystal Palace School of ctical Engineering.—The new course will commence on dnesday, September 13th. Principal, Mr. J. W. Wilson, M.I.C.E., .Mech.E.

Goldsmiths' College (University of London).—The new sion commences on September 25th (enrolling September 18th). plete evening courses in mechanical and electrical engineering provided; Mr. W. J. Lineham is head of the department. An nouncement regarding the College is published in our advertise- at pages to-day.

The Electrical Standardising, Testing and Training titution (Faraday House).—We have received an illustrated phlet relating to the Institution, which gives full particulars the staff (of which Dr. Alexander Russell is the principal), pointments held by old students, and the courses of training vided for present and future students. As is well known, the raday House Institution has for many years practised the ndwich" system, being associated with over 70 engineering cerns, which receive the students during the second and fourth rs of their course of training. The excellence of the system s been amply demonstrated by the many successes achieved by students, and the facilities for instruction afforded by the new ablishment and its equipment are well calculated to enable the titution to maintain its honourable position. A list of testi- nials from parents and old students, and the Electrical gineering Syllabus, have also come to hand; the latter gives tailed information as to the courses of instruction, fees, &c. e next term commences on September 25th.

Colliery Hooligans.—A somewhat serious charge was preferred against some youths at Seaham Harbour Police Court on August 25th, when James Dent and James Rowe, employed at Dawdon colliery, were charged with having extinguished the electric lights at the shaft bottom on August 25th. William Jeff, an "onsetter," stated that on the morning named about 60 youths and others went to the shaft bottom to go to bank in the cage. There was much crushing, and witness ordered them back. There was a little disturbance, and meanwhile the lights were frequently extinguished. John Harper, a wagon-way man, said he saw the two defendants extinguish the lights. Each defendant was fined 2s. 6d. and costs.

Sports.—The sixth annual sports of the Robertson and Osram Social and Athletic Club are to be held to-morrow, Saturday, September 2nd, at 2.30 o'clock sharp, on the ground of the Latymer Upper School, Wood Lane, Shepherd's Bush.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On 26th inst., Mr. F. H. Brandreth, who for the last three years has been chief assistant at Grantham, was presented by the staff with a case of razors, and a silver-mounted walking stick. Mr. J. E. Edmundson, in making the presentation, referred to Mr. Brandreth's good work in Grantham, and wished him success in his new sphere as resident manager at the Electric Light Works, Stamford.

Mr. C. W. Jackson, of the Ipswich Corporation Outside Department, has been appointed chief assistant engineer to the Grantham Electric Light Works, in place of Mr. Brandreth, who has gone to Stamford.

General.—The Telephone Committee of the Portsmouth T.C. has decided to increase the salary of the engineer and manager (Mr. H. J. Andrews) from £260 to £300 per annum, by £20 a year for two years.

Obituary.—We regret to state that the death occurred early in August of Mr. William Dunlap Sargent, who was for many years vice-president and general manager of the New York and New Jersey Telephone Co., and latterly in charge of the Brooklyn branch of the New York Telephone Co. Mr. Sargent was born in 1845.

NEW COMPANIES REGISTERED.

Ardrossan and Saltcoats Electric Light and Power Co., Ltd. (7,959).—This company was registered in Edinburgh on August 11th, with a capital of £20,000 in £1 shares, to carry on the business of an electric light, power and heat supply company. The subscribers are:—G. Balfour, M.I.E.E., 22A, College Street, Cannon Street, E.C., 100 shares; A. H. Beatty, 22A, College Street, Cannon Street, E.C., contractor, 100 shares; R. F. Shepherd, 16, Charlotte Square, Edinburgh, W.S., 1 share; J. Balfour, 23, Heriot Row, Edinburgh, W.S., 1 share; J. W. S. Fullton, 50, Hamilton Place, Edinburgh, clerk, 1 share; A. T. Anderson, 5, Victor Park Terrace, Corstorphine, clerk, 1 share; W. Paterson Gray, Hillview, Davidson's Mains, cashier, 1 share. The number of directors is not to be less than two or more than six; the first are G. Balfour and A. H. Beatty; qualification, 100 shares. Registered office, 63, Castle Street, Edinburgh.

Weaverham Electricity Supply Co., Ltd. (117,358).—This company was registered on August 22nd, with a capital of £5,000 in £5 shares, to carry on the business of electrical engineers, electricians, manufacturers of and dealers in electrical apparatus, suppliers of electricity for light, heat or power, &c., in Weaverham and district. The subscribers (with 100 shares each) are:—J. W. Smith, Ivy House, Weaverham, medical practitioner; W. H. Burgess, Rose Cottage, Weaverham, merchant; G. H. Dean, Wallerscote, Weaverham, farmer; R. Howarth, Gate Inn, Weaverham, hay and straw merchant; R. N. Gandy, The Hollies, Acton Bridge, surveyor; A. Davies, Gate Inn, Weaverham, traveller; E. H. Herbert, Woodfield, Acton, yarn merchant. Minimum cash subscription, £2,500. The number of directors is not to be less than three or more than seven; the first are J. W. Smith, W. H. Burgess, G. H. Dean, R. Howarth and R. N. Gandy. Qualification, £100. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Curtis & Co., Ltd. (117,400).—This company was registered on August 25th, with a capital of £2,000 in £1 shares (1,000 preference), to take over the business of an electrical engineer and medical electrician, &c., carried on by W. Curtis, at 24, York Place, Portman Square, W. The subscribers (with 150 preference shares each) are:—L. H. Rosenheim, 2, Lime Street Square, E.C., merchant; W. H. Rosenheim, 2, Lime Street Square, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are W. Curtis and Elma Curtis. Remuneration as fixed by the company. Registered office, 101, Leadenhall Street, E.C.

Darnell Acoustic Co., Ltd. (117,382).—This company was registered on August 24th, with a capital of £100 in £1 shares, to carry on the business of manufacturers of and dealers in electrical and other instruments for deafness, medicinal preparations or medical or surgical appliances. The subscribers (with one share each) are:—Mrs. G. Hincks, Jesmondene, St. Margarets; G. S. Clapp, 104, Taviot Street, Poplar, E., accountant. Private company. The number of directors is not to be more than five; Mrs. G. Hincks is permanent governing director. Registered office: 383, Mansion House Chambers, 25, Budge Row, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bankfoot Power Co., Ltd. (98,134).—Issue on July 28th of £10,000 debentures, part of a series of which particulars have already been filed.

Cleveland and Durham Electric Power, Ltd. (89,539).—Issue on July 24th, 1911, of £28,000 debentures, part of a series of which particulars have already been filed.

Landaulet Co., Ltd. (72,890).—Return dated June 7th, 1911 (filed July 8th). Capital £50,000 in £10 shares: 3,928 shares taken up; £39,280 paid. Mortgages and charges, £6,000.

African Direct Telegraph Co., Ltd. (21,895).—Return dated June 14th (filed June 19th). Capital £300,000 in £10 shares; 23,600 shares taken up; £236,000 paid. Mortgages and charges, £8,600.

Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd.—Particulars of £10,000 debentures, created July 21st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd. (75,139).—Particulars of £11,807 debentures, created August 3rd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,566 18s. 11d. Property charged: the company's undertaking and property, present and future including uncalled capital. No trustees.

Issue on August 3rd, 1911, of £10,000 debenture stock, part of a series secured by trust deed dated December 9th, 1908, between the North of England Trustee, Debenture and Assets Corporation, Ltd., and this company also registered. The stock was limited in the first instance to £10, 000, but has now been increased to £50,000.

Shanghai Electric Construction Co., Ltd. (86,795).—Return dated May 18th, 1911. Capital £320,000 in £10 shares. All shares taken up. £317,000 paid. £3,000 considered as paid. Mortgages and charges, nil.

Anchor Cable Co., Ltd. (69,073).—Return dated June 6th, filed June 7th, 1911. Capital £250,000 in £10 shares; 6,500 shares taken up; £10 per share called up on 4,600, and £5 per share on 1,500; £53,500 paid; £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

British Electric Automatic Machines, Ltd. (109,404).—Return dated July 28th, filed August 9th, 1911. Capital £150,000 in 200,000 pref. and 400,000 ordinary shares of 5s. each; 30,000 pref. and 5,280 ordinary shares taken up; 5s. per share called up on 10,000, and 1s. per share on 20,000; £8,259 paid, leaving £241 in arrears; £1,320 considered as paid on 5,280 shares. Mortgages and charges: Nil.

Electricity Supply Co., for Spain, Ltd. (29,103).—Return dated July 4th, 1911. Capital £105,000 in 20,000 pref. shares of £5 each and 9,900 ordinary and 100 founders' shares of 5s. each; 17,330 pref., 19,900 ordinary, and 100 founders' shares taken up; 5s. per share called up on 19,900 ordinary; £4,975 paid; £86,675 considered as paid on 17,330 preference and 100 founders'. Mortgages and charges: £131,400.

Electromotors, Ltd. (60,826).—Return dated June 1st, 1911. Capital £50,000 in £1 shares. 42,370 shares taken up. £1 per share called up. £39,195 4s. paid, leaving £3,174 16s. in arrears. Mortgages and charges, nil.

Heswall Electric Light Co., Ltd. (55,482).—Return dated May 31st, 1911. Capital £1,500 in £1 shares. 1,225 shares taken up. £1 per share called up. £1,225 paid. Mortgages and charges, nil.

Gorseinon Electric Light Co., Ltd. (39,944).—Return dated June 3rd, filed June 29th, 1911. Capital £4,000 in £1 shares. 2,000 shares taken up. £1,998 paid, leaving £2 in arrears. Mortgages and charges, £800.

Europe and Azores Telegraph Co., Ltd. (39,452).—Return dated July 12th, filed July 13th, 1911. Capital £200,000 in £10 shares. All shares taken up £10 per share called up on 14,432. £144,320 paid. £55,680 considered as paid on 5,568. Mortgages and charges, nil.

Llanelly and District Electric Lighting and Traction Co., Ltd. (64,341).—Trust deed dated August 3rd. 1911, to secure £60,000 debenture stock, charged on lighting and tramway undertakings, leasehold power station and sbed, and company's other assets, including uncalled capital. Trustees: Century Insurance Co., Ltd., 18, Charlotte Square, Edinburgh.

A memorandum of satisfaction in full on August 8th, 1911, of charge dated March 22nd, 1911, securing £25,000, has been filed.

Dawlish Electric Light and Power Co., Ltd. (108,147).—Debenture dated July 25th, 1911, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: The Capital and Counties Bank, Ltd.

J. Stone & Co., Ltd. (80,901).—Return dated June 22nd, filed June 29th, 1911. Capital £700,200, in 30,000 preference shares of £10 each, and 400,200 ordinary shares of £1 each. All shares taken up. £200,000 paid on 20,000 preference. £500,200 considered as paid on 10,000 preference and 400,200 ordinary. Mortgages and charges: Nil.

CITY NOTES.

Perth Electric Tramways, Ltd.

THE annual meeting of this company was held on Tuesday, at the offices of the London Chamber of Commerce, Salter's Hall Court, Cannon Street, E.C., Mr. A. H. P. Stoneham presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 309), said that as the meeting was very late this year, the shareholders would doubtless like to know the returns for the eight months of the current year ended August 25th. He was pleased to say the figures were £10,300 ahead of the corresponding period of last year, but as the figures then were affected by the strike, the most useful comparison was to compare the returns with those for the corresponding eight months of 1909, on which they showed an increase of £6,700. The delay in holding the meeting had arisen owing to the fact during the last three months the board had been occupi negotiations as to the disposal of the tramways. The fact that Perth had increased so tremendously during the last few that the people had come to the conclusion that they ought to the tramways. They, as directors of the company, of c took quite a different view. They thought that, seeing had had 10 years of struggle, and were just on point of getting 10 years' rich reward, that they c to be left in peace to reap the reward which they consi they had so justly earned. They had always done their duty t public; they had not only kept to their contract, but had, in largely exceeded their obligations or their intentions. Whe concession was granted to the company it was for 17 miles of t they were now operating over 30 miles. They recognised that had a certain duty to the public, and they had entered upon extensions in that spirit, and believing that in future years would benefit the shareholders. They were informed by engineers that some of those extensions could not possibly them until after an interval of two or three years, but that were advisable in the interests of the public. For two or three they were unprofitable, and now, just as they were beginni become profit earning, it seemed rather hard that the com should be assailed by the public as if they had done the injury instead of having done them a service. He was glad t that the Mayor of Perth, Mr. Molloy, who had been in Londo some months, had admitted that the company had done its well, and that the Perth tramways were as good as any he seen in his travels, and he was also good enough to admit th they consented to sell they ought to have a reward for their ente and the risks they had run. Mr. Molloy told them that the peo Perth would not stand the means of locomotion being in the han private enterprise any longer, and he asked them to name a at which they would be willing to sell the undertaking to the Council. They naturally said: We have a very good business we don't want to sell, but if the circumstances are like what you and there is going to be dissatisfaction among the public, r than have any trouble, we shall recommend the shareholders to if only a fair price is given to us, but we want a bid from you subsequently appeared that, although it was quite true that was a very strong feeling in Perth that the tramways shou acquired for the use of the public, the opinion seemed to favour of a purchase by the State rather than by the City Co and that being so, as the Premier happened to be in London fo Coronation, he (the chairman) took the opportunity of asking what the views of the Government were on the matter. Of co he had to be very diplomatic, but he said he believed there feeling in the City that the Government should acquire the t ways. The Premier returned to Perth about the commenceme July, and in his opening speech for his election campaign, he s that proposals would be submitted for the nationalisation o Perth tramways. Before the Premier left this country, he (the c man) and Mr. Wethered had a very long conversation with him o subject, and he asked what price they would take. He (Mr. Stone) told him that, of course, he could not bind the shareholders that having consulted several of the large holders he would recommend them to take anything less than £500,000. He tho they would agree that that was a very low price to ask for the u taking. They certainly had 15 years to run before the Council the right to buy them, and at the end of that term the price w the Council would have to pay was to be settled by arbitra They had taken the opinion of the best experts whom they c find in London to try and find out approximately about what they would get at the end of that period, and, as far as they advised, they would receive about £750,000. He thought, there that in consenting to a sale for £500,000 they were asking a moderate price. The State would purchase a going concern ear a very large amount of money, and they would save about £ or £3,000 in London expenses. Their profits in 1909 were £30 and if they added the London charges (£3,103) they had a profit of £33,260. For the year 1911 things would be much be provided the company continued to go on as it was now d The profits up to the end of June were £19,700, so that fo whole year they ought to be £39,400. The London expenses w have to come out of that, which would leave them about £3 at the end of the year as profit. They knew that the Governm could borrow at 4 per cent., and 4 per cent. on £500,000 was £20,000 a year, so that if the Government bought them for £50 they would have a profit of £17,500 a year, and they would have an annual increase which they were entitled to expect, loo at the prosperity of Perth. Personally, he should be very sorr sell for £500,000, or in fact to sell at all, but if they were goir have trouble with the city council and the State, they thoug would be better to consent to sell. If the Government insi upon their selling, he thought they were entitled not only to a price, but to the thanks of the people for what they had don helping towards the expansion of Western Australia. It was at all certain that they would sell, and he would be perfectly tent if they did not. If they kept the enterprise, there wa doubt they must do something to keep pace with the increa growth of the city, and that would mean more cars and dup tions of the system and possibly extensions. They had not seric considered that question, because of the pressure that was b brought upon them to sell, but he might say that they had ha offer of £50,000 of fresh capital on very fair terms if they dec to go on.

MR. C. WREN seconded the motion.

Replying to questions by shareholders, the CHAIRMAN said if they received a definite offer of purchase, the directors w call the shareholders together at the earliest possible moment.

e basis on which the purchase money should be distributed g tbe ordinary and the preference shareholders, he agreed that ically the preference shareholders could only claim to be paid t par, but he would remind them that in order to effect a sale uld be necessary to get the consent of both classes of share- rs. The preference shareholders would say: "We have got a ; per cent., and unless you can find us 6 per cent. somewhere ve sball not sell." He reckoned that if they ever did come to the preference shareholders would ask to be treated on the footing as the holders of ordinary shares; but he had no t they would be able to come to some arrangement satisfactory l parties. With regard to the use of motor omnibuses for ban traffic in place of extensions, they had again had the er examined by experts, and they were quite satisfied it would be quite useless for them to attempt to run motor s. Tbe cost of running such vehicles in London amounted to t 7d. per mile, and that was over the very best roads in the l. In Perth, although the roads were fairly good, it would e safe to count upon a less cost than 10d. or 11d. per mile, and p of that there was the very heavy depreciation, and the fact motor omnibuses could not carry so many people as the ways. Having regard to all these considerations, their ers strongly advised them not to have anything to do with vebicles, as to do so wonld only lead to a huge loss of money. e report was adopted.

Kalgoorlie Electric Tramways, Ltd.

meeting of this company was held on Tuesday, at the offices e London Chamber of Commerce, Oxford Court, Cannon Street, under the presidency of Mr. A. H. P. Stoneham.

ie Chairman, in moving the adoption of the report (see TRICAL Review, p. 308), said he was sorry to say that they not very good results to record for the past year. The company dependent upon Kalgoorlie and Boulder, both of which towns entirely dependent upon the mining industry, and that stry unfortunately was not in the flourishing state that it was n the company was formed, and consequently their returns suffered considerably. Under the circumstances, he was afraid ould not hold out any hope of any great improvement in the re. It all depended upon whether more mines were opened, to a certain extent upon the construction of the Trans- inental Railway, which might open up a fresh district, of h Kalgoorlie would be the centre. When the tramway was some years ago, it was thought that Kalgoorlie was to be the re for the whole district, but that had not turned out to ie case. As they could not make traffic the only thing they l do was to keep down the expenses, and they had very materially reduced—in fact, they had been got n to such a point that they could not reasonably anticipate cing tbem any more. The shareholders might recollect that took tbeir supply of electric power from the Kalgoorlie Power Tbat company from time to time had made propositions to n to work the tramways for them under an agreement at so h per mile, as they thought they could work them cheaper than tramway company could. When they came to work the thing the Power Co. declined to enter into the agreement, and they continued to purchase their power from them. He thought was a pretty good proof that they were working the tramways heaply as possible. There was another possibility, which was the State might acquire their undertaking. The tendency all ugh Australia was to nationalise the means of locomotion; as a rule, one found that the State only wanted to acquire a ern when it was exceedingly prosperous, and, unfortunately, were not in that prosperous condition which was likely to te the cupidity of the State.

R. O. Wethered seconded the motion.

he Chairman, in reply to questions, said that the meeting ld bave been held two months ago, but the directors thought st to wait and see what policy the Government intended to t in regard to the nationalisation of the tramways in tralia. So far they had only decided upon acquiring the Perth nways. With regard to paying a dividend on the ordinary es, he would remind them that their credit balance, which at end of 1909 was £4,982, was only £5,031 this year, so that they e only about £100 better off on the year. In the opinion of the ctors it would be foolish to divide that £5,000 in paying a ll dividend—it was far better to utilise it in paying off their enture debt as quickly as possible. As to the London expenses, y had been kept at a fairly low figure, and all the directors ced their fees by a large amount two years ago.

'be report was adopted.

The Ottoman Union Company for Electrical Enterprises.

E report for 1910-11 of the Union Ottomane, Société pour Entre- ses Electriques en Orient, to which reference was made editorially August 25th, relates to the second year of the company's exist- e, and states that, in consequence of the lack of favourable portunities, it was impossible to further extend the field of ivity. The Société des Tramways de Constantinople remained sole undertaking with which the company had been occupied. ree new lines had been provided for by the tramway company's vention of 1907, and two had been completed, and the third also so far as the width of the streets permitted. The network now amounted to a route length of 14·6 miles and a track length of 24·3 miles. At the beginning of the year, the company obtained sanction to use electric traction and also permission to connect its lines on both banks of the Golden Horn by means of a track laid across the new Karakcuy bridge now in course of construction. In return, the company had agreed to pay to the City of Constantinople a certain tax per kilowatt-hour and a share in the profits. The necessary funds had been raised by the company calling up the unpaid amount of £T2 10s. per share, thus making the shares £T10 fully paid. By this means the interest of the Union Ottomane in the Constantinople undertaking had been considerably increased, and the Union had therefore concluded an agreement with the Deutsche Bank whereby the latter took over the advances and credit liabilities of the tramway. The new works undertaken by the tramway had interfered with the working, and the company had consequently only been able to pay a dividend of 3 per cent. on the share capital. It is added that the efforts of the Union to obtain tbe Constantinople concession for electric lighting and power supply were unsuccessful, the right having been secured by a Belgo-Hungarian (Ganz) group. As previously reported, the Union proposes to dispose of the tramway shares and go into liquidation in consequence of inability to extend the scope of the enterprise.

The Zurich Bank for Electrical Enterprises.

The report for 1910-11 of the Bank für Elektrische Unternehmungen, of Zurich, which is connected with the group of the A.E.G., and is the most important electrical investment company in Europe, states that the greatest transaction undertaken since the bank was formed, was the combination with the Electricity Co., formerly W. Lahmeyer & Co. Of the £1,250,000 of Lahmeyer shares, those representing £1,086,000 were exchanged for shares in the bank, which increased its share capital by £800,000, and allotted £651,600 to Lahmeyer shareholders, whilst the balance of £148,400 was issued to a banking syndicate and yielded a premium profit of £90,800. By the connection with the Lahmeyer Co., the bank obtained an extension of its sphere of interest from which advantage was expected, although the first year might not at once yield the financial results. The bank had also taken over from that company a large block of shares held by the latter in the Felten & Guilleaume Carlswerk, and had given shares in other companies in exchange. The accounts of the bank show the following figures for the past two years:—

	1910-11.	1909-10.
Share capital	£2,400,000	£1,600,000
Loan capital	2,094,000	1,920,000
Net profits	251,700	167,800
Dividend	240,000	160,000
,, per cent. ...	10	10

It will be seen that the loan capital, as well as the share capital, is greater than in 1909-10, an issue of £400,000 in 4½ per cent. bonds having been made last April. The report gives particulars of the many undertakings in which the bank is interested, and of the sales of shares and purchases of fresh securities.

Oxford Electric Co., Ltd.—A dividend at the rate of 6 per cent. per annum has been declared for the half-year.

Ibbotson Bros.—A final dividend of 6s. per share is recommended, making 10 per cent., tax free, for the year ended June 30th. £15,217 is carried forward. The same dividend was paid in the previous year.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, September 6th.—Ransomes, Sims & Jefferies, Ltd.—133,334 5½ per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 133,334; and £166,667 4½ per cent. first mortgage debenture stock.
Welsbach Light Co., Ltd.—£240,000 4½ per cent. debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

British Insulated and Helsby Cables, Ltd.—£200,000 5 per cent. mortgage debenture stock.
Ransomes, Sims & Jeffries, Ltd.—Preference shares and debenture stock, as above.
Welsbach Light Co., Ltd.—Debenture stock, as above.

Application has been made to the Committee to allow the following to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 87,000 ordinary shares of £1 each, fully paid (Nos. 428,776 to 466,675); and 227,011 7 per cent. cumulative participating preference shares of £1 each (Nos. 500,001 to 727,011).

Blackpool and Fleetwood Tramroad Co.—At a general meeting of the proprietors held at Fleetwood on August 24th, Mr. G. Richardson, the chairman, said the profits for the half-year, after paying debenture interest, were £5,782, against £5,277 for the corresponding period of 1910, an increase of £594, and the expenditure was less by £24. During the half-year they had taken from reserve £3,020 for renewals of cables and track, but they had, on the other hand, placed £1,750 to those accounts. They had still a sum nearly equal to the amount he had named, to spend on the track to complete the entire renewal. He formally moved the adoption of the report and the payment of a dividend at the rate of 4 per cent. per annum, absorbing £3,000, writing off a sum of £1,250 for depreciation, and £500 to the general reserve account, leaving a balance of £1,122 to be carried forward to the current half-year. This was agreed to.

MARKET QUOTATIONS.

Wednesday, August 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a Acid, Hydrochlorlo	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (orystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	£2 dec.
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n oasks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	65/-	10/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	8½d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, oasks ..	per lb.	8d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b „ Wire, in ton lots ..	„	£102	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £45	..
c Brass (rolled metal 2" to 12" basis	per lb.	7½d.	..
c „ Tube (brazed)	„	8½d.	..
c „ „ (solid drawn) ..	„	7d.	..
c „ Wire, basis	„	6¾d.	..
c Copper Tubes (brazed)	„	9¾d.	..
c „ „ (solid drawn ..	„	8¾d.	..
g „ Bars (best selected) ..	per ton	£71	..
g „ Sheet	„	£71	..
g „ Rod	„	£71	..
e „ (Eleotrolytio) Bars ..	„	£58 10	..
e „ „ Sheets ..	„	£74 10	..
e „ „ Rod ..	„	£61 10	..
e „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine..	„	8/6	..
h India-rubber, Para fine	„	4/10	3½d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	47/-	3½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£14 10 to £14 12 6	2/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	..
d Mica (in original oases) small ..	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain oastings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinnm	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£192 to £193	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-frlotlon Metals ..	per ton	£45 to £150	..
k Zino, Sh't (Vieille Montagne bnd.)	„	£33	15/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, L
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Stewarts & Lloyds, Ltd.—The directors have declared an interim dividend for the half-year to June 30th at the rate of 6 per cent. per annum on the preference shares and 10 per cent. per annum on the preferred ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

It cannot be pretended that Stock Exchange markets are in anything like a happy state of mind even yet. One thing and another seem to conspire against the peace of prices, so that holders of securities may well be excused for thinking that there is no end to the mal-influences which cause continual depression in their capital. Fortunately so many people are still away making holiday, when prices cease from troubling and holders are at rest, that they are spared the unpleasant sensation of seeing values decline day by day. Some time, no doubt, there will be an end to the incessant liquidation of weak accounts, which lies at the root of much of the trouble, and, with the opening of a new month, hope always spr as eternal as too often it proves to be unfounded.

Quotations, however, have got down on to a level at which of them certainly look low enough, and it may well be that autumn will provide better markets than have prevailed during past quarter. The next thing we suppose that the Stock Exch will begin to worry about is the rise in the Bank rate usua September or October, although this is an occurrence so reg that it should not have any effect even upon gilt-edged securiti

The Home Railway Market is still troubled by sales, obvio due to the closing of stock by people who have not sufficient m to go on paying further losses. Moreover, the various obst that have arisen in connection with a full settlement of the rail strike are considered quite strong enough pegs upon which to h further falls. Consequently there are declines of ¾ in Metropol Consolidated and 1½ in District Ordinary stocks. Even surplus l has gone down to the extent of a point, while Brighton Defe has suffered a very sharp drop. The leading companies have traffic, a good part of which will certainly not be recovered, there is an idea that dividend declarations in respect of the cur half-year will not be so rosy as seemed likely a couple of mo ago. Underground Electric income bonds, however, picked up of the loss of last week, while Central London Deferred ro 50 middle upon a little investment demand.

Amongst the tramway descriptions, Isle of Thanet Prefer have moved up to 2¾ on the assumption that the company is get nearer the time when it may be able to pay the full dividen these shares. The weekly traffics show a steady improvement w favours this theory, and although it may be some time before cent. is distributed, the present buyers are looking forward to time when this shall take place. Meanwhile, it may be not that the 4 per cent. Debenture stock stands at 80, at which the is around 5 per cent. on the money, and the improvement in price of the Preference should, of course, be reflected in the of the Debenture stock. London United Tramways 4 per Debentures dropped back 2, and British Electric Traction Ordi fell ⅛. In Hammersmith and Chiswick, at all events, there general expectation that the London County Council will sho take over part of the London United's lines, but this does necessarily afford much consolation to shareholders in company.

In the foreign group there are a few small rises, mostly cerned with the prior-charge stocks of the leading compa The common shares are mostly a little duller. For exan Mexico Trams are a point lower, and Rio Trams fell ½, which afterwards regained. Manaos Debentures dropped 2. On the hand, Perth Electric Tramways Ordinary hardened ⅛ on the b showing which the company makes, and a rise of ⅛ has been sec by Brisbane Tram Ordinary shares.

Mexican descriptions, on the whole, are a little easier. Mex Light and Power Preferred fell 2, and the First Mortgage De ture Bonds 1¼, while Mexican Electric Light Bonds are 1½ d The vagaries of Northern Light and Power Bonds have somewhat arrested this week, and the price at 40 shows a loss. Shawinigan Water is again lower, and Canadian Ge Common fell 1.

The feature amongst manufacturing shares is the steady ris some of the better-class issues. Indiarubber shares gained Henley's Preference and Callender's Preference are both ⅛ hig nor is it easy to buy such investments as these except at nearly the top prices quoted. British Westinghouse Prefer moved down to 7s. 6d., and Electric Construction Ordinary are easier at 14s. 4½d. In both cases there have been sellers of s lots, and these being offered were quite enough to depress market. Rubber shares are strong, and general opinion for the price of the commodity to go over 5s. per lb. in the future. It is, of course, quite close to this price now, but t will be a heavy offering at Mincing Lane next week, and consi able interest attaches to the way in which the auction sale Mincing Lane will pass off next Tuesday.

Marconi's attract most of the attention which is being dev to the telegraph and telephone market. Like other shares in w there is a fairly large speculative account open, they gave wa little, but the fall was a mere trifle compared with the advance they recently enjoyed, and the price soon shook off weakness. Anglo-American Deferred have been swayed by movements of American Railways, in which there was a se slump, followed by a partial recovery during the past few d On balance the stock is ⅛ lower, while the Ordinary and Prefe hardened. In spite of that American slump, however, Mac Companies Preference put on another 1½ points, making a ris 4 within a fortnight. West India and Panama shares are a t lower, and Western Telegraphs fell ⅛, although the compa Debenture stock again rose 10s.

Of the Trust Companies, Globe Ordinary shed ⅛ on sales sai be for speculators who had to realise investments in order to for losses incurred in other markets. Submarine Certificates on ½.

National Telephone Third Preference are a trifle easier, the ferred and Deferred stocks remaining unchanged. Both Deben issues are ½ higher. Oriental Preference rose ⅛, while United R Plate Telephone lost a similar fraction.

In the English Electricity Supply market business is extren quiet. Newcastle Ordinary and Preference have been moved to bring the prices into line with those prevailing in the No Urban Preference went back ½, but the company's 4½ per c Debenture stock hardened a little, and St. James' 3½ per c Debenture moved in the same direction. Amongst the Metropol Company's Ordinary and Preference shares there is not a soli change to record

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	7⅜— 8¾ xd	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾— 9¼ xd	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½ xd	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7¾— 8¼ xd	..	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅝— 7⅞ xd	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3½— 4½ xd	..	5 19 2
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝— 5 xd	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞— 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12¼— 12¾	..	5 9 10
Do. 6 % Cnm. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Dnrham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜— 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	½— ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛— 2⅝	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	—1	5 4 8
Folkestone	5	5½	6	4½— 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	8½	9	6⅞— 7⅜	+ ⅛	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6¾— 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝— 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅝— 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾— 4¼ xd	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½— 4	+ ⅛	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	+ ⅛	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7⅞	8	..	..	..
Oxford	5	7	7½	6⅛— 6⅜	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅞— 9½	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	+ ½	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜— 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅛— 1¼	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½— 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2¼— 2¾	— ¼	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87½— 89¼	+ ½	5 0 7
Westminster, Ord,	5	10	10	7½— 8 xd	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½— 5¾	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅝— 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	108 —113	—1	6 3 11
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	¾— ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	88 — 90	..	5 11 1
Falgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16— 5/16	..	..
Do. 6 % Pref.	1	6	6	13/32— 29/32	..	8 6 8
Jamaica Broadstreet, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2¾— 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88⅜— 89¾	— ¾	5 11 5
Mexican Lt. & Power, Common	$100	4	4	87 — 89	—1	4 9 11
Do. 7 % Cum. Pref.	$100	7	7	108 —110	—2	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	— ½	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 9 11
Montreal, Lt., H. and Power	$100	6	7	165 —170	..	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 41	—1	12 3 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	114 —116	—1	3 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	32/32— 31/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7¾— 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98⅜—100⅛	..	4 19 6
American Telep. & Teleg., Cap.	$100	8	8	136 —138	—1	5 15 11
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3⅝	67⅛— 69½	+ ⅛	5 7 11
Do. 6 % Pref.	Do.	6	6	111⅝—112⅝	+ ¼	5 6 5
Do. Def.	Do.	25/-	30/-	25½— 25½	— ⅛	5 17 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101½—103½	..	4 16 7
Chili Telephone	5	8	7	61/16— 7 3/16	..	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87⅞— 89½	..	4 9 5
Cuba Telegraph	10	6	6	10½— 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½— 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜— 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	4½	7⅞— 8⅜	— ⅛	5 7 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102 —104	..	3 16 11
Eastern Extension	10	7	7	13½— 14	+ ⅛	5 0 0
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10⅜— 11¼	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½— 58½	..	5 11 1
Mackay Companies Common	$100	4	5	86 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	76 — 78	+1½	5 2 7
Marconi's Wireless Telegraph	1	Nil	Nil	2 5/16— 2 7/16	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	⅞— 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	117½—120½	..	4 13 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜— 5⅝	— ⅛	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98½—100½	+ ½	3 9 8
Do. 4 % Deb.	Do	4	4	98½—100½	+ ½	3 19 7
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1 9/16— 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1 5/16— 1 7/16	+ 1/16	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5	8⅝— 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	132 —135	+ ½	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼— 7½	— 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅜— 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2 9/16— 2 13/16	— 1/16	2 13 4
Do. 6 % Cum. 1st Pref.	10	6	6	10½— 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¼— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13½— 14	— 8	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	+ ½	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 29th.	Rise + or Fall —	Present Yield £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛— ⅜	..	Nil
Do. 5 % Pref.	1	5	5	½— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	¾— 1½	— ⅛	Nil
Do. 6 % Pref.	10	1½	1½	3½— 4	..	3 15 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	3	3	67 — 69 xd	..	4 6 11
Do. Pref.	100	4	4	85 — 87 xd	..	4 12 0
Do. Def.	100	2	2	49 — 51	+1	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	29½—30½	..	4 18 4
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13 xd	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅞— 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2⅜	2½— 3	+ ¼	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3½— 3⅝	..	Nil
Do. 4 % Deb.	100	4	4	70 — 75	—2	5 6 8

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 29th.	Rise + or Fall —	Present Yield £ s.
	*					
Metropolitan Railway Consol.	100	1	1⅜	44½— 45	— ⅜	3 1
Do. Surplus Lands	100	2⅜	2¾	65 — 67	—1	4 2
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14
Do. 3½ % Pref.	100	3½	3½	88 — 90	..	3 17
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	..	3 18
Metropolitan District Ord.	100	Nil	Nil	24⅜— 25¼	—½	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3¼	86 — 88	..	3 13
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 9
Metropolitan Elec. Trams, Ord.	1	5	5½	⅜— 1½	..	5 6
Do. Def.	1	Nil	Nil	⅛— 1/16	..	Nil
Do. 5 % Pref.	1	5	5	⅞— 1 xd	..	5 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15
Potteries, Ord.	1	2	2	2 — 2⅛	..	..
Do. 5 % Pref.	1	5	5	3⅛— 3⅜ xd	..	7 12
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18
South Metro. Trams, 6 % Pref.	1	3	6	⅛— ⅜	..	10 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10
Do. 6 % Income	100	Nil	1	60 — 62	+1	1 12
Do. Power House Debs.	100	..	4	101 —103	..	3 17
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛— ¼	..	Ni
Do. 6 % Pref.	5	Nil	Nil	2⅜— 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛— 5 5/16	..	5 3 6
Do. 2nd Pref.	5	5	5	4⅜— 5	..	5 0 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4⅝	101 —103	+1	4 7 5
Do. 5 % Deb.	100	5	5	100⅜—102½	+ ⅜	4 17 7
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½— 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6⅝— 7⅛	+ ⅛	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	139 —143	..	5 11 11
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	103 —105	+ ½	4 5 9
Calcutta Trams, Ord.	5	4½	6	5¾— 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16— 9/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 5/16— 5 7/16 xd	..	4 12 6
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	+1	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf,	1	6	6	1⅛— 1 1/16	..	5 13
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	88 — 91	—2	5 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97½— 99½ xd	..	5 0
Mexico Trams Com.	$100	7	7	119 —121	—1	5 15
Do. Gen. Con. 5 % Bonds	..	5	5	99½—100½	..	4 19
Do. 6 % Bonds	100	6	6	98½—100½	— ½	5 19
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛— 7¾	..	6 13
Do. 6 % Pref.	5	6	6	5¾— 5¾	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	¾— 1	+ ⅛	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜— 5⅝	..	5 4
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4
Rio de Janeiro Trams	$100	1	4½	115½—116½	— ½	3 1
Do. 1st Mort. 5 % Bonds	..	5	5	101¾—102¾	..	4 1
Do. 5 % Mort. Bonds	100	5	5	97¾— 98¾	..	5
Sao Paulo Tram, Lt. and P.	$100	10	10	178 —181	..	5 16
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98	..	5
Un. Elec. Trams Monte Video	5	5	6	5½— 6	..	5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	⅜— ¾	..	Nil
Do. 6 % Pref.	1	12	9	1¼— 1⅝	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜— 5⅝	..	4 12 6
Do. Pref.	1	6	6	1⅜— 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞— 7⅛	..	6 15 7
Do. Pref.	5	6	6	5¾— 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westingbouse, Pref.	3	Nil	Nil	¼— ½	— 1/32	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/32— 1/16	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛— ⅜	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	..	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9¼— 9⅝	..	7 15 11
Do. Pref.	5	5	5	4 13/16— 5 1/16	+ 1/16	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3½— 3⅝	..	4 17 0
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅛— ¼	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2

Dick, Kerr	1	6	5	1⅜— 1⅝	..	5
Do. Pref.	1	6	6	1 3/16— 1 5/32	..	5
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	⅛— 1/16	..	N
Do. fully paid	5	Nil	Nil	1/16— ⅛	..	N
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 5
Electric Construction	2	Nil	2½	2 1/32— 2 5/32	— 1/32	6
Do. Pref.	2	7	7	1 15/16— 1 31/32	..	7
Greenwood & Batley, Pref.	10	7	7	7⅜— 8¼	..	8
Do. Deb.	100	5	5	94 — 96	..	5
General Electric, Pref.	10	5	5	8½— 9	..	5 11
Do. Deb.	100	4	4	88 — 93	..	4
Henley's, Ord.	5	15	15	12½— 12⅞	..	5 16
Do. Pref.	5	4½	4½	5 — 5¼	+ 1/16	4
Do. Deb.	100	4½	4½	106½—108½	..	4
India-Rubber, G. & T.	10	10	10	12 — 14	+ ½	7
Do. Pref.	10	5	5	9⅞— 10⅜	..	4 16
Telegraph Construction	12	17½	20	34½— 36½	..	6 11
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	Nil	3/32— 5/32	..	N
Do. Pref.	5	1½	Nil	⅜— 1	..	N
Do. Deb.	100	4	4	55 — 65	..	6

* Unless otherwise stated, all shares are fully paid.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1911.

THE July returns of the electrical exports from this country show a falling off in total of some ten thousand pounds in value as compared with those of June. Noticeable decreases occurred in the values of telegraphic, telephonic and cable exports, but, on the other hand, the electrical machinery section improved, reaching a total of over £168,000 for the month. The month's total, however, bears a favourable comparison with the monthly returns of 1910, if allowance be made for the extraordinary telegraphic exports which occurred in five months of that year. The import total for July amounted to £188,360, as compared with £183,260 in the previous month, an increase occurring in the telegraphic section, while lamp and machinery imports show a falling off.

The re-exports at £19,791 are some £9,000 lower than in June.

Notable purchasers of British electrical goods were our Australian and South African colonies, while South America, India, Japan and Canada were, as usual, good customers.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	481	364	78	216	466	4,446	398	45	...	98	3,076	9,668
Germany	1,485	2,798	24	385	334	563	723	58	...	25	...	6,395
Netherlands and Java	447	1,173	93	86	44	440	...	3	...	...	27	2,313
Belgium	880	642	105	173	113	4,836	43	...	...	857	177	7,826
France	808	38	1,108	13	18	4,266	283	...	...	147	2,362	9,043
Portugal	9	20	35	13	...	101	284	...	...	22	5	489
Spain and Canary Isles	751	...	24	25	51	1,040	...	...	...	...	293	2,184
Switzerland, Italy and Austria-Hungary ...	155	...	172	12	7	3,374	1,619	14	...	77	10	5,440
Greece, Bulgaria, Roumania and Turkey ...	270	23	93	30	...	612	3	60	...	35	10,588	11,714
Channel Isles, Gibraltar, Malta and Cyprus ...	25	46	28	31	181	19	...	3	...	12	447	792
U.S.A., Philippines and Cuba	47	25	15	297	9	4,658	37	...	...	...	2,896	7,984
Canada and Newfoundland	523	5,213	393	946	1,644	6,305	27	286	65	97	38	15,537
British West Indies and British Guiana ...	1	43	26	28	...	...	...	38	10	97	...	243
Mexico and Central America	615	2,866	145	106	12	220	...	...	...	483	...	4,447
Peru and Uruguay	64	11	145	380	27	127	...	20	...	830	14	1,618
Chile	187	451	363	242	66	2,825	...	...	...	62	116	4,312
Brazil	356	1,188	342	347	390	2,420	740	2	...	4,809	7,232	17,826
Argentina	1,169	3,912	597	1,170	754	20,307	692	1,861	162	4,383	2,289	37,296
Colombia, Venezuela and Bolivia	...	...	55	...	...	606	...	...	...	...	...	661
Egypt, Tunis and Persia	607	359	85	...	10	5,376	628	254	28	688	4	8,039
British West Africa	65	429	131	142	9	753	...	307	21	18	259	2,134
Rhodesia, O.R.C. and Transvaal	1,780	795	324	1,865	4	5,310	175	300	21	119	9	10,702
Cape of Good Hope	1,303	903	119	942	360	1,827	40	3,481	44	154	981	10,154
Natal	1,173	6,480	1,036	1,006	16	787	...	174	...	685	15	11,372
Zanzibar, Brit. East Africa, Mauritius & Aden	46	11	46	143	...	25	...	9	11	20	484	795
Azores, Madeira and Portuguese Africa ...	408	273	199	137	24	574	81	10	...	...	57	1,763
French African Colonies and Indo-China ...	16	35	28	72	74	...	...	...	...	...	...	225
China and Siam	430	743	310	106	429	2,170	187	40	...	56	904	5,375
Japan and Korea	251	40	80	44	475	28,710	3,345	210	...	880	42	34,077
India	1,852	8,986	1,920	1,805	488	15,165	2,896	2,728	51	526	150	36,567
Ceylon	99	754	85	157	300	1,214	39	144	...	202	53	3,047
Straits Settlements, Fed. Malay States and British North Borneo	136	661	217	336	100	462	86	109	88	189	726	3,110
Hong Kong	20	213	288	14	204	598	265	22	20	...	...	1,644
West Australia	577	796	52	30	322	757	...	2	...	75	329	2,940
South Australia	605	144	49	20	25	984	...	...	...	313	65	2,205
Victoria	1,404	6,586	145	1,143	641	8,191	...	300	28	9,753	218	28,409
New South Wales	2,125	7,127	825	1,561	675	22,008	2	48	107	617	421	35,516
Queensland	230	103	1,365	326	151	2,242	...	8	...	492	...	4,917
Tasmania	...	139	40	68	93	...	...	33	...	27	...	400
New Zealand	985	1,778	280	816	6	1,590	125	337	...	1,247	302	7,466
Total, £	22,385	56,168	11,465	15,233	8,522	155,908	12,718	10,906	656	28,095	34,589	356,645

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	166	...	67	71	...	2,478	421	402	10	4,319	7,934
Germany	1,469	4,172	1,127	16,823	1,882	50,521	30	1,006	4,493	38,150	119,673
Holland	...	...	120	1,324	...	62	...	...	8	139	1,653
Belgium	374	1,910	3	18	177	3,539	42	688	328	7,154	14,233
France	...	750	707	1,591	538	739	...	615	3,489	2,661	11,090
Switzerland	34	1.771	179	62	...	2,361	60	...	11	540	5,018
Italy	...	184	12	...	...	48	...	...	...	3,026	3,270
Austria-Hungary	...	1,513	458	536	...	185	...	...	246	49	2,987
United States	1,729	44	137	1,049	19	11,516	7,258	112	120	466	22,441
Total, £	3,763	10,344	2,810	21,474	2,616	71,449	7,811	2,823	8,705	56,504	188,299

Additional imports: Canada, goods, £35; Spain, carbons, £26.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	12,316	1,695	...	1,736	...	4,752	...	145	541	301

TOTAL EXPORTS: £356,645. TOTAL RE-EXPORTS: £19,791. TOTAL IMPORTS: £188,360.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

The Propagation of Electric Currents in Telephone and Telegraph Conductors. By J. A. Fleming, M.A., D.Sc., F.R.S. London : Constable & Co., Ltd. Price 8s. 6d. net.

In the early part of last year Dr. Fleming delivered a course of lectures at University College on the theory of the transmission of alternating currents, with particular reference to telegraph and telephone working. In view of the importance which transmission questions have assumed during recent years, great interest was taken in these lectures, and when Dr. Fleming, during a course of lectures on electrical measurements, which he delivered at the same institution in the early part of this year, said that he was arranging to have his transmission lectures, and also the course of lectures on which he was then engaged, incorporated in book form, the announcement was received with great satisfaction.

The book has now been published, and it certainly fulfils the hope expressed by the author, that it may serve as a stepping stone to the work of original investigators of a more advanced character.

Up to the present there has been no work in which the student or engineer engaged in telegraph or telephone matters could find, in a single volume, a fairly full account of the modern methods of dealing with transmission problems. It was necessary to refer to numerous detached papers, written by investigators on both sides of the Atlantic, and therefore Dr. Fleming deserves the thanks of the telegraph and telephone engineering profession for the work he has done in collecting the information contained in these scattered papers, and placing it in a readily accessible form.

A knowledge of the use of hyperbolic trigonometry is, unfortunately, not yet very widely spread among electrical engineers, but, since great use is made of this branch of mathematics in modern transmission theory, Dr. Fleming devotes the first chapter of his book to a brief explanation of its fundamental principles. A useful table of hyperbolic functions of imaginary quantities is given at the end of the chapter.

The second chapter deals with the propagation of electric waves along conductors. The reflection phenomena which occur at the ends of a circuit are discussed, and the chapter concludes with an investigation into the attenuation and wave-length constants of a line.

In Chapter III the theory of the propagation of simple periodic currents along a telephone loop is worked out. The three cases of a loop disconnected at the distant end, short-circuited at the distant end, and with the distant end closed through a receiving instrument, are separately considered, and the formulæ giving the current and voltage in different portions of the circuit under these different conditions are obtained.

The fourth chapter deals with the question of the propagation of actual telephonic speech waves over a loop, and discusses the various methods which have been proposed for improving the quality of transmission over a telephone circuit.

In the fifth chapter the theory of the transmission of signals over a submarine cable is worked out, and the method of improving the speed of signalling by means of curb-sending is explained.

Chapter VI deals with the special case of the propagation of high-frequency currents, such as those used in wireless telegraphy, and also with the case of the transmission of currents of very low frequency, or of continuous currents, over leaky lines.

In Chapter VII are given the methods used for actually measuring the constants of cables, in order that the formulæ obtained in the previous chapters may be put to practical use.

The eighth chapter deals with the application to practical cases of the theory previously given, and shows how nearly the results obtained by actual measurement agree with those obtained by calculation.

In the last chapter the methods employed in present-day practice for improving transmission over telephone circuits, aerial, underground, and submarine, are described.

The book concludes with a table of hyperbolic functions o angles from 0 up to 7·5 radians.

It will thus be seen that the subject of transmission ha been treated in all its different aspects, and that after work ing through this book, the student should have a good all round grasp of, at any rate, the ground work of this branch of applied electricity.

Unfortunately, however, there is a very large number o errors in the book, many of which, we regret to say, do no appear to be ordinary printers' mistakes. The argument i also somewhat obscure in several places. It would appear a if the book had been prepared very hurriedly for the press and that sufficient care had not been given to the correctio of the proofs, so that the slips mentioned have been over looked. Doubtless, in the subsequent editions which, w think, will certainly be required, the necessary correction will be made.

In view, however, of the great importance which th subject possesses, and the annoyance which is likely to b caused by these errors to students who are approaching i for the first time, we give below some notes, which we hop will enable the reader to avoid the difficulties with which perhaps, he would otherwise have been troubled.

Page 18, 9th line—

$$\text{P F} = \sqrt{y^2 + (x - c)^2}$$

should be—

$$\text{P F} = \sqrt{y^2 + (c - x)^2}.$$

The equation as it stands applies to the case when th line F P has turned through an angle greater than a righ angle, but, with the figure as shown, the correction mentione above is necessary.

Page 18, 12th line.—It is suggested that this line read a follows :—

"Accordingly, $\text{P F}' + \text{P F} = \frac{2\,c\,x}{a}$, from equation (3) because $\text{P F}' - \text{P F} = 2\,a$."

Page 20, Equation (10).—The final term in this equatio should be—

$$-\int \frac{x^2}{\sqrt{x^2 - a^2}} \cdot d\,x.$$

Page 20, Equation (14).—This should read—

$$\varepsilon^u = \cosh u + \sinh u.$$

Page 22, Equation (20).—The third term should be—

$$+ \frac{u^2}{1.2} - \ldots.$$

Page 22, Equation (21).—The fourth term should be—

$$+ \frac{u^7}{7} + \ldots.$$

Page 24, Line 24.—

$\frac{x}{a}\cosh u$ should read $\frac{x}{a} = \cosh u$.

Page 27, Equation (35).—

$$\text{Tanh}\,(a + j\,b) = \frac{\text{Tanh}\,a + j \tanh b}{1 + j \tanh a \tanh b}$$

should read—

$$\text{Tanh}\,(a + j\,b) = \frac{\text{Tanh}\,a + j \tan b}{1 + j \tanh a \tan b}.$$

Page 28, 11th line.—Cosh $a + j\,b$ should read cosh $(a + j\,b)$.

Page 28, 27th line.—The angle should be 85° 56′ 36″ not 89° 7′ 44″.

Page 60, 4th line, and page 61, 5th line.—References ar made to "small circles marked with a dot and a cross" o fig. 4, and also to the magnetic flux lines being shown dotte on the same figure. The magnetic lines are shown on th diagram in question full, while it is the lines of electri strain which are shown dotted. Also, the small circle marked as described above do not appear to exist. Such inconsistencies between a diagram and the text are apt t be extremely puzzling to the reader, as Dr. Fleming himsel observes on page 129 !

Page 66, 3rd line from end.—"Sending end" should read "receiving end." See last paragraph on page 71.

Page 78, Equation (20).—This equation does not appea to have been previously given in the book, although Dr

leming introduces it as an expression which has already een obtained.

It may, however, be deduced thus :—Rewrite equation 19), changing the sign of x, so as to obtain x measured from he receiving end. Find $\frac{dV}{dx}$ from this altered equation, nd equate it to equation (25), page 68. Then again hange the sign of x, so as to get x measured from the send- ng end. This gives equation (20).

Page 78, Equation (22).—The bracket before cosh P x hould be deleted.

Page 79, Equations (24) and (26).—It is not clear, ithout much further explanation than is given by Dr. leming, how these equations can be deduced. The method s as follows :—

Rewrite equation (19), measuring x from the receiving nd. We thus get—

$$V = A\, e^{Px} + B\, e^{-Px}.$$

If now distances be measured from the sending end, the x n this equation becomes $(l-x)$ and we get—

$$V = A\, e^{P(l-x)} + B\, e^{-P(l-x)}.$$

Therefore $V = A\,[\cosh P(l-x) + \sinh P(l-x)] +$

$$B\,[\cosh P(l-x) - \sinh P(l-x)].$$

$$V = (A + B)\cosh P(l-x) + (A-B)\sinh P(l-x).$$

In a similar manner we can deduce from equation (20) the following equation—

$$I = \frac{1}{Z_0}[(A-B)\cosh P(l-x) + (A+B)\sinh P(l-x)].$$

When $x = l$ we have $V = V_2$ and $I = I_2$.

This gives $V_2 = A + B$

and $I_2 = \frac{A - B}{Z_0}$

since sinh 0 = 0 and cosh 0 = 1.

Hence $A = \frac{V_2 + I_2 Z_0}{2}$

and $B = \frac{V_2 - I_2 Z_0}{2}$.

Substituting these values for A and B in the equations just obtained for V and I, we get the required equations (24) and (26).

Page 88, Equation (64).—In order to deduce equation (70) a third theorem is required, which can be demonstrated by a method similar to that employed to demonstrate theorem II. The third theorem is as follows :—

$$B\sinh\delta + A\cosh\delta = \sqrt{A^2 - B^2}\cosh(\delta + \gamma)$$

where $\tanh\gamma = \frac{A}{B}$.

Page 124, 25th line.—"0·2 heavy" should read "0·2 henry."

Page 190, 9th line.—Dr. Fleming is deducing an expression for the capacity of a long cylindrical wire of circular section with radius r, length l, and having a charge ρ per unit area. He obtains the value of the potential, and then adds :—

"But, since $Q = 2\pi r\rho l$ is the whole charge on the wire, the capacity $C = \frac{Q}{V}$."

We do not suppose that any reader will be misled into thinking that the equation $C = \frac{Q}{V}$ depends on the fact that $Q = 2\pi r\rho l$, but we quote this as an example of looseness of expression and want of logical sequence which does not tend to smooth the path of the student.

Page 191, Equation (7).—This is the force in the direction O P, not that in the direction P O.

Page 191, Equation (8).—The upper integration limit, ∞, has been omitted.

Page 192, Equations (11) and (12).—Instead of—

$$V_A = (-2q\log r + C) - (-2q\log D + C)$$

equation (11) should read—

$$V_A = (-2q\log r + C) + [-2(-q)\log D + C],$$

also, instead of—

$$V_B = -(-2q\log r + C) + (-2q\log D + C),$$

equation (12) should read—

$$V_B = [-2(-q)\log r + C] + (-2q\log D + C).$$

Page 224, 16th line.—The equation—

$$A = \frac{p\,C\,V}{10^6}$$

should read—

$$A = \frac{n\,C\,V}{10^6}.$$

Page 250, 6th line from bottom.—

should be— 10^{6-6} / 10^{-6}.

From the foregoing it will be seen that the errors are by no means few and unimportant, and to a student, who approaches the subject as a new one to himself, may cause considerable perplexity.

PROCEEDINGS OF INSTITUTIONS.

Electric Traction in Switzerland.

By E. Huber-Stockar.

(*Abstract of paper read at the Zurich meeting of the* Institution of Mechanical Engineers, *July*, 1911.)

(*Concluded from page* 292.)

Lötschberg Railway.—The Bern-Lötschberg-Simplon, or B.L.S., is constructing a normal gauge double track railway, which will give the most direct access to the Simplon, and consequently to Italy from the north-western part of Switzerland and the Bernese lake district. It will be of great importance to international passenger and freight traffic, as it considerably shortens the distance of travel between important places.

The new railway is noted for its tunnel across the northern main range of the high Alps. This is 14,536 m. (9 miles) long, or only 463 m. shorter than the St. Gotthard Tunnel. The new railway, still in course of construction and to be opened probably within about two years from now, has a length of 60·4 km. between Frutigen and Brigue, and will resemble the St. Gotthard railway a good deal in general character.

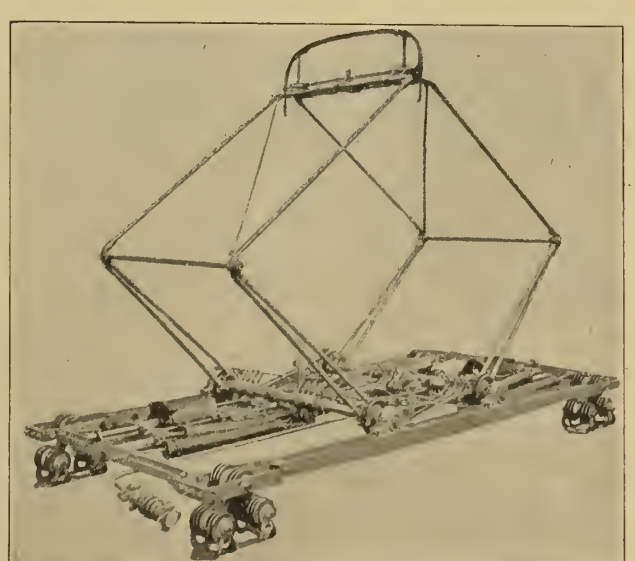


Fig. 14.—Pantograph Collector, Lötschberg Locomotive.

The access to the northern end of the new railway is a line from Spiez, on the Lake of Thun, to Frutigen, 13·4 km. long and operated by steam since 1901. This has been equipped electrically by the B.L.S. After careful consideration, single-phase traction with high voltage (15,000) and low frequency (15) were adopted, and towards the end of 1908 orders were placed with the A.E.G. for one locomotive of 1,600 H.P., with Oerlikon and Siemens-Schuckert, jointly for three passenger motor-cars of 450-900 H.P. each, one locomotive of 2,000 H.P. and the equipment of the line. The three motor-car equipments have been made by the Siemens firm., the cars

TABLE III. Bern-Lotschberg-Simplon Data.

	Motor-cars (3).	2,000-*h.p. locomotive* (1).	1,600-*h.p. locomotive* (1).
Arrangement of axles	Two bogies with two axles each	Two bogies with three axles each	Two half-locomotives, each with two driving and one adjustable pony axle
Total weight	52 tons approx. 64 seats	90 tons	96 tons
Total weight on drivers	30 tons (later on 52 tons)	90 tons, equally distributed	68 tons, 25 tons on pony axles
Weight of electric equipment	21 tons approx.	44 tons	49 tons
Weight of one motor, one transformer	3·8 tons ; 4·0 tons	9·8 tons ; 5·5 tons	14·0 tons
System of motors and speed control	Series, auxiliary poles, voltage speed, speed control by contactors	Series, auxiliary poles, voltage control by contactors	Repulsion voltage speed control by contactors
Transformers on car	Two of 450 K.V.A.	Two of 1,000 K.V.A., ratio 15,000 : 420	
Voltage of motors	—	420-0	—
Power of one motor (1 hour rating)	230 H.P.	1,000 H.P.	800 H.P.
Number of motors on vehicle	Two (later on four)	2	2
Mechanical arrangement	Enclosed motor, spring suspended, geared (1 : 3·45) to driving axle	Motor rigid in spring supported bogie truck, high, open, geared (1 : 3·25) to counter crankshaft below, connecting rods	Motor rigid in spring-supported main frame, high, open, connected by almost perpendicular rods in counter crankshaft, connecting rods horizontal
	With four motors.		
Maximum total pull on tread	7,400 kg.	16,000 kg. coefficient of adhesion 1 : 5·3	13,500 kg.
Maximum total pull on hook	6,300 kg.	13,000 kg.	—
Normal speed of vehicle	45 km. per hour	42 km. per hour	40 km. per hour
Normal weight of train without locomotive		500 tons on 15·5 per cent. : 310 tons on 27 per cent.	400 tons on 15 per cent. 250 tons on 27 per cent.
Speed maximum	70 km. per hour	70 km. per hour	75 km. per hour
Acceleration.	—	0·05 m. per sec. per sec.	—

by Schlieren, the large locomotive by Oerlikon, and its mechanical part by Winterthur. The mechanical part of the A.E.G.'s locomotive is by Krauss & Co., of Munich.

The electrification of this short line of access, Spiez-Frutigen, was undertaken as an experiment, and in case of success, as a preparation for electric traction on the whole line from Spiez to Brigue, 73·7 km. in all. The success has been such that it will be extended to the whole line and on the same system. For this reason, the Spiez-Frutigen electrification deserves special consideration as being the first section of a main railway, furnishing in certain respects exactly the problem of the St. Gotthard electrification—namely, long heavy grades of 2·7 per cent., and heavy trains requiring 2,000 H.P. and more.

The electric current for the present service on the Spiez-Frutigen line is supplied as single-phase A.C. at 16,000 volts and 15 cycles for use on the motor-car and locomotive equipments.

The overhead contact-line of the Spiez-Frutigen line is of most substantial design, all supports being of steel. The devices for the supply of current to the individual sections of line or railway stations, for protection from lightning, and the electrical apparatus, are nicely housed, in a style, up to the general standard of installation on main railways.

The general data of the motor-cars and locomotives are found in Table III. The brakes of all vehicles are of the Westinghouse type.

The contacts are of the pantograph pattern and are capable of self-adjustment from 4·800 m. to 7·050 m. height.

The large gears of the 2,000-H.P. locomotive are of the N spiral type made by Citroën, of Paris. The pitch circle diameters are 1,453 and 447 mm. They are automatically machine cut, work without noise and vibration, have surfaces much in excess of those of any other type of gear wheels, and run at a circumferential speed of 22 m. per sec. The maximum surface-pressure on the teeth is 260 kg. per sq. cm.

The B.L.S. locomotive of the Oerlikon Co. is near the limit, where the use of gearing affords a decided advantage over connecting rods direct from the motor. The gearing does away with all reciprocating parts within the cabin of the locomotive and makes balancing easy. For low-speed locomotives, especially freight engines, with a large pull on the draw-bar and comparatively little horse-power, the gearing is a decided advantage in many respects and is likely to be commonly adopted. The locomotive built by the A.E.G. for the B.L.S. is of novel design in electric traction on Swiss railways. The motors are placed high in the cabin, with cranks on the motor-shafts, from which motion is transmitted to the horizontal connecting rods of the driving wheel axles, by means of a system of intermediate connecting rods reciprocating up and down. The geared and the gearless type of locomotives will probably have each a more or less defined field of application of its own. There will be a field open to both types, where either will represent more or less a compromise.

In general, with low speed, and more particularly with powerful low-speed locomotives, the adoption of gears permits of more satisfactory design, construction and operation, while, with a high-speed locomotives, the elimination of gears is either advantageous or otherwise desirable. The locomotives of the B.L.S. are neither of high nor low speed. Their maximum power is, however developed on the up-grades at low speeds, while the higher speed occur on the down slopes with no load, and on the gentle slopes c levels only with less than full load on the motors. It will b highly interesting and important to compare the two radicall different types of locomotives on the B.L.S., where there are reason for each. The transformers on the vehicles were arranged to permi of working at half contact line voltage, if 15,000 proved impra ticable. In fact, at the time when all trains were steam-drive and the electric vehicles were being run for experimental purpose some flashing over from smoky insulators in the Hondrich Tunne (1,604 m. long), just behind Spiez, was observed, and a periodics

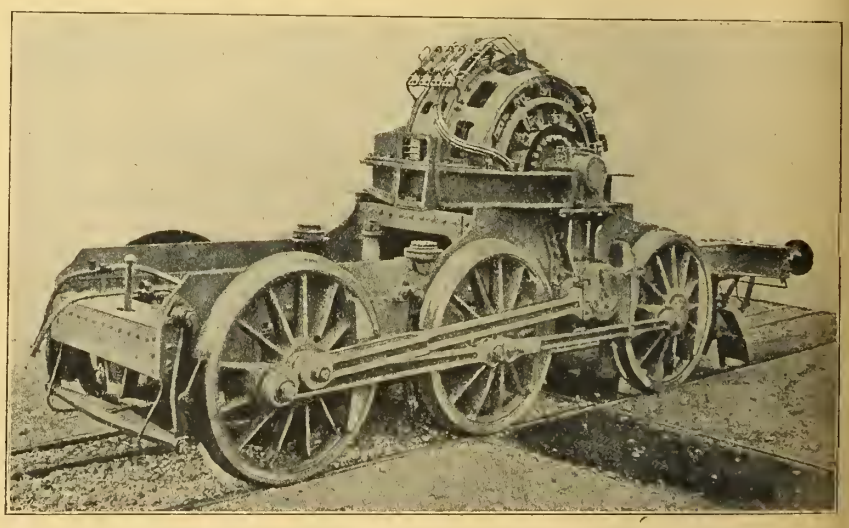


Fig. 15.—Oerlikon 1,000-H.P. Bogie, for Lötschberg 2,000-H.P. Locomotive.

cleaning of the insulators was made. Since steam traction ha disappeared no such trouble has been experienced, and it i expected, as the smoke nuisance will not exist on the new line, tha the contact-line voltage will not require any reduction. At an rate, the B.L.S. electrification will conclusively prove whethe single-phase, high voltage, low periodicity electric traction is th right method for the operation of a railway.

Engadin (Rhätische Bahn).—The company operates about 217 km of line, all in the Kanton Granbündten, and is constructing at th present time a new line from Bevers, in the Upper Engadin, t Schuls, in the Lower Engadin, about 49 km. long.

This new line, together with the sections already existing in th Upper Engadin, will be operated by electricity. Single-phase A.C. of 1 cycles and 10,000 volts has been chosen. The low voltage is justifie by the smaller power required on a narrow-gauge railwa and by the difficulty which might have been encountered in placin

contact wires in the restricted space of the numerous and lengthy narrow-gauge tunnels.

The contact line will be overhead, with collectors of the pantograph bow type. It is intended to work exclusively on the locomotive train plan, which is the plan of operation of the remainder of the Rhätische Bahn. The orders for three locomotives of

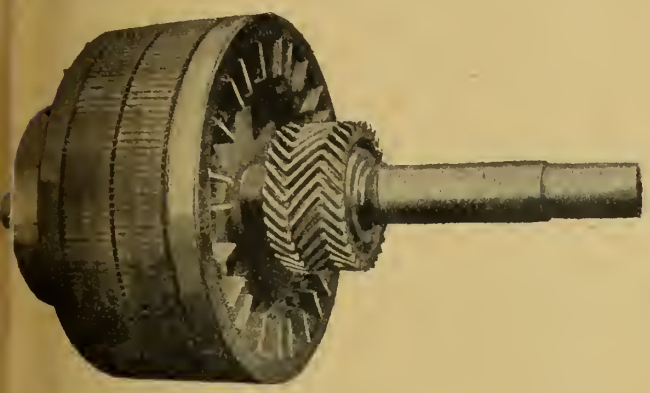


Fig. 16.—Armature and Gear Wheel, Lötschberg Locomotive.

0 H.P. each, for eight of 300 H.P. each, and for the line equipment, have been placed with the following firms—A.E.G., Alioth, Brown-Boveri, Oerlikon and Siemens-Schuckert.

There will be three different patterns of each of the two different types of locomotives. As far as the author is informed, all these locomotives will have motors placed in the cabin above the axles, geared to counter crankshafts, the cranks of which will be connected with the cranks of the driving axles by connecting-rods, the details being arranged in some of the numerous ways possible.

The Schweizerische Studiencommission für electrischen Bahnbetrieb.—This paper would be incomplete if it did not mention, in addition to the electric railways working or building, the work done for years in Switzerland, with a view to elucidating the general railway electrification question under Swiss conditions.

The principal conclusions of the Studiencommission as to systems of electric traction, and more particularly as to unified periodicity of A.C. for electric traction, are exhibited in practice in the series of railways described, beginning with the Seebach-Wettingen experimental line of the past and ending with the Engadin line of the Rhätische Bahn now in course of construction.

holds the record up to now, at the same time adopting speeds and accelerations more or less in excess of those accepted for the hypothetical electric traction of "1904."

Of the figures that follow, those in parentheses refer to the "future." The speeds of express trains are from 85 (90) km. per hour on the level to 40 (50) on 1 in 40 grades. The speeds of passenger trains are 55 (75) to 26 (50), and those of freight trains 38 (45) to 18 (35).

The starting H.P. is limited to 1·25 times the normal H.P. on 1 in 40 grade; acceleration as such is, however, limited to 0·15 (0·20) m/s/s with express, to 0·15 (0·30) m/s/s with passenger and to 0·10 (0·10) m/s/s with freight trains. The weights of the trains will not increase much in the future because of the car couplings (all increase in traffic will be met with faster and more frequent trains); these were in 1904 (maximum in parentheses) actually: with express trains on most sections 200-220 (280-350) tons, with passenger trains 120-180 (240-350), with freight trains on the main line 350-380 (500) and on other sections 270-350 (330-370) tons, all exclusive of locomotives. In fact, freight trains being moved by two eight-wheelers at the head and one at the rear are usual on the slopes. There will be required about 19 (21) motor-cars of 200-500 (400-1,100) H.P., about 9 (15) fast locomotives of 1,800 (2,200) H.P., and about 37 (38) goods locomotives of 800 (1,500) H.P.

Electric single-phase alternating-current, of 15 cycles and 15,000 volts for the supply to sections immediately adjacent, and of perhaps three times as much for transmission to transformer sub-stations supplying the sections remote from the power station, is proposed. There will be 2 (3) power stations required, the most important one situated a little below Airolo, near Ambri-Piotta station, having Lake Ritom as a water-power storage. The power required for traction is considerable and the load line has enormous peaks. The total power developed on the tread of the locomotives on the whole line ("future" figures in parentheses) will amount to about 14,000 (22,000) H.P. maximum and about 5,000 (10,000) on the average. On individual sections the proportion of maximum and average is, however, less favourable. There will be required from the hydraulic turbines 27,000 (46,000) H.P. maximum. There will be installed in 2 (3) power stations, hydro-electric machinery of about 50,000 (95,000) H.P., including stand-by.

The Studiencommission has investigated the application of accumulator batteries for storing power for the local peak loads. It has, however, been found uneconomical, on account of the highly increased expenditure for sub-station machinery, plant, maintenance and operation.

The total cost of new plant, new rolling stock and accessories, alterations on telegraphs, telephones and signals, supervision, interest during construction, all complete, will amount to about 44 (67) millions of francs. These figures give an idea of the magnitude of this electrification which is expected before long. The

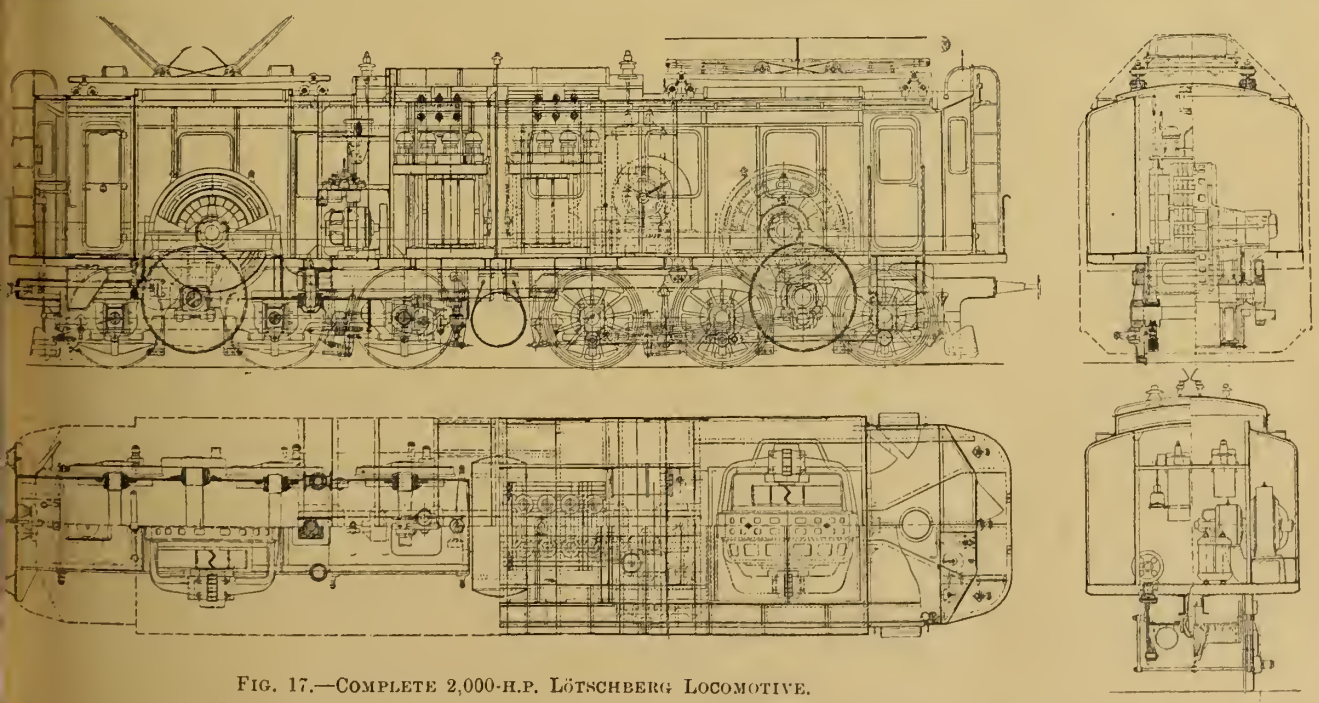


Fig. 17.—Complete 2,000-H.P. Lötschberg Locomotive.

St. Gotthard Railway.—The traffic on the St. Gotthard line has developed to the limits of steam operation. There is a continuous demand for more powerful engines for dealing, on the long and heavy grades, with a tonnage comparable with that of the busiest flat country main railways. The railway, with a length of 274 km. (170¾ miles), presents the problem of electrification in a still more general way than does the Lötschberg, firstly, because the creation of the power stations forms part of the problem; and secondly, the more or less level sections north and south of the steep slopes require high speeds. Moreover, the St. Gotthard electrification is of unusual magnitude.

The Studiencommission has prepared two complete projects for this line. The first project, called "1904," has been prepared for the sole purpose of a fair and complete comparison of actual steam-traction with a hypothetical electric-traction under known precise conditions of traffic. The second project, called "Future," presupposes a traffic considerably in excess of the traffic of 1907, which Federal Railways, a few years ago, acquired ample water-powers in five places along the line, which amount to considerably more than what will be required by any electric traction scheme on the St. Gotthard.

In the hypothetical case of "1904," where electricity does not show to advantage on account of the small traffic to keep the plant busy, the cost per ton-kilometre of train weight, exclusive of locomotive weight, is exactly equal for steam and electric traction, if scrapping of useless steam locomotives is not considered: if it is, the cost of electric traction is not quite 3·5 per cent. in excess. On account of the greater weight of steam locomotives, steam traction appears to be notably cheaper, if measured by ton-kilometres inclusive of locomotives.

Under the "future" conditions of traffic, electric traction is much cheaper than steam traction was in 1907 and 1908, depreciation of steam locomotives, now still running but useless elsewhere, being fully considered. The difference is so great that the conclusion

appears to be justified that the St. Gotthard can be operated electrically at a financial advantage over steam in the near future.

Interest on new capital investment and depreciation of new plant have been fully considered in determining the cost of operation.

Though cheaper operation as expressed in figures is the only efficient stimulus in the case of a railway, still, the greater comfort to travellers, to train crews and to trackmen in the tunnels—of which there are more than 46 km. in all—the reduced corrosion of rails in tunnels, the less rapid deterioration of the carriage outfits,

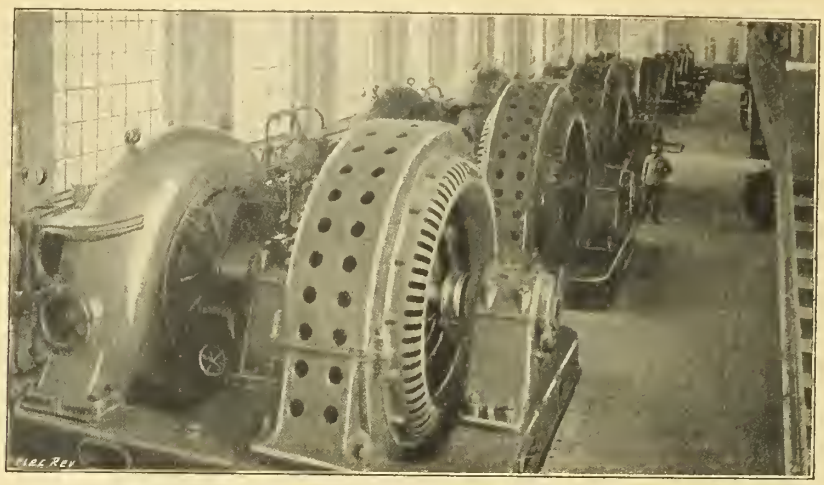


Fig. 18.—Interior of Power Station supplying the Lötschberg Railway.

the elimination of the feed-water nuisance in winter, the cost of coal probably increasing, and many other things not expressed in figures, are of considerable practical importance, and will, if the estimates appear satisfactory, cause electrification to come earlier.

Conclusion.—Railway electrification has made, and is making, good progress in Switzerland. As regards system, single-phase current of low periodicity (15) and high contact line voltage, varying from 5,000 to 15,000, according to circumstances, is being sanctioned by experience and by authority.

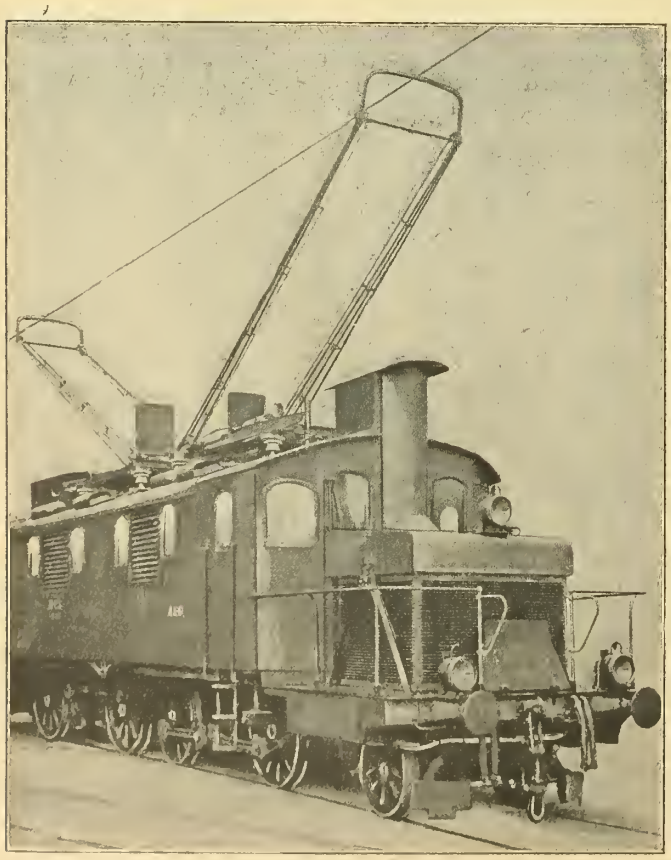


Fig. 19.—A.E.G. 1,600-h.p. Lötschberg Locomotive.

An important electrification of a new principal line—the Lötschberg—is to be carried out in the immediate future, and a still more important one, that of the St. Gotthard Railway, is well prepared.

Railway electrification and electric traction on a large scale is in a great measure a problem of power station economics. All electrification in Switzerland is directly connected with the utilisation of water power.

FERRARIS METERS ON VARIABLE LOA

In a recent communication from the Physikal. Techn. Reichsanst K. Schmiedel describes a valuable investigation into the accur of Ferraris meters on variable current and voltage supply. Mo and clock meters are practically unaffected by such variati (Orlich and Schulze, 1909), but in Ferraris meters there is damping effect of the stray A.C. flux from the current and press coils to be considered, in addition to frictional damping.

From the differential equation of rotat of the meter armature it follows, by a v simple process of approximation, that if Ferraris meter at standstill be sudde loaded with its full-load current—which maintained constant till full speed is attai (after time t_1), and then suddenly and co pletely removed, only to be again resto after time t_2, during which the meter j comes to standstill, and so on (fig. 1)— error F is introduced in the reading of instrument given by—

$$F = f \cdot \frac{1}{t_1} \cdot \frac{K \cdot B}{A^2}, \quad \ldots \quad (1$$

where K = armature mt. of inertia (cm.^{2} grm
f = frequency of supply.
A = damping torque due to permanent magnet and voltage coil stray flux,
B = full load damping torque due to stray current coil flux,
} at ω = 1 radn./s

The meter reads too high, and by amount clearly proportional to the arm ture moment of inertia and the current c stray flux.

By arranging a circuit as in fig. 2, a number of Ferraris met (a—d) may be subjected to such a variable load as the above by of the rotating switch S. The meter readings are compared w that of a standard Aron meter N, and during the time the met are out of circuit a substitutional resistance r is inserted maintain a constant load on the supply G.

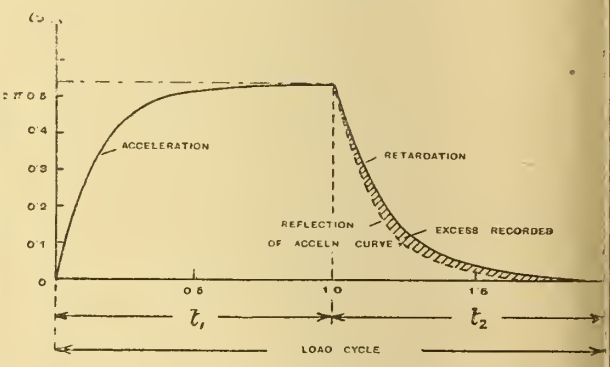


Fig. 1.—Test Load Curve, Ferraris Meter.

The calculated and experimental errors of four Ferraris met thus loaded and tested are shown in the accompanying table. T temperature coefficient of the meters was so small that the differen in the heating effects on steady and variable loads was negligib Satisfactory agreement was obtained between the theoretical a experimental data. Meter a (which had a sharply peaked loa

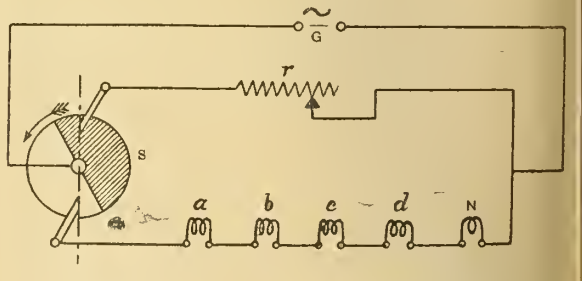


Fig. 2.—Test Connections, Ferraris Meter.

error curve) showed the influence of excessive "current" flu damping, and meter c that of high armature inertia.

Case II.—A closer approximation to practical conditions attained by assuming the current to vary from $\frac{2}{3}$ maximum full load value, and *vice versa*, at regular intervals (say 1 sec. remaining constant *during* the successive periods. Equation (now becomes :—

$$F = f \cdot \frac{1}{9} \cdot \frac{1}{t_1} \cdot \frac{K \cdot B}{A^2} \text{ (see col. 6)} \quad \ldots \quad (2)$$

the errors due to the variable loading do not equal the erence in error frequently existing between half and full ady) load.

er.	Max. driving torque (cm. gm.).	Mt. inertia armature. (cm. gm.).	Calculated error. Case I.	Experimentally determined error. Case I.	Calculated error. Case II.
	7·61	322	+ 1·7%	+ 1·9—2·6%	+ 0.2 %
	4·77	236	+ 0·4%	+ 0·2—0·5%	+ 0·04%
	2·99	362	+ 1·5%	+ 1·1—1·7%	+ 0·2 %
	7·19	339	+ 0·4%	+ 0·4—1·1%	+ 0·04%

f the meter be subjected to such rapid current variations < ½ sec.) that the armature cannot complete its acceleration etardation ere a fresh load variation occurs, the error equation omes very complex, and quite considerable errors arise.

n most cases the damping due to the stray voltage circuit flux onsiderably greater than that due to the "current" flux, hence former exercises the more serious effect on the accuracy of the er. Nevertheless, as the result of theoretical and experimental estigations, it is found that only on very rapid (and consider-) variations of voltage does the influence of the latter on the uracy of the meter become serious.

Thus, in order that Ferraris meters may be as independent as er types of current and voltage variations, it is only necessary .void (1) high armature inertia; (2) powerful damping torque compared with the driving torque), due to stray "current" or essure" flux; (3) large variations of current or voltage of rt duration.

LECTRICITY FROM A DRAINAGE CANAL.

(Concluded from page 319.)

ANSMISSION LINE, TERMINAL STATION, SUB-STATION AND DISTRIBUTION SYSTEMS OF THE SANITARY DISTRICT OF CHICAGO.

E main transmission line of this installation follows the East nk of the drainage canal from the generating station 1½ miles ow Lockpool, to the Western Avenue terminal station 30 miles ay, where the transmission pressure of 44,000 volts is stepped vn to the city distribution pressure of 12,000 volts.

As first constructed the transmission line comprised two circuits 19-strand aluminium conductor, equivalent in current-carrying acity to No. 000 copper. These circuits were carried upon 000-volt petticoat insulators mounted on steel poles or towers. e poles are of bridge construction, measnre 60 ft. overall, and et 6 ft. in concrete, which is rounded off above the surface of surounding ground to provide drainage for any water that y collect at the base. The lower cross-arm, also of steel lattice rk construction, measures 18 ft. across, and the upper cross-arm ft. When first erected the two circuits were installed in the al manner on these cross-arms, and an earth wire clamped at peak of each pole was carried throughout the length of line.

n order to secure additional carrying capacity for the increasing d. the original arrangement of the transmission wires has been dified by the addition of two suspension type insulators hung m the lower crossarm at points midway between the original ticoat insulator pins. Mounting an additional petticoat insu-or at the peak of the poles will thus make available nine ulated wires, *i.e.*, three separate circuits. The last wire, taking place of the original earth wire, is, according to the New York *ctrical World*, now being erected. During the past summer, wever, the line has been worked with the pole peak earth wire position and earthed at every fourth tower. This arrangement s undertaken in order to avoid lightning disturbances, and ticularly satisfactory results have been obtained from the tected circuit. The circuit on the south side of the pole line med by the lines carried on the two petticoat insulators and one pension insulator on the lower arm has been equipped with the thed-ring type of protection.

At each of the numerous railway crossings the petticoat ulators are replaced by strain insulators in each direction, ploying also suspension type and pin insulators at each such jiction.

The steel towers are erected at 350-ft. intervals, and for 18 miles the line are set in holes blasted out of the solid rock and after-rds filled with concrete. The vertical shafts of these towers 42 in. square at the base and 14 in. at the top, and each tower nplete weighs 1·8 tons.

Following the transmission line an underground telephone ble has been laid between the terminal station and the power base, providing two separate circuits. At half-mile intervals ese cables are brought up to junction boxes at the surface of e ground, where the line patrol men can obtain communication th the generating station by inserting the plug of the lineman's lephone set. This telephone line is, of course, quite free from ise or inductive effect.

The Western Avenue terminal station of the transmission line, where the incoming 44,000-volt energy is transformed to a pressure of 12,000 volts for distribution within the city limits, is situated on the south bank of the drainage canal near the Western Avenue Bridge. The building is a concrete block structure measuring 124 ft. × 70 ft. × 24 ft. high. Besides housing the transformers, this building contains the distributing equipment for the 12,000-volt circuits, and a 2,300-volt sub-station for supplying energy to lamps and motors in the immediate neighbourhood.

The transmission lines are led into the station through hooded entrances at the second floor or gallery level. At this point provision is made, by an arrangement of cross-connecting switches, for quickly utilising as a transmission delta any three of the six complete conductors which may remain unaffected in case of partial breakdown of the line. The line is protected at the end by 44,000-volt aluminium cell lightning arresters. After traversing the choking coils, the energy is led through transformer switches, and through series transformers operating the trip relays on these switches. Six banks of 4,000-KW. each oil-insulated water-cooled transformers have already been installed in the station for handling the transmission circuits. The high-tension bus-bars are equipped with motor-operated oil switches for tying together the high-tension sides of adjacent pairs of transformers. This arrangement is also duplicated in both the main and transfer bus-bars in the low-tension side of the transformers. All the 44,000-volt conductors in the station, which are carried on the insulators mounted on pipe construction, are painted red, as a danger signal to workmen.

The 12,000-volt leads from the transformer banks are taken to the hinge terminals of double-knife, double-throw disconnecting switches. The upper terminals of these switches communicate with the main station bus-bars through motor-controlled oil switches, and from these main bus-bars through solenoid-operated oil switches, and thence through double-knife, double-throw, disconnecting switches, similar to those described above, with the respective outgoing commercial circuits. The lower clips of the transformer switches are connected through electrically operated oil switches to the transfer bus-bars, and thence through another group of hand-operated switches to the lower clips of the feeder line double knife switches. This seemingly complex arrangement of knife switches makes it possible to transfer a circuit from the main to the transfer bus-bar, or *vice versa*, without interrupting the supply to the feeder. The sectionalising switches in the 12,000-volt bus-bars are, like those in the 44,000-volt bus-bars, equipped with time-limit relays. There are 20 outgoing circuits, each feeding separate parts of the city.

The control of the transformer switches on both the 44,000-volt and 12,000-volt sides is effected from a bench-board on the operating gallery at the south side of the station.

At the north end of the station is an 18,000-KW. bank of oil-insulated water-cooled transformers, stepping down from 12,000 volts to 2,300 volts to provide the supply for adjacent consumers. At this building also are two centrifugal pumps for supplying cooling water for the various transformers, and two motor-generator sets for furnishing direct current for station lighting and oil switch operations. These pumps and direct-current generators are direct-coupled to 440-volt, three-phase induction motors.

In a small separate building is situated a 60-cell battery which supplies energy for actuating the remote-control switches in the station.

As the sanitary district of Chicago is a public body organised and supported by the ratepayers who compose the population of the City of Chicago and an outlying fringe of territory, the trustees of its board have naturally taken the view that its electrical output should, as far as possible, be utilised for the public benefit of the population, and large use has accordingly been made of the energy for municipal lighting and pumping purposes.

Of course, when the system was first put into operation municipal needs were not equal to the output of the plant, and the sanitary district officials have organised a sales department for aggressively undertaking the distribution of its output to commercial concerns. The commercial load has in three years grown to a totally connected value of 20,000 H.P. in lamps and motors. The municipal load is meanwhile 13,357 H.P.

The rates for industrial motor service are based on a maximum demand system, the consumer's demand either being measured by a demand meter or estimated by multiplying his total connected horse-power by agreed percentage factors.

The rate for 12-hour lighting service is £3 2s. 6d. per H.P.-year to municipalities.

The affairs of the sanitary district are controlled by a board of nine trustees elected by the people, three being chosen each year.

Exhibition at West Hartlepool.—We have received a prospectus of the North of England Exhibition, which is to be held from November 13th to December 9th, 1911, at the Queen's Rink, Clarence Road, West Hartlepool. The 34 sections include foods, drinks, sports, motor-cars, church furniture, dress and fashion, perfumery and so forth, but what may be of more direct interest to our readers from the business point of view are the following:—Mining and metallurgy; shipbuilding (including electric lighting of ships); engineering and machinery; gas and lighting (which includes machines for generating electricity); electricity; smoke abatement, &c. There is a total floor space available for exhibits of nearly 38,000 sq. ft. Copies of the prospectus may be obtained from the general manager, Mr. G. Scott, 7, Victoria Road, West Hartlepool.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

FRANCE.—The French Customs Authorities have recently issued the following decisions as to the duties to be levied on certain imported goods :—

	Francs per 100 kg.
Steam boilers with internal furnaces furnished with Galloway and similar tubes, the number of tubes per furnace being :	
At most 5	10·50
More than 5	14
Automatic regulators for turbines	10
Ventilators worked by electricity :	
Small apparatus consisting of a motor furnished with metal wings : motor dutiable as "dynamo-electric machines" at rates from ... Wings dutiable as "detached parts of machines, other than electric," or "manufactures of aluminium, other," or "nickelled manufactures," according to kind.	13 to 110 (according to weight)
Apparatus of large size without electrical equipment, to be worked (by means of a transmission band) by an electric motor, dutiable as "ventilators according to kind," at rates varying from	8 to 15
Apparatus of large size, other, provided with coils and electrical attachments, dutiable as electrical apparatus, according to kind, at rates varying from	30 to 110
Electric cranes—motor, rheostat and electric engines, crane properly so-called—and wagon or truck (if any), are subject to duty separately.	

NOTE.—Where the exact duty is not stated above, reference should be made to the tariff published in the ELECTRICAL REVIEW, in which the rates of duty by headings mentioned are given.

ARGENTINA.—The Argentine *Boletin Oficial (Official Gazette)* for July 18th contains a revised list of the materials and articles which may be imported into the Republic free of duty by such railway and electric tramway companies as are entitled by law to this privilege, for the construction and working of their lines. The Board of Trade have received a copy of this *Boletin*, and it may be inspected at the Commercial Intelligence Branch, 73, Basinghall Street, E.C.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,322. "Electric controlling or synchronising pendulums." R. MILNE. August 14th.

18,324. "Electrical heating and ventilating appliances." F. RIPPINGILLE August 14th.

18,331. "Electrical heating element." T. JUDD. August 14th.

18,351. "Manufacture of metal filaments for electric lamps." E. R. GROTE. August 14th.

18,355. "Method and apparatus for the reception and production of sound waves." O. REINHARDT. (Convention date, March 1st, 1911, Germany.) August 14th. (Complete.)

18,360. "Reversible galvanic batteries." W. MORRISON. (Convention date, October 10th, 1910, U.S.A.) August 14th. (Complete.)

18,375. "Terminal clips for electric wires." J. H. KAESEN. August 14th. (Complete.)

18,392. "Manufacture of filaments for incandescent electric lamps." H. HOGE and "Z" ELECTRIC LAMP MANUFACTURING CO., LTD. August 14th.

18,462. "Mountings for wall telephone sets." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) August 15th. (Complete.)

18,473. "Heating liquids by electricity." T. MCCLELLAND, JUN. August 16th.

18,487. "Electrically-propelled vehicles." E. M. MUNRO and R.E.T. CONSTRUCTION CO., LTD. August 16th.

18,526. "Dynamos." A. A. PRICE. August 16th.

18,575. "Starting switches for electric motors." SIEMENS BROS. DYNAMO WORKS, LTD., and E. SCHUPP. August 17th. (Complete.)

18,583. "Electric light fittings." M. J. RAILING and G. MAURICE. August 17th.

18,584. "Fixing the covers of electrical switches and the like fittings." M. J. RAILING and G. H. IDE. August 17th.

18,586. "Telephones." B. GWOZDZ. (Addition to 17,363 of 1911). August 17th. (Complete.)

18,611. "Automatic starters for electric motors." M. B. FIELD and FERRANTI, LTD. August 17th.

18,630. "Magnetic compasses." KELVIN and J. WHITE, LTD., F. W. CLARK and HON. L. W. P. CHETWYND. August 18th.

18,648. "Automatic telephone exchange systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) August 18th. (Complete.)

18,649. "Telephone exchange circuits." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) August 18th. (Complete.)

18,667. "Electric switches." H. A. CRABB, A. H. F. PERL and C. H. HUTCHINSON. August 18th.

18,674. "Machines for covering or insulating wire." D. NOBLE. (Convention date, August 18th, 1910, United States.) August 18th. (Complete.)

18,680. "Attachment of insulator carrying arms to telegraph and like poles." BULLERS, LTD., and E. H. CHAMBERS. August 19th.

18,692. "Electrical indicating systems." E. J. WEEKES. August 19th.

18,693. "Electrical signal apparatus." W. S. REYNOLDS. (Convention date, March 17th, 1911, United States.) August 19th. (Complete.)

18,733. "Carbon electrode for electrical purposes." PLANIAWERKE AG. GES. FUR KOHLENFABRIKATION. (Convention date, October 6th, 1910, Germany.) August 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and Liverpool and Bradford ; price, post free, 9d. (in stamps).

1910.

SWITCHING MEANS FOR DYNAMOS FOR CHARGING ACCUMULATORS FOR USE W MOTOR-CARS AND OTHER VEHICLES. J. E. Olvis. 9,775. April 21st.

ELECTROMAGNETIC SEPARATOR DRUM OR PULLEY. James Hawley, Ltd., S. Saunders and — Jones. 17,126. July 19th.

PRINTING TELEGRAPH INSTRUMENTS. E. J. Kessels. 17,322. July 21st.

CONTROLLERS FOR USE IN CONNECTION WITH ELECTROMOTORS. Electric Ordnance Accessories Co., J. R. Garner and M. H. Mueller. 17,349. J 21st.

ELECTRIC FURNACE WITH A RECEPTACLE FOR THE CHARGE ARRANGED ON FURNACE CHAMBER. A. Helfenstein. 17,650. July 25th. (July 27th, 19

ELECTRIC CONTACT MECHANISM FOR THE AUTOMATIC STOPPING OF MACHI V. Hallstream. 18,012. July 28th.

ELECTRIC MOTOR CONTROLLERS. Adams Mfg. Co. (Cutler-Hammer Mfg. 18,191. July 30th.

DYNAMO-ELECTRIC MACHINERY. Brown, Boveri & Co. (Akt.-Ges. Bro Boveri et Cie.) 18,195. July 30th.

LAMPS OR LANTERNS FOR INCANDESCENT ELECTRIC LAMPS. W. Wardlo. 18, August 2nd.

ELECTRICAL CUT-OUTS. A. C. Reyrolle and A. Reyrolle & Co. 19,851. Au 25th.

AUTOMATIC ELECTRIC SWITCHES. H. Leitner. 20,257. August 30th.

MEANS OF CONTROLLING THE CONNECTION AND DISCONNECTION OF A PLURAL OF ELECTRICAL CIRCUITS TO OR FROM ANOTHER SUCH CIRCUIT. J. Sut and C. J. Sutton. 20,685. September 15th.

PUSH-BUTTON ELECTRIC SWITCHES FOR CONTROLLING ELECTRIC LIFTS AND LIKE. J. C. Etchells. 22,355. September 27th.

AUTOMATIC TELEPHONE SYSTEMS. E. Neuhold. 23,669. October 12th. (Octo 27th, 1909.)

1911.

VEHICLES FOR GRAVITY OR SWITCHBACK RAILWAYS OR TRAMWAYS. J. R. Trig and G. Lynch. 1,215. January 17th.

DRIVING MECHANISM FOR ELECTRICALLY-PROPELLED VEHICLES. Tribelh 3,151. February 8th.

ELECTRIC INSULATORS. Bullers, Ltd., and G. V. Twiss. 3,272. February

ELECTROLYTIC METERS. E. Weintraub. 3,648. February 13th. (Febru 14th, 1910.)

TIME-LIMIT OR RETARDING DEVICES FOR USE WITH ELECTRIC CIRCUIT-BREAK Electric and Ordnance Accessories Co. and N. Collins. 4,457. Febru 22nd.

PROCESS FOR THE CLOSING OF THE SEAMS OF TUBES BY MEANS OF ELEC RESISTANCE WELDING. D. Timar and L. Presser. 4,602. February 2 (May 2nd, 1910.)

ELECTRICAL SWITCH OR CONTROLLING DEVICE. G. Wallace and J. E. Grah 6,861. March 18th.

ELECTRICAL TIME-SWITCH. G. Wallace and J. E. Graham. 6,862. March 1

CONTINUOUS ELECTRIC CURRENT GENERATORS WITH SEPARATE EXCITAT Fried. Krupp Akt.-Ges. 7,045. March 21st. (May 18th, 1910.)

CARTRIDGE FUSES FOR ELECTRICAL PURPOSES. W. Creswick and J. Benth 9,038. April 11th.

The Continental Electrical Industry.—The Bank Electrical Enterprises, of Zurich, in the course of its annual rep for the year ended with June, 1911, refers to the general econon situation in Switzerland. Germany, and other countries in Euro which is stated to have undergone no thorough change. Althou the electrical manufacturing industry is well employed, and, part, even very well employed, complaints are made alm everywhere of inadequate prices. Among the undertakir which show a progressive development even in times of quietn in business the report mentions electricity supply works ; t result is regularity in the proceeds, and as a consequer further circles of investors turn to the shares of such compan for investment. Nevertheless, competition manifests itself st where exclusive rights are not held, and this often renders difficult for individual works to develop in a profitable mann As far as railway working by electricity is concerned, the rep states that the system is becoming a fact to an increasing exte now that the trials made by authorities have proved its gr superiority in working in all cases where the traffic is heavy, a the method is the most economical where water-power or cheap fu is employed. Whilst Germany, England, France and Italy w effecting the conversion of railways to electric traction at a ra rate, Switzerland for the time being was still maintaining a waiti attitude. Naturally, the large manufacturing firms were destin to derive advantage in the first place from the general employme of electrical energy for industrial and traction purposes. But n withstanding the favourable prospects for such firms, the rep remarks that with one exception the bank has not considered advisable to increase its holding of shares in manufacturing co panies, as experience has shown that the dividend results of su securities can be largely influenced by the conditions of trade p vailing at any time.

THE
ELECTRICAL REVIEW.

VOL. LXIX. SEPTEMBER 8, 1911. No. 1,763.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,
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THE SUCTION GAS PROBLEM.

WE print elsewhere in this paper an abstract of a paper embodying many points of distinct interest, which has been read by Mr. W. A. Tookey before the British Association. Mr. Tookey has for a long time been associated in a very prominent manner with the development of the suction gas plant, and his moderation in statement and claim must be the subject of our congratulation.

Probably one of the most valuable features of his paper is the evident feeling that it is useless to base his arguments concerning the relative value of steam or gas engines upon so-called test results: what is required is the actual day-by-day experience of the engineer who has "lived with" the plant. Formerly we were far too often subject to the clamour of suction gas plant manufacturers, who sought to make speedy converts by conducting "tests" under abnormal conditions, and thus obtaining astonishing results which would not be sustained in practical working. That a more systematic, careful and scientific method of research has supervened is a matter for congratulation.

Another point which is of great value in this connection is the demonstration of the fact that the suction gas producer plant is not an eliminator of skilled labour. The author admits, in a very fair and open manner, that maintenance and repairs are necessary, and we draw the inference from his paper that they are on about the same scale of frequency and magnitude as those in a similarly sized steam plant. Possibly Mr. Tookey will say they are a little less; but this does not affect the main point in our argument. We frankly do not care to accept, without a great deal of reserve, any claim for any plant, be it electrical or mechanical, that it will without attendance, maintenance or repair, do work which formerly required the employment of technical assistance. On the one hand, we are sorry for the men thrown out of employment, if the claim is true; on the other, our experience of invention and discovery is that in ninety-nine cases out of a hundred the technical craftsman is dismissed at one end of the scale to be called in at the other to put matters right again. In saying this, we know we are open to challenge; until we are converted, however, we believe that there is a permanent place for the technician not only in the design, but in the operation of power plant.

For this reason, and not through any animosity to the suction gas plant as a means of power production, we have felt it our duty in the past to protest against statements which we felt to be exaggerated, if not untrue, as to the possibility of eliminating skilled labour by the installation of these plants. We felt that such an impression, if allowed to get abroad among manufacturers, would lead them to disappointment and loss, and we are glad to note the care and completeness with which Mr. Tookey has dealt with the actual ascertained costs of running and attendance.

We do not, however, wish to traverse too closely the

ground which Mr. Tookey has made his own ; we are sure that our readers will prefer to examine for themselves the operating results which have been obtained and to compare them with cases known to themselves. Obviously, the author has only been able to draw upon a limited number of installations for his facts, and it is possible that some of our readers may be acquainted with other installations whose working figures are available for confirmation or otherwise of his figures. We shall gladly welcome any communications upon the subject in our "Correspondence" columns provided that useful data and not merely opinions are given. The matter which we wish to discuss here is one to which the paper merely acts as an introduction. It is the closing portion that is the most suggestive, as it indicates a position to which all electrical engineers should be alive.

We have the contrast betwen the semi-portable steam plant, the Diesel engine, and the suction gas plant. The first represents the effort to combine the advantages of the central steam-driven station in a private plant. The second is probably the best method known of utilising fuel oil ; the third, commencing operations on anthracite or coke, is now rapidly finding a wide field of application in the utilisation of factory waste. How does the steam-driven central-station power plant stand with relation to each of these three ? As regards the first, it is a clear-cut comparison of price of power generated locally or transmitted, inasmuch as the means of production are the same. We want data to show for the small superheated-steam plant the actual operating costs, in the same precise way as Mr. Tookey has demonstrated those of the suction-gas plant. Except where distances of transmission are very long, it seems to us that the advantages of large power units and a good diversity factor will give the preference to the centralised plant.

As regards the second type of power producer, the Diesel engine has opened our eyes to the commercial availability of oil fuel both on land and at sea ; and, granted that we can at all times secure an adequate supply of oil fuel, there is no doubt that new conditions of competition have arisen which were unknown to the steam engineers of 10 years ago. Many of the smaller electric generating stations are now equipped with oil engines of this type, and are operating with very satisfactory results. It must not be forgotten, however, that, in Great Britain at any rate, the supply of oil fuel depends on uninterrupted transport in even greater degree than that of coal. We need not labour this point ; the recent strikes of railwaymen and dockers bear their own warning to all thinking men. If fuel oil becomes an important factor in our industrial life, then adequate and ample oil storage is of as great importance as grain storage to our national prosperity.

The true aspect of the third type—or, rather, that which the third type foreshadows—has not yet been fully realised in this country, although we are beginning to be aroused. The keynote of future industrial progress will be the elimination of waste, and of this the throttle-governed high-speed suction gas plant fed by works' refuse, to which Mr. Tookey refers, is one of the portents. It is marvellous that the twentieth century should have dawned before engineers should have utilised the waste heat from coke ovens in Durham to drive steam-operated electric stations. Is it a rash propheey to say that shortly, with the advent of the large gas-power engine, we shall see the elimination of the intermediate steam links in such plants and the direct drive of large generators by gas engines fed by the gases from the retorts ? Such work is already done on the Continent. Even where an electric supply over hundreds of square miles of countryside is not so feasible as it is in Northumberland and Durham, is there not a field for enterprising municipal engineers of such industrial areas as, say, Sheffield or Birmingham, to enter into contracts with manufacturers to utilise their waste heat and waste products in gas-driven (if necessary, steam-driven) plants feeding on to the municipal mains, and thus making use of the diversity factor the operations of the whole city to use up every bit of po generated ? This would be better than is the case at pres of letting all this power and material go to waste, and be even than a manufacturer putting up his own little po plant and electric works distribution system as the o alternative to taking the city supply obtained from coal boilers. The economic advantages of the waste heat pla have already been demonstrated on a large scale ; why is application not more generally made ?

We suggest, as a basis for discussion and possible acti that the present competition between centralised and priv power plants is put on a false basis having regard to changed conditions of which we are now aware. We sugg co-operation, not competition, between the central po supply authority and the private manufacturer, even o small scale, who has waste that he does not know what to with. We venture to think that in many instances energies of those who, like Mr. Tookey, are interested in industrial utilisation of waste, could be profitably united w those of the engineers who have problems of general sup of electricity under their consideration.

The L.C.C. and Wood Casing.

According to the daily Press, on strength of an allegation to the effect t several of the recent big fires in Lond have been caused by badly insula electric wires—on what authority we do not know— Building Committee of the L.C.C. is considering advisability of promulgating a decree that all hotels a lodging houses wired in wood casing shall be rewired in st tubing. It is notorious that the arbitrary and vexati building regulations of the County Council have alre driven many works and factories out of London to pla where the local authorities recognise that industry should encouraged not repressed ; the hotels and lodging hou cannot escape in this way from the tyrrany of "s government," and must, therefore, prepare for trouble the threatened edict is issued, and can be legally enforced

There are two aspects from which the matter may viewed. Our concern is mainly with the technical aspe and we say without hesitation that so drastic a proposal absolutely unjustified by the facts. Wood casing is by means the culprit that it appears to be considered ; there numerous buildings of every size and description whi were wired 20 or more years ago in wood casing, and which the installation is to-day in irreproachable conditi while any contractor or consulting engineer can point cases where steel tubing put in but a few years ago h failed disastrously. It is not a question of wood casing steel conduit, but of good or bad workmanship. The use wood casing is expressly sanctioned by the latest editi (April, 1911) of the Wiring Rules of the Institution Electrical Engineers, and therefore by some 50 insuran companies and innumerable electricity supply authorit which have accepted these rules as standard practice ; a a large portion of the Institution building on the Emban ment is still efficiently wired in the original wood casi that was put in some 23 years ago. We need go no furth for authority, nor should the L.C.C.—the I.E.E. wiri rules embody the knowledge and experience of the leadi experts in the electrical world, and should suffice even f that autocratic assembly.

And this brings us to the second aspect of the question—the liberty of the British citizen. It is a singular but u questionable fact that the present is an age of continu encroachment upon the liberty of action of the individu particularly in the direction of administrative restrictio upon industry framed ostensibly for the public benefit, b eventually reacting adversely upon those intended to profit, we have shown in previous articles. So long as a man co ducts his business honestly, without detriment to his fello men, and without infraction of the amenities of society, l

entitled to exemption from meddlesome and pettifogging laws such as that in question. The cost of the expensive rations that would be necessitated by its operation must eventually upon the shoulders of the public, who have de no demand for its adoption, and would be not a whit better off if it were put in force. Both technically and nomically the suggested by-law is unnecessary and objecnable, and we trust that wiser counsels will ensure its ection.

Noisy Motorists.

Repeated protests in the Press have drawn the attention of the responsible authorities to the growing nuisance conuted by the abuse of warning signals by the drivers of tor vehicles, and the Commissioner of Police of the Metolis has issued a circular calling upon the owners and vers of motor vehicles to do what they can to reduce the noyance caused, especially at night, by the excessive and ve-raeking use of the horn or of unsuitable devices. Unless this is done voluntarily, the Commissioner points out, re is certain to be an insistent demand for repressive islation.

We cannot too heartily endorse the views of the Comssioner. No one resident within the metropolitan area n have failed to realise that some motorists have lately opted devices which emit the weirdest and most unearthly cophonies—howls and shrieks as of wild beasts in paroxysms rage—which are not only distracting to the ear, but are so obviously intended to clear the way far ahead of the hicles. Now, the latter object is one with which we have sympathy. We have no objection to the maintenance of reasonably high speed on roads where the conditions of affic admit of it, but where there is much traffic, and in all nsely populated centres, all motorists who profess to have any gard for the comfort and rights of their fellow citizens—at is to say, all who possess the essential qualification of a ntleman—will moderate their speed to a value which nders the use of frightful and terrifying noises superfluous. The proper function of the signal is not to drive other ers of the public way to the roadside, but simply to give rning of the approach of a swifter vehicle, and to prevent cidents at crossings. Some hold, not without reason, that e total prohibition of such signals, by compelling drivers exercise greater caution, would be a salutary ordinance. e do not go so far as that, but we cordially agree that the creasing volume of hideous noise due to motor-'buses, motorcles, and the instruments of torture worked by the exhaust motor-cars, is rendering life in London more and more tolerable, and that drastic steps should be taken to abolish e nuisance.

Labour Unrest and the Trades Disputes Act.

The lawyer who ponders over the recent trouble in the railway world will naturally turn his attention to the Acts of Parliament which are intended to define and limit the powers of the Trade Unions. It he need not make any very extended research. There no necessity for him to go back earlier than 1906. Had not been for the measure which was passed in that year it doubtful whether the recent strike of railway employés could ve reached such gigantic proportions. Reducing it to its ements, this strike was the result of nothing but an agreeent amongst workmen to break their contracts of employent. It was such an act which gave rise to the Taff Vale ailway case; which mulcted a Trade Union in heavy mages, and which gave rise to the political agitation which dminated in the Trades Disputes Act. Possessing that charter of liberty," the trade unionists are now in a position agree to break their contracts, and yet remain outside the w of conspiracy. That law restrains both the doing of a wful act by unlawful means, and the doing of an unlawful t by lawful means—provided the parties are not concerned a trade dispute. The Executive Council of the Amalamated Society may recommend their members to leave ork without notice, and yet the Union funds cannot be ade liable for any of the damage thereby occasioned.

Another anachronism of the law relating to Trade Unions which is brought into relief by recent events is the legalisation of peaceful picketing. It is, of course, as we have already said, a contradiction in terms. In theory it is well enough; but in practice it is the more violent among the pickets who prescribe the policy and methods of persuasion which are to be adopted. It is to be hoped that some day a Government will come into being which is ready and willing so to amend the law relating to Trade Unions that the common law of conspiracy shall apply to trade disputes, and that picketing of all kinds shall be put an end to.

Electrical Schemes in Constantinople.

Some further particulars have been published in the Continental newspapers regarding the electrical schemes in Constantinople, to which reference was briefly made in our last issue, and which aim at the combination of the interests of the proposed electricity works with those of the local tramways. As is known, the concession for the electricity works was granted to Ganz & Co., who is said to have formed a Turkish company for the purpose in association with the group of the Deutsche Bank, although previous announcements have associated Belgian and French interests with the scheme. In the case of the Constantinople tramways, the concession for the conversion to electric traction was given to the tramway company itself, whose shares are largely held by the Ottoman Union of Zurich, which recently announced its intention of disposing of them to a Belgian group. It is now sought to combine these two undertakings, in the first place, by the establishment of a Constantinople syndicate (Corsortium de Constantinople), in which the lead will be taken by the Société Financière de Transports et Entreprises Industrielles, of Brussels, which is understood to be closely associated with the Loewe group of Berlin. There will also belong to this group various Paris banks, the Deutsche Bank, the German Orient Bank and its allied banks, the Berlin Electrical Enterprises Co. and the Belgo-Hungarian financial group of the Ganz Co. The extension and conversion of the tramways will require about £1,440,000, and the electric supply works and gas works will represent a further £720,000. In addition, the Deutsche Bank proposed to bring into the syndicate a scheme for the construction of an underground railway, which is estimated to involve an expenditure of £1,440,000. The three undertakings comprise a total of £3,600,000. The syndicate will subsequently form a Belgian company to take over the enterprises, the share capital to be £1,800,000 and the loan capital also £1,800,000. It is possible, the *Berliner Tageblatt* states, that the syndicate may succeed in obtaining the valuable telephone concession, as the Paris Thomson-Houston Co. and the "American Webb Co.," which acquired the privilege in June, 1910, are not willing, the newspaper declares, to take over the obligations which were subsequently imposed upon them. We are, however, able to say that this hope is purely an effort of the Teutonic imagination, for there is no foundation whatever for the suggestion here made. The future Belgian company will have on its board representatives of Germany, France, Belgium and Switzerland, and presumably also of Austria and Hungary.

Olympia.

One of our correspondents, who is either humorously inclined or must have a painful recollection of disappointment experienced at exhibitions which have been unfinished at the date of opening, writes suggesting that we should warn engineers, whose visit to Olympia must be confined to a single date, that some of the exhibits are almost certain to be incomplete during the first few days. And this was written three weeks in advance of the opening! Surely, if the next fortnight be utilised as it should be by exhibitors, everything will be ready in good time. Whatever has been in the past, cannot our firms show in 1911 how things *should* be done? Will those concerned take the hint?

AUTOMATIC TRACK CIRCUITS.

By an Engineering Correspondent.

Whenever a railway accident occurs, the correspondence columns of the public Press are filled with suggestions and recommendations from well-meaning people concerning the prevention of similar occurrences in the future. Speaking generally, a few of those recommendations are good, some are bad, the majority are impracticable.

An idea has been expressed that the duplication of signalmen would halve the risk attendant on lapses of memory, since the cases would be rare when both men would forget essential facts at the same moment. But such a remedy would not be infallible; it would lead in comparatively moderate signal boxes to a mutual slackening of the sense of responsibility through its being borne on two pairs of shoulders. For this reason the idea finds little support.

The prevailing notion appears to be that complicated mechanism will atone for individual failure or take the place of human intelligence and alertness. The fact should by this time be widely known that in the manipulation of railway traffic the personal factor can never be cancelled. Mind is worth more than matter, and without the intervention of the personal element at crucial situations, the finest inventions and most up-to-date equipment will only bring disappointment.

Ameriea has a genius for invention and organisation, but she is finding that over-elaboration of equipment can defeat the very end for which it is designed. Throughout that vast country railway administration is such that employment is reduced to the lowest possible proportion. In the vicinity of many large towns, the railways are equipped with automatic signals—some alternating, others direct-current systems—whilst immense tracts of territory are traversed by metalled roads throughout which the signalling arrangements are of the crudest description.

The best example of automatic signalling in this country is to be found on the Underground Electric Railways of London. A full description of the system, including an account of the signal boxes necessary to operate that company's crossings and termini, was published in the Electrical Review for March 22nd, 1907, and need not be repeated here. According to recent reports the average number of failures is small and the cost of operation satisfactory; but no one whose opinion really counts would affirm that the general introduction of automatic signalling on steam railways was an indispensable factor in the elimination of railway accidents. It should be remembered that the main line of a British railway is intersected with industrial sidings to an elsewhere unparalleled degree. The actuation of the points which give admission to those sidings is controlled by sentient beings; furthermore, a goods train having entered a siding and discharged a portion of its load, requires that someone should decide as to the propriety of its re-entering the main line.

When crossings or junctions exist, the problems become more complex; and yet it has been seriously urged that when two trains converge upon one section of line, track relays should be fixed at suitable points and operated by whichever train arrives first, to lower the necessary signals, and block the advance of the other train. Another writer suggested that when a train had to cross over from one main line to another, involving, as it would do, the moving of points, the operation of signals and the protection of itself from up and down trains, signalmen could be dispensed with and an arrangement fitted in the driver's cab whereby the condition of the line ahead could be ascertained, and, if clear, the occupant of the footplate could reverse the points in the direction required and proceed on his way. In answer to these proposals, it only needs stating that the automatic control of junctions and terminal stations is outside the purview of railway economics.

Close observers have noticed that accidents rarely occur on those sections of railway which are free from complications, but that serious mishaps more frequently take place in the handling of traffic as a result of failure on the part of the human factor. Apparently there exists a gap between the excellent appliances of the various railway companies on the one hand and the imperfect manipulation of the same moments of mental aberration on the other. How to bri the gap between complicated mechanism and human fallibil is the problem at issue.

In reporting upon the railway disasters of bygone years, was customary for the Board of Trade Inspectors to reco mend the provision of electric treadles, which appara served as an intermediate link in the chain across the g referred to. Many of these appliances are in existence to-d and the statement may be ventured that they have been means of preventing numerous mishaps at various crises.

But the test of experience with treadles has revealed seve inherent limitations that militate against their extenc usefulness, and this may be the reason why progress railway companies are now adopting, and Board of Tr Inspectors are also recommending, short-distance tr circuits in lieu thereof, which answer the same purpose i far more satisfactory manner.

A treadle consists essentially of an iron box or l fastened to the sleeper end or attached to the side of t running rail. This box or bar is furnished with a spring mercury contact, normally open, but closed by the depr sion of the rail caused by the weight of an engine or coa passing over the spot where the apparatus is fixed. T closing of the electric contact brought about by this depr sion is utilised in completing a circuit that rings a warni bell or other device inside the signal box. The limitati of a treadle may be set forth in the following order :—(If an engine driver stopped short of a treadle, the depress would not be made, and an indication would not be giv though the engine might be actually standing a few ya away. (2) In the event of a train not provided with brakes becoming divided, the first portion would pass o the treadle and ring a warning bell, whilst the rear port would continue to foul that section which the signalman l reason to believe was clear. (3) If a battery failed or treadle contact became inoperative, the signalman wo have no immediate warning of these defects notwithstand that the rail had actually been depressed by the passage a train. Such a condition of affairs might in cert eventualities lead to serious results.

An automatic track circuit possesses none of these d advantages, since every pair of wheels of every vehicle the train would indicate their presence in an unmistaka manner, whether the circuit was 9, 90, or 900 yards lc Failure of the working parts would instantly manifest its by a visual or audible warning; furthermore, the fracture e rail metal outside the bonds would cause an alarm

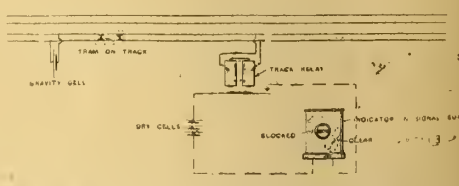


Fig. 1.—Short-distance Automatic Track Circuit, showi how the Presence of a Train on the Line is indicat at the Signal Box.

reason of the fact that current traverses the rails, and not dependent for its action upon the depression of the lin as is the case with treadles.

A study of the sketch (fig. 1) will show that a lc pressure current flows from a battery along one rail of t track through a relay and back to the battery along t second rail. The relay makes and breaks a local circ which performs different signalling functions, according special requirements. As soon as an engine or coach wi metal wheels and axles enters the insulated section, a sh circuit is established, the track relay becomes de-energised, a the local circuit is broken, which causes the safety applia at the signal box to operate. This warning is continu until the insulated section again becomes clear. It imperative that intermediate rail joints be suitably bond and that a metallic connection shall exist between the h and the tire of every carriage wheel.

The essential parts of a track circuit may be summari thus :—Four insulated rail joints, a gravity battery a

low-resistance relay, an indicator (200ω) showing "clear" and "blocked" positions, two dry cells and sundry connections.

Numerous are the applications to which track circuits are devoted, their chief uses being: (*a*) to denote the presence of a train by means of a reversible disk; (*b*) to lock the rear signal whilst a train occupies the advance section; (*c*) to restore the signal-arm to danger immediately a train has passed; (*d*) to lock the block during the time a train is upon the insulated track.

That any or all of these contrivances, separately or in combination, should be necessary as adjuncts to the existing lever frame interlocking, the absolute block telegraph appliances, the telephone and other electrical auxiliaries, is not undeserving of comment. This would, however, be an unwarrantable digression.

(*a*) Consider the means employed of reminding a signalman of the presence of a train, engine or trolley along a predetermined section of line. First, let it be clearly understood that whilst the insulated section of track is free from traffic, the indicator in the signal box is maintained at "line clear" position by the completion of a local circuit through the armature contacts of the track relay. Immediately a train or vehicle occupies any portion of the insulated section the line current is interrupted, a shunt is interposed, viz., the wheels and axles, thus depriving the track relay of its supply of electrical energy, whereupon the armature contacts are broken and the indicator assumes the "line blocked" position by gravitation. When the train has passed out of section the track relay is once more energised, and the indicator is automatically reversed.

(*b*) It can be argued that if a signalman neglects the block telegraph regulations, it is not unreasonable to assume that in a moment of forgetfulness he may overlook the additional warning supplied by the "track" indicator and lower his signal for the admission of a train into a section already occupied. Hence, it has been found desirable, in certain instances, automatically to lock the signal lever from the track circuit in such a manner that it is impossible to lower the semaphore while the section ahead is blocked. How this is accomplished may be gathered from an inspection of the second diagram (fig. 2). An imaginary case will best illustrate the idea. A manual lever is depicted with the object of showing its relation to the branch home signal. Suppose a train occupied the track section A B, and was merely waiting for the lowering of the branch starting signal to proceed on its journey, it will be obvious that under absolute block working the branch home signal should not be lowered for the admission of a second train

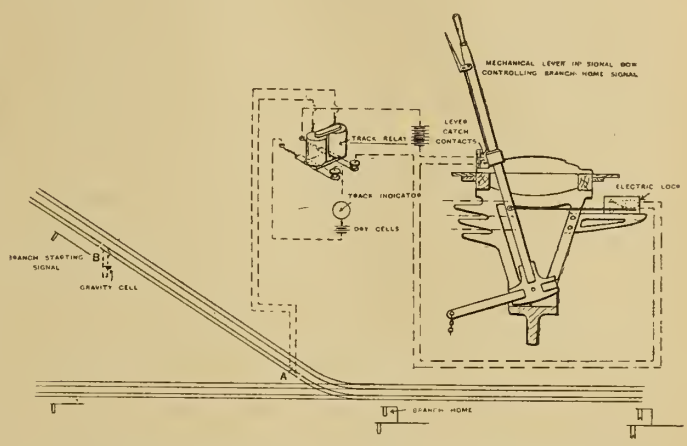
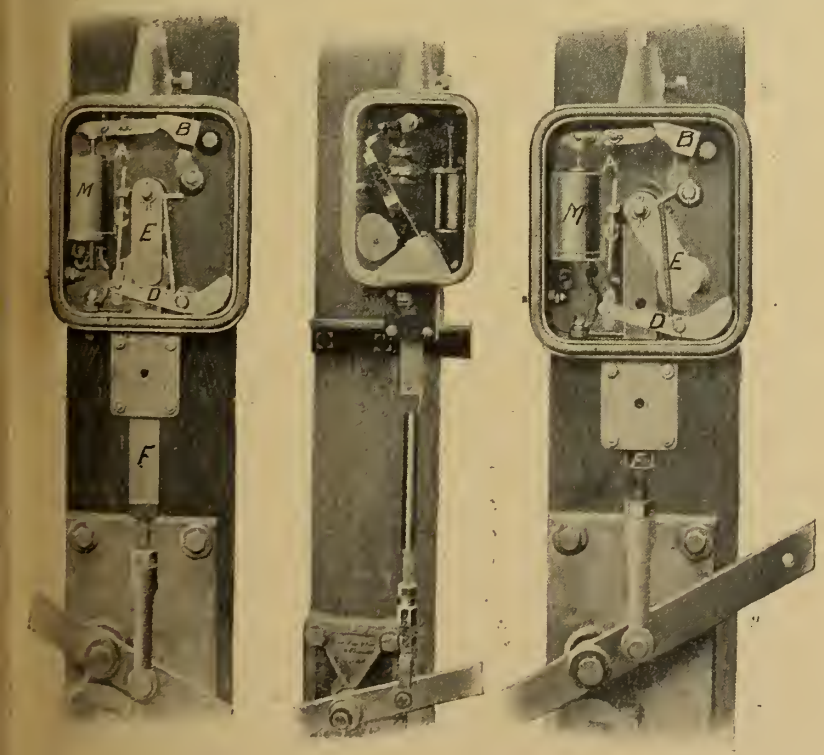


Fig. 2.—Automatic Control of Signal Lever and Track Indicator from Insulated Rail Track Circuit. Immediately a Vehicle occupies the Insulated Rail Section A B, the Armature of the Track Relay falls.

into the section A B, and further that any efforts on the part of the signalman in the direction named should be frustrated. The wiring diagram (fig. 2) shows how such a safeguard may be effectively provided. One pair of insulated rail joints should be inserted at the heel of the junction and the other pair about an engine length beyond the branch home signal.

(*c*) Few words are necessary to explain the general utility of an arrangement whereby the "track" circuit automatically restores the signal arm to danger in the rear of a train irrespective of the signalman's movements. For this purpose "Sykes" signal arm replacers are extensively used, and, what is of equal importance, are eminently satisfactory. The apparatus is fixed between the balance weight lever and the signal arm, and moves with the upright rod when the arm is lowered. When in the moved position, the presence of a pair of wheels in the track circuit breaks down the relay circuit, as previously described, thus operating the "replacer" mechanism and resulting in the arm being put to danger. Sometimes the "replacer" is fixed under the cabin lever frame instead of at the signal, but the function performed is identical. By this arrangement a train protects itself in the rear upon its passage out of one section into another. In this connection the track circuit need not be more than one rail length.



a *b* *c*

a, Signal arm in normal position. When a train passes over the track circuit, current entering magnet M attracts armature A and releases hammer B, which falls on rod C and disengages the catch D from roller-arm E; weight of parts forces roller-arm to position shown in *c*. When the signalman replaces his lever, the slide F moves down, and the roller-arm is caught up by catch D.

Fig. 3.—"Sykes" Signal-Arm Replacer.

(*d*) In the block system of signalling a railway is divided into a number of sections by a series of signal boxes, not more than one train being allowed on one line in a section at one time. In each signal box there are block indicators, one for each line of rails in each section, electrically connected to similar instruments in adjacent boxes. If these appliances be connected to the track circuit so that the latter automatically locks the block needle in two signal boxes during the time a vehicle occupies any portion of the insulated section, a distinct advantage will have been gained.

The wiring sketch depicted in fig. 4 illustrates how such a combination is realised. It is not claimed that this represents finality, but it is in advance of what is being done in many parts of the kingdom, and

wherever it has been installed satisfactory results are reported.

Electric light and power engineers, who are unfamiliar with the practical application of electricity to railway signalling, naturally inquire whether it would not be more economical to arrange the wiring so that electrical energy was only absorbed during the time a vehicle occupied the insulated track section. The answer is in the affirmative, but economy is not everything; in this case considerations of safety have prior claim, and it cannot be denied that a closed rail insulated track circuit, properly installed, fulfils this condition in a perfect manner. It may be pertinent to inquire what constitutes a proper installation. In the first place, it is a fundamental principle in signalling that the failure of any part of the system shall result in the signal going to danger. Therefore, in designing a track circuit, care has to be exercised in preventing a wrong indication whenever an electrical fault develops.

The poising of a track relay, though apparently a trifling detail, is really an important item. In each of the sketches,

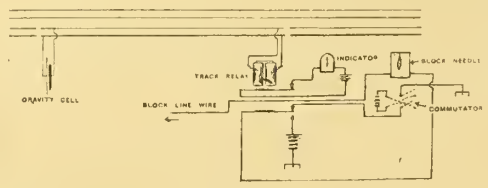


Fig. 4.—Short-distance Track Circuit inter-connected with the Block Apparatus, so that the Presence of a Train is recorded on a Track Indicator, and also on the Block Instrument in the adjacent Signal Boxes.

figs. 1, 2 and 4, the armature is shown below the coils, whereas the usual position is on the side. This precautionary measure is justified on the grounds of safety, since a broken armature spring or an interruption of the current would cause the armature to fall away from the core and thus ensure a disconnection in the local circuit.

Another important condition is that a D.C. track circuit should be installed in strict accordance with Ohm's law.

The resistance between the rail metals is lower when the ballast consists of cinders than when the sleepers are packed with stone chippings. There is an immense difference in the ballast resistance between a wet and a dry day. Ordinarily the current tends to creep across the sleepers and back to the battery without having performed its proper functions at the relay end; it is necessary, therefore, to ascertain the ballast resistance under the worst possible conditions. Having obtained this datum the adjustment should be such that the relay armature is on the verge of falling during the worst weather conditions, the battery being in fairly good order. This not only admits of a factor of safety; it ensures that the chargeman is giving due attention to maintenance.

The resistance from rail to rail under wet or snowy weather conditions should never be less than that of the track relay in that circuit, and since the ballast resistance decreases in direct proportion to the length of the track circuit, it follows that the longer the insulated section the lower the resistance of the relay, so as to ensure that the necessary current will pass through the relay coils. On the other hand, it is of the utmost importance that a carriage truck or horse box should register its presence as an effectual shunt whenever such vehicle is detached from a train and left on the main line.

City Fire.—Owing to the outbreak of fire at Messrs. Ward, Lock & Co.'s premises, Messrs. C. H. Cathcart & Co. are unable to continue business for a few days, and the indulgence of the trade is asked for. They would be glad of new sets of lists from all firms who issue catalogues, as the whole of their stock is spoiled.

Hungary.—It is reported that the Ericsson Co., of Stockholm, Sweden, are in negotiation with a Buda-Pesth syndicate with regard to the establishment of a branch telephone factory in Hungary.

THE BRITISH ASSOCIATION.—I.

On Thursday, August 31st, the Association settled down sectional proceedings, and, as usual, our chief interest centi in the doings of Section G (Engineering). Before delive ing his address, the chairman, Prof. J. H. Biles, referred the fact that the programme of the Section this year was good one. The papers were grouped under sub-sectio which facilitated the attendance of those who were specia interested in the subjects, and so stimulated discussio On Friday there was to be a series of papers connect with the application of electricity to ships and to oth engineering purposes. On Monday there was to be important joint discussion with the Mathematical Section "Flight"—a discussion in which two kinds of investigato pure and applied, would meet together. Papers on rad telegraphy and wireless telegraphy would follow, and Tuesday there would be an important morning on prim movers, when the question of what was the best type prime-mover would be brought right up to date and proper discussed. There would be a meeting on Wednesday, papers were still coming in.

After the chairman had read his address to an audience about 80 persons, the president (Sir Wm. Ramsay) mov the usual vote of thanks, and this was seconded by M Alexander Siemens, who said that the address had consid ably interested him owing to his connection with cable-layi operations. The motion of the ship was of importa because of its effect upon the cable that was being la and anything which contributed to our knowledge rolling and how to prevent it was most accepta to cable-makers. Mr. Worby Beaumont next occupi the attention of the Section with his paper on the orig and production of corrugation on tramway rails. M Siemens, in opening the discussion, thought that difficulty would be overcome by constructing rails w hard resisting material on the sides, the head of t rail being of soft material, everything being so calculat that the soft material was elastic so as to take its old fo again after the wheel had passed. They would thus ha the remedy that the wheel would not touch the rail a line as it did at present, but would be bedded, a thereby the pressure per square inch would be so m reduced that the crumbling need not take place. Sir W. White related experiences of his own bearing upon subject, though not connected with tramway rails, and s that he did not find himself in agreement with Mr. Siem as to his remedy, which he described as "a dream Among the other speakers was one who said that it was no means impossible to make the tire surface of the wh capable of yielding so as to increase the line contact some larger area. It might be possible either by reduci the stiffness of the tire itself, or by a layer between t outer tire and the wheel, to get a larger contact. M Beaumont replied at some length to the discussion. regard to the question of speed, a great many users a running authorities in different towns held that it w impossible to reduce the speed; the great trouble w that tramcars being on fixed lines were obliged to ma very high speeds when they could get a chance to so, in order to retain traffic. It came down to t commercial question as to which method was t best, or which would survive. The rail mention by Mr. Siemens would be a reversion to the old wrough iron rail used years ago, which gradually spread sidewa being of material which could be kneaded on two strips alo both sides of the rail. It was perfectly true that larg wheels could not be used on tramcars at the present momen but he thought that electric motor-propelled vehicles w being used in the streets which suggested that by modific tion of the car it would be possible to use larger wheels the tramcar. As to the elasticity of Mr. Siemens's rail, was afraid it was more in the nature of ductility. T question was a commercial one, and in certain tramways was bringing the cost of repairs and renewals of permane way up to such a figure that it was becoming improba that tramcars would be able to run excepting where they w kept going out of the rates.

The remainder of the morning was devoted to an accou

y Mr. G. K. B. Elphinstone, of the Anschutz Gyro-ompass. The attendance was very gratifying as indicating he great interest that is taken in this instrument, of which he author gave a clear description illustrated by a number f photographic and diagrammatic lantern slides, the ompass itself being subsequently shown to a large number f his listeners in an adjoining room.

On Friday morning the chief feature of the Section was ne consideration of Mr. H. A. Mavor's paper on "Electric-lly-driven Ships' Propellers," and Mr. B. P. Haigh's con-ribution on "Electrical Steering." Both of these authors nade very profitable use of the lantern, and both of them ere rewarded with a discussion which elicited many points f interest. We shall refer in a later issue to the contents f these papers and the questions which arose in the iscussions. The attendance fell away with remarkable uddenness when the meeting turned its attention to the ext business in the programme, and Mr. T. F. Wall's con-ribution on "The Single-phase Repulsion Motor" was given o a gathering of 18 all told—probably there was some ounter-attraction elsewhere which exercised a greater pull t this particular moment. Interest was renewed omewhat when the more popular subject of human usceptibility to vibration was introduced by Captain I. Riall Sankey, on behalf of Mr. W. Pollard Digby and imself. The subject was both human and humorous, and rovided a welcome occasion for light reading and con-ersation after three hours or thereabouts of really serious roceedings. Two brief reports on gaseous explosions and luminium alloys respectively having been taken as read, embers betook themselves to a corner of the hall, where hey were able to discover, by means of the Vibragraph lready described in our pages, their own degree of usceptibility.

In accordance with the usual custom the Sections did not t on Saturday, but adjourned until Monday, when Section resumed its proceedings with the joint discussion on eronautics referred to by the chairman, and demonstrations wireless telegraph apparatus.

The following is a list of the papers and reports considered in ne Engineering Section (G), on Thursday and Friday last week, nd from Monday to Wednesday this week :—

Presidential address, Prof. J. H. Biles.
"On the Origin and Production of Corrugation on Tramway ails," by W. Worby Beaumont.
"The Anschutz Gyro-Compass," by G. K. B. Elphinstone.
"Electrical Drives for Screw Propellers," by H. A. Mavor.
"Electrical Steering," by B. P. Haigh.
"The Single-Phase Repulsion Motor," by T. F. Wall.
"Some Preliminary Notes on a Study as to Human Susceptibility o Vibration," by W. Pollard Digby and Capt. H. Riall Sankey.
Report of Committee on Gaseous Explosions.
"Some new Aluminium Alloys," by Prof. E. Wilson.
Joint discussion with Section A (Mathematical and Physical cience) on "Aeronautics," opened by A. E. Berriman.
"Recent Developments in Radio-Telegraphy," by Prof. G. W. O. owe.
"Portable Equipment for Wireless Telegraphy," by Capt. H. iall Sankey.
"Economical and Reliable Power Generation by Over-type Super-eated Steam Engines," by W. J. Marshall.
"Suction Gas Engines and Producers," by W. A. Tookey.
"Diesel Engines," by Chas. Day.
"Crude Oil Marine Engines," by J. H. Rosenthal.
"The Manufacture of Nitrogen Compounds by Electric Power," E. Kilburn Scott.
"Smoke Abatement; the possibility of fixing a new standard of noke emission from factory chimneys," by Dr. J. S. Owens.
"A New System of Continuous Transportation for Passenger and her services," by W. J. Lewis.

Among the papers, reports, &c., read in Section A (mathematical d physical science) were the following :—
"The Infinitesimal Transformation of an Electromagnetic Field to itself," by H. Bateman.
"A Friction Permeameter," by W. H. F. Murdoch.
"On the work done at the Bureau of Standards on the Absolute easurements of Electric Current," by Prof. N. E. Dorsey.
"The Specific Heats at High Temperature and the Latent Heats Metals. Part I, Aluminium and Zinc," by H. C. Greenwood.
Report of Committee on Experiments for Improving the Con-ruction of Practical Standards for Electrical Measurements.

In the Chemistry Section (B) a report on "Electroanalysis" was bmitted by a Committee; also a report on "The Present Position Electric Steel Making," by Prof. Andrew McWilliam, A.R.S.M., M.Met.; and a report by a Committee on the "Influence of Carbon and other elements on the Corrosion of Steel."

In the Agriculture sub-Section the following were submitted :—
"The Effect of Minute Electrical Currents on the Growth and Metabolism of Bacteria," by J. H. Priestley and Miss E. M. Lee.
"The Effect of High-Tension Electric Discharges and Current Electricity on Plant Respiration," by J. H. Priestley and R. C. Knight.

In the Physiology Section a report on "Electromotive Phenomena in Plants" was submitted.

Suction-Gas Engines and Producers.

By W. A. Tookey. *Section (G) (Abstract).*

The paper is essentially a comparison of engine performances on the test bed with results obtained in daily operation, together with some notes on the working costs for fuel, oil, labour, &c. The performance results cover suction gas-power plants of various types and different capacities when the output over the period of test can be measured by the generation of electric current and the raising of water, so taking into account the combined efficiencies of the electric or pumping machinery and that of the gas-power plant. The author acknowledges the abnormal conditions under which some "test" figures are taken, and offers further figures compiled from statements of users in various parts of the world, taking into account the variations of consumption due to the different grades of fuel used, the variations of output, load fluctuations, length of stand-by periods, and variation in the human element. From records of non-stop runs, it is pointed out how reliable these installations are and what little attention is really needed, provided the man in charge efficiently discharges his duties, and the engine is properly correlated to the producer, and the latter to the quality of fuel and the rate of its combustion. Figures relative to the consumption of lubricating oil are included, as being of special interest in view of the criticisms that have been made in this respect. These are moderate, especially when the oil is filtered for re-use on other machines. Capital cost for producers and engines erected is dealt with, including the cost of buildings. Finally, a discussion of the relative advantages of liquid-fuel engines of the Diesel type and of the suction-gas plant is given, the author inclining to the opinion that, although, according to test results, it would appear that suction-gas engines and producers are threatened by a competitor which offers nearly equal cost of operation, there are claims of a negative kind which must incline the balance of advantages in favour of the gas power plant, at all events for moderate powers, for surging loads, and for duties which

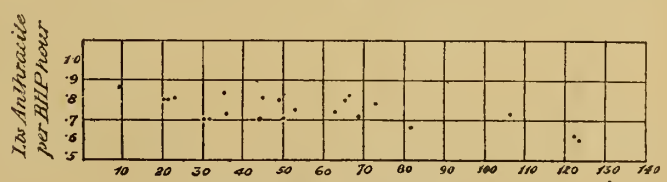


Fig. 1.—Chart showing Fuel Consumption in b.h.p. Tests.

many years of experience have shown cannot be efficiently performed with economy by compound condensing steam engines.

Dealing first with the b.h.p. tests, the author shows that, dependent on design and state of manufacture, the actual consumption of combined engines and producers working on anthracite is between 0·7 and 0·85 lb. per b.h.p.-hour, and that the uniformity of coal consumption ranges from about 10 to over 220 b.h.p. Most of the test results in his first table, on which he establishes these figures, are due to M. Mathot. Fig. 1 shows a target diagram, giving the fuel consumption results obtained under such test conditions, while fig. 2 indicates graphically the relation between the actual piston displacement per cycle per minute per b.h.p. developed and the coal consumption in lb. per b.h.p.-hour. It will be seen that the limits are closely defined. With best fuel and most skilled attention, 1 b.h.p. can be developed with a piston displacement of 3·5 cb. ft. per minute, while with conditions less favourable, a displacement of 4·5 cb. ft. per minute per b.h.p. is required. There seems to be no diversity in the consumption figures as a consequence of variation in the size of the unit. It is also shown in the table above referred to that when working at about half load the b.h.p.-hour can still be obtained from less than 1 lb. of anthracite under the average conditions of tests. In support of this, a test curve, by Prof. Aimé Witz, of a Winterthur engine fed with town gas was shown, the amount of heat admitted to the cylinder in the form of gas being plotted against kw. outputs, and it appears that the consumption in calories per kw. does not rise appreciably till the load is below one-half the maximum capacity of the engine.

The second portion of the paper deals with consumption figures in actual practice. The factory owner desires to know what he can expect the average consumption of a gas engine and producer to be when the engine is working throughout the day under loads that are ever varying according to the work passing through the driven machines, how far the test figures will be affected by the unavoidable losses due to the continued slow combustion of the fuel during stand-by hours, and also the probable total fuel con-

TABLE I.—Actual Working Results obtained from Combined Gas Engine, Suction-Gas Plant and Dynamo Sets.

H.P.	Maker.	User.	—	Kw.-hrs. per hr.	Fuel.	Per annum.	Lb. per Kw.-hour.	Pence per Kw.-hour.
Two 20	Campbell	Great Eastern Railway	46 hrs. per week	13·8	Anthracite at 31/6, and waste carbon-ends	£45	1·935	0·3265
65	Gardner engine (Mersey producer)	Walton-on-Naze Elec. Works	10 % load factor	—	Anthracite	—	2·9	0·632
96	Campbell	Broxburn Elec. Station	9 hrs. per day, 15 hrs. stand-by	46·5	Anthracite at 16/9	—	1·48	0·133
115	Hornsby-Stockpt.	Ascot District Gas & Elec. Co.	—	—	Coke at 16/6	—	—	0·197
120	Campbell	Workington Bridge & Boiler Co.	53 hrs. per week	37·9	Coke screenings at 8/- per ton	£52	2·9	0·1243
Two 250	Westinghouse (Campbell producer)	Davis & Timmins, Ltd.	273,583 units per yr. of 2,712½ hrs.	109	Anthracite at 30/-	—	2·15	0·246

sumption, in order to fix upon the maximum capacity of an engine he is about to purchase, as, although he wishes to provide plenty of margin to cope with future extensions, or to minimise the effect of the development of a fault in either the gas producer or the engine which may temporarily restrict the amount of power available per explosion, yet he does not want to put down a larger engine than necessary, if that larger engine will result in a greatly increased bill for fuel. The author gives what he believes to be reliable figures, compiled from users' reports received by makers of producers and gas engines. Fig. 3 shows graphically the relation of rated H.P. to hourly consumption of fuel, the uniformity of results being noticeable; only in one or two cases do the performances nearly approach the figure that would be reached if the fuel consumed amounted to 1 lb. per rated B.H.P.-hour—even when, as in all the cases mentioned, stand-by and all other losses are included. Speaking generally—and none but general assumptions can be made upon

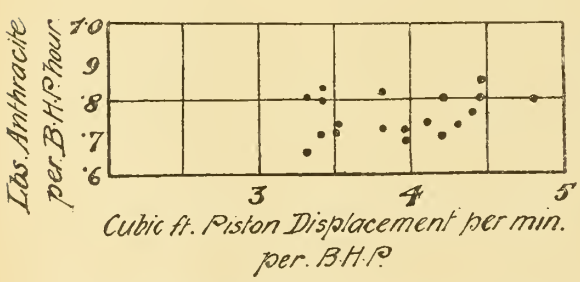


Fig. 2.—Chart showing Relation between Consumption of Fuel per B.H.P.-Hour and Specific Piston Displacement per B.H.P.-Minute.

such a table—it would appear that the average consumption of fuel of suction gas plants is at the rate of 0·6 lb. of fuel per rated B.H.P. per hour, inclusive of all losses. Taking the group of engines between 30 and 50 rated B.H.P., in a score or more of engines all working with different kinds of fuel, in different districts, in charge of men of different ability, driving machinery at work for different numbers of hours per day, and with different load factors, and with a constantly differing rate of output, involving, apart from differences in the size and styles of producers, different rates of fuel combustion per unit of fire area, it is to be noted that a difference of 10 lb. of fuel per hour or thereabouts represents the higher and lower limits of fuel consumption.

From this the author develops two arguments, the first being that no other form of prime mover in units of equal size can give the same low record of fuel consumption, and that even with the improvements in steam engine practice made in recent years, no type exists that with an efficient boiler can be sold at such a price and be run for such a cost as will successfully compete with the gas power plant. The second argument is that to obtain the best results from a gas power plant it is not only the production of good gas that matters, but also the admixture of that gas with a suitable quantity of air to form an explosive mixture within the walls of the engine cylinder. Upon the efficiency of such proportioning of the mixture on the part of the attendant depends the amount of energy obtained per working stroke, and thereby the power and economy of the engine are at once affected. That such low hourly consumptions can be so universally obtained with suction gas plants proves that the attendant is powerless to affect the economy to any appreciable extent, and conversely that the necessary manipulation is so readily learned that the factory owner can safely rely upon uniformly economical working. In a steam plant, on the other hand, it is well known that coal can be wasted by neglect to control the combustion during stand-by hours. In many cases, owing to carelessness or neglect, the stand-by losses are permitted to reach 10 lb. per stand-by hour instead of from 4 lb. to 5 lb., which is the usual figure in practical working. The lowest stand-by consumption known to the author is one of 1 lb. per hour, but this is rarely obtained, it being necessary, in order to ensure the fire being in a fairly active state for ready quickening in the morning to the gas-making temperature, to allow rather more air to pass through the furnace than is there implied.

The author then passes to the performance of suction gas plants and gas engines combined with dynamos or pumping plants. For electricity production test performances are given for plants varying from 30 to 250 rated H.P. running on gas works coke or anthracite. The consumption in pounds of fuel per kilowatt-hour ranges between 1·24 (a 45-H.P. Campbell-Morris-Hawkins set) and 1·675 (a 68-H.P. Tangye-Cie. Anon. Continentale combination), and in order to compare the test figures with those obtained per Kw.-hour in actual practice, with varying load factors and different conditions of working data, shown in Table I are given. From this it is evident that the average consumption, including stand-by losses and other wastage of fuel, the latter being burnt at different rates of combustion, and being of different grades of quality, amounts to about 2 lb. of anthracite per Kw.-hour. In cases where this figure is exceeded it will be observed that the fuel is coke, while in one instance the load is on the engine for only four hours out of the 24 when anthracite is used. The test results on the pumping plants, as expressed in foot-pounds of work performed per 100 lb. of fuel consumed by the different plants, vary widely, the author

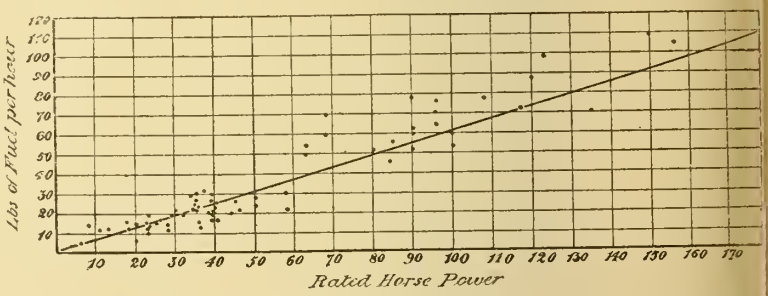


Fig. 3.—Actual Hourly Consumption of Fuel, including Variations due to Different Grades of Fuel, Load Fluctuations, Different Load Factors, Length of Stand-by Periods, Ability of Attendants, Rate of Combustion in Producer, &c.

explaining this by putting down the divergencies to the varying efficiencies of the pumping machinery.

As regards general reliability, the author quotes the statement made by, or on behalf of, the Workington Bridge and Boiler Co. after changing over from a compound horizontal enclosed engine with forced lubrication, fed by steam at 80 lb. pressure from a Lancashire boiler, that, "As regards reliability, there is practically nothing in it between the two; possibly the steam plant has the advantage, if anything, as regards actual stoppage." In this case the working costs were reduced from 1·195d. to 0·452d. per unit, including fuel, labour, oil, water, repairs, &c. The author points out that two developments in gas-engine design have improved its elasticity of output: the first is throttle-governing as opposed to the "hit and miss" principle, throttle-governing having the advantage of greater smoothness of running due to the graduated force derived from consecutive explosions, instead of a greater or lesser number of explosions of full intensity, which makes for so distinct an improvement, while the diminution of working stresses in the more important working parts gives consequent longer life. The other improvement is increased rotative speed. In the author's opinion the increase in the rate of power generation per unit of time, and consequent greater ability to deal with sudden increases of load without the slowing of the engine, is a very decided improvement. For any engine to be successful under working conditions, it is necessary that the generation of power shall be equal to the rate of absorption of power. Machinery of some descriptions demands an output of power, for perhaps but a few seconds, much greater than that required over a greater period. If the engine were to be no larger with regard to output capacity, but of quicker revolutions, the rate of power generation would be greater per instant of time, and it would thus be able to cope more successfully with momentary overloads. The higher speed of revolution that is now common practice, coupled with the improved method of throttle governing, undoubtedly brings the gas engine into a position more favourable to withstand the criticism of lack of overload capacity that has so frequently been levelled against it.

The author reviews the methods of lubrication adopted in older types of gas engine, whereas in most modern engines the lubrication of the cylinder and that of the gudgeon pin are separately provided for. Forced lubrication is fitted to the cylinder and the piston, the quantity of oil pumped per stroke being adjustable to

ieet varying grades of oil and varying temperatures which affect iscosity. The main bearings are provided with oiling rings, hich, constantly dipping during their rotation on the shaft into n oil-well formed below the bearings, enable the same oil to be sed over and over again without waste. Therefore, the con-mption of lubricating oil has now been brought down to xtremely low figures, while after filtration most of the oil can e used again upon the line shafting and general machinery of ne factory. In the latest types of gas engine there is a fair egree of uniformity in oil consumption to some extent indepen-ent of size, as shown in Table II. The reduction of consumption a third, due to filtering as shown in lines 3, 4 and 5, are inte-sting. As regards consumption of water for washing the gas, enerating the water vapour in the producer and cooling the engine rlinder, the author gives test figures due to M. Mathot, indicating iat the water used depends on the men in charge. The figures nge from 3·64 gallons per B.H.P.-hour for an Otto Deutz 22·83-B.H.P. engine to 15·15 gallons for a Delamarre 75·86-B.H.P. igine, other figures being given for generator only.

TABLE II.—Consumption of Lubricating Oil. Working Results.

Maker.	B.H.P.	Pints of oil per hour.	Remarks.	User.
Tangye	Three 63	0·422	Engine & pumps	N. E. Rly., York
,,	68	0·278	No filter 1st yr.	Cie. An. Continentale
,,	68	0·1044	Filter 2nd yr.	,,
,,	68	0·0947	Filter 3rd yr.	,,
,,	68	0·55	Engine & dynamo	—

much as 42 per cent. of the total heat value of the fuel is represented by the work performed upon the piston of the engine as recorded by the indicator, whereas the equivalent of a consumption of 0·7 lb. of anthracite per B.H.P. with a combination of gas engine and suction-gas producer would represent a thermal efficiency, on the I.H.P. basis, of but 31 per cent. The consumption of liquid fuel per B.H.P. with a Diesel engine is usually at the rate of 0·45 lb. per hour. The price of the oil fluctuates according to the ruling market prices, but for the present purposes can be fixed at 50s. per ton. At this rate the cost per B.H.P.-hour is about 0·12d. Upon the basis of 0·7 lb. of anthracite per B.H.P.-hour, 30s. per ton, the cost of fuel for the suction gas plant is 0·1125d. As far as fuel cost alone is concerned, there is not very much to choose between the two types, and the decision to install the one or the other must rest upon other considerations. One very serious consideration to the disadvantage of the Diesel engine is the matter of capital outlay, involving as this does not only increased annual standing charges for interest on the sum expended beyond the relative cost of a suction gas installation of equal power, but also the allowance for depreciation must be increased in proportion. In some instances, where the engines are of considerable capacity, and are working long hours with sufficient load to enable low consumption to be taken full advantage of, and where local conditions are least favourable to the gas power plant, the balance inclines to the use of the Diesel engine. But even then the gas power plant, calling as it does for attention of a less skilled nature, can frequently be run at a lower rate for attendance, while the consumption of lubricating oil is usually lower. As regards the semi-stationary steam engines combined with a high-pressure boiler with superheater, jet condenser, with two-stage or compound expansion, from test results it has been found that under full loads the consumption of fuel per B.H.P.-hour has been brought to the low figure approximately of 1 lb. of coal, and this being so, the steam engine has been able to show to much better

TABLE III.—Combined Costs for Fuel, Oil and Attendance.

H.P.	Maker.	User.	Remarks.	Fuel, pence per hour.	Labour, pence per hour.	Oil and stores, pence per hour.	Total, pence per hour.
Two 132	Campbell	Glaholm & Robson, Sunderland	Anthracite 104 tons, coke 52 tons, and town gas to eke out power	17·0	9·25	3·74	30·0
ne 140 and one 40	Crossley	Arrol-Johnstone Car Co.	Anthracite at 15s. 6d.	10·75	5·35	·642	16·75
Three 63	Tangye	N.E. Railway, York	—	7·0	6·0	·965	14·0
Two 150	Westinghouse	Davis & Timmins, Ltd.	Anthracite at 30s.	35·0	14·6	5·34	55·0
96	Campbell	Broxburn Elec. Station	Anthracite at 16s. 9d.	7·7	4·95	1·18	13·83
50	Hornsby	F. B. Grant & Co., Teddington	82 weeks, 4,587 hours	4·4	2·22	0·602	7·2
39	Tangye	Robt. M. Stirling, Glasgow	Anthracite at 11s. 6d.	1·18	1·0	—	2·18

Table III has been compiled to show the actual working costs per our of engines of various sizes, using fuel of different qualities nd at varying prices, as regards the three chief items of fuel, oil ncluding waste, rags and other stores, in some cases) and attend-nce. In engine repairs and renewals, the chief items of expense ccur in the renewal of piston rings, refacing and perhaps renewal f exhaust valve, re-boring or renewal of the cylinder liner. The earings require occasional refitting, but rarely need re-lining. As ar as the piston rings are concerned, the usual rate of renewal at the rate of about one a year. The exhaust valve may eed to be replaced about once every four or five years, while ne life of a liner and piston can be taken as on an average bout seven years. Of course, these periods vary according the actual number of hours worked during the periods eferred to, and according to the attention given to minor atters, such as re-bushing of levers, replacement of worn ns and spindles which, if neglected, may cause excessive eterioration of other working parts. As far as the producer is oncerned, the firebricks lining the generator require to be renewed bout every two years, for which the material costs little, besides ne time occupied in dismantling and re-erecting, which runs into bout three days. Generators made with sheet-steel casing will sually require patching around the part exposed to the action of ne heated gases within the ashpit after about five years of work, nd perhaps renewal of this portion about every seven years. Cast-on is preferable for this portion of the apparatus, but is only used or the smaller powers on account of first cost. Fire-bars will be anted about every two years or at longer periods, unless the re is worked at a high temperature, arising from an insufficiency f steam, which causes burning out. The cost of all these is not ore than that of similar work on steam plant, including eaning, scaling, preparing boilers for inspection, and repairs to uxiliary apparatus. As to capital outlay, the cost—including ngine, producer, pulley, water-circulating tanks, piping (to what as-engine makers call "standard arrangement"—that is, when ne component parts are disposed within about 20 ft. from one entral point), foundation and builders' work, and average labour erection, but not including cost of space occupied or any special uildings required—ranges from about £140 for a 10-B.H.P. instal-tion to about £1,100 for a 155-B.H.P. installation. From 150 50 B.H.P. the total cost is at the rate of about £7·5 to £8 per .H.P. From 40 B.H.P. downwards the rate per B.H.P. increases, anging from about £9 to £11·5 in the smallest size.

The author institutes some comparisons of suction-gas engines nd producers with Diesel engines and semi-stationary steam ngines. As regards the former, repeated tests have shown that as advantage than ever before in competition with the suction gas engine. In the latest designs of semi-stationary engines special attention has been given to accessibility of the boiler tubes and the superheater, to enable the necessary cleaning to be carried out with thoroughness and dispatch; but with a gas engine there is no excessive temperature or high pressure in any part of the apparatus other than within the engine cylinder, and then only for but a fraction of a second. A further advantage in favour of the suction gas engine and producer is that with the latter the attendant can be engaged in other work throughout the factory, and need give only occasional inspection when fuel charging at long intervals. With the steam plant, a man has to be constantly in attendance to keep the fire going, while it is well known that the manner in which the stoking itself is carried out frequently affects the fuel consumption by as much as 15 to 20 per cent. Water softening and purification plant, by adding to the capital cost, has sometimes to be added to the steam plant, while sudden fluctuation of load involves some waste of fuel in blowing off excess steam.

In conclusion, the author gives mention to the recent developments in the utilisation of factory waste, such as wood chips, sawdust, cotton seeds, &c., for producer fuel, and to the use of bituminous coal in the place of anthracite.

The Diesel "Oil" Engine.

By Charles .Day. *Section G.* (*Abstract.*)

The economical generation of power for industrial purposes depends mainly upon the following factors:—

1. (*a*) The attainable economy of working at different loads of the prime mover itself, including boiler or gas producer, and all accessories such as condensers, feed pumps, water pumps, &c.

(*b*) The degree to which this attainable economy can be practically maintained under the conditions of working, and the load factor.

2. The stand-by losses, *i.e.*, the expenditure necessary to keep the plant ready for work when wanted.

3. Wages of engine-room attendants, stokers and other men employed about the power house.

4. Expenditure on lubricating oil, cleaning, waste and sundry stores.

5. Cost of repairs and of the maintenance of all parts of the plant in good working condition.

6. The cost of water for condensing, and for boiler feeding in the case of steam plant, for the engine water jackets, and for the gas producer in the case of gas plant, or for the engine water jackets in the case of Diesel plant.

From the mere enumeration of these items, it is very obvious that tests either on makers' works, or on site, even though the tests extend for a week or so, do not form a sufficient guide as to the real value of the engines for industrial purposes, and that a far safer, in fact, the only safe conclusion, can be formed from a study of results obtained in actual practice. For instance, it matters not how economical an engine may be in regard to fuel if the expenditure in other directions more than out-balances the gain in fuel consumption.

In actual service it is not to be expected that power plant can always be kept and worked at its highest efficiency. The average results actually obtained over a term of years differ considerably from those attainable under the very best of conditions.

The great difficulty most buyers find is in securing reliable figures of power costs from people engaged in trade, except in the case of electric supply stations. The writer does not know of any body of large power users who systematically prepare accounts showing their power costs on a uniform basis and publish them. This practice in connection with electric supply stations fortunately does give an independent and authoritative basis from which valuable deductions can be made. The figures published in the *Electrical Times* cover practically almost all the supply stations in Great Britain, and this information, combined with information obtained direct from station engineers, has enabled the author to determine the average results obtained in such stations. With different types of plant these averages, for stations having a plant capacity not exceeding 1,000 H.P., are as follows:—

TABLE I.—Average Cost per B.T.U. Sold.

Type of engine.	Fuel.	Lubricating oil, waste, stores and water.	Wages.	Repairs and maintenance.	Total works cost.	Load factor.
Steam...	·45d.	·06d.	·25d.	·26d.	1·02d.	14·7
Gas ...	·43d.	·09d.	·28d.	·24d.	1·04d.	15·3
Diesel...	·23d.	·04d.	·19d.	·07d.	·53d.	14·3

The limit of 1,000 KW. was fixed owing to there being as yet no large electricity supply stations equipped solely with Diesel engines or gas engines. Of course, better results are obtained when driving machinery which gives a better load factor, but the causes which produce loss are, as a rule, the same, though modified in extent. The general conclusion formed from a study of electricity stations holds good for the great majority of power users, though, perhaps, not applicable to some special trades, where engines can be run continuously on almost uniform loads. It is also necessary to point out that the figures include some items which should not strictly be charged against the power plant. For instance, the wages items include figures for men working on cables, street lamps, and in sub-stations, whilst the repairs items include repairs to such parts. Also it is necessary to mention that the figures give the costs per unit sold and not per unit generated.

From the averages it is clear that a substantial gain is obtained by the adoption of Diesel engines, as against either gas or steam engines, the figures being beyond doubt substantially accurate. It is also noticeable that the gain is not only on fuel consumption, but is practically in the same proportion on the other items of expenditure.

The great saving shown by these average figures is confirmed by repeated experiences of the author. In many cases, although the figures guaranteed with Diesel engines have been no better than figures previously guaranteed, and obtained on tests, with existing steam and gas engines, the Diesel engines have shown over extended periods a saving of 50 and 60 per cent., and in some cases an even greater percentage, the result being due to the fact that the Diesel engine's average working results were very much nearer to the guaranteed figures than with gas or steam engines, combined with the fact that the relatively high cost of working at light loads with gas or steam had not been sufficiently taken into account when considering the guaranteed figures.

When going through cost records to prepare the average figures previously given, the author noticed very wide differences of cost per unit, particularly in the case of the steam plant. He therefore had the average cost calculated for steam stations of different capacity, and as the results are interesting, they are given separately in Table II.

The table shows the great improvement which follows increase of size with steam stations, or expressed in the reverse direction it shows how great is the disadvantage of small stations when steam power is used.

It is further to be noted that even with the largest steam stations, the costs per unit generated are no better than for quite small stations using Diesel engines, and this in face of the improved load factor. This is a most important point, and shows that small Diesel stations can profitably supply at prices hitherto thought to be obtainable only in densely populated centres having large power stations.

In all cases the figures which have been given are works cost, and do not include anything for interest on capital and depreciation. It is hardly possible to give a definite statement showing the cost of constructing and equipping power houses of different types, as there are so many variable factors. However, the author's experience of a considerable number of estimates indicates that up to a capacity of, say, 1,000 KW., there is generally little difference between the gross capital expenditure required, whether steam, gas or Diesel engines be adopted.

Having now dealt with what may be termed the commercial aspect, it may be well to study briefly the constructional features desirable in engines for dynamo driving. For speeds

TABLE II.—Average Works Cost per B.T.U. Sold, on Steam Stations of Different Sizes.

Capacity of station not exceeding	Fuel.	Lubricating oil, waste, water and stores.	Wages.	Repairs and maintenance.	Total.	Load factor.
KW.	d.	d.	d.	d.	d.	
250 ...	·63	·09	·35	·36	1·43	13·2
500 ...	·56	·06	·27	·29	1·18	13·3
750 ...	·43	·05	·23	·24	·95	15·4
1,000 ...	·40	·05	·23	·21	·89	16·8
1,500 ...	·42	·04	·17	·18	·81	16·9
2,000 ...	·37	·04	·16	·21	·78	17·7
3,000 ...	·33	·04	·15	·17	·69	17·4
4,000 ...	·40	·03	·14	·20	·77	18·8
5,000 ...	·34	·03	·11	·16	·64	18·7
7,000 ...	·36	·04	·13	·20	·73	17·9
10,000...	·26	·03	·09	·13	·51	22·6
20,000...	·30	·03	·11	·16	·60	19·6
50,000...	·23	·02	·10	·11	·46	20·56

which are not slow, engines of the multi-crank type become desirable, otherwise serious vibration is likely to be caused. For the same reason it is important that the distance between the centre lines of the cylinders of an engine be reduced as much as possible, and on this account the vertical construction is much more suitable than the horizontal, and gives much better accessibility. The vertical design is also better from the point of view of piston wear.

Very complete enclosing, combined with forced lubrication, is in the author's opinion an absolute essential for high-speed engines, whether steam, gas or oil. With the first few oil engines to which forced lubrication was applied, a portion of the lubricating oil got drawn up into the cylinders. Improvements in construction have, however, completely overcome this, and now the oil consumption is quite as low with the forced lubrication as with the ordinary systems. For moderate speeds of revolution, ring lubricating main bearings are thoroughly satisfactory, combined with centrifugal lubrication to crank pins. With such an arrangement less complete enclosing meets all requirements of cleanliness.

There is another point in regard to the multi-cylinder design of engine which should be mentioned, viz., that with this design a smaller diameter of cylinder is required for a given power than with a single-cylinder engine. With internal combustion engines this is of great importance, as, after a certain size, every enlargement of cylinder diameter brings with it increased constructional difficulties, and a greater liability to breakdown.

Turning now to the particular features of the Diesel engine itself, Carnot enunciated the conditions required for a perfect heat engine, and Diesel propounded a scheme which to a certain degree met the Carnot conditions. The original cycle has become modified to that now adopted, which may therefore be claimed to be the nearest to the Carnot cycle which present day practical limits admit.

The heat efficiency of the Diesel engine, though far from perfect, is still much better than that of any other heat engine, as is readily seen from the fuel consumption, which is 0·44 lb. of fuel oil per B.H.P. per hour. The fuel consumption is also low at partial loads, viz.:—¾ load 0·45 lb., ½ load 0·47 lb., and ¼ load 0·62 lb. per B.H.P.-hour.

These are not records, but everyday figures, and are for engines of quite moderate size. With larger engines the fuel consumption per H.P. is rather lower, but increase of size does not give anything like the improvement in fuel consumption that occurs with steam engines. This is a point to be remembered when fixing the size of engine to be adopted in a station. With steam plants the size of engine should be kept up, whilst with internal combustion engines the size within certain limits can with advantage be kept down.

Owing to the high economy at light loads it is often found distinctly advantageous to run a Diesel engine in preference to using a storage battery.

The oil generally used is residual petroleum, *i.e.*, the residue left from petroleum after the lighter oils have been distilled off. The increased demand for petrol will certainly tend to increase the further supply of residue, whilst the opening up of new oil wells in various parts of the world is steadily increasing the oil supplies. Not only is residual petroleum used for Diesel engines, but residue shale oil and gas works tar oil are now much used.

The fuel oil used can be almost any of the fuel oils which are used for boiler firing, and a wide variety of oils can be used with no alteration of the engine, this being probably explained by the fact that a pulveriser which will sufficiently pulverise a thick, viscous oil can easily pulverise the thinner oils. The use of oil fuel carries with it certain advantages in the way of ease of handling and of cleanliness. With coal it is difficult to avoid dust, and this must be particularly objectionable in the case of steam plant where the engines are carried on the boilers, thus placing a considerable quantity of moving machinery in the neighbourhood of the coal.

ith oil there are no ashes to cart away, and thus handling of ritty materials is entirely eliminated. Usually the oil is pumped om an outside storage tank to the small tanks near the engines.

The question may naturally be asked whether Diesel engines are itable for long periods of continuous running. In reply to this, ie following instance may be quoted.

At the Birkdale electricity works a Mirrlees-Diesel was put down little over four years ago. The station engineer recently made a turn, which showed that the engine had on the average worked 3¾ hours out of every 24 hours throughout the four years, or an verage stoppage of about 1½ hours each Sunday.

Numerous cases could be given of large savings effected, but the gures already given substantially prove this, and are, perhaps, ore appropriate for a paper of this kind.

Diesel engines of the Mirrlees make have been fitted on board any warships and first-class cruisers, for driving dynamos; also me have been used for boat propulsion. It might be of interest mention that the first Diesel engine made in Great Britain was Mirrlees-Diesel engine, and was made over 14 years ago, consequently the present Mirrlees-Diesel engines represent quite a long perience; and the present appreciation of this engine is not a mporary boom, but is based on substantial experience.

TELESCOPIC METAL MASTS.

s the Komet type of telescopic metal poles* use is made of a eries of concentric steel tubes able to slide one into the other like ne tubes of a telescope. Any or all of the sections can be run up, ut it is automatically arranged that the inner (smallest) tube oes up first, the next larger then following, and so on; no tube an rise till the next smaller one is fully extended. The tubes are ach strengthened by three steel rings (A, B, C, A′, B′, C′, &c., fig. 1), hich further serve the purpose of holding each tube concentric ith the one beneath it (A, B, A′, B′, &c.) and of interlocking with he flange (B, B′, &c.) on the tube above (C, C′, &c.).

The actual raising device consists of a flexible band of steel S S, f thickness varying with its width (and usually ranging from to 8 mm.), provided with shoulders along its length equal to the istances between A′ A″, &c. (fig. 1) when the mast is fully

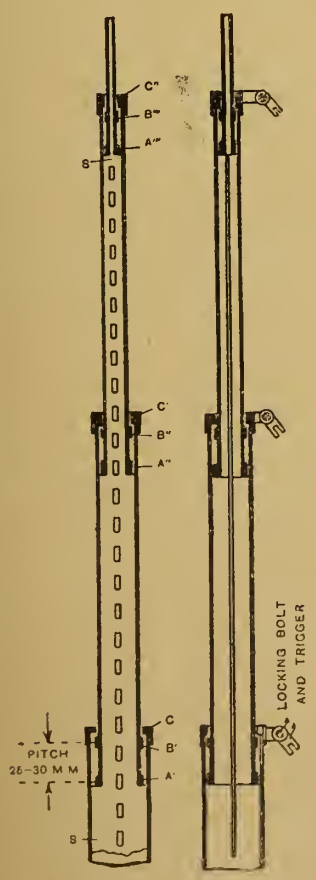


Fig. 1.

extended. This band fits inside each tube it penetrates, with no more than a mechanical clearance; when the mast is lowered, it is stored on a drum D (fig. 2), being then fed up as required by the toothed winched drums *d d′*. The drum *d* carries teeth which engage with rectangular slots in S S and suitable recesses in *d′*.

The top of each tube is split for a short distance down its length, and the collars C, C′ can be tightened by a double-threaded bolt to which is attached a projecting lever or trigger (see fig. 1). As each section of the mast, from the centre outwards, is fully extended, the next is automatically released, and, on its commencing to rise, its clasping trigger engages with a stationary pin; the double-threaded locking bolt is thus given a quarter turn, tightly clamping the fresh section to the one last erected.

The masts are generally circular, but may be square in section; in the first case, the elevating band is placed diametrically within the tubes; in the second, diagonally. Any desired temporary fittings

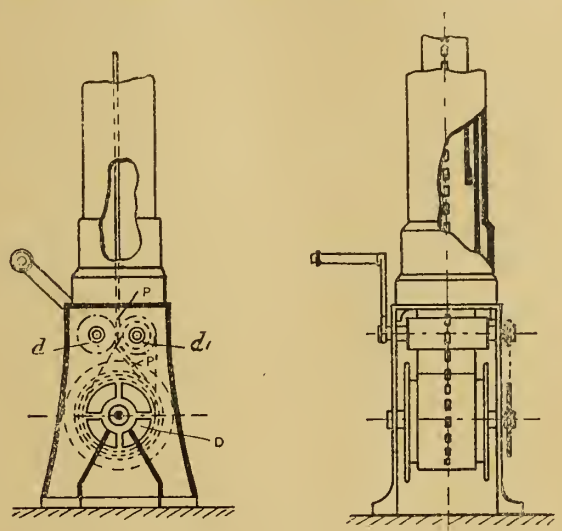


Fig. 2.

may be secured to the mast as its sections are elevated, and any permanent attachment may be used which will not interfere with complete "nesting" of the sections.

The weight of a conical mast of 25 m. (82 ft.) maximum height is about 120 kg. (265 lb.), while a pyramidal mast capable of extension to 10 m. (33 ft.) height and able to carry four observers (for military manœuvres, &c.) weighs 110 kg. (242 lb.). For "wireless" work a special mast capable of extension to 70 m. (230 ft.) has been made; this can be raised by four or five men in 25 minutes.

In the writer's opinion, the weakness of this system lies in the very great stresses set up in a steel band by winding it round such a comparatively small drum as D (fig. 2) must necessarily be.

Assuming the yield stress of the steel to be 17 tons/sq. in., and the ultimate strength to be 28 tons/sq. in., the drum diameter, in order that the skin stress due to bending may not exceed—(*a*) elastic limit; (*b*) 7 tons/sq. in. (f.s. of 4 on ultimate strength) must be, respectively, 610 cm. or 1,480 cm.—both of which dimensions are here impracticable.

It is clear that the band might easily be bent at P P′ (fig. 2) to a yet smaller radius than that of D, and, in any case, it seems to be impossible to avoid stressing a considerable length of the band S S far beyond its elastic limit. The mechanical properties of the metal would thus be seriously deteriorated. The band would receive a permanent curved "set," most of which would be forcibly removed every time the mast was erected. Apart from the great "fatigue" set up in the metal by frequently removing the "set," the band would take advantage of the small clearance necessarily allowed between its width and the internal diameter (or diagonal) of the tubes, to retain a certain amount of sag within the latter. The frictional resistance to the elevation of the masts should, therefore, be excessive, and one would expect serious scoring of the internal surface of the tubes. The increased clearance thus formed would aggravate the trouble.—R. E. N.

* See *Zeitschrift des Vereins deutsches Ing.*, October 22nd, 1910; also *Le Genie Civil*, 1911, page 102.

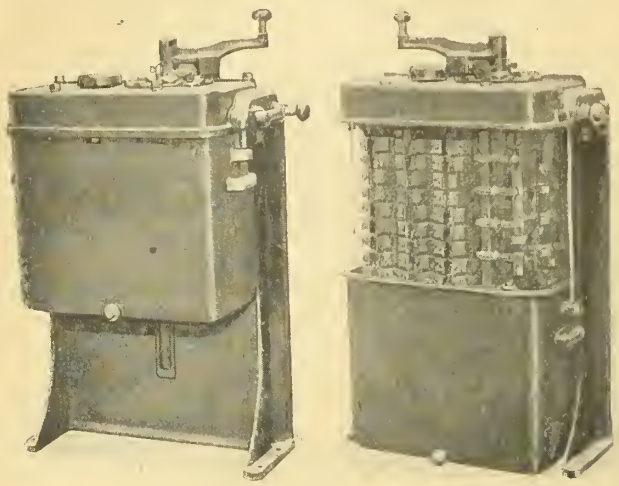
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Reversing Controller for Induction Motors.

Messrs. Dick, Kerr & Co., Ltd., of Abchurch Yard, E.C., have recently introduced a new type of contactor controller, with a view to avoiding entirely the use of contacts rubbing on a slowly-moving drum for the make and break of currents, thereby ensuring that, however severe and exacting the conditions may be, the maintenance shall be extremely low. The contactor system gives a quick break and make, and maintains the surfaces smooth and clean, and at the same time has a minimum of wear on the contacts.

It will be seen from fig. 3 (p. 372) that there is a fixed frame on which are mounted the spindles A 1, carrying movable arms A 2, to which are fixed contacts A 3, each spindle carrying the number of arms with contacts corresponding with the steps of the rotor resistance, of which there are usually nine, with one step full resistance. These arms A 2 have a rotating movement on the spindle and also a small lateral movement, the combination of these movements ensuring that the contact pieces shall approach one another (when making circuit) at such an angle as to ensure a good wiping-action contact on the fixed contacts B 1.

Each of the movable contact pieces A 3 is held extended to the left by means of a spring, the spring movement being limited by blocks A 5. This addition ensures that in each case, when contact is made between the two contact pieces A 3 and B 1, any wear or unevenness of alignment relative to one another will not cause



Figs. 1 and 2.—Dick, Kerr Reversing Controller for Induction Motors. Closed and Open.

sparking, as in the closed position perfect contact is made against the full compression of this spring. Fig. 4 shows one of these movable contacts on a larger scale.

It will be seen from fig. 3 that a main operating pillar C is actuated by means of the controller handle, and carries a number of cams, each cam being appropriated by one of the movable cradles A 4, on which are pivoted the movable contact arms A 2.

In addition to this, the operating pillar has a cam E (see fig. 5) with a recess into which projects a roller F 3.

The first operation of the handle moves the cam E, closing the stator circuits. At this point the motor is connected to the line with all resistance in the motor circuit.

The next and following notches actuate the movable contacts in turn to make contact with the fixed contact pieces. An automatic

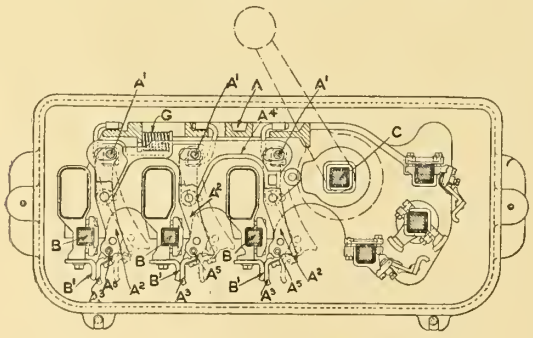


Fig. 3.—Plan of Controller Mechanism.

notching device is also attached to the handle, which prevents the operator from moving forward more than one notch at a time. The time automatically allowed between the notches permits the motor to accelerate the requisite amount before it is possible to pass to the next notch.

When it is desired to stop the motor, the controller handle can be brought rapidly to the "off" position, the whole of the

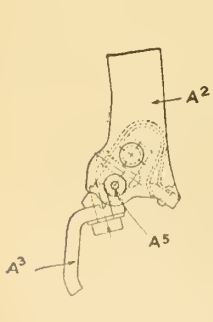


Fig. 4.—Detail of Movable Contact.

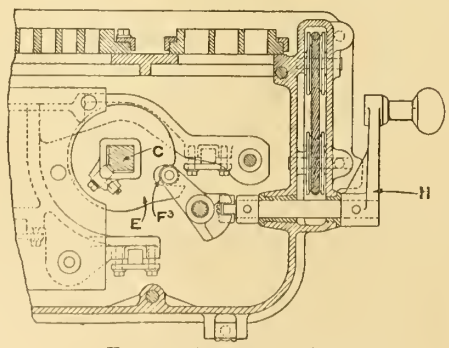


Fig. 5.—Operating Pillar and Reversing Handle.

speeding-up action being reversed, and the stator connection being broken last.

For starting-up the motor in the opposite direction the handle H is brought into operation, the movement of which raises or lowers the reversing drum, so that the stator connections are reversed.

The reversing handle is locked in position by the first movemen of the controller handle; also the controller handle is locked by the reversing handle in any intermediate position of the latter.

The casing of the controller moves vertically up and down in guides, the whole of the weight, including that of the oil, being taken by a counterweight.

The whole of the current-carrying parts are immersed in oil, and the lowering of the controller case, which contains the oil, leaves the whole of the contacts exposed and at a convenient height for inspection or repair.

These controllers are usually supplied with 10 positions in either direction, and, although this number is rather less than is usually considered necessary in a drum type of controller, it has been found in actual practice that a much smoother acceleration is obtained than is possible with the older type.

The controllers can be supplied in two forms—for three and two-phase wound rotors; both can be used for either balanced o unbalanced regulation.

The average dimensions are 5 ft. high × 2 ft. 7 in. wide. The operating handle is at the top, as in the tramway type of controller and the reversing handle on the right-hand side.

DEFECTS AFTER THE COMPLETION OF WORKS.

[FROM A LEGAL CONTRIBUTOR.]

When does the liability of a contractor come to an end Assume that he enters upon the job and does the work t the satisfaction of the engineer, as the case may be; can he then wash his hands of the whole business, and disclaim all further responsibility?

Much depends, of course, upon the terms of the engineering contract. It may contain a clause which renders the engineer's approval of the work final and binding between the parties, or it may not. Thus the decision of the engineer may be subject to review in accordance with the arbitration clause of the contract. Again, there may or may not be a maintenance clause imposing liability upon the contractor to maintain the work even after the final certificate has been granted.

With a view to testing and ascertaining the duration of contractor's liability, let us take a perfectly simple case. Assume there is an ordinary contract by which the contractor must do the work in accordance with a specification drawn up by an engineer. The work and materials are to be approved by the engineer; the contractor does the work; the whole job is passed by the engineer; and the final certificate is issued, and payment of the final instalment of the contract price is made. Some time later, foundations begin to give way and damage is done to the extent that a great part of the superstructure is damaged and has to be renewed. Who is liable?

Apart from the terms of the contract, it is manifest that the contractor could not by any possibility be held responsible for defects arising in the course of time from wear and tear. But if there is a structural defect which ought to have been detected and put right when the works were in hand, it is conceived that the contractor remains liable for that.

The time at which the defects become apparent has material bearing upon the question of liability. Thus, a breakdown 10 years after completion may be due to ordinary wear and tear; while if the same mishap were to occur within a month of the contractor handing over the work as complete, it would require very strong evidence to show that he was not at fault. It is impossible to lay down a general rule by which the liability of the contractor can be ascertained. The time; the nature of the defect; the kind of use to which the work is put—all these things are matters which the Court would have to consider in arriving at a decision.

The following points have been clearly decided:—(1) That mere acceptance of the works by the employer is no answer to a claim by the employer in respect of defective work; and (2) if there is a settlement between employer and contractor, it is a question of fact whether that settlement is intended to cover future as well as past claims for damages. In Jones *v.* Bright, 1829, 5 Bing. 533, the plaintiff bought copper sheathing from the defendant, and used the same upon a ship. The plaintiff sent the ship on a voyage; but the copper instead of lasting four or five years

usual, became corroded and useless after four or five onths. It was held that the plaintiff was entitled to eover damages, although he accepted the ship.

Circumstances may arise, however, in which the certificate an architect or engineer may prevent the employer making claim for defects. Thus it was decided in the case of ord Bateman *v.* Thompson, 1875, 2. H.B.C. 23, that here a certificate of completion and satisfaction by the nployer's architect is made conclusive and is given, the em-oyer has no right of action against the builder for defects ibsequently discovered, except within the time and upon ie terms specially stipulated by the contract. The facts of iat case were somewhat peculiar. The work done by the ntractor was disgraceful, but a period of six years elapsed etween the completion of the work and the beginning of the tion. The architect, however, had approved the work and aterials, and had duly certified the amounts due under the ntract from time to time. Lord Coleridge, C.J., clearly nunciated the principle which led the Court to say iat an action would not lie against the con-actors. He said :—"This is the ordinary case, not an arbitration, but of the employer having made the certi-cate of the architect binding in certain cases against himself, nd still more of his having made his own expression of atisfaction binding against himself. And having received ie one and having expressed the other, he cannot now say iat he did not receive the one or did not express the other. t may seem a hard thing to say, but the answer is the nswer which Mr. Justice Wills gave in the case of Goodyear . Mayor of Weymouth, 1865, 35 L.J.C.P. 12, that if you mploy an architect who does not know his business, and who ertifies that he is satisfied when he ought not to express atisfaction, you must be bound by his mistake. It is not n the least an answer to say that you have employed an rchitect who does not know his work, and if people employ rchitects who do not know their work, and who lead them nto mistakes, and place contractors bound hand and foot into he hands of such persons, and such persons either pass ad work, or, as it appears in this case, actually direct bad ork, they cannot afterwards in equity or fairness turn round n the contractor, and say, 'Now I will bring an action for amage that I have sustained, because you have fulfilled the irect instructions of a man whose authority I made binding pon you ; but as he did not know what he was about, and ecause I have suffered damage from an authority which myself made despotic over you, I now turn round upon ou to make you liable for the damage I have sustained.'"

In one case (Sharp *v.* The Great Western Railway, 1841, 11. L. J. Ex. 17) the plaintiffs had manufactured certain ocomotive engines under the following contract :—"Each ngine and tender to be subject to a performance of a dis-ance of 1,000 miles with proper loads, during which trial Messrs. S. & Co. (the plaintiffs) are to be liable for any reakages which may occur, if arising from defective naterials or workmanship ; but they are not to be respon-ible for, nor liable to, the repair of any breakage or damage whether resulting from collision, neglect or mismanagement f any of the company's servants, or any other circum-tances, save and except defective materials or workmanship. The performance to which each engine is to be subjected to ake place within one month from the day on which the ngine is reported ready to start ; in default of which Messrs. S. & Co. shall forthwith be released from any respon-ibility in respect of the said engine ; the balance to be paid on the satisfactory completion of the trial, and release of Messrs. S. & Co. from further responsibility in respect of such engine." It was also agreed that the fireboxes should be made of copper, of the thickness of $\frac{7}{16}$ in., and they were accordingly so made, and that the best materials and workmanship were to be used. The engines performed the distance of 1,000 miles within the month of trial, but nine months afterwards the fire-boxes of one of them burst, when it was discovered that the copper had been considerably reduced in thickness. In an action against the defendants for the balance due from them, it was held that they could not give evidence of an inherent defect in the copper, no fraud being alleged, since, by the terms of the contract the month's trial, if satisfactory, was to release the defendants from all responsibility in respect of bad materials and bad workmanship.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Arcana Imperii.

A few days ago I happened to be a passenger on a certain city tramcar, and could not help but notice the way the car was stopped and kept waiting for so dignified an official as the chairman of the undertaking. The car had got some 30 to 40 yards from the last *official* stopping place (which was not one of the "Cars stop by request"), when a person came out of an hotel, hallooing and brandishing his arms for the car to stop, which it did when the conductor saw who the person was.

A fellow-passenger remarked, "It's the chairman of the trams," and several other remarks I heard, which were, to say the least, not at all complimentary to the one under discussion.

This tramway system is supposed not to pay, and I think there is a special rate in the city to make up for the working deficiency. Perhaps they would be a benefit to the rate-payers, if punctuality and non-favouritism were demonstrated to those in charge of a car by the officials, and especially by so high an official as their chairman.

Double-Gloucester.

Labour Troubles.

Under this heading there has recently been proceeding in your columns a correspondence arising out of several leaders which have appeared on the same subject. The attitude evinced in the latter has been one of undisguised antagonism to the workers, and their position has been totally ignored. As a reader of the Review for several years, I have observed that the invariable attitude taken by it upon any labour question is that of urging the claim of the employer to squeeze every possible ounce of profit out of the workers. The only point of view it appreciates is that of the employers. This, of course, is only natural. It represents the views, in general, of manufacturers, with whose interests those of the paper are closely bound, and it takes the view of these things which is dictated by its own interests. Be it said to its credit, however, that it makes no claim to impartiality.

This, however, cannot be said of your correspondent, Mr. Wyatt, who prefaces two columns of mostly irrelevant remarks anent the subject, written in a spirit of hostility to the working class, by an avowal of his impartiality and of his sympathy towards them. Sympathy the working class are always offered in unstinting quantities ; where they ask for anything more concrete they get batons and bullets.

The sophistries of this gentlemen hardly call for reply. He totally ignores the facts of the situation. This is the position, and if Mr. Wyatt is interested in these matters, he will leave the quack remedies of German and any other bureaucracy and study it.

Labour applied to natural resources is the sole source of wealth. Nothing possessed of economic value can be produced save by the application of human energies, mental and physical, to the raw material of nature. Society is divided roughly into two classes—those who own the raw material of nature (in which I include, for the present, such things as machinery, railways, &c., which are the medium between man and nature) and those who do not. The latter class, possessing no property, in order to live must obtain permission from the owners to work. In other words, they must sell the only thing they possess, namely, their power to labour. The ownership of the means of life constitutes one small section of the community, the masters of the remainder.

All wealth, I repeat, is produced by the application of human energies to the raw materials provided by nature, but those who apply this energy, the workers, when they have produced wealth, do not own it. It is taken by the people who own the means of production.

Those who produce, those upon whose exertions society is founded, and by whose exertions its continued existence

alone is possible, do not own the wealth they have produced. Therefore they are poor. They produce all food, they have the worst: they build palaces, and live in hovels: they construct motor-cars, and walk: they make fine clothing, and wear shoddy: they make boots, and have scarcely a pair to their own feet. In return for their labour power they receive, on the average, a bare subsistence rate, called their wages.

These are facts within the cognizance of all of us; the cause is:—That the means of life, which are essential to everyone of us, are owned by a few members of the community.

The workers do not completely realise this yet, but they do realise the contrast between their lot and that of their masters. Their everyday experience tells them that their condition tends to become worse, and that the insecurity of their existence becomes more pronounced year by year. They are learning their power, and the recent strikes are a revolt against their conditions.

Mr. Wyatt may talk glibly about the "unenlightened multitude," but it is the "unenlightened multitude" that makes the mare to go; let them stop work, and we soon see who are the essential factors in modern production.

He reproaches a previous correspondent with "waving aloft the flaming torch of class hatred and enmity." With the unprovoked (see *Manchester Guardian*, &c.) Liverpool shambles yet fresh in the mind; with the spectacle of the country patrolled by the British Army to protect the property, and intimidate the striking employés, of the railway companies; with the remembrance of how the Press of the country, almost without exception, shrieked hysterically for the maintenance of "law and order," recommending the copious administration of grape-shot: this accusation of exciting class hatred is, to say the least, distinctly ingenious.

W. J. G.

Liberty is a glorious thing,
A spendid demonstration of
Unity, Loyalty and Solidarity.

No doubt we can all subscribe our admiration to the above sentiments expressed by your correspondent "Labour."

But has Trade Unionism these expressed sentiments as its basis? Decidedly not. It is a most pernicious form of individualism.

The Trade Unionist, in seeking to free himself from the economic forces that everyone has to contend with, loses his freedom and becomes a slave to his union, the tool of a set of agitators, who have themselves broken the economic bond by posing as liberators, demanding, of course, pay from their slaves.

It is above question that the leaders of these strikes, the leaders mind, for these are the men that other misguided men are following, are not men (to put it exceedingly mildly) most of us would care to acknowledge in that capacity.

As for unity, loyalty and solidarity, Trade Unionism prostitutes these virtues. To whom is the Trade Unionist united other than to his particular friends, *i.e.*, men in his own trade *and members* of his union? Do men of the stamp of Ben Tillett impersonate the Promethens, the enlightened democracy, your correspondent, assuming the prophetic air, speaks of? If so, may Heaven save us from such loyalty and solidarity!

Now, let me give you the straight tip, Mr. "Labour." We all want unity, liberty and solidarity, and, what is more, I feel sure that our country means to maintain it inviolate, as far as it lies in its power.

But, Mr. Editor, I think you will agree that there is something to be said in mitigation of these unfortunate occurrences. The growth of Trade Unionism, however ineffective as an objective force, has to be reckoned with. It is a force that has grown for some purpose, and, like all evils, must be met fairly and squarely. I must admit, however, that I do not feel competent to go into this matter, because it seems to me that the remedy lies in a direction which strikes a blow at our democratic constitution, and for a weak individual such as myself to offer suggestions of so drastic a nature, would be unwise.

But I might just say that Mr. A. W. Wyatt, who contributed to your "Correspondence" columns of August 18th, makes a remark which I believe has a very importa bearing on this matter. He says, "The day of the sm employer who could take an individual interest in each his employés is past, and big combines, without a soul conscience—(I have heard them described as being witho a body to kick, or a soul to save—T. G.)—have taken place." Yes, the loss of this intimacy between emplo and employé accounts for a good deal of the trouble.

Yet, I am sanguine enough to believe that there are s a number of employers who have not lost all respect their employés. Also, that there are still a large number the latter, who realise that the poverty of the employer deal with the economic situation is as great, nay, e greater than his own. Strikes are undoubtedly a natio calamity, and it does seem a pity that some courageous s is not forthcoming to stem the torrent of revolution and neutralise the wild tirade of the agitator.

It is useless for us workers to allow our dissatisfaction get the upper hand of us in this way, by the fomentations men who are mostly non-workers. For we must remem that even those who are better off, from a monetary point view, have their difficulties to meet and deal with. must remember that we all are members of one great Empi and that to become so sharply divided against ourselves i serious menace to our future welfare.

United we stand;
Divided we fall.

And we stand or fall all together. **T. Gaunt**

[Since this section of the Review was closed, we ha received other communications which we do not regard useful contributions to this correspondence; but as bo sides have now had a sufficient opportunity for expressi their opinions, we do not propose to continue the pres discussion. As to whether the question is one coming witl the province of a journal whose *raison d'être* is to watch matters which have a bearing upon electrical engineeri industry, we have very definite convictions. Further, wh every reader knows that we have always allowed both sid full and equal opportunity for considering the merits of a question, we decline to publish useless tirades or perso abuse. If writers will bear this fact in mind it will sa them some disappointment.—Eds. E.R.]

Publicity Literature.

The adverse criticism on the literature published by t supply companies and corporations, is, to my mind, somewl unwarranted.

Possibly this advertising matter is not all that could desired, but one must take into consideration the difficult of the proposition. Here is what we may term a new pow about which the general public know but very little. T question is, where is the line to be drawn between t adoption of popular language and technical language? A to what extent is the suggested educative policy to applied? The latter is the most important point raised the article.

Your correspondent looks forward to a time when soi elementary work will be produced on electrical matters. E however, overlooks the fact that, generally speaking, t prospective consumer is not interested in electricity, beyo its application to his needs. Any attempt to burden hi with voluminous detailed information and instructive matt even though it may be "elementary," will result in impression that the adoption of electricity involves a gre deal of trouble. He does not want to know all about ser burning, metallic filament lamps and transformers. T question is, how much does it cost to use electric ligh What saving is effected? What advantage does it poss over other methods of illumination? All these and oth questions can be answered without recourse to technic language.

The constant driving home of the merits of electric lig through the medium of the Press and attractive circula &c., will, sooner or later, make a favourable impressi and produce inquiries. It is then the duty of the canvass to turn these inquiries into business. He has the advanta of being able to study each individual case, and apply su able arguments. When he meets a prospective customer

inquiring turn of mind—then, and then only, is it safe go into the technical side of the question.

It is not so much the quality of the advertising matter at is at fault, as the limited amount of advertising and ·cularising that is being done. For instance, I have ·ed in a 12 roomed house for nine years, and so far have t been approached by the Corporation electricity works ·her by letter, circular or personal call. I am sure, how-·er, that the time will come, as the efforts of the Publicity ·mmittee are progressive, and they have already done much further the use of electricity.

A. J. Greenly.

London, E.C., *September 5th*, 1911.

THE OFFICE AS A WORKSHOP.

By EDWARD G. FIEGEHEN, A.M.I.Mech.E.

In all engineering establishments we may classify the ·ployés under two main headings—workmen and staff.

During recent years the detailed organisation of our ·orkshops has received much attention—with the result that ·ery facility and encouragement is now given to the work-·en to maintain the high rate of production shown to be ·ssible under favourable and systematic conditions of ·rking.

The new school recognises the indispensability, in addition purely mechanical facilities, of such items as adequate ·hting, efficient ventilation and heating, and a prompt ·pply of materials and instructions to secure the best ·sults.

The improvements in the construction of machine tools ·d the introduction of improved tool steels, have, of course, ·ntributed largely to recent progress, but with this factor e are not at the moment concerned.

The benefits arising from the reorganisation of our work-·ops, we may add, has been shared fairly equally by master ·d man.

On examining the progress made in the offices during the ·me period, we find certainly a noticeable increase in the ·mber of labour-saving devices in use, but on all sides a ·d lack of intelligent organisation designed in a similar ·anner to obtain the best possible results from each ·ployé, and this in spite of the fact that the average rate pay is here somewhat higher, and that the staff have pre-·sely the same human characteristics as their fellows in the ·ops, the sedentary nature of their occupation making ·em if anything more susceptible to their surrounding ·nditions.

Many firms who possess the most up-to-date workshops ·e still content with office buildings, the many defects of ·hich are not by any means conducive to economy and ·ficiency, and, in such cases, one is tempted to suggest that ·e manager who has so successfully applied his knowledge ·the conditions favourable to maximum production on the ·orkman's part, should now turn his attention to the ·nelioration of the conditions under which the clerk and ·raughtsman work.

He will find in many cases that the lighting is defective ·ther in quantity or direction, and consequently at the end ·f the day many of the men are suffering more or less from ·eadache due to eye strain.

To a draughtsman especially, the appropriate direction of ·e light is most important, and to be compelled to work in an ·nfavourable light is a serious discouragement to the most ·ndustrious man.

In the shops, owing to their height and floor area, special ·rrangements for ventilation are rarely needed in this ·ountry, although certain systems of warming shops by hot ·ir perform this additional function.

In the offices, on the other hand, the limited air-space per man presents a clear space for adequate ventilation, and yet we rarely find any provision of the kind.

Many manufacturing engineers' "offices" are merely spaces partitioned off in a temporary manner from the works, and, in the natural desire to avoid encroaching unduly upon the "productive area," the floor space allotted to the staff is often merely sufficient to secure what may be termed "mechanical clearance."

An increase in the number of workmen employed may, of necessity, be accompanied by the erection of additional bays, but the accommodation in the office will generally remain unaltered, in spite of certain additions to the staff.

Let us put the case for a proper air supply in a simple manner—it is well known that the human body is comparable to a steam engine and boiler, inasmuch as each is a prime mover converting chemical energy into mechanical work; deprive the boiler furnace of the necessary supply of oxygen, and the steam pressure gradually falls and the speed and power of the engine diminish.

Bearing this in mind, it is easy to realise that reasonably fresh air is in very truth the "working fluid" of the clerk, and that if, after a few hours in a stuffy office, the clerks—even the most industrious of them—involuntarily yawn and feel limp and lazy, it is a clear indication that the energy supply is throttled, and we cannot blame them for the natural impulse to escape to more normal conditions as soon as the whistle blows.

After all, at the present time, we are open to the indictment of exploiting our brains at the expense of our bodies, and until we realise that the efficiency of the former is inseparably connected with the health of the latter, we shall continue to pay the penalty exacted by Nature.

The writer cannot recall an engineer's office where a really workable system of *air changing* (as distinct from *air stirring*) is in use, but remembers only too vividly some in which, after the first hour or two, it required a distinct and continued effort of the will to resist the tendency to fall asleep.

Many private offices, occupied by heads of departments and other officials, are merely tiny spaces partitioned off from larger areas. In the lower part of these "boxes" (for they deserve no better name) the heavy carbon dioxide accumulates until it reaches the level of the victim's face, and then the trouble commences.

The writer feels certain that if an impartial and searching test could be arranged to verify such complaints, and to ascertain the improved output attainable, merely as the result of the introduction of efficient ventilation, a proper system of fresh air supply would be installed in all progressive engineers' offices, merely as a continuation of their successful workshops policy and from similar purely commercial considerations.

Another essential service that is, as a rule, very imperfectly performed in offices is that of heating; but although insufficient or irregular heating certainly involves discomfort, it does not affect the output so seriously as defective air supply, which latter directly reduces the vitality of the workers, as we have seen above.

A minor distraction that cannot fail to reduce the output is that of *noise*. Much of this is unavoidable, and passes, in fact, unnoticed; but it is, indeed, strange that brain-workers have tolerated for so long the harsh insistent rattle of the telephone call-bell. It seems absurd that to an instrument, never removed more than a few fect from its user, an alarm should be fitted with a range of perhaps 50 yards, and yet the type survives. It is indeed a matter for conjecture whether the introduction of the telephone into our offices, under present conditions, is on the whole a benefit or otherwise. At any rate, it is certain that in any scheme of office reorganisation the relegation of this instrument to its legitimate sphere should form the subject of most careful investigation. At the present time its tendency is to dominate all grades, breaking in disastrously upon calculations and discussions, and frequently wasting the time of other workers besides the speaker.

Possibly the employment of a smart and resourceful official, comparable to a "press censor" and through whom the bulk of the messages would pass, would prove conducive

to the increased efficiency of the erstwhile "slaves of the bell"—in fact, a very similar process of selection is found necessary in many merchants' offices to protect the buyer from the unwelcome importunities of travellers.

It is an axiom of works management that each worker should be provided with a sufficiently good supply of material and instructions to keep him continuously engaged, and it is the foreman's duty to anticipate his prospective requirements, and to arrange to the best advantage the sequence of his operations.

The application of the same principle in the office would effect in many cases a vast improvement, not only in the quality of the work, but by actually reducing the energy expended upon it. For example, the daily work of many a highly-paid member of the staff cannot be seriously commenced until he receives his share of the morning's letters, which, however, have first to pass through the hands of the general manager. Should this gentleman turn up later than usual, the work of this department at least, is disorganised and delayed, and either important work has to be rushed to ensure its completion before closing time, or overtime, with all its disadvantages and hardships, has to be ordered.

A moment's reflection will show clearly that the activity of a large section of the technical office staff is determined almost exclusively by the nature of the morning's letters, whilst the necessity for catching a desired collection or foreign mail will often restrict the time available for the compilation of the desired information.

Under existing arrangements the draughtsmen, clerks and typists engaged in this department arrive at 8.30 or 9 a.m. (when they are least required), whilst the manager, who usually distributes the letters and inquiries and formulates in outline the day's programme to the heads of departments, is yet on his way to business.

Now, to apply the principles of sound organisation to this problem, it is clear that the manager and the heads of departments ought really to be the first arrivals at the office, an early delivery of letters being arranged.

An uninterrupted hour's work in advance of general office hours would enable the necessary instructions, based upon the correspondence, to be given to each responsible official, so that when the rank and file arrive they can at once be employed at full capacity. Thus, with an adequate and willing staff, "overtime" need only be resorted to in an exceptional emergency, and no additional burden need be laid on those in authority.

In the shops it is held to be distinctly bad management to "break into" a man's job for the sake of some triviality, in fact, many foremen blankly refuse to do so except under great pressure.

The manager of a concern is, in fact, a workman taking a salary many times greater than a journeyman's wage, and yet we find many of his class who allow their time to be wastefully cut up.

Medical men fix definite hours of consultation to suit the convenience of both their patients and themselves, and the arrangement entails no hardship upon either party.

A somewhat similar arrangement would give the manager ample time for his important work, interviews, &c., free from interruption, whilst the knowledge that he can be approached without hesitation at definite hours would save many fruitless journeys on the part of others.

Special circumstances will, of course, at all times override such rules, and rightly so; but very little reflection will show the evils of the prevalent lack of system in this direction.

In conclusion, we have only to accustom ourselves to looking upon the office *as a workshop* to realise that many of the cardinal principles of success determined in connection with the actual manufacturing departments can be logically applied here also.

We may perhaps never be able to offer to the efficient clerk or draughtsman inducements to greater activity analogous to the bonus systems of the workshops, but we can, and should, keep him continuously supplied with appropriate work under favourable conditions, and thus afford the ambitious ones a fair chance of qualifying for promotion.

THE CHARGING OF, AND FOR, IGNITI BATTERIES OF PETROL ENGINES.

By WALTER E. ROGERS, A.M.I.E.E.

In the above title, the "of" refers to the electrochem process, while the "for" is pecuniary only.

The advent of the motor-car, which is being followed the flying machine, has flooded this country with a hos small secondary batteries, which, of course, require charging at frequent intervals.

In these days when so much is said, and more writ about day load for the electricity works all over the wo it is a matter of surprise to me to find that whilst our ch are inserting advertisements for representatives to push installation of cooking and heating appliances, &c., littl no attention is being bestowed upon a class of small load, which may, as the writer hopes to show, be cultiv actually at the generating station with practically no ca outlay for mains, sub-stations, &c.

One of my late chiefs did everything to discourage being sent to the works to be re-charged, by charging them at an exorbitant and prohibitive rate, because, he s they were a bother. Yet he would go many miles to se a 5-H.P. motor consumer, and would be very sarcastic to mains superintendent over delay in connecting a ¼- potato peeling machine, which entailed a capital ou of, perhaps, £10, and a revenue of a few shillings per ye

Looking round the works where the motorist is cat for, more or less, what do we find? In the meter room shift engineer's office, there is a piece of acid-eaten and besprinkled flexible, a corroded lampholder and, perhaps, small celluloid box being charged, price 6d.

Yet, again, I find a board equipped with batten la holders and, sometimes, a quite unnecessary ampere-h meter. I say unnecessary, because it is pretty well kn that at 100 volts a 32-C.P. carbon-filament lamp ta 1 ampere approximately, and a 16-C.P. ½ ampere. At hig voltages the current is proportionately lower for the s candle-power. An ammeter may be a useful adjunct to charging outfit, but the only instrument really necessar a portable voltmeter, reading 0 to 5, or, perhaps, 10 volt

In some provincial towns where I have resided, ev motor engineer, garage, cycle repairer, plumber, &c., has his own charging equipment supplied from the street m *via* the shop lighting, &c.; the local station man rejoic in the fact that he was charging a number of accumulat through lighting meters—*i.e.*, he was obtaining 3d. or per unit for what might rightly be considered power l This, of course, sounds very nice, and relieves the works all trouble and the usual row which takes place when Al man Grouser's old battery happens to have been put charge the wrong way round, as is invariably done sooner later. But it does not tend to popularise electricity w the local paper comes out with an account of the destruct fire which gutted Messrs. ——'s premises last night, cau by the fusing of electric wires, and the usual st comments thereon. What really happens is that just the electrician of the particular motor bodger is leav in the evening, a 10-ampere-hour battery in a celluloid c is brought in to be charged by 9 a.m. to-morrow, as t owner wants to start for Timbuctoo on his new "Roli Romper" at that hour. "So please give it a good charg Our electrician places it on the wooden window ledge, wh there are already three other similar batteries on cha adjacent to two tins of cycle oil, a curtain, and some dirty was To connect the battery, he takes a piece of wire, bare insulated, it matters not, and twists it round a termin switches on, and bolts for his tea. Nothing happens at on but after a time C^2R begins to make its presence felt at t terminal, which has the twist of wire round it. This aided by the battery being on wrong way round. From t point it is not difficult to trace the sequence of events fr the time the celluloid ignites to the arrival of the fire briga and the fusing of electric wires, &c. Another place wh the first spark actually occurs is where the brass screw o terminal is actually burned, or more often, soldered into t lead; here corrosion frequently takes place, and the termi

it being too stiff for fingers, having learned that nuts ould always be tight, we assist the coming fire by using a ir of pliers.

Since the occasional ignition of a celluloid battery appears evitable, even when proper treatment is accorded, it being only uestion of a sufficient number of cells passing through the dividual's hands for one to be destroyed sooner or later, eps should be taken to minimise the damage when e conflagration has started. An old disused fire-place, ovided there is a chimney, affords as convenient a arging station as can usually be found. Procure a lead-ied wooden tray, which, roughly speaking, should be fan-aped. Place the fan-handle at the back of the fireplace, e tray being horizontally propped up in front on bricks; en, with ordinary care, no damage will be done to the rroundings when the flare-up comes.

The installation of a separate meter for charging secondary lls at every charging station throughout the town, in order at energy may be sold at power rate, is objectionable, ether your meters are purchased out of borrowed capital according to the latest L.G.B. requirements, which are nnd practice and finance. All I have written, of course, rectly concerns the D.C. station only, but now that the ercury rectifier is a practical success in all but first cost, ir A.C. friends may expect to hear some more about "fusing electric wires." One station in London, with which I am quainted, commences by posting up in a conspicuous place, here a person handing in a battery can read it, the llowing :—

NOTICE.

RECHARGING ACCUMULATORS.

Whilst every care is taken of batteries, the ——— cannot cept responsibility in regard to damage done, or defects arising in e course of recharging. The leaving of batteries for recharging taken as an acceptance of this condition.

I have not copied the above as a sample of English, nor n I advise upon the strict legality thereof, but I give it mply to convey a hint to the unwary, as damage, either nuine or imagined, will undoubtedly arise when any number batteries are dealt with.

For instance, say it is the switchboard attendant's duty to ok after these cells. However much he knows about roxide of lead, it is not right to expect that he can variably sandwich the duties of synchronising an alternator, ist as load is coming on, with connecting up a small battery rrectly as regards polarity, time and hard usage having equently obliterated all marking on the box. So that casionally a mistake will be made, with disastrous results far as the particular battery is concerned. It must also be membered that quite a lot of the batteries brought in will completely exhausted, as Mr. William Bayley, whose ence bears endorsement, knows nothing, and cares less, out 1·8 volts per cell as a minimum, beyond which he ould not discharge.

The following is a method which has proved very con-nient for recording and identifying cells, and which tisfactorily dealt with some 300 batteries of the ignition pe between the end of June, 1910, and the end of February, 11.

The receipts during the above period were of the order of 5; the pecuniary charge was 4d. to 6d., according parently to no system whatever, but groundless agreements ade by the ruling power with the customer, without y consideration having been bestowed upon the actual cost curred on the part of the charging authority. Taking a se at random, I find a 4-volt 40-ampere-hour battery took units to bring it up, the customer being charged 4d., hilst the total works cost in the above station was pub-shed at approximately 1d. per unit sold. Comment on my art would be superfluous.

A system of tokens proves very reliable. We may have a uplicate set numbered consecutively 1 to 50 or 100 as the se may be. The customer's token is simply a brass disk bout the size of a half-penny, bearing the same number as he token which is attached to the battery when first rought in. The latter token should be composed of me acid-resisting material such as celluloid. Each oken has a small hole near its periphery, so that when not n use it may be strung on a wire. The same hole serves s a convenient means whereby, with the aid of a piece of lead or composition fuse wire, the token may be readily attached to the battery. For connecting cells in series during charge I find soft fuse wire about 18 or 20 S.W.G. most convenient, as a momentary short-circuit in connecting up will do no harm.

I find that in dealing with the 300 cells referred to, about 1½ lb. of soft fuse wire have vanished; but as the value of this does not exceed about 2s., it does not constitute a serious matter.

Whilst touching upon the question of cost, it may be well to mention here that I have known of a standard price of 6d. per battery being fixed upon, irrespective of capacity, with a view of avoiding complaint and complication. Result: a certain customer came in one day with a battery in a beautiful box, which aroused my suspicions, and upon removing the lid I discovered seven cells in series, ranging in capacities from 10 to 40 ampere-hours each.

A method of charging, pecuniarily speaking, which I put forward for what it is worth, and which appears fair to all parties, is to have a fixed price per pound weight of cell when full of acid. Suppose the price is equal to the total cost of production per unit, including standing and all charges; we then catch our friend with his seven cells in one box, and everybody knows what it will cost to have such and such a battery recharged. No meter is required, but only a pair of scales. In support of charging for recharging cells at so much per lb. weight, be they in celluloid, glass, or wood boxes, I submit the following figures, taken from seven batteries, just as they have come in since I commenced to draft this article.

Number of batteries dealt with = 7.

Capacity	10	ampere-hours.	Weight	3 lb.	9 oz.
,,	40	,, ,,	,,	9 lb.	1 oz.
,,	10	,, ,,	,,	4 lb.	10 oz.
,,	*25	,, ,,	,,	11 lb.	8 oz.
,,	30	,, ,,	,,	7 lb.	2 oz.
,,	*50	,, ,,	,,	14 lb.	4 oz.
,,	*100	,, ,,	,,	23 lb.	8 oz.
Total	265		Total =	73·5 lb.	say.

* Signifies in wood cases with carrying straps.

This gives us a mean weight per cell of 10·5 lb. All were 4-volt cells. If the price charged be equal to the total works cost as published, we should, taking the particular works I have cited, have obtained 10½d. per cell, whereas with the methods and system actually in vogue there, 5½d. only was obtained, including about 2 oz. of acid in one cell.

Again, I have stated that the receipts, based on the 4d. and 6d. arrangement, amounted to some £5 for 300 cells recharged. Had my system been in operation something like £13 would have been taken. I would give away the necessary water and acid required for topping or filling, and would have all cells filled before weighing, regardless of any message sent with the cells.

Turning now to the necessary equipment for recharging, I advise a lead-lined wooden tray, say, 3 ft. × 2 ft. by about 3 in. deep. Place transversely in this tray three wooden racks or gratings, each measuring 2 ft. × 1 ft. The gratings must be thoroughly painted with anti-sulphuric paint; each lath of which the gratings are composed should be 2 in. deep by 1 in. broad and spaced apart about 1 in. Fix the charging tray in some convenient position, where it is always under the eye of the man responsible, be he shift engineer or switchman.

On the wall behind the tray two boards should be fixed, each equipped with a charging resistance consisting of, and wired independently with, six lampholders and one switch. I say two boards, for if a number of cells arrive simultaneously they will vary in capacity and their requirements as to magnitude of charging current.

Having got to work and commenced to charge, one quickly discovers as gassing takes place, that the vents provided with many cells are totally inadequate, and unable to pass away the gases formed, it being frequently necessary or desirable to remove the filling plugs or stoppers; in doing so one or two of the said stoppers are apt to be dropped. It is for this reason that I have divided my wood rack or grating into three sub-racks, for each sub-rack can be lifted separately as required to recover the dropped stoppers. Also these wooden racks prevent the batteries on charge from standing in acid inadvertently spilled, thus protecting the

outer sheet-iron or wood containing-box and strap carrier which frequently embraces individual cells.

Quite 20 per cent. of the cells brought in will require topping. Here is a small difficulty, for not one cell in a hundred is designed to admit a hydrometer, or even to allow the use of a suction or pump hydrometer by which the electrolyte is drawn into a tube, thus providing sufficient vertical height to float the instrument for ascertaining the specific gravity of the liquid.

Again, many of the cells brought in in connection with portable lamps, &c., will have microscopic apertures for introducing acid or water. As very small glass funnels are difficult to obtain, probably we shall have to draw out a piece of $\frac{3}{4}$ in. or $\frac{5}{8}$ in. glass tube; with a little care and sufficient heat, one can manufacture a very useful little funnel. A glass syringe will answer the purpose: but as the plunger is usually packed with cotton, frequent repacking is required.

Much can be done by using the body or barrel of the syringe as a funnel, having previously withdrawn the piston. Owing to the difficulty in using a hydrometer, one can only guess whether water or acid is required to bring the electrolyte up to the proper level. When the cells are sufficiently transparent to permit a view of the plates, experience will guide one as to the advisability of topping with water or acid. For instance, generally speaking, if the positive plates appear eaten or crumbly near the surface of the electrolyte, use H_2O only. If the same plates appear unusually light in colour, H_2SO_4, specific gravity 1,200, may be used. These are by no means infallible rules, but the merest hints, gained through long experience.

Also I am told that the eye of experience can roughly estimate the density of acid by the speed with which a strip of litmus paper is acted on, but, candidly speaking, I can obtain no intelligible result with litmus paper. The rapidity with which a freshly cleaned or scraped piece of metal, such as brass, tarnishes under the influence of a splash of electrolyte, may be taken as a very rough guide to acidity. But here again experience alone will help.

REVIEWS.

The Calculus for Beginners. By J. W. Mercer, M.A. Cambridge University Press. Price 6s.

This work is intended primarily for young people—for boys who are, or will be, interested in the applications of the calculus to physics and engineering. With regard to this, the author makes some pertinent remarks in his Preface. He says, for instance, "I had much rather that a boy, confronted with a problem, should, after analysing it, be able to say, 'If I could differentiate (or integrate) this function of x, I could solve the problem,' than that he should be able to perform the operation without seeing its bearing on the problem." Again, "I believe that boys, especially on the science side of a school, could profitably begin the study of the subject at a much earlier age that is usual."

That a boy should understand a process before being able to work the process, seems reasonable; that he should be able to work a process before understanding it, is lamentable. Unfortunately, the calculus is just one of those subjects that a boy can work and use without understanding. He can learn in a very short time to differentiate and integrate the simpler functions, just as a parrot can learn to speak. For the operations involved depend simply on memory of mechanical detail, and not at all on the intelligence. One cannot help asking if it is wise to teach even the elements of the calculus to boys. Would it not be better to keep them at algebra and trigonometry, and thus give their minds a good soaking in ordinary mathematical principles—principles which have to do with stationary, inanimate quantities—rather than start them off, before they are developed, on principles that have to do with movement and life?

The experience of the reviewer gives, at any rate, a positive answer to these considerations. He has a large experience with boys undergoing a semi-physical, semi-engineering course of training, and he can assuredly say, as a result of this experience, that boys of 15 or 16 years of age are *incapable* of understanding the reasoning on which t calculus is based. Why this should be so is difficult to s It seems to be one of the laws of nature for which there no accounting. Perhaps there is a critical state of mind youth, an age before which such principles as are involv in the calculus are incapable of assimilation, and after whi the difficulty is removed or becomes less. That there such a critical age, those who have wide experience in classes of teaching will be inclined to agree.

The reviewer, then, is of the decided opinion that t calculus should not be taught until the age of 17 or 18 reached. Any teaching before this age, no matter h clever and painstaking it be, will in the vast majority cases lead to that machine-like non-understanding use of t subject which it is, or should be, the object of every teacl to prevent.

Of the numerous works on the calculus produced duri the last few years, the book before us is a good avera sample. Owing to the class of readers for whom it is tended, it inclines to be "long-winded" and "prosy x^n is the only function whose differential coefficient required in the first 250 pages. Thus there is a migh *leading up* to the subject, a drawn-out attempt to get t student into a state of mind to grasp it; and the ve laboriousness of the process must at once convince anyo that a condition of brain requiring such an absurd amou of preparation is artificial. How much better it is to w till Nature does most of this work, to wait till the boy is few years older, till the critical age is passed, till all th absurd forcing becomes unnecessary.

The book evidences a great amount of painstaking effo and, if the limitations referred to above are understood, one that a teacher may use with discretion for his ol students.

We trust, however, that no further books on the calcul for engineers will be published for some time, as the mark is now well supplied with works of this type.

The Design of Static Transformers. By H. M. Hobar M.Inst.C.E. London: Constable & Co., Ltd. Pri 6s. net.

This book treats of the design of transformers, and mo particularly single-phase transformers, from an essentia practical standpoint. Purely theoretical work and fund mental principles are almost entirely omitted, and the auth refers the reader to the two standard English treatises on t subject, and also to one of his own books.

The book opens with an introductory chapter containi an interesting account of Mr. Hobart's personal experien with transformers—from testing in a primitive mann 2-kw. lighting transformers up to actually designing lar machines. There is also given a bibliography of papers transformers which have appeared since 1888. An importa paper on design, which does not appear in this list, is th one by Mr. A. R. Low, published in Vol. XLIII of th Journal of the Institution of Electrical Engineers.

In Chapter II a method is given for determining th leading dimensions of a transformer of given rating, and particular case is worked out fully for a 20-k.v.a. tran former. This method consists in using a considerab number of curves for obtaining various factors required i the calculation, and is almost exclusively of an empiric character. This, perhaps, is the best method until a ma has acquired the necessary experience and confidence b lengthy practice at transformer design, but a certain amoun of faith is requisite to take a number of curves for grante The economical design of a transformer depends to a ver large extent on the dimensions adopted for the windin window; and the information given in the curv co-ordinating winding width with output is substantially th same as that in a private notebook used by the reviewe In this chapter the author predicts future sorrow on th part of electrical manufacturers who are not taking u the construction of transformers with avidity, and there i something to be said for this, as transformer manufactur does not necessitate a forest of patterns, although prices ar somewhat "cut."

Chapter III is a short account of the relation between cor loss and annual efficiency, and the same 20-k.v.a. trans

mer is taken as an example. It is here pointed out that considerable reduction in the core loss below a certain minimum means bad regulation, and the cause thereof is ably entered into.

Magnetising current, power factor, &c., are treated in the st chapter, and the effect of the alloyed steel, almost versally used nowadays, compared with the old-fashioned n of former times, is well shown by means of curves. e author rightly lays stress on the fact that owing to poor ministration it is a common occurrence for the establish- nt charges to make a very large percentage of the total rks cost. In certain large concerns in which the reviewer s had personal experience, the reverse is very much the se. It is not only in small works that a very keen eye leed is kept on financial matters of all and any kind.

In Chapter V we have four pages devoted to the con- eration of windings and their insulation. A curve is ven for the thickness of insulation between primaries and condaries, and the author says "this may safely be used hen suitable insulations are intelligently employed," which somewhat indefinite. More information as to the several aterials now used for this work should certainly have been ven.

The influence of the frequency is treated in the next apter, and tabulated designs are given for cycles of 15, and 50 for a 20-K.V.A. transformer; the increase in re loss at the lowest frequency is well shown, notwith- nding the much greater amount of material employed.

The regulation of transformers receives attention in apter VII, and Kapp's two diagrams are well described d worked out for the above-mentioned 20-K.V.A. trans- rmer.

Chapter VIII is the longest but one in the book, and deals th the heating of transformers. Some of the constants ven for the estimation of the temperature rise coincide most exactly with those used by the writer. Mr. Hobart ry rightly condemns the advice of certain manufacturers o recommend the allowing of temperature rises of the order 150° C.

Containing-cases and tanks are described in the next apter and some good practical information is given.

The book concludes with a chapter on large forced cooled ansformers, and data are given as to the amount of air and ater required by the different types.

This treatise is regarded by the author as merely troductory, and such important subjects as the mechanical resses in the windings, the design of terminals and bushings, ditional insulation of end turns, protective devices, auto- ansformers, &c., have not been included. This is rather pity, since the book is only a small volume of 174 pages.

A blemish in the book is undoubtedly caused by the use of mmas for the decimal points, and it is difficult to under- and what Mr. Hobart expects to gain by the introduction this unusual feature. There are also a few illustrations the manufacturers' catalogue type which take up space d do not appear to serve a very useful purpose, and it ould have been better had a few plates of working drawings en substituted.

The book is free from nebulous discursiveness, and a dis- nctive peculiarity is that vital dimensions can be obtained a rapid and efficient manner. The book is well printed, ound in a serviceable style, and worth the price asked r it.—H.G.S.

BUSINESS NOTES.

Consular Notes.—Japan.—The following information is rom the report by H.M. Consul-General at Kobé (Mr. R. de B. ayard) on the trade of that district in 1910, which will shortly be ssued:—

The outstanding feature of the year was the number of gas plants which were set up, both for supplying towns with gas and for small suction gas electric power stations. In the early part of the year the bulk of the orders were given for British machinery, but during the latter half Continental firms secured a number of important contracts, principally by undercutting British prices. During the latter part of the year local manufacturers also secured orders for the less important parts of the town gas plants, only the main machinery being imported. As regards rubber electric cables, a local factory, equipped with British machinery and having the services of a British cable expert, has made great progress since last year, and can successfully compete with British goods in price and delivery. As regards quality, time alone will prove. For paper-insulated cables there is still a demand, and large contracts have recently been secured by Continental manufacturers at very low prices

Local industrial development is most noticeable in electrical enterprises, such as electric tramways and railways, and in the installation of power stations for electric lighting, &c. Although the aspiration of the Japanese merchant is towards "direct trade" and the entire elimination of the foreign merchant as the medium of trade, there seems to be no likelihood of such consummation. With the exception of Japanese firms with well-established business connections abroad, the majority must find it to their profit to deal with the local foreign merchant, who is fully informed as to requirements in his own country. Foreign firms on the spot who import machinery and other classes of goods, keep themselves fully posted as to Japanese requirements, and are also in the best position to fill contracts which are made privately and are not put up to public tender. At the same time, there seems to be a complaint of the lack of British commercial travellers—not a new complaint by any means in the Far East. Such men should be experts, though not necessarily acquainted with the Japanese language, as English is the general business tongue in Japan, and, in any case, interpreters can be secured if required.—*Board of Trade Journal.*

Book Notices.—*The Electric Clock Buyer's Catechism*, published by the Silent Electric Clock Co., of 192, Goswell Road, E.C., is an ingeniously-devised little pamphlet, in which, by question and answer, the hypothetical buyer is made acquainted with the leading features of electric clock systems—in particular, of course, that of the company above-mentioned—and is eventually so far convinced that he writes to them for their catalogue. The facts that the "Silent Electric Clock" never needs winding, suffers practically no wear and tear, and is admirably adapted for use on board ship, are brought out, and a long list of installations is given.

"Science Abstracts." Vol. XIV, Part 8. August 25th, 1911. Sections A and B. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVII, No. 6. August, 1911. New York: The Society.

Correction.—In the advertisement of the Sloan Electrical Co., Ltd., in our last issue, their telephone number was incorrectly given. It should be 4,380, not 4,360.

Marking Time.—Among recent sales made by the International Time Recording Co., of 151, City Road, E.C., are the following:—Waterlow Bros. & Layton, three recorders; Gramophone Co., nine recorders; London General Omnibus Co., 14 recorders; Gale & Polden, two recorders; Rolls-Royce, Ltd., two recorders; British Thomson-Houston Co., two recorders; Swan, Hunter & Wigham Richardson, Ltd., three recorders; Reuben Gaunt and Sons, six recorders.

Dissolutions and Liquidations.—Solium Electrical Co., Ltd.—Creditors should send particulars of debts, &c., to the liquidator (Mr. E. Harlow, 23, King Street, Nottingham) by September 30th.

Midland Engineering Co., Ltd.—A meeting is to be held at 11, Waterloo Street, Birmingham, on October 5th, to hear an account of the winding up from the liquidator, Mr. H. W. Brettell.

Electrical Trade in Austria.—The exports of electro-technical articles from Austria-Hungary in the month of June this year, shows a further advance on the record figure previously reported. The increase in exports is especially noticeable in glow lamps, the aggregate from January to June, of which reaches the value of 3,120,000 kr., against 1,750,000 kr. in the same period of the previous year. The improvement consequently amounts to nearly 80 per cent. The export of arc lamps likewise advanced, namely, from 137,340 kr. to 202,440 kr., or about 70 per cent. Cables and insulated wire also showed improved figures, namely, 270,000 kr., against 154,000 kr. in the first half of 1910, and carbons, 605,000 kr., against 484,000 kr. The total value of all electro-technical articles exported was 5,374,000 kr., against 3,842,000 kr. in 1910. On the other hand, the imports of electro-technical articles attained the figure of 13,597,000 kr., against 10,855,000 kr., in which figures dynamos ranked for 5,170,000 kr., against 4,167,000 kr. in 1910. Measuring instruments stood for 2,800,000 kr., against 1,800,000 kr. (an advance of 50 per cent.), and carbons 380,000 kr., against 232,000 kr., or a 70 per cent. increase.—*Elektrotechnik und Maschinenbau.*

Petrol-Electric Omnibuses.—We are informed that as a result of the successful running of the new "Tilling-Stevens" petrol-electric omnibuses in London service, Messrs. Tilling have decided to adopt that type for all their future omnibuses, and are constructing a fleet to replace their present horse-drawn vehicles. Messrs. Tilling have designed the chassis and body, which are being built at their works at Peckham. The electrical transmission is supplied by Messrs. W. A. Stevens, Ltd., of Maidstone. An agreement has been entered into between the two companies, in which Messrs. Tilling have secured the sole rights of use and sale of the "Stevens" patent electrical transmission for use in omnibuses and mail vans in the Metropolitan Police area, Messrs. Stevens to have the sole rights of manufacture and sale of the complete "Tilling-Stevens" petrol-electric chassis outside the Metropolitan Police area, and also inside the Metropolitan area for vehicles other than omnibuses or mail vans. The same con-

struction will be adopted in the chassis for use either inside or outside London. The "Tilling-Stevens" petrol-electric vehicles are the result of exhaustive experiments extending over a period of four years under public service conditions in London. The first vehicle, which is still in service in excellent condition, has run over 120,000 miles. As the new vehicle has been designed by the oldest-established motor-omnibus company in London to meet the latest requirements of the Metropolitan Police, it possesses all the essential qualifications for success, and its extreme silence, smooth running, flexibility and ease of control, together with low cost of upkeep due to the substitution of a flexible electrical transmission for the gear box, should appeal to the travelling public as well as to the operating engineer.

Trade Announcements.—The Walsall Electrical Co., Ltd., have appointed Messrs. Paterson & Service, of 38, Bath Street, Glasgow, as their sole agents for Scotland and Islands.

Messrs. Farraway Bros., of Chelsea, have opened new additional showrooms at 146, Kensington High Street, W., where they would like to receive manufacturers' catalogues, &c., of electrical accessories and accumulators.

Electric Light at the Coronation Durbar.—The general illumination and lighting at Delhi and other towns during the visit of their Majesties King-Emperor and Queen-Empress will form one of the most important and attractive features of the occasion. Several of the most important contracts have been placed with Messrs. F. & C. Osler, Ltd., of Bombay and Calcutta. The principal of these contracts cover the King's Camp in Delhi, as also the Viceroy's, the Circuit House in Delhi, where his Majesty will reside, and a large majority of the Indian Chiefs' camps, including those of Hyderabad, Bhawalpur, Travancore, Mysore, Cooch Behar, Benares, &c., numbering in all 40 camps. In addition, Messrs. Osler have also received orders for a very large number of electric light pillars required for the external lighting of the camps. The same firm has received the contract for the lighting of the Agra Circuit House, where her Majesty the Queen will stay when the King is in Nepal.—*Indian Textile Journal.*

Bankruptcy Proceedings.—J. D. Carlmark, electrical engineer, West Bromwich.—First and final dividend of 11d. in the £, payable September 11th, at 191, Corporation Street, Birmingham.

Foster Arc Lamps.—The Foster Engineering Co., Ltd., of Wimbledon, have secured the order for 450 of their B.E. type single enclosed arc lamps for Messrs. William Whiteley's new premises. The same firm recently supplied a large number of lamps of the same type for Messrs. Pinchin & Johnson's factory, and Messrs. Arding & Hobbs's store at Clapham Junction was lighted in its interior by over 70 of the Foster arc lamps. The B.E. lamp has been made by the firm for a number of years, and its popularity continues to increase. It burns equally on either A.C. or D.C.; the consumption is under ½ unit per hour, and the lamp only requires trimming every 80 hours, this being the life of a pair of carbons.

Catalogues and Lists.—Messrs. Matthews and Yates, Cyclone Works, Swinton, near Manchester.—Twenty-four-page booklet relating to the Cyclone Plenum system as applied for the heating and ventilation of industrial buildings. The system is very fully illustrated, the Cyclone electric fan, electric blower and exhauster, blower and heating battery being shown, also the system applied in humidifying and ventilating weaving sheds, removing steam from a dye-house, &c.

The Maschinenfabrik Oerlikon, Oswaldestre House, Norfolk Street, Strand, W.C.—Leaflet illustrating and describing their portable insulation cutter for commutators.

Mr. Percy Pitman, 3, Willcott Road, Acton, London, W.—Price list of Pitman water wheels, also a six-page pamphlet describing same, together with a list of the improvements with which they are now fitted; price leaflets relating to the "Hector" turbine bottle brusher and the Hector hydraulic motor. The firm has orders in hand, or recently completed, for the following, among others:—Dublin Corporation, Regent Street Polytechnic, Belfast Technical College; National Electric Construction Co., Ltd.; Egyptian Government, and Hartley University College, Southampton.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflet illustrating torsion sleeve joints for overhead transmission lines.

The Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Two "Phœnix Bulletins," eight pages each. No. 2A deals with direct-current generators and large motors, and No. 4A with alternators. The contents in each case consist of illustrated specifications of the machines, both the parts and the complete machines being shown by reproductions from photographs. In the alternator bulletin sizes and outputs are tabulated, and a list of recent installations is given.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—New price list, "D 1," giving illustrations of a variety of new designs of glass shades for tantalum and tungsten lamps. Contractors who are considering their stocks just now when consumers are overhauling their lighting accessories in readiness for the darker evenings, will find reflectors listed here for all types of fittings. The assortment of shades includes satin finished, opalescent and etched types, also coloured bead shades. Readers interested can have copies of the list on application.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown.—List No. 40A, of 24 pages, containing tabulated sizes, prices and other particulars of twin cables, concentric and high-tension cables, flexible conductors and cords.

Messrs. Rose Bros., 38 and 39, Beech Street, Barbican, Londo E.C.—Supplementary catalogue (1911-12) of pocket electric lam watch stands, coils, motors, bichromate batteries, toy electric trai and trams, hand and cycle lamps, and sundries. The catalogue well illustrated, and shows prices very distinctly. A separate l gives prices of the "Comet" dry batteries.

LIGHTING and POWER NOTES.

Aberdeen.—The T.C. has fixed the rate for electricity 3½d. per unit for lighting, 2½d. to ⅞ths of a 1d. for power, and for heating. This is a reduction of ¼d. per unit for lighting.

Accrington.—The Electricity Committee has decided obtain an automatic pressure regulator for the Oak Hill sub-stati at a cost of £62, and to expend £50 for stock for the showroom be opened at the Post Office Arcade. At the request of the Hi lingden Corporation, the Committee agreed to allow its staff supervise the laying of the mains in connection with the electrici supply of Haslingden, subject to a payment of £3 per week f such services.

Barrow.—In his annual report, Mr. H. R. Burnett, t borough electrical engineer, states that the capacity of the ge rating plant is still sufficient to deal with the demand, and additions to it have been made during the past year, but the feed panel and oil separator have been connected up and put in service, and the latter has effected a reduction in the consumpti of water. In November, 1910, the Local Government Board sa tioned the borrowing of a further £4,500 for extensions of mai &c. As this sanction was given without the holding of an inqui it is assumed that the Board is satisfied with the position of t undertaking and with the manner in which the information requir by the Board with regard to the various loans has been supplied. table illustrates the growth of the undertaking during the l 10 years, and shows that the number of consumers is now 90 lamps, 88,979; units sold, 1,249,163; maximum load, 951 kw load factor, 14·99 per cent. The output for all purposes during t year has increased by 10·5 per cent., which is the largest increase far obtained since the commencement of the tram service. The large increase is again in the supply for power and heating purposes, t output for which for the first time exceeds that to the tramwa There is every prospect of a further large increase in output for pow purposes in the near future, and since the price of electricity w reduced to 1d. per unit, the demand for supply for domestic hea ing purposes has shown satisfactory signs of development. Th financial result of the year's working is as follows:—Total receip £14,435; total costs, £6,406; per cent. of costs to receipts, 44·3 gross profits, £8,028; per cent. of gross profit to capital expende 6·98; total costs per unit 1·231d.; average price obtain per unit, 2·717d. Financial result: profit, £706. In conclusio the report reviews the receipts and expenditure, and Mr. Burn says that the capital redeemed after only 12 years' workin exceeds the cost of the original works, in addition to which the is a sum of £998 standing to the credit of the renewals funds.

The T.C. on Monday authorised the electrical engineer to obta a few grillers and heaters for letting out on hire, at a cost n exceeding £50; also to install an electrically-driven centrifug pump at the electricity works for raising the water from the h well to feed the water tanks, at a cost of about £70.

Bath.—The T.C. having applied for a loan of £7,90 for the provision of a Diesel engine plant at the electricity work a L.G.B. inquiry will be held on September 15th.

Biddulph.—A meeting of the Finance Committee of th U.D.C. is to be held on 12th inst. to receive the report of the canva of property-owners with reference to the proposed electric lightin scheme.

Bognor.—Mr. Tate, having informed the U.D.C. tha he intends applying to the B. of T. for a prov. order for electri lighting, the Council on Friday decided to discuss the matter in com mittee on September 8th.

Braunton.—The formation of the E.L. and Power Co which is to undertake the public and private lighting of the parish is now practically assured, almost all the necessary capital havin been subscribed.

Bridlington.—The T.C. has applied to the L.G.B. fo a loan of £1,500 for the installation of a new feeder cable fro the electricity works to the junction of Horsforth Avenue an Neptune Street.

Brighton.—The Lighting Committee has recommende the T.C. to abolish meter rents, except in the case of consumer upon the maximum demand system, and to make certain reduction in the charges for energy.

Bury St. Edmund's.—The electrical engineer, in hi annual report, refers to the satisfactory nature of the past year' results. The all-round expansion of the business, although steady, i most marked. The number of new consumers connected during th year has been well maintained, and an increase of over 20,600 units representing an income of about £450, have been sold. For th increase in the works cost, the coal bill is mainly responsible. Thi

partly due to the fact that, although there was a considerable crease in the output, the amount of refuse, naturally, did not crease proportionately, but at times, owing to the wet season, left uch to be desired for steam-raising purposes. Again, the in-iciency of the condensing plant and its inability to satisfactorily al with the heavy winter loads, as has already been reported, was no small measure responsible for an increased coal consumption. ıe importance of these matters has been fully realised, and in der to obtain a greater use of the destructor steam-raising plant, periments have been made during the past few months with rious fuels to assist the burning of the refuse, and for use at such nes when sufficient refuse cannot be obtained. In this respect, ke has given good results—especially when burnt alone—but the st is somewhat high, and during the past month trials have been ade with "slack," and the results have been eminently satisfactory. ıe removal of the condensing plant from the boiler house, and the orough overhauling of this plant generally—which work is now hand—will practically overcome the difficulty in this respect, d a marked economy in fuel consumption should result, and, with e economy that will be obtained by the new generating plant w about to be installed, there should be a substantial reduction generating cost during the present year.

Caergwrle (Wrexham).—A correspondent writing in gard to a small local electricity company, says:—"This small mpany was formed on my representation to some local people at since the advent of the tungsten lamp, and given permission use bare overhead mains, electric light was commercially possible n in a village like this (about 1,500 population). Of course, the ee per unit is higher, 8d. at present, but this allows a 17-watt mp to be run 7½ hours for 1d., and this, by the testimony of our stomers (many of whom have 1d. slot meters) is *cheaper* than oil, d. of course, vastly superior. There is no gas company here. The pply was turned on on July 16th, 1909, over two years ago, and s never failed since for one second, night or day. It has grown wly and steadily, but now there is a mighty rush for it, and in a nth or so we shall have double the number of lamps we had ee or four months ago. The Gwalia Forge supplies steam power so much per unit, and the attendance is provided at a contract e per unit—total cost at present 4¾d., leaving 3¼d. per unit for e company for sinking fund and profit."

Cavan.—At a special meeting of the Urban Council last ek the following notice of motion was handed in by Mr. Pollock: hat the Urban Council proceed forthwith to install an electric nt for the purpose of the public and private lighting of the town, l that a sufficient sum be borrowed to carry out the scheme."

Ceylon.—The Colombo Electric Tramways and Lighting have recently installed a 300-KW. tandem set, consisting of a Bliss & Morcom engine, Dick, Kerr D.C. generator, and G.E.C. S.A.) alternator. Early in 1910 a 225-B.H.P. Diesel engine lt by Messrs. Willans & Robinson was installed, to displace a cintosh Seymour steam engine of similar size, and the installa-n of a 525-B.H.P. Diesel, built by Messrs. Carels Frères, of Ghent, now in progress, coupled to a 350-KW. Lancashire Dynamo and tor Co.'s generator.

Cheltenham.—The mains are to be extended to the leworth Estate, which is now being developed for building poses. The Council's application to the B. of T. for a prov. er extending the Cheltenham lighting area, to include the ishes of Leckhampton, Swindon and Prestbury, and the ishes or hamlets of Bishop's Cleeve, Southam, Brockhampton l Woodmancote, is to be proceeded with. The borough electrical ineer is to prepare a scheme and plan showing the area, &c., to ncluded in the order, and the Cheltenham and Winchcombe D.C.'s are to be asked for their consent to the application.

Chile.—The *Diario* of June 26th contains a decree roving a project submitted by Don Salvador Correa for supply-the town of San Vincente, department of Caupolican, with ctric light. Work is to be begun within six months, and shed within a year, from the date of the decree (June 20th).—*ard of Trade Journal.*

Continental Notes.—ITALY.—The Provincial Council of Piemont, at its last sitting, has approved of the erection of a water power station in the Orco Valley of a total capacity of 40,000 H.P., estimated cost of which is put at 33,010,000 lire. This outlay will include the regulation of the natural streams of the whole ley and the afforestation of the mountain slopes, so that improve-nt works on a large scale are contemplated. The province will however, itself carry out these works, but will hand them over company, who will be pledged to set apart a portion, free of , of the electric power for the use of the province, so that the er will derive not only the economic advantages which such portant works will confer, but a constant income from the sale electric current.—*Elektrotechnik und Maschinenbau.*

tatistics recently compiled show that Italy possesses some 29 rge electric supply concerns of capacities ranging from 77,400 P. to 3,250 H.P. The largest number of these concerns—10—situated in the Province of Milan, the distribution of the ainder being as follow:—Three in Torino, two each in Venezia, ova and Napoli, and one each in Brescia, Roma, Bari, Firenze, no, Palermo, Lecco, Porto Maurizio and Intra. Only a few of se concerns are run wholly for single industries, the majority ing their current to various consumers. Their operations thus l to the creation of industries where none existed before, or to enlargement of previously existing undertakings. The hanical, chemical, textile, lighting, transport, milling, &c., ustries have thus been greatly stimulated in their development, new power tending to the substitution of forms of large output capacity for small industries sparsely scattered here and there.—*L'Ingegneria Ferroviaria.*

AUSTRIA.—The extensive scheme of the Pretovia Co. to erect a large hydroelectric establishment on the River Drau has successfully passed the scrutiny of the Imperial Commission, the only objection urged against it being easily met by the raising of the dam wall, whereby the normal capacity will be increased to 54,000 H.P. Furthermore, the stretch of water between the two stations can be converted into a reservoir to equalise the supply in the various seasons.—*Elektrotechnik und Maschinenbau.*

At a meeting recently held at Preore (Tyrol), at which 25 representatives of communes were present, it was decided to erect a central station at Zuclo, making use of the waterfall of Ri di Mulini for the generation of power. The plans for the scheme have already been drafted by the Unione Trentina.—*Zeitschr. Oest. Ingenieur und Architekten Vereins.*

BOHEMIA.—A new central electric lighting and power station is about to be established in the town of Jungbunzlau.

SPAIN.—La Sociedad Hidro-Electrica de la Cerbigona is the name of a new company which has lately been formed at Hojos (Caceres) with a capital of £10,000 to establish a small central station for the electric lighting of the town and several places in the district.

Devonport.—The main generating station for electrical power and lighting in the North Yard, Devonport, and the new generating station for pneumatic power in the South Yard, are receiving considerable additions to their equipment. At the first-named station the new turbo-dynamos have a B.H.P. of 1,600. In the new South Yard station, which is devoted to the storage and distribution of compressed air, the air compressing plant is driven by motors of from 400 to 500 H.P., this being one of the largest air compressing installations to be fitted.

Eastbourne.—Mains are to be extended to Cavendish Place at a cost of £125. The E.L. Committee has decided to make a rebate of ½d. per unit to all consumers whose supply exceeds 40,000 units per annum.

Garvagh.—A meeting of the shopkeepers and residents of Garvagh was held on 29th ult., for the purpose of making arrangements in connection with the proposed adoption of an electric lighting system. It was agreed that 14 lamps of 25 C.P. each be erected and placed at regular intervals between Hermitage Porter Lodge and the Upper Bridges, the expense for their upkeep to be levied on the rate of the townland of Garvagh. A sub-committee was appointed to confer with Mr. Stewart as to the necessity for the installation of accumulators. Reports as to the number of house-owners who were agreeable to adopt the light were considered satisfactory, only some three or four having refused.

Greetland.—The U.D.C. has decided to apply to the B. of T. for a prov. order for E.L., with a clause authorising the transfer of the order to the Electrical Distribution of Yorkshire, Ltd.

Herne Bay.—The U.D.C. on August 30th discussed *in camera* the question of transferring the E.L. order to the Gas Co. or Messrs. A. E. Hunt & Sons, a local firm. No decision was arrived at, and the subject was again referred to the Law and Parliamentary Committee.

Hoyland.—A Committee has recommended that Mr. Senior, of Mexbro', be engaged by the U.D.C., at a fee of 10 guineas, to report in the matter of the application for a prov. order by Electrical Distribution of Yorkshire, Ltd.

Hyde.—At a meeting of the T.C. some information was given relative to the merits of gas and electricity for street lighting purposes. In moving the adoption of the minutes of the Committee, Councillor Robinson stated that the cost of the electric lighting installation was 50 per cent. more than gas, and the maintenance, taking the price of energy at ·825d. per unit (as quoted by the Joint Board) was 33 per cent. more. Since these figures were worked out, however, they had been informed that the lamps would be charged for at the rate of 13s. 9d. each for energy. This reduced the price of energy to ·75d. per unit, the maintenance being reduced from 33 per cent. to 25 per cent. dearer than gas. After going into the figures very carefully and examining the lights in the streets, the Committee had come to the conclusion that they could see no reason for changing to electric light, and they had, therefore, decided to carry out the street lighting improvement with gas. The Committee's recommendation was confirmed.

Inverness.—A rather serious fire occurred at the generating station of the North of Scotland Electric and Power Co., on Sunday afternoon. The engineer and manager, Mr E. J. Williams, who lives quite near, was on the scene immediately, but the fire had got a good hold. Mr. Williams and others tried to keep the fire in check with the works' appliances, but by the time the brigade arrived, the entrance hall, lobby, workshop, store above, and meter room were involved, the wood stairs to the latter being quickly demolished. The brigade directed their efforts to prevent the fire spreading to the battery rooms and wiring store, luckily with complete success, although the door leading to the former was destroyed. Considerable damage was done to interiors and to stock, and all the copper rod connections between the battery and switch-board were destroyed, as well as the entire stock of meters and indicators. It being Sunday the plant was not running, and the interruption to the supply caused little inconvenience. By 4 o'clock temporary connections had been made, and the supply was resumed. The fire, which originated near some lockers where the staff keep their overalls, was probably caused by a match thrown down amongst some waterproof coats used by the mains' staff. At no time was the generating plant in jeopardy, as there is a 3-ft. gable between the engine room and the rest of the building.

London.—Shoreditch.—The Lighting Committee has recommended the conversion of the whole of the gas lamps in the streets north of Old Street to incandescent electric lighting at a cost of £665. The necessary cables, 14 miles in 160 streets, are to be laid at an estimated cost of £8,385. These cables are to be of sufficient size, not only for the street lamps, but to meet any reasonable demand likely to arise. The work will be done gradually.

The Lighting Committee has submitted a revised scale of charges for power and for factory lighting, which, it is proposed, shall take effect after the September meter readings, the reduction of income being estimated at £2,512 per annum.

Merthyr Tydfil.—The Electric Traction and Lighting Co., Ltd., has offered to install the E.L. at Mardy Hospital for £220, and to supply current on a five years' agreement by overhead mains at 3d. per unit up to 5,000 units per annum, and 2d. per unit beyond. The estimated quantity required per annum is 5,000 units, the cost of which would be £62 10s., whereas gas would cost £110. The Visiting Committee recommended the acceptance of this offer, but the T.C. has deferred its decision, with the view of obtaining other tenders.

Norton (near Malton).—The U.D.C. has decided to substitute gas for electricity as the motive power in the pumping of water at the waterworks. Some years ago the Council changed from gas to electricity. Recently a five years' tender for pumping was invited from the Malton Gas Co., and from the Northern Counties Electricity Supply Co. The tender of the electricity company, which was based upon the units used in the last contract, amounted to £171 per annum, that from the gas company being £96. The Council decided to accept the latter.

Peterborough.—Complaints having been made of the unsatisfactory state of the electric light at the public library, it has been found to be due to the variations in the voltage caused by two adjacent cinematograph halls. The proprietors of the halls have been called upon to provide appliances to prevent disturbance in the general public supply, and unless this is done the supply of current for cinematograph purposes will be discontinued.

The T.C. has decided to delete a minute from the Electricity Committee recommending a free supply of electricity to the private residence of the chief assistant engineer.

Plymouth.—The annual report of the borough electrical engineer (Mr. E. G. Okell) for the year ending March 31st last, states that connections for supplies to 140 new consumers have been made, and the total lamp connections have been increased from the equivalent of 89,107 to 96,276 30-watt lamps. The number of motors on private consumers' premises is increased from 162 to 188, representing an increase of 90 H.P. connected, the aggregate total horse-power at the end of the year being 663. The total number of units sold has increased from 2,456,070 to 2,601,277, there being an increase of 17,000 sold to tramways. 121,971 to private consumers and 6,236 used for public lighting ; 5,300 yards of cable have been used for extensions and for the connection of new supplies. During the year 87 vessels have been discharged by means of the transporter. The statement of income and expenditure for the undertaking shows that the total cost of production is slightly below the figure realised in the year 1908-9, and is therefore the lowest yet recorded. The works cost for the last three years have been '91d., '88d. and '83d. respectively, and the total cost 1·23d., 1·30d. and 1·22d. per unit, exclusive of capital charges. The quantity of coal used is larger than last year, and the price paid has also averaged slightly higher. The total expenditure incurred in the production and supply of electricity for generation, distribution, management, &c., has been £13,202, as compared with £13,308 for the year 1909-10, a reduction of £108, notwithstanding the increased output and load. After setting aside £9,848 for interest and sinking fund charges there remains a balance of £2,967, from which £1,797 has been taken to meet the cost of new meters, services and mains, leaving £1,170 to be taken in aid of rates.

Runcorn and Widnes.—Rapid progress is being made with the laying of electricity mains in Runcorn and Widnes by the Mersey Power Co., and it is anticipated that supply will be available by October.

South Africa.—Kimberley.—Practically all the electricity used in Kimberley is supplied by the power station of the De Beers Consolidated Mines, Ltd. The plant comprises 12 Babcock and Wilcox boilers, with superheaters and mechanical stokers, induced draught and economisers, and three Westinghouse-Parsons turbo-generators of 1,500 KW. each, with surface condensers. An additional turbo-generator of the British-Westinghouse Rateau type, giving 4,000 KW. at 5,000 volts, three-phase, 50 cycles, is now being erected, making the total capacity of the plant 8,500 KW. The supply pressure is 220 volts A.C., for lamps and motors ; the Town Council is supplied with electricity in bulk for lighting the town, which is done with arc lamps about 60 in series on constant-current transformers from the 5,000-volt mains. Energy for traction is supplied through rotary converters to the Alexandersfontein Railway (7 miles), and the Victoria Tramway Co.'s system (4 miles). The machine tools in the De Beers workshops are driven by D.C. motors at 220 volts, supplied from synchronous motor-generator sets ; with this exception, and that of the traction supply, all power is A.C., motors over 100 H.P. each being generally supplied at 5,000 volts. Underground lamps are supplied at 110 volts, and motors at 220 volts A.C.

Rand.—*African Engineering* states that the Rand Wate Board are installing two electricity driven high-lift centrifug pumps, each capable of raising 2,500,000 gallons a day, at Zurbekor

The same exchange reports that Mr. Kotze, the Governme mining engineer, estimates that if the electric generating and co companies of the Rand were to combine they could produce electr energy at ¼d. per unit.

It further states that "the Randfontein Estates Co. are supplyin electric energy at a cost of ¼d. per unit. The cost of the Randfo tein generating plant works out at £16 per KW. installed. T working costs amount to 0·247d. per unit, of which 0·153d. accounted for by fuel.

South Shields.—During the past year, the Corporatic electricity supply department sold 3,476,539 units, as compar with 3,166,296 units for the previous year, an increase of 9·7 p cent. The lighting units sold last year increased 1·5 per cen the power units increased 7·4 per cent., but the traction un decreased 14·4 per cent. The average price charged per u (private and public supply, less public lamp maintenance) w 1·76d. as against 1·84d., a decrease of 4·3 per cent., whilst t working expenses per unit (less public lighting maintenance) we ·86d. as against ·95d., a decrease of 9·4 per cent. The maximu combined load on the station was 2,054 KW., as compared wi 1,760 KW. in the previous year. and the combined load factor w 19·32 per cent., as against 20·53 per cent. in the previous year. T total capital expenditure at the end of the last 12 months w £188,173, the total revenue £26,307, and the gross profit £13,1 the last-mentioned figure showing an increase of 12·7 per ce over the previous year's figures, and giving a percentage of gr profit to total capital expenditure of 6·9. The price obtained unit for private supply, lighting and power, was 2·08d., a decre of 1·4 per cent. ; for public supply, lighting (less public la maintenance), 1·29d., or an increase of 2·3 per cent., and price for public supply and traction was 1·41 d., or an increase ·7 per cent. over the previous year's price. Owing to the increa demand for power, the Corporation recently obtained the sanct of the L.G.B. for the borrowing of £7,580 for the provision of n plant at the electricity works. The total estimated cost of scheme is £10,080. The balance of £2,500 will be taken out the electricity undertaking reserve fund.

A contract has been placed with the British Westinghouse Co. a 1,500-KW. 1,500 R.P.M. high-pressure Rateau turbine, direct coup to one 1,000-KW. D.C. generator for traction and power work, also direct-coupled in tandem one 1,100-KW. single-ph 50 periods 2,100-volt alternator for lighting. The plant is to supplied with a surface condenser, and the circulating water be obtained from the River Tyne. The air pump is to be of Westinghouse-Le Blanc pattern, motor driven, and on the sa shaft will also be connected the hot water extraction pun The amount of the Westinghouse Co.'s tender was £7,972. and set is to be in running order before the end of the year.

Southport.—The Corporation has applied to the B. of for consent to the placing of certain transmission lines abo ground along various routes in the borough for the purpose supply under the Southport Electric Lighting Order of 1891.

Stoke-on-Trent.—The B.G. has decided to have electric light installed also electric fans, at the new operating room medical officer's residence, at an estimated cost of £130, the tend to be confined to local contractors. An X-ray apparatus is also be provided.

York.—The Corporation electricity works were opened April, 1900, and have now a total capacity of 1,860 KW. an maximum load of about 1,270 KW. The units generated during past 12 months amounted to 257,269 for public lighting. 739, for private lighting, 595,937 for power purposes, and an additio 607,319 for tramway purposes. In view of the gradually increas demand for electrical power, the Corporation recently sought obtained sanction for a loan of £14,863 required for extension its electricity undertakings. It has been estimated by the electrical engineer (Mr. J. W. Hame) that, whilst during the curr year 2¼ million units will be sold, next year approximately 4 mil units will have to be generated. Accordingly, contracts h recently been let for a 1,250-KW. B.T.-H. three-phase tu alternator, rotary converters and switchgear to cost £8,006, and a Babcock water-tube boiler, automatic stoker and steam pipe w at £1,918. These extensions are expected to be in operation at the middle of October.

The T.C. has consented to the Co-operative Society laying an e tric cable along the frontage of its premises in Railway Stree payment of an acknowledgment of 5s. per annum.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Electricity Committee has presen recommendations to the Council this week concerning an acci sustained by a tram conductor whilst working on the Hasling section. The accident occurred while the man was leaving the to adjust a signal, he being knocked down by a passing motor It was pointed out that if the automatic signalling arrangem operating on the Oswaldtwistle section had been installed, such accident could not have taken place. The Committee decided representation be made to Haslingden Corporation with a vie inducing them to adopt the automatic system of signalling.

Aberdeen. — The T.C. has approved of the Tramway ommittee's report refusing to recommend that any alteration hould be made in the existing rates of pay in the tramways epartment.

Birkenhead.—It is intended by the Corporation to suitbly reward those of its employés who loyally fulfilled their uties during the recent industrial troubles in that town. The lectricity Committee proposes to make the following grants: Mr. V. Wyld (borough electrical engineer), £25; Mr. G. P. Shallcross assistant electrical engineer), £10; other employés, one week's ages. The Tramways Committee similarly recommends a week's xtra wages to drivers, conductors, inspectors, &c., car cleaners, oint boys, track cleaners, car repairing, &c., staff, overhead line ien, office staff and time keepers, and to the tramway manager's hree principal assistants a week's extra wages, or a week's extra olidays, at their option.

Blackburn.—The Tramways Committee has decided to ay each driver and conductor in its service 10s. extra pay for the xtra work occasioned by the recent railway strike.

Blackpool.—At the T.C. on Tuesday, Ald. Brodie' hairman of the Tramways Committee, referred to a letter received om the district secretary of the National Union of Gasworkers nd General Labourers, asking for certain alterations in the rrangements of shifts and conditions of labour of tramway emloyés. He thought they would all come to the same conclusion as ie Committee did—that the suggested alterations were too ridiculous or consideration. He expressed his appreciation of the loyalty of ie majority of the tramway men, whose good sense prevented the ien from entering upon a strike which a few discontented ones ould have desired. The tramways were having an exceptionally ood time, and up to Monday evening the receipts were fully £5,000 ore than last year. The estimated loss of receipts caused by the ilway strike was from £1,000 to £1,500.

Continental Notes.—Germany.—A scheme has been rawn up by the contracting firm of Lentz & Co. for the construcon of an electric railway from the centre of the city of Breslau to ie much-frequented mountain resorts in the Zobten Mountains. he line, which is to be 42 km. long, will take a different course om the existing State line, namely, up the Sattelhöhe between obten and Geiersberg, ending at a point 380 m. above North Sea vel. It is contemplated to make the journey in 50 minutes in ther direction, and at fares lower than those of the State railway. ie rolling-stock will consist of 13 motor-cars, 60 coaches, two ost and parcel wagons and 30 goods wagons. Electric lighting id heating plant will be fitted to the rolling stock. The cost of e scheme is put at M.6,100,000.—*Elek. und Masch.*

According to a German contemporary, the Maschinenfabrik Oerton has just turned out an electric locomotive of unusual size and haracter. It is an alternating-current locomotive of 2,000 H.P. pacity, 13,000-kg. tractive force, and working at a pressure of ,000 volts and 13 to 17 periodicity. It is thus larger than that uilt last year by the A.E.G. for the same line; than that built for e Simplon tunnel by Brown, Boveri & Co.; than that built two ars ago for the Pennsylvania Railway, and also than the goods comotive built for the Italian State Railways. It is to be run on e Spiez-Lötschberg-Simplon line. It is from the designs of the gineer, Thormann, and is described by our contemporary as the st demonstration that with single-phase alternating current the ghest requirements of existing and projected lines can be satisd, without exceeding the Continental standards with regard to le pressure, and without standing behind steam driving so far regards regular working capacity.

A scheme for the construction of a light electric railway between endelbruch and Strasburg is at present under consideration.

Austria.—Plans are being prepared in respect of a proposed ctric tramway between Elbogen and Carlsbad, Bohemia; the strian Siemens-Schuckert Co. is interested in the scheme.

Darwen.—The Board of Trade has communicated with e Corporation Tramways Department, suggesting that speed dicators should be fixed on the tramcars. The Committee, hower, has decided to defer any such step until the interview between e Board and the Association of Tramway Managers has been ld.

Darlington.—The T.C. has applied to the B. of T. for extension of time for three years for the construction of the mways to Haughton.

Glasgow. — Following upon the strike of the drivers d conductors in the employment of the T.C. tramways departnt, some interesting points have arisen. One of these was ntained in questions directed to the convener of the Tramways mmittee at the last meeting of the Corporation. It was stated reply that only employés who had been convicted of misconduct d been refused reinstatement, but it was argued by questioners at men who had taken no active part in the dispute, but who d refused to act as temporary drivers, had been dismissed. was also alleged that men known to be members of the Comttee of the Municipal Employés' Association had been refused restart, and on all points official investigation and report was mised. In a report to the T.C., the Chief Constable points out at in order to provide a suitable force during the strike all leaves absence had to be stopped, and his men were kept on duty for riods varying from 18 to 24 hours continuously, and provided th food while on duty. The Corporation has approved of a posal that all constables deprived of their fortnightly day off ould be granted a day's pay at the rate of 8d. per hour for the extra time on duty. A special sub-committee has been asked to inquire into a report by the Chief Constable, showing that the services of the police during the strike involved an extra cost of about £1,557, to meet which it is expected the tramways department will be asked to contribute.

The T.C., at the next meeting, is to be asked by the Tramways Committee to petition Parliament for a provisional order to empower it to extend several of the tramway routes both within and without the city. The original propositions included the construction of a relief line from Eglinton Toll to Sauchiehall Street, about a mile and a half in length, and necessitating a new bridge over the Clyde and the removal of St. Enoch's Parish Church and other properties; an extension of about half a mile from the present University terminus to Byres Road; an extension from Kellermont and Canniesburn Toll through Bearsden to Milngavie, a distance of two and three-quarter miles; an extension of about two miles from Cathcart to the Sheddens, between Clarkston and Busby; and a continuation from the present terminus at Baillieston to Coatbridge, about two and a half miles. The total proposed extensions make over 10½ miles of double track. At a meeting of the Sub-Committee on Tramways Extensions the proposals were approved *in toto*, but the parent Committee refused to sanction every item, disapproving of the proposed extensions to Milngavie from Canniesburn Toll and Coatbridge. The Finance Committee, however, have recommended that additional borrowing powers be obtained for the sum of £465,400, subject to the deduction of the amount application to proposed lines not actually approved by the T.C.

The T.C.'s Tramways Committee has also had under consideration the advisability of applying for Parliamentary powers for an amendment of the Corporation Acts, to the effect that the following assessments, which are levied on the full value of the tramway lines, should only be levied on one-fourth of the value thereof, viz.:—Police, sanitary, statute labour, sewage, roads and bridges, parks, registration of births, registration of voters, diseases of animals, and lunacy assessments. It was explained that the other Corporation assessments were only levied on one-fourth of the value, and that this was also the law with regard to assessments on the tramway lines in burghs adjoining the city in terms of the Burgh Police (Scotland) Act, 1892. An amendment that in view of the recent decision of the Sheriff of Lanarkshire and the town clerk, no further proceedings should be taken, was carried.

It is reported in the Press that a Corporation tramcar driver was seized with faintness on Saturday afternoon, and fell from his car. A young man sprang on the car, but could not apply the brakes in time to prevent collision with a car in front. The driverless car was itself knocked off the track, and five passengers received various injuries.

Halifax.—The annual report of the tramways manager, Mr. W. M. Rogerson, for the year ended March 31st last shows that the total revenue was £92,573; working expenses, £60.480; paid in interest on capital, £10,634; paid to sinking fund, £9,823; net profit, £11,514. The capital of the tramway undertaking now stands at £400,149; mortgage debt, after deducting loans repaid, £317,383. Passengers carried during the year, 17,067,865, against 16,323,755 last year. The receipts from parcels increased from £1,803 to £1,922. The staff of the tramways numbers 346.

Huddersfield.—The extension of the borough tramway system from Holly Bank, Edgerton, to the boundary at Birchencliffe was opened on Tuesday, August 29th, a 15-minute service being inaugurated. Negotiations are also proceeding between the Huddersfield Corporation and the Elland D.C. respecting a further extension of the tramways to Elland.

Liverpool. — The Tramways Committee on Friday, September 1st, held its first meeting since the recent labour dispute. The Press were asked to retire, and subsequently an animated discussion took place regarding the total number of men who originally came out on strike, and the total since reinstated. Mr. Mallins (general manager) stated that 435 men were originally out on strike. Of these, 325 were uniformed men, and 210 of them had been taken back. Of the remaining 110 shedmen, 35 had been reinstated. Alderman Salvidge said those figures did not tally with certain statements which were being circulated, and he suggested that Mr. Mallins should make a note of the figures which he (the Alderman) had supplied, and institute inquiries into the matter. Mr. Gates inquired whether any harsh conditions were being imposed on the reinstated men. The Chairman assured the Committee that such was not the case. The men had simply to fill up one of the ordinary application forms, and no question of their trade unionism was involved.

London.—On Saturday afternoon last a four-wheel single-truck double-deck car, owned by the L.C.C., ran off the track at a sharp curve at the end of a slight descent in Lewisham High Road, and then overturned, killing one passenger, a young man aged 20, and injuring 17 others.

The inquest was opened on Tuesday. Evidence was given by the car-driver, by a learner who was with him at the time of the accident, and by L.C.C. officials and others, including a member of the public who was passing when the car went over. The last witness said that the groove of the rail was clogged with sand, and the rail was worn out. The jury in returning their verdict found that the evidence was insufficient to show why the car left the rails, and they added a rider urging that greater attention be paid to the cleansing of rails at junctions and curves.

The Board of Trade inquiry by Col. Von Donop was held on Wednesday.

According to the *Daily Telegraph*, Messrs. John Mowlem & Co., Ltd., have secured the contract for the construction of the Edgware

Road to Paddington Tube, and also the extension from Charing Cross to the Embankment for the London United Electric Railways.

Manchester.—The Manchester and Salford tramway men have decided not to strike, and on Tuesday, at a meeting of the Municipal Employés' Association, Councillor Jones, organising secretary, advised the members to present their demands to the City Council; the meeting passed a resolution to the effect that they should demand redress of their grievances without resorting to a strike. The members of the Association some time ago passed a resolution declaring that after August 31st they would refuse to work alongside non-union men.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee, on August 31st, instructions were given to the city engineer to prepare the necessary plans for carrying out the extensions of the system sanctioned by the Act just passed through Parliament. The new route to Newburn and extensions to the present routes in Shieldfield, Jesmond and Heaton are included.

North Wales.—The B. of T. has authorised the construction of a light railway in the parishes of Maenan, the Abbey, Caerhun, Dolgarog and Trefriw in North Wales.

Rochdale.—On Wednesday, August 30th, the Tramways Committee decided to increase the wages of those employés who had been in its service four years a farthing per hour. This will benefit about 65 per cent. of the workmen, and will mean an increased annual expenditure of £500.

TELEGRAPH and TELEPHONE NOTES.

Chile.—A project for establishing a telephone service in the town of Constitucion has been approved.—*Board of Trade Journal.*

Italy.—In the budget of the Italian Minister of Posts and Telegraphs for 1910-11, there is an extraordinary credit of 3,210,000 lire for extensions of the existing telephone network. These include not only 700 miles of new lines in Italy itself, but also various lines of international importance, viz., the lines from Rome to Milan, and through the Simplon Tunnel; Turin to Milan, and Genoa to Milan, communicating with the German and Austrian systems; and Milan to Chiasso, and Milan to the Simplon Tunnel, to facilitate traffic with Basle and Zurich in Switzerland.—*Elektrotechnik und Maschinenbau.*

Postal Telegraphs.—At a meeting of the National Joint Committee of Postal and Telegraph Societies on Saturday last, the wages and working conditions of telegraphists and linemen were discussed, and it was resolved to ask the P.M.G. to appoint a Select Committee of the House of Commons, and to hold mass meetings in support of this demand.

The Melograph.—The well-known telephone firm of L. M. Ericsson, of Stockholm, is interested in a Swedish invention called the Melograph, a patented registering and reproducing musical instrument, the use of which was recently demonstrated at the works of the firm. The inventor of this apparatus is a Swedish engineer named Nyström, from Karlstad, who in 1891 took out the first patent for the new device, which was at that time very incomplete. The "Melograph," which is worked by means of electricity, can be used in combination with all key instruments, such as pianos and organs. Whilst a piece of music is being played on an instrument in the usual manner, the Melograph registers the tune on a chemically-prepared ribbon, ruled for music, which is covered with a substance resembling wax. The music can afterwards be read like a Morse telegram, and transcribed into ordinary notes. The "Melograph" fulfils a double function; for it not only records, but also reproduces music, with the same expression and rendering as the performer used.

Telegraphing Round the World.—The *New York Times* recently dispatched a telegram of nine words round the world to itself, a route of 28,613 miles; the circuit was completed in 16½ minutes, and the message passed through 16 relays. The record is held by a message sent round the globe on the opening of the Pacific Cable 11 years ago in 9½ minutes, but on that occasion the route was cleared in advance and all the operators were standing by in readiness for the dispatch. The *Times* message, on the other hand, was handled as a purely commercial message. The route was everywhere north of the Equator, passing through Honolulu, Manila, Hong Kong, Singapore, Bombay, Suez, Gibraltar and Fayal.

Wireless Telegraphy.—The Company (Telefunken) for Wireless Telegraphy, of Berlin, announces in its official organ that it has participated to a "considerable amount" in the Australasian Wireless Co., Ltd., of Sydney, which was formed last April with an ordinary share capital of £50,000 and £15,000 in 6 per cent. cumulative preference shares. The Australasian Company has already received orders for two large wireless stations for Australia, and has booked contracts for the equipment of installations on more than 40 merchant steamers. It is added that the Telefunken Co. has acquired the patent rights of the Norwegian, Capt. Hovland, for a secret wireless telegraphic system and the right of the Russian inventor, Fagan, for a telescopic mast for portable stations.

Wireless Telegraphy in Germany.—Some interesting particulars were given on the progress of wireless telegraphy in Germany at a recent meeting of the Kolonial Technisch Kommission. Prof. Goldschmidt stated that reports recently made that wireless communication had been set up between Germany and the Cameroons, 6,000 kilometres distant, were without foundation, or at least were only justified by single successes without practical value. The bridging of immense distances was disproportionate with the size of the appliances used, and, in his opinion, the solution of transmitting wireless telegraphic messages to the greatest distances lay, first, in the construction of extraordinarily large stations and gigantic towers: and secondly, in the employment of great power in order that the waves emitted should give a regular volume of sound in the receivers of intensity superior to that produced by atmospheric and other disturbances. A society had been formed in Berlin, the Hochfrequenz Maschinen A.G., which possessed a capital of over million marks, to carry out researches to this end. Prof. Slaby said that the progress made since Marconi transmitted messages 100 miles, to the present, when 5,000 km. were bridged was largely due to German research, especially in the adaptation of wireless telegraphy to the marine service. But much still remained to be done; it was, however, a well-known fact that Imperial assistance had been given to extensive researches, which had now been carried on for two years, with a view to forwarding messages from the Nauern station to the Cameroons. These researches had not yet achieved the wished-for results, and in technical circles it was not quite clear what the cause was. The solution was thought to lie in the direction of employing machinery of much greater power.—*Elektrische und Maschinelle Betriebe.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—October 3rd. 42 miles of paper insulated, lead-covered telephone cable, for the P.M.G. £ "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" August 25th.

November 21st.—One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—October 25th. Cable and paper sleeves for the P.M.G. See "Official Notices" September 1st.

Tasmania.—October 2nd. Porcelain insulators for the P.M. See "Official Notices" September 1st.

Belgium.—November 27th. The municipal authorities of Tournai are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town during a period of 30 years. The specification can be obtained at the price of one franc from the Hotel de Ville, Tournai.

October 3rd.—La Société Nationale des Chemins de Fer Vicinaux of Brussels (14, Rue de la Science), is inviting tenders for the contract for the overhead equipment of the Salzinnes-Malonne section of the Onoz-Profondeville light electric railway.

October 4th. Tenders are invited by the same society for the installation of electric traction on the Brussels to Halcht suburban line. The works comprise overhead equipment, transformer station, electric locomotives, &c.

Birkenhead.—The Tramways Committee is to invite designs and tenders for six new cars for the New Ferry route.

Blackpool.—September 19th. Waterproof clothing for tramway employés, for the T.C. Chas. Furness, general manager, West Caroline Street.

Bray (Ireland).—September 19th. 2,500 yd. of concentric, paper-insulated and lead-covered cable, 2,000 volts, for the U.D.C. See "Official Notices" to-day.

Brazil.—November 14th. Tenders are invited by the municipal authorities of Pelotas for a 40 years' concession for the supply of electric power and light, and the establishment and working of electric tramways in the town. For further particulars see this column last week.

Brighton.—September 12th. Electrical fittings for the B. of G. B. Burfield, clerk, Parochial Offices.

Bulgaria.—September 30th. Finance Administration authorities at Sofia. The establishment of a central electric lighting station at the port of Varna.

Eccles.—September 12th. High-tension single-phase alternating-current switchboard, consisting of three generator and five feeder panels, for the T.C. H. W. Angus, electrical engineer, Cawdor Street, Patricroft; returnable deposit of £1 1s.

Haslingden.—September 9th. Electric light installations for various public buildings, for the Corporation. See "Official Notices" September 1st.

Italy.—October 3rd. Italian State Railway authorities at Rome. Three electrically-operated cranes for the docks at Venice.

Keighley.—September 25th. Coal-handling plant, storage reservoir for 200,000 gallons of water, and two circulating pumps, for the Corporation Electricity Works. See "Official Notices" to-day.

Maidenhead.—September 11th. Coal for the electric power station, for the T.C., for a year. Borough Electrical Engineer

Merthyr Tydfil.—September 12th. Electric wiring and fitting for the Mardy Hospital Buildings. Borough Engineer.

New Zealand.—November 1st. Tenders are invited by the Municipal Corporation at Dunedin for (1) a vertical type gas engine, or alternatively, Diesel oil engine, of 500 B.H.P. capacity, suitable for connecting by rope drive to an A.C. motor and a D.C. generator mounted on one shaft, and running at 500 R.P.M., and (2) a direct-coupled set consisting of a vertical type gas engine, or alternatively, Diesel oil engine, and D.C. generator of 800 KW. capacity at 550 volts. Separate tenders to the Town Clerk, Dunedin. A deposit of £100 is required with each tender, to be increased by the successful tenderer to £500. A copy of the specification and form of tender, &c., may be seen by British makers at the Commercial Intelligence Branch of the Board of Trade.—*Board of Trade Journal.*

Pontypridd.—September 12th. Water-tube boiler and Foster superheater for the U.D.C. See "Official Notices" September 1st.

Roumania.—November 19th. The lighting of the town of Tulcea by electricity. "Mairie de Tulcea," Tulcea.

Spain.—September 30th. The Spanish Ministry of Posts and Telegraphs in Madrid are inviting tenders for the concession for the establishment, and working during a period of 15 years, of a telephone exchange in the town of Orense.

The "Junta especial de Subastas, Ministerio de Marina," Madrid, invites tenders for the supply of two radio-telegraphic installations, one of a naval type, and the other capable of being carried by a landing party. The upset price is put at 42,000 pesetas (about £1,550), and a deposit of 2,200 pesetas (about £80) will be required with each tender. Local representation is essential.—*Board of Trade Journal.*

Sweden.—September 15th. The Harbour Authorities at Norrköping require some electrical windlasses, and request possible suppliers to make tenders. Tenders, marked "Anbud a leverans av elektriska förhalningsspel," to "Hamnstyrelsen, Norrköpings Stads Byggnadskontor," Norrköping. A copy of the specification (in Swedish), together with a translation, may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., where also the name of a trader through whom firms might submit their offers may be obtained.—*Board of Trade Journal.*

Swinton and Pendlebury.—September 9th. Electric cables, joint boxes, compound, &c., for the U.D.C. See "Official Notices" September 1st.

Wishaw.—September 11th. Carbons for Oriflamme arc lamps for the T.C. See "Official Notices" September 1st.

CLOSED.

Bridlington.—The T.C. has accepted the tender of Messrs. John Watt & Co., Ltd., of Hull, for coal for the electricity works.

Great Eastern Railway.—Messrs. Royce, Ltd., of Trafford Park, have been awarded an order by the Great Eastern Railway for 11 electrical capstans of the "Royce" patent free collard type and spares for use on the company's wharf and goods yard at Blackwall. The order also comprises 10 electrical jib cranes, two electrical hoists and spares.

Halifax.—The Tramways Committee has accepted the tender of Messrs. Murgatroyd & Horsfall, jewellers, to supply and fix in Commercial Street an electric master clock, at £4 10s.; and to supply and fix at Union Street, Cow Green, and Waterhouse Street, receiver clocks at £3 3s. each.

New Zealand.—The British General Electric Co., Ltd., Harbour Street, Wellington, have secured the contract for the electrical plant, switchboards and motor pumps for the Gisborne Borough Council. The company have also supplied the Wellington City Council with a quantity of 1,000-C.P. Osrams, these being, we understand, the largest lamps introduced into the Dominion.

Salford.—The Corporation, on Monday, accepted the tender of the Lancashire Electrical Co. for the complete installation of intercommunication telephones (34 stations) in the Salford Town Hall and New Annexe.

Stalybridge.—The contract for the installation of electric light in St. Paul's Church has been let to Messrs. Drake & Gorham, Ltd.

Stockton-on-Tees.—The T.C. has accepted the following tenders:—

Richardsons, Westgarth & Co., Ltd., Hartlepool.—Mixed pressure turbine combined with a Siemens direct current 400 to 500-KW. generator, £2,923.
Klein Engineering Co. (1908), Ltd., Manchester.—Cooling tower.
T. Sugden, Ltd.—Superheaters.
Drake & Gorham.—Switchgear.

Stoke-on-Trent.—The T.C. has accepted the tender of Mr. Wardle, of Longport, for the new power station, at £5,120; and that of Messrs. Grant & Sons, of Burslem, for the extension of the Burslem Electricity Works, at £615.

Wakefield.—The City Electric Light Committee has accepted the the tender of Messrs. Higgins & Pashley, for the supply of a weighbridge to the electricity works, at a cost of £41 10s.

Warrington.—The T.C. has accepted the tender of Messrs. Matthews & Yates, Ltd., for the supply of an induced draught plant.

Wigan.—The E.L. Committee of the T.C. has accepted the tender of Messrs. Duckham & Co., Ltd., for oils for a year for the electricity works.

NOTES.

Olympia Electrical Exhibition.—The Conference of Chief Officials of the Electric Supply Companies of London, assisted by many provincial supply companies and certain of the London Borough Councils, have taken two large spaces on either side of the central gangway. One of these stands will be fitted up as an Inquiry Bureau, and will contain an important exhibit from the Publicity Committee. The other stand will be arranged as a Demonstration Room, with seating accommodation for about 50 visitors, the object of the Conference being that the fullest opportunity should be afforded for practical demonstrations of the latest developments in electric lighting, cooking, cleaning and other devices. Exhibitors are invited to communicate with Mr. F. J. Walker, Hon. Secretary of the Conference, 19, Carnaby Street, W., with a view to taking advantage of this arrangement, which cannot fail to be beneficial to all parties concerned. No charge will be made for the use of this room. The Conference are also arranging for a series of popular competitions, which will be open to all visitors to the Exhibition, and attractive prizes will be offered for the best replies received. Full particulars of these competitions will be shortly announced.

We are asked to state that the management of the Exhibition will be happy to send any contractors pictorial posters of the Exhibition on hearing from them, and on consideration of such contractors exhibiting these bills in their windows, they will be entitled to two complimentary tickets to the Exhibition. The greater the public attendance at the Electrical Exhibition the more the industry may expect to benefit generally, and we would therefore urge all contractors to assist to the utmost of their power in giving the Exhibition full publicity in their windows and shops and in conversation with their clients.

German Labour Troubles.—Reuter's Berlin representative states that at a meeting of Berlin electric fitters held on August 31st, it was decided to approve the resolution previously adopted at a meeting of the men's delegates, to the effect that the tactics hitherto observed should be modified, and that agreements on the conditions of labour should in future be concluded with each individual firm instead of between the different organisations of employers and employed.

New Effect of Electricity.—A correspondent writes:—"When switching off the arc lamps in Goring Road, Llanelly, recently, a young man named Lee, in the employ of the local electric light company, received a severe shock from the current. As a result he was struck dumb, and for ten days since has been unable to speak. He is otherwise physically well, and hopes are entertained that he will soon recover the lost faculty." We are pleased to add that he regained the power of speech on Sunday last.

Appointment Vacant.—Shift engineer for the electricity works of the Public Works Department, Southern Nigeria (£250). See our advertisement pages in this issue.

Electrical Publicity.—The Electric Supply Publicity Committee has made a further issue of publicity matter. There is one point of particular excellence, and that is the coloured drawing which figures on the front cover of the booklet and on the mail card. This is a design by the well-known artist, Mr. Cecil Aldin, who has obtained such widespread popularity as a painter of dogs in their various moods. In the present instance, he has two dogs in a very happy moment in front of an electric radiator. The booklet is issued at a very convenient moment, as it will be just in time for sending out with the September quarter's accounts. The inside of the heating booklet is equally excellent; the booklet is just the thing to put in the hands of consumers. The mail card, on which the illustration has been reproduced, has the reverse side left blank, so as to be used for correspondence, and would form a very attractive advertisement. The issue also includes a four-page circular, in which the safety of electric light comes to the fore-front, as against certain disastrous gas accidents quoted from the Press; and a power booklet of good size, got up on the most approved lines.

A Charmed Circle.—A correspondent writes:—"Recently a 'short leet' of a round baker's dozen were fore-gathered in the civic hall of a certain town in the shire of broad acres. Prior to individual examination by the elected (more or less) great unpaid, as was but natural on so auspicious an occasion, discussion turned upon central station matters. Almost needless to relate, the consensus of tone was of a decidedly pessimistic character. Conversation then, as a matter of course, drifted to the prevailing strike, one of the 'hopefuls' remarking that two absentee selected candidates had probably got hung up somewhere on the line.

"At that moment the door of the waiting-room was opened, the incomer being a gentleman bearing obvious signs of recent travel. The room was of the usual 'board' type—long official table, conventional uninviting chairs, &c. Advancing towards the table, the new arrival, addressing the ring of candidates in apologetic tone, 'regretted his inability to be on time through delay of trains owing to railway dispute.' Imagine the consternation of the embarrassed station man on hearing the round of hearty laughter which greeted his explanation. The delicate irony of the situation was that a meeting of shift engineers and mains men should have been mistaken for a committee of town councillors. One usually associates obesity and senility with our civic representatives. Some station men may perhaps before long be included in the latter category, and 'shift' to another stage, as Shakespeare puts it—the last stage of all; but whilst things in the station world remain as at present the likelihood of any of the fraternity being suspected of approaching embonpoint seems rather remote."

Nitrogen from the Air.—According to *Affärsvarlden*, a company has recently been formed at Stockholm for the exploitation of a new electrical process for extracting atmospheric nitrogen. The promoters of the company are some of the most prominent men in financial and commercial circles, and the capital is 3,000,000 kroners (£166,667), which can be increased later. The new process has been invented by the engineers Th. Thorsell, C. Bjorne and B. Lundin. During the first year the company intends to have the process thoroughly tested by means of experiments, which are going to be carried out on such a large scale as to form a basis for the continuation on commercial lines. After the necessary experience has been gained, a large factory is to be built at Gothenburg.

The chief difference between this new process and those already in existence, and used in Sweden, and especially in Norway, is that the former is not altogether dependent on a large supply of electrical energy, but requires a comparatively small amount. This advantage explains the possibility of deriving the power for the new factory from the Trollhättan Waterfalls, which is by no means very cheap. On the other hand, Gothenburg offers such facilities with regard to shipping as no other Swedish port, and for this reason, with an export trade in view, this place has been chosen as the centre of this new industrial undertaking.

Train Lighting in Germany.—According to information emanating from railway circles, the management of the Prussian-Hessen State Railways seems disposed to approach more closely the question of introducing the electric light in passenger trains. As a result of the disasters caused by the escape of gas, the sleeping cars in past years have been equipped with the lighting system owned by the Train Electric Lighting Co., of Berlin. Each coach is provided with a dynamo driven by belt from the axle, of the Rosenberg type, and a battery is provided for furnishing light when the train is at a standstill.

Electric Ambulances.—According to the *Standard*, the Port of London Authority will the week after next put into service the four electric ambulances intended for first aid use on the London Docks.

Annual Sports.—The Robertson and Osram Social and Athletic Club held their sixth annual sports at the Latymer Upper School Grounds, Wood Lane, Shepherd's Bush, on Saturday afternoon last. The programme of events included flat racing for girls, men and veterans respectively, egg-and-spoon race, skipping races, tug-of-war, three-legged, obstacle and wheel-barrow races. The judges were Messrs. C. Wilson, F. P. Driver, E. G. Sheppard, G. Jessop and C. Beaven. Mrs. C. Wilson distributed the prizes. The Middlesex Military Band played selections during the afternoon and at dusk for dancing. The hon. secretaries were Messrs. G. H. Freeman and L. Jordan.

Educational Notes.—City of London College. The new term commences on October 2nd; classes are provided physics, &c. See our advertisement pages to-day.

University College, London.—The new session begins October 2nd. Degree and diploma courses are provided, and spec courses for students partially trained elsewhere. Postgradu work is also arranged for, and an entrance scholarship (120 guine is open for competition. See our advertisement pages to-day.

Borough Polytechnic Institute, S.E.—The institute reope on September 25th. Instruction is given in electrotechnics un Dr. J. Henderson. See our advertisement pages to-day.

Enamel Insulated Wires.—The steady progress th is being made in the development towards perfection of enan insulation for wires is well exemplified in the third edition of pamphlet on the subject recently issued by Messrs. Connolly Br Ltd., of Blackley, Manchester. The makers state that their enan is unaffected by alternations of moisture and dryness, by sunligh and by a permanent temperature of 300° F., while it can be expos temporarily to a temperature of 600° or 700° F. without inju and to 400° F. for several hours. The enamel is also proof agai alkalis and other powerful solvents, including alcohol, and electr lysis. What has especially caught our attention, however, is t fact that these wires are now being put forward not only f winding the coils of instruments, arc lamps, transformers and fi magnets, as well as for telephone and bell circuits, but also f electric lighting. For this purpose the enamelled wires are doul cotton-covered and compounded, twinned, and braided with cott impregnated with flame-resisting compound. Such wires, it stated, have withstood pressures up to 8,400 volts A.C. when d and 2,000 volts A.C. when immersed in water for eight days. T makers recommend their use for circuits up to 220 volts, and infor us that the Bradford Corporation Electricity Department, aft prolonged investigation, recommends its adoption, in conduit, f electric lighting circuits. We anticipate, therefore, furth interesting developments in this direction, and congratulate t firm on the progress already accomplished.

Creosoting Timber by the Rüping Process.—Messr Richard Wade, Sons & Co., Ltd., of Hull and Staddlethorpe, ha installed extensive plant at Staddlethorpe to carry out the R Rüping process of creosoting timber. This process is a Germ invention, and, judging by its success on the Continent, it bids f to supplant the existing creosoting processes. At the invitation the directors of the firm, one of our representatives visited Tuesday the extensive timber yards of Messrs. Wade and witness some interesting demonstrations. There was a large and rep sentative gathering of commercial men and others interest including Mr. James Sinclair, of the National Telephone C Mr. E. Roberts, of the General Post Office; Mr. Morgan, of t G.P.O. stores; Mr. Johns, of the London and South-Weste Railway; Mr. Bricknell, Hull assistant city engineer; Mr. T. Holm manager of the Hull Corporation Telephones, and others.

On arriving at the works, the visitors were met by Mr. E. S. Wa and Mr. Christopher Wade, and shown over the yards and premis For the demonstrations, various shapes and kinds of wood w selected, such as redwood, poles, timbers, sleepers, fencing, pavi blocks and whitewood battens and boards. These were all weigh and measured and then sealed up in a cylinder, where they w subjected to an air pressure of about 50 lb. per sq. in., and then cylinder was filled with creosote, the air pressure being maintain Next a pressure of 80 lb. per sq. in. was put on, after which t pressure was released and the cylinder opened. The timber was th taken out and reweighed, showing the amount of oil remaining in Various pieces of the wood were cross-cut, and showed a remarkab penetration of oil, nearly to the centre. This, it was stated, w impossible in the old method except at a great cost, and this al applied to the white-wood, into which it used to be practical impossible to inject the oil. One of the things which impress the visitors was the extreme cleanliness of the wood. It was qui dry and clean to handle, and not dirty and clogged with oil as generally the case with creosoted wood. By this method, it wa clearly shown, the cost is very greatly reduced, for waste of th preserving liquid is entirely avoided, whilst better results a obtained, it seems, than by the old method. The firm is the on one that has adopted the process in this country, though exper ments have been made in London for some time past.

The visitors were entertained to lunch at the conclusion of th demonstration, and Mr. Johns (London and South-Western Railwa Co.) thanked the directors for the opportunity of seeing th demonstrations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industr also electric tramway and railway officials, to keep readers of th Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. J. McKenn shift engineer at the power station of the Lancashire Electr Power Co., has been appointed shift engineer to the Midland Electr Corporation, Ltd.

Mr. E. C. Lloyd, second assistant mains superintenden Wallasey Corporation electricity works, was presented with copper fire suite, by the staff and employés of the department, c the occasion of his marriage.

Mr. H. R. Campion, borough electrical engineer at Dewsbury, whose serious illness we recently announced, is slowly improving, but it will be some weeks before he will be able to resume his duties.

The staff at the Derby Corporation electrical department has presented a set of decanters to Mr. Geo. Dearle on his marriage.

Tramway Officials.—The staff of the Sheffield Corporation tramways have presented a silver tea tray to Mr. H. E. Yerbury, chief engineer, as a wedding gift.

Mr. A. N. Batley, who is leaving Yarmouth to take up an appointment in the Swindon Corporation tramways department, has been presented by the staff with a purse of gold, and a Gladstone bag.

General.—Mr. A. McAdam, assistant electrical engineer of the Ordnance Gun Carriage Factory, Jubbulpore, India, will shortly resign his position.

We regret to learn that Mr. Walter Dunn, who has rendered such splendid and faithful service as secretary of the Junior Institution of Engineers during the past 27 years, is about to retire from that position. We wish that the Council's pressure upon him to reconsider his decision had been more successful, but "considerations of health," and these alone, have compelled him to relinquish the office, into the duties of which he has so long thrown himself heart and soul.

Obituary.—Mr. James Dodimead.—We regret to learn that Mr. James Dodimead, senior partner of Messrs. James Dodimead & Sons, passed away on Wednesday.

CITY NOTES.

Underground Electric Railways Co. of London, Ltd.

The directors' report for the half-year ended June 30th, states that the net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £106,105, and the amount receivable under guarantee on Metropolitan District Railway assented first preference stock was £2,687. The net income from the operation of the power house was £45,472 ; the interest on £1,000,000 4 per cent. first power house debentures, and a proportion of commission, discount and expenses incurred in connection with the issue, required £20,870, leaving a surplus from the power house of £24,602, making the revenue total £133,394. The service of the £1,000,000 5 per cent. prior lien bonds required £26,549 ; the service of the £2.818,700 4½ per cent. bonds of 1933 required £67,349 ; leaving a surplus over half-yearly charges of £39,496, which amount will be applied as follows : Interest at the rate of ½ per cent. per annum on £4,928,050 6 per cent. income bonds of 1948, £36,960 : income-tax, £2,289 ; leaving a balance to reserve applied in reduction of the accumulated revenue deficiencies of £246.

The income from investments for the six months shows an increase of £15,678 (about 17 per cent.) over that for the corresponding half-year of 1910. The directors note with satisfaction that the Metropolitan District Railway Co. has paid for the last half-year a dividend at the full rate of 4½ per cent. per annum on its first preference stock, and that consequently the company is now deriving the full benefit of the arrangement under which it guarantees the dividend on the Metropolitan District Railway assented first preference stock. The company received on balance in respect of last half-year the sum of £2,686, whereas for the corresponding half-year of 1910 the amount paid by the company was £1,343.

The traffic of the railway companies and the London United Tramways, Ltd., in which the company is interested, is increasing satisfactorily.

The eighth Parsons turbine has now been installed in the power house, and is in operation. The net output of electric energy during the half-year was 69,636,800 KW.-hours, as against 63,627,200 KW.-hours during the corresponding period of 1910.

London Electric and District Railway Acts.—The London Electric Railway Bill referred to in the last report received Royal assent on June 2nd last. The railway company has let the contracts in connection with the construction of the Charing Cross and Paddington extensions and actual construction has been started. It is hoped that these works will be completed within 18 months. The Metropolitan District Railway Bill referred to in the same report also received Royal assent on the June 2nd last. The powers conferred by this Act, whereby the Lots Road power house undertaking is to be purchased by the joint committee of the Metropolitan District and London Electric Companies and leased to the two railway companies, were fully explained in the circular issued to the shareholders and holders of 6 per cent. income bonds of the company on June 9th last. A provisional agreement has been executed stating the terms on which the power house will be transferred to the joint committee and leased to the two railway companies as on and from January 1st next.

£1,250,000 London Electric Railway 4 per cent. preference stock has been sold during the half-year for delivery on September 1st next. The proceeds will be used towards the redemption of the entire series of £1,000,000 5 per cent. prior lien bonds on that date. The proceeds of £2,200,000 Metropolitan District and London Electric Railways joint power house rent charge stock which has been sold for delivery on January 15th next will constitute the purchase price for the Lots Road power house undertaking above referred to, and will be used to redeem on that date £1,000,000 4 per cent. power house debentures and £1,088,700 4½ per cent. bonds of 1933.

Stocks, shares and other property stand in the books at £11,991,917, and consist of stocks and shares in associated companies, consols, and lands and buildings other than power house property. The decrease of £23,717 mainly results from the sale of £25,000 London Electric Railway debenture stock.

The power house depreciation fund at the end of the half-year was £171,524. The interest of the company in this fund, as well as in the special maintenance fund amounting at the end of the half-year to £3,051 in cash, being included in the power house sale, will be transferred with the power house undertaking to the Metropolitan District and London Electric Joint Committee.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Aberdare Electric Lighting Co., Ltd.
Albion Battery Co., Ltd.
Buenos Ayres Electric Light Co., Ltd.
General Heating and Lighting Co., Ltd.
Heswall District Power Co., Ltd.
Private Wire and Telephone Installation Co., Ltd.
Via Eastern Code Co., Ltd.

Claud Hamilton, Ltd.—The general meeting was held on August 30th at Glasgow. Mr. Alex. J. Fergusson, C.A., chairman of the board, presided, and moved the adoption of the report, which recommended the payment of a dividend of 10 per cent. on the ordinary capital of the company, after making adequate provision for depreciation, carrying substantial amounts to the various reserve funds of the company and paying the dividend on the 5 per cent. preference shares. The motion was seconded by Mr. Claud Hamilton, and unanimously adopted. Mr. Claud Hamilton was re-elected a director, and the auditor was re-appointed.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for dividends on the company's 7 per cent. cumulative first and 6 per cent. cumulative second preference shares for the half-year ended June 30th, 1911, have been posted.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List :—

Hastings and District Electric Tramways Co., Ltd.—268,235 ordinary shares of 10s. each fully paid, Nos. 130,001 to 398,235, and 80,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 80,000, partly in lieu of the preference shares of £5 each now quoted.

The Committee has ordered the undermentioned to be quoted in the Official List :—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 37,900 ordinary shares of £1 each fully paid, Nos. 428,776 to 466,675, and 227,011 7 per cent. cumulative participating preference shares of £1 each fully paid, Nos. 500,001 to 727,011.

Newcastle and District Electric Lighting Co., Ltd.—The directors have declared an interim dividend at the rate of 3 per cent. per annum for the half-year to June 30th.

Electric Supply of Victoria, Ltd.—The directors' report, as abstracted in the *Financier*, states that the accounts for the year to March 31st, after payment of debenture interest, show a profit of £11,340. After adding £6,212 brought forward and deducting £5,599 paid on account of the preference dividend due and £4,722 for the debenture stock redemption account, there remains a credit balance of £7,231. The preference dividend in arrears amounts to £16,211.

Davis & Timmins, Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (7½d. per share), less income-tax, on the ordinary shares, for the half-year to June 30th.

Globe Telegraph and Trust Co., Ltd.—The directors have declared an interim dividend of 2s. per share, free of income-tax, on the ordinary shares for the first quarter.

Dumbarton Burgh and County Tramways Co., Ltd.—The directors report that the accounts for the year ended July 31st show an available sum, after providing for debenture interest and including £3,010 brought forward, of £8,468, out of which the directors recommend payment of the dividend on the preference shares, leaving £2,768 to be carried forward.

British Electric Transformer Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (7½d. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend at the rate of 10 per cent. per annum is announced, payable October 2nd.

Oxford Electric Co., Ltd.—The directors have declared a dividend at the rate of 6 per cent. per annum, less tax, on the ordinary shares for the half-year to June 30th.

Continental.—France.—A company has just been formed at Flines-les-Racher (Nord) with the title La Société Electrique de Flines-les-Racher, to establish a small central electric lighting station in the town.

Russia.—The report of the Compagnie d'Electricité de Varsovie, of Warsaw and Paris, for the last financial year shows a net profit of 460,167 roubles, as compared with 301,896 roubles in the preceding 12 months. The dividend is being increased from 2 to 4 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Aug. 30	3,261	+ 13	13	21,680	+ 347	..	..
Ayr	Sept. 2	764	+ 55	16	6,906	+ 88	8	..
Bath	„ 2	2,073	+ 73	35	29,882	+ 1,154	..	..
†Belfast	Aug. 25	4,493	+ 524	21	97,139	+11,928	40	8
Birkenhead	Sept. 3	2,312	+ 16	22	26,138	+ 961	13·7	..
Birmingham Corp.	Aug. 26	17,018	+3,665	21	168,521	+25,414	56·4	..
Blackburn	..	..	..	..	..	..	..	..
†Blackpool Corp.	„ 24	2,560	— 157	.	36,747	+ 3,565	..	..
Blackpool-Fleetw'd	Sept. 2	3,481	+ 417	9	16,059	+ 1,251	..	..
†Bolton	Aug. 27	2,449	+ 53	22	55,794	+ 4,186	26	..
Bournemouth	„ 30	4,790	+ 39	22	42,731	— 1,722	21·9	..
Bradford	„ 26	11,844	+1,322	21	121,290	+10,187	56	1·8
Brighton	Sept. 3	2,769	+ 242	22⅔	26,187	+ 1,808	9·5	..
Bristol	„ 1	14,630	+2,153	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Aug. 25	461	+ 26	34	7,380	+ 67	3·65	..
Barnsley	„ 25	583	+ 77	„	6,272	+ 404	..	..
Barrow	„ 25	928	+ 305	„	10,273	+ 1,077	5·37	..
Devonport	„ 25	1,214	+ 285	„	16,812	+ 2,497	8·85	..
Gateshead	„ 25	2,199	+ 176	„	35,329	+ 2,016	11·25	..
Gravesend	„ 25	481	+ 13	„	7,261	+ 205	6·5	..
Greenock	„ 25	1,782	+ 265	„	24,584	+ 3,146	7·25	..
Hartlepool	„ 25	697	+ 29	„	9,260	+ 784	6·72	..
Kidderminster	„ 25	303	+ 22	„	4,114	+ 279	..	..
‡Leamington	„ 25	455	— 6	„	6,050	+ 332	..	..
Merthyr	„ 25	451	+ 18	„	7,140	+ 134	2·9	..
Metropolitan	„ 25	17,958	+2,012	„	298,653	+46,782	22	..
Middleton	„ 25	1,099	+ 319	„	11,878	+ 1,046	8·5	..
Mid. Joint Com'tee	„ 25	8,654	—3,474	„	190,829	— 4,413	..	..
Oldham—Ashton	„ 25	1,405	+ 175	„	19,226	+ 734	9·13	..
Peterborough	„ 25	396	+ 21	„	4,355	+ 427	5·31	..
Potteries	„ 25	3,506	+ 77	„	65,252	+ 6,380	29	..
Rothesay	„ 25	1,277	+ 187	„	8,037	— 16	2·75	..
Southport	„ 25	870	+ 118	„	10,622	+ 444	8·17	..
S. Metropolitan	„ 25	2,207	+ 164	„	29,879	+ 1,686	..	..
Swansea	„ 25	2,557	+ 168	„	39,050	+ 2,413	12·5	..
Tynemouth	„ 25	1,065	+ 69	„	9,531	+ 356	3·75	..
Weston-s-Mare	„ 25	1,006	+ 144	„	6,076	+ 641	3	..
‡Worcester	„ 25	659	— 36	„	10,093	+ 462	5·75	..
Wrexham	„ 25	252	+ 35	„	3,443	+ 159	..	..
Yorks. Wool. Dist.	„ 25	2,341	+ 201	„	35,876	+ 2,575	17	..
Miscellaneous	„ 25	602	+ 73	„	7,821	+ 346	..	..
Burnley	Sept. 2	2,812	+ 354	..	..	..	11·7	1
Burton-on-Trent	„ 3	627	+ 35	22	6,744	+ 624	6·6	..
Bury	„ 3	2,646	+ 243	22⅔	29,971	+ 3,106	22·5	..
Cardiff	Aug. 19	5,569	+ 680	20	22,132	+ 5,047	..	..
Chatham and Dist.	„ 31	1,924	— 70	35	30,037	+ 310	15	..
Cork	„ 31	1,104	+ 63	35	17,622	+ 505	9·9	..
Croydon	„ 21	3,648	+ 144	..	40,190	+ 3,425	..	..
Darlington	Sept. 2	447	+ 33	23	5,136	+ 534	..	..
Darwen	„ 1	552	+ 67	22	6,073	+ 543	4·36	..
†Dover	Aug. 19	385	— 32	20	5,652	+ 850	4·7	..
Dublin	Sept. 1	13,056	— 360	..	65,309	+ 9,622	54·2	..
Dundee	Aug. 30	2,388	— 200	15⅔	18,515	— 397	15	..
East Ham	Sept. 2	2,140	+ 26	22⅓	24,659	+ 1,350	7·9	..
Exeter	„ 1	783	+ 50	22	8,219	+ 707	5·5	..
Glasgow	„ 2	38,450	+4,669	..	251,275	+17,379	98	·75
Hastings	Aug. 31	3,154	+ 99	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	Sept. 2	5,654	+ 82	22	63,468	+ 2,960	14·5	..
Ilkeston	Aug. 31	264	— 16	22	2,994	+ 110	..	..
Ipswich	Sept. 2	1,144	+ 99	22	10,894	+ 694	10·5	..
Kilmarnock	„ 2	323	+ 20	16	2,858	+ 312	4·25	..
Lancashire United	Aug. 30	3,004	+ 454	35	47,341	+ 1,726	39	..
Leeds	„ 26	15,501	+1,361	21	162,817	+11,584	108	..
Leicester	..	..	..	..	..	..	..	..
Leith	Sept. 2	1,365	+ 146	15⅔	11,352	+ 999	8·7	..
†Liverpool	Aug. 19	8,333	—3,169	33	378,783	+12,296	116	2·5
‡L.C.C.	„ 23	82,482	+1,200	..	935,469	+59,701	142	6
London United	Sept. 2	14,158	+ 411	..	234,298	+ 9,897	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
Manchester	„ 2	82,006	+1,575	22	864,414	+21 848	183	..
Newcastle	„ 2	8,882	+ 830	..	96,026	+13,338	14·5	..
Newport	„ 2	1,375	— 51	22	16,416	+ 891	14·5	..
†Oldham	„ 3	1,892	+ 123	..	45,261	+ 1,737	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	Aug. 30	1,647	+ 73	22	17,731	+ 1,365	..	..
Salford	„ 28	9,863	+ 861	21	106,855	+ 6,007	..	..
Sheffield	Sept. 5	12,511	+ 686	..	148,822	+10,154	40	..
Southampton	Aug. 30	2,802	+ 575	22	28,589	+ 3,762	22	..
Southend-on-Sea	„ 30	2,290	+ 346	22	17,597	+ 2,538	..	..
South Shields	Sept. 2	1,332	+ 98	22	14,741	+ 1,845	..	..
Swindon	Aug. 30	350	+ 42	22	3,594	+ 433	..	..
Tyneside	„ 30	1,348	+ 426	9	5,245	+ 644	..	..
Wallasey	Sept. 2	2,313	+ 273	22	26,270	+ 4,148	..	..
Walthamstow	„ 2	1,581	+ 69	22	18,274	+ 1,627	9	..
West Ham	Aug. 31	9,914	+ 491	22	61,289	+ 6,184	15·25	..
Wolverhampton	„ 30	1,939	+ 180	22	22,339	+ 1,479	25	..
Cen. London Rly.	Sept. 2	7,823	—1,852	9	88,685	— 8,175	6·32	..
City & S. Lon. Rly.	„ 3	5,969	— 108	9	27,168	— 456	7·26	..
Dublin Lucan Rly.	„ 1	341	— 31	9	1,580	— 51	7	..
G.N. and City Rly.	„ 2	2,608	— 43	9	12,110	+ 246	3·5	..
L'pool Overh'd Rly.	„ 3	2,921	+ 63	..	13,780	+ 349	6·8	4·3
Llandudno-Col. Bay	„ 1	1,460	+ 43	39	11,899	+ 467	..	..
London Elec. Ry. Co.	„ 2	21,210	+ 45	9	104,205	+ 1,475	21·25	..
Mersey Railway	„ 2	3,314	— 498	9	16,965	— 1,602	4·5	..
Metropolitan Rly.	„ 3	30,982	— 783	9	144,577	— 3,250	24·5	..
Met. District Rly.	„ 2	19,328	+ 613	9	94,208	+ 4,228	24	..
Anglo-Argentine	„ 2	93,881	+5,819	..	1,702,558	+158,816	..	..
§Auckland	July	16,199	+1,452	..	..	..	23·3	·6
Bombay (B.E.T.)	Aug. 4	5,519	+ 478	33	88,222	+ 5,397	..	..
Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 2	7,515	+ 154	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	July	8,320	..	..	23,784	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Aug. 15	1,508	+ 144	..	22,040	+ 1,861	..	..
§Montevideo	Aug.	24,015	+1,759	..	850,272	+14,658	..	..
Perth (W.A.)	Sept. 1	3,091	..	..	66,208	+11,883	22	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have once more been subjected to series of harassing incidents. Of these, the largest looming Morocco, which has appeared in the financial firmament as a di turbing factor of cumulative intensity. Then there have bee troubles in the markets, and the continued unsettlement which still felt with regard to labour on some of the leading railway lin All things considered, there is little to induce fresh business, a what trade remains is mainly of the investment order, such as go on steadily all the year round.

Home Railway stocks had a severe shake-out again, whi lowered prices of the steam stocks very substantially. T traffics of the strike fortnight have, of course, been bad. This w generally expected, although, perhaps, the losses are more th anticipation looked for. But besides the takings, the domes trouble in the Stock Exchange referred to in the preced paragraph, brought about severe liquidation, which swept Ho Railway stocks on to lower levels. One of the chief sufferers h been Brighton Deferred Stock, which got down to 93½, some points lower than it stood about Easter time. A partial recove ensued upon the settlement of the difficulty on the Great Easte Railway, which threatened to become acute last week, but balance many stocks have fallen. Amongst the latter are includ Metropolitan Consolidated stock with a drop of 1½, Surplus La and District Ordinary, which fell a point each, and Undergrou Electric Railways income bonds, which also lost 1. City and Sou London Ordinary went back ½, Central Londons are steady, t Deferred retaining its recent improvement.

British Electric Traction 5 per cent. Debenture eased off to 9 and the Preference shares have not been a particularly go market, showing ⅛ loss. Metropolitan Electric Tramw Debenture fell ½, and Bath Trams Preferred Ordinary went back 3s. 1½d., marking a fall of 1/16. These are the only notewort changes amongst Home Railway and Tramway issues.

In the foreign list, British Columbia Deferred fell 2, and t market here is not so firm as it has been. The Mexico gre also is easier, Mexico Trams going back 3, and Rio Trams falling while Sao Paulos reacted a point. The Bond issues are stea although a trifle irregular as regards the price movements, wh are quite small. Rather a feature in this market is a further r of 3/32 in Perth Electric Tramways Ordinary shares, which ha gone up to 4 5/16 *ex* dividend, showing a rise of 4s. 1½d. during past fortnight.

Mexican light and power issues went down on news of r having broken out in connection with the elections in that coun The Common fell 1; both the Preferred and the 1st Mortg Bonds are easier. Monterey Bonds lost ½, and it is furt suggested that the easier tendency of such securities as thi due to the reason already mentioned here, namely, that holder such issues have lately been obliged to sell, in order to pay los incurred elsewhere. Canadian General Electric Common she point, and there are a few *ex* dividend markings which have prices very little down on balance.

Amongst the Telegraph and Telephone stocks and shares, feature is a steady demand for the Eastern issues. East Ordinary is up 1, Eastern Extensions rose ⅛, following upon th improvement of last week. The market has got into a position considerable strength, and appears to be attracting more investm attention than it has done for some time past. In the face of way in which Marconi shares have also been rising, this is an in cation that the Marconi scare may now be considered practically an end, so far as the old cable companies are concerned. Marc shares themselves are 1/16 easier, and another speculative stock Anglo-American Telegraph Deferred—show a fall of ½, althou the company's other stocks are unchanged. Directs are down West India and Panama lost 1/16. Globe Telegraph and Tr Ordinary reacted a trifle. National Telephone Deferred and Th Preference sagged slightly.

India-Rubber Co.'s shares are a good feature, with an advance 20s. Beyond this, there is practically no quotable alteration, exc such as is provided by *ex* dividend markings amongst the ma facturing issues. The rubber market shows a good deal of streng and it has withstood the elements of depression in other departme rather surprisingly well, for which, no doubt, one reason is to found in the fact that the market is well buttressed by the b account.

Amongst English Electricity Supply shares, Urban Prefere and Edmundson's Preference have returned to the same level 2¼ middle, showing losses on the week of ¼ and ⅛ respective There is, of course, very little market in either. County of Lon Preference lost ⅛. A slight demand for Central Electric ¼ per ce Guaranteed Debentures put the price a point higher, raising it 100½. London Preference, South Metropolitan Preference, City of London shares are all *ex* dividend, the deductions be reflected in the prices, and beyond this there is practically noth of interest in the market.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
ournemouth & Poole, Ord. .	10	5½	5½	7⅜ — 8⅜	..	6 5 9
Do. 4½ % Pref...	10	4½	4½	8⅜ — 9⅜	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock.. ..	Stock	4½	4½	101 —103	..	4 7 5
rompton & Kensington, Ord...	5	10	10	7¾ — 8¼	..	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 7¾	..	4 7 6
entral Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	+1	3 18 5
haring Cross, West End & City	5	5	5	3¼ — 4¼	..	5 19 2
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 5	..	4 10 0
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb... ..	100	4	4	94 — 98	..	4 1 8
helsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
ty of London, Ord.	10	7	7	12 — 12½ xd	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12¾ xd	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
unty of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
unty of London, Ord... ..	10	5	5	7⅜ — 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	10⅞ — 11⅜	— ⅛	5 5 6
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 7 5
imundson's, Ord.	5	Nil	Nil	⅛ — ⅜	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2⅜	— ⅛	Nil
Do. 4½ % First Mort. Deb...	100	4½	4½	83 — 86	..	5 4 8
ilkestone	5	5½	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
ove	5	8¾	9	6⅞ — 7⅜	..	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝ xd	..	6 3 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾ — 4½	..	5 17 8
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum. ..	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7½	6⅝ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅝ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	Nil	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb. ..	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref...	1	7	7	1 1/16 — 1 1/16 xd	— 1/32	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	— ¼	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	87½ — 89½	..	5 0 7
Westminster, Ord, ...	5	10	10	7½ — 8	..	6 5 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

elaide, 6 % Pref.	5	6	6	5⅛ — 5⅜ xd	..	5 11 7
lcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ — 5¼ xd	..	4 15 3
lgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
nadian Gen. El. Com. ..	$100	7	7	107 —112	—1	6 5 0
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
rdoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
c. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
c. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
c. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85 — 87 xd	..	5 14 11
lgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	7/8 — 15/16	..	8 6 8
ministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	+ ½	4 16 7
dras, Ord.	5	Nil	..	2¾ — 3¼	..	..
lbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
xican El. Lt., 5 % 1st M. Bds.	..	5	5	88¼ — 89¼	— ¾	5 12 1
xican Lt. & Power, Common	$100	4	4	86 — 88	—1	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	106 —108	—2	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	—1	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88½ — 90½	— ½	5 10 6
Montreal, Lt., H. and Power ..	$100	6	7	165 —170	..	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 41	..	12 3 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101⅓ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	4	4	114 —116	..	3 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	Nil	Nil	22/32 — 31/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105 —107 xd	..	5 12

TELEGRAPH AND TELEPHONE COMPANIES.

azon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
o. 5 % Deb. Red.	Stock	5	5	99½ —100½	..	4 19 6
erican Telep. & Teleg., Cap.	$100	8	8	136 —138	..	5 15 11
o. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
glo-American Telegraph ..	Stock	3⅜	3⅜	67½ — 69½	..	5 7 11
o. 6 % Pref.	Do.	6	6	111⅜ —112⅝	..	5 6 5
o. Def...	Do.	25/-	30/-	24¼ — 25	— ½	6 0 0
glo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100 —102 xd	+1	4 18 0
li Telephone	5	8	7	6 15/16 — 7 3/16	..	4 18 3
mmercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
ia Telegraph	10	6	6	10¼ — 11	..	5 9 1
o. 10 % Pref...	10	10	10	17½ — 18¼	..	5 9 7
ect Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
o. 10 % Cum. Pref... ..	5	10	10	8⅜ — 8⅞	..	5 14 3
o. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
ect United States Cable ..	10	4½	4½	7⅞ — 8¼	— ⅛	5 9 1
ect W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
tern Telegraph, Ord. Stock	Stock	7	7	137 —140	+1	5 0 0
o. 3½ % Pref. Stock.. ..	Do.	3½	3½	84 — 86	..	4 1 5
o. 4 % Mort. Deb.	Do.	4	4	102 —104	..	3 16 11
tern Extension	10	7	7	13⅝ — 14⅛	+ ⅛	4 19 1
o. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
t and S. Africa Tel. 4 % Mt. Db. Manritius Sub.	25	4	4	100 —102	..	3 18 5
be Telegraph and Trust ..	10	5 7/8	5 7/8	10⅝ — 11⅛	— ⅛	5 5 7
o. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
at Northern Telegraph ..	10	18	18	31 — 32	..	5 12 6
o-European Telegraph ..	25	13	13	56½ — 58½	..	5 11 1
kay Companies Common ..	$100	4	5	86 — 88	..	5 13 8
o. 4 % Cum. Pref.	$100	4	4	76 — 78	..	5 2 7
rconi's Wireless Telegraph	1	Nil	Nil	2¼ — 2⅜	— 1/16	..
Monte Video Telephone, Ord...	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref. ..	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	117 —120	— ½	5 0 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 9/16	— 1/16	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	98½ —100½	..	3 9 8
Do. 4 % Deb.	Do	4	4	98½ —100½	..	3 19 7
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	..	4 7 0
Oriental Telep. and Elec. ..	1	8	8	1 9/16 — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1 5/8 — 1 7/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacifio and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5	8⅜ — 9⅜	..	4 7 9
Submarine Cables Trust ..	Cert.	6	6	132 —135	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2½ — 2⅞	— 1/16	2 14 7
Do. 6 % Cum. 1st Pref. ..	10	6	6	10½ — 10¾	..	5 12 11
Do. 6 % Cum. 2nd Pref. ..	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds.. ..	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	1/16 — 1/4	..	Nil
Do. 5 % Pref.	1	.5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	3/4 — 1 1/4	.	Nil
Do. 6 % Pref.	10	1½	1½	8 3/4 — 3 7/8	— 1/8	3 17 5
Do. 5 % Deb.	100	5	5	93 — 96	1	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	3	3	67 — 69	..	4 6 11
Do. Pref.	100	4	4	85 — 87	..	4 12 0
Do. Def.	100	2	2	49 — 51	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1½	29 —30	— ½	5 0 0
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11½ — 12½	— ½	4 16 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1 1/8	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3½ — 3 3/4	..	Nil
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Metropolitan Railway Consol.	100	.1	1⅜	43 — 43½	—1½	3 3
Do. Surplus Lands	100	2⅜	2⅜	64 — 66	—1	4 3
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14
Do. 3½ % Prcf.	100	3½	3½	88 — 90	..	3 17
Do. 3¼ % Con. Pref.	100	3¼	3¼	87 — 89	..	3 18
Metropolitan District Ord.	100	Nil	Nil	23¾ — 24¼	—1	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3½	86 — 88	..	3 13
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 9
Metropolitan Elec. Trams, Ord.	1	5	5	2 3/32 — 1 5/32	..	5 6
Do. Def.	1	Nil	Nil	1/4 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 1	..	5 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	102 —104	— ½	4 16
Potteries, Ord.	1	2	2	7/32 — 1/16	..	..
Do. 5 % Pref.	1	5	5	3/32 — 2 3/32 xd	..	7 12
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18
South Metro. Trams, 6 % Pref.	1	3	6	1/32 — 1/32	..	10 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10
Do. 6 % Income	100	Nil	1	59 — 61	—1	1 12
Do. Power House Debs.	100	..	4	101 —103	..	3 17
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2 1/8 — 2 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16 — 5 1/8	..	5 3 6
Do. 2nd Pref.	5	5	5	4¾ — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	+ ½	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6 5/8 — 7 1/8	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	137 —141	—2	5 13 6
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	103 —105	..	4 5 9
Calcutta Trams, Ord.	5	4½	6	5 3/4 — 6 1/4	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16 — 5/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 1/8	..	4 12 6
Do. 4 % Deb.	100	5	5	95 — 98	+1	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	1/4 — 5/8	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf,	1	6	6	15/16 — 1 1/16	..	5 13
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1½	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16
Do. 5 % Deb.	100	5	5	97 —101	..	4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	88 — 91	..	5 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97½ — 99½	..	5 0
Mexico Trams Com.	$100	7	7	116 —118	—3	5 18
Do. Gen. Con. 5 % Bonds	..	5	5	97 — 98 xd	..	5 2
Do. 6 % Bonds	100	6	6	98½—100½	..	5 16
Para Elec. Rlys. & Lt., Ord.	5	..	10	6 1/2 — 7 1/2 xd	..	6 17
Do. 6 % Pref.	5	6	6	5½ — 5 5/8 xd	..	5 6
Do. 5 % 1st Deb.	100	5	5	99¾—101½	..	4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1 3/16 — 1 1/16 xd	+ 3/32	2 7
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 5/8 — 5 5/8	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9
Rio de Janeiro Trams	$100	1	4½	11 3/4 — 11 5/8	— 3/4	3 17
Do. 1st Mort. 5 % Bonds	..	5	5	101¼—102¼	..	4 17
Do. 5 % Mort. Bonds	100	5	5	98 — 99	+ ⅓	5 2
Sao Paulo Tram, Lt. and P.	$100	10	10	177 —180	—1	5 11
Do. 5 % 1st Deb.	$500	5	5	102½—104½	— ½	4 17
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98	..	5 2
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	5/8 — 3/4	..	Nil
Do. 6 % Pref.	1	12	9	1 1/16 — 1 1/8	..	7 7 8
Babcock & Wilcox	1	24	26	5 5/8 — 5 3/4	..	4 12 6
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 1/4 — 7 1/8	..	6 15 7
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4 7/8	4½	94 — 97 xd	..	4 12 9
British Westinghouse, Pref.	3	Nil	Nil	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/4 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61 xd	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 1/8 — 9 3/8	..	7 15 11
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3½ — 3¾	..	4 17 0
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2
Dick, Kerr	1	6	5	1 3/8 — 1 5/8	..	5 6
Do. Pref.	1	6	6	1 31/32 — 1 3/32	..	5 9
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	1/8 — 1/16	..	Ni
Do. fully paid	5	Nil	Nil	1/16 — 2/8	..	Ni
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3
Electric Construction	2	Nil	2⅜	31/32 — 1 1/32	..	6 8
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	8½ — 9	..	5 11
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	15	12 — 12 3/4 xd	+ ⅛	5 17
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16 xd	+ 1/8	4 5
Do. Deb.	100	4½	4½	106½—108½	..	4 2
India-Rubber, G. & T.	10	10	10	13 — 15	..	6 13
Do. Pref.	10	5	5	9 7/8 — 10 3/8	..	4 16
Telegraph Construction	12	17½	20	34⅛ — 36⅛	..	6 11
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	Nil	3/32 — 5/32	..	Ni
Do. Pref.	5	1½	Nil	1/2 — 1	..	Ni
Do. Deb.	100	4	4	55 — 65	..	6 3

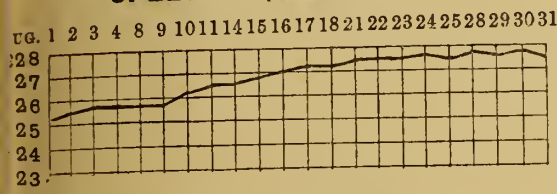
* Unless otherwise stated, all sbares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

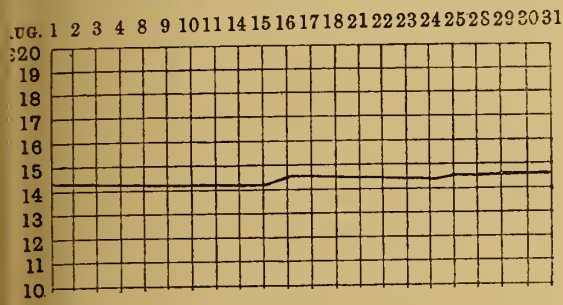
METAL MARKET.

Fluctuations in August.

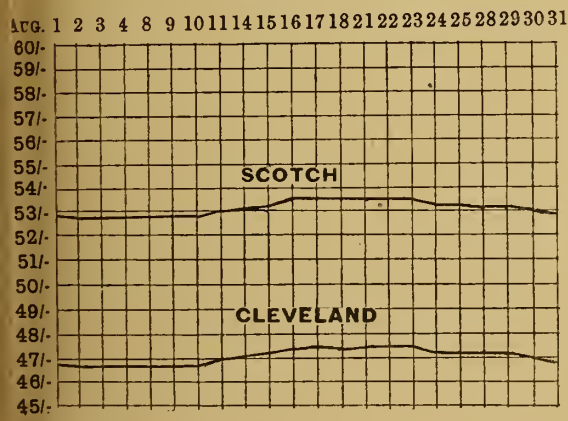
SPELTER (G.O.B's.).



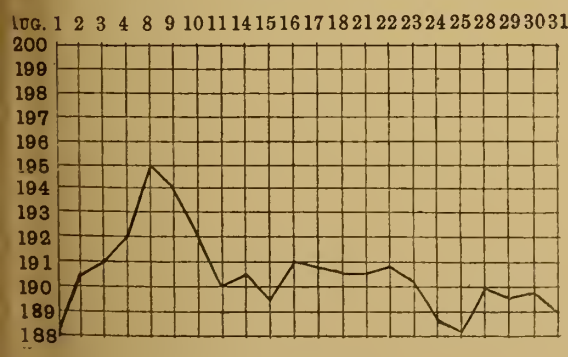
LEAD (ENGLISH).



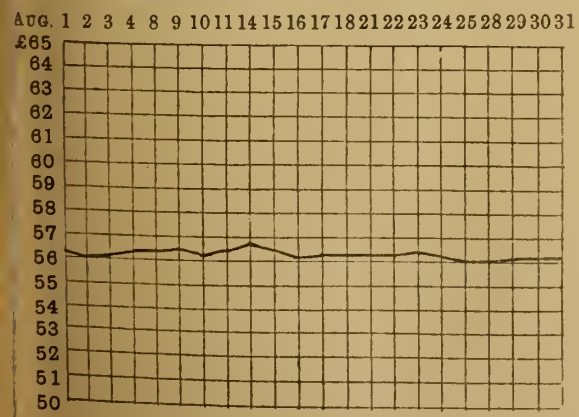
IRON.



TIN.



COPPER (G.M.B's.).



A REVOLUTIONARY SUGGESTION.

[COMMUNICATED.]

It should be, and is, a general rule in business concerns to promote existing employés when vacancies occur, in place of bringing in new men from outside. This question of promotion requires very careful consideration, the more so as the person who is called upon to make the choice only knows the capabilities of his subordinates to a limited extent, and is apt to select the man who shows off his wares to the best advantage.

It is only a man's *confrères* who are working with him, or perhaps under him, who know his qualifications thoroughly, and, such being the case, it would appear advisable that this knowledge should be extracted and made use of.

It is, of course, impossible to consult the prospective subordinates individually as to the fitness of one of their number to be placed over them, but there is no reason why they should not be asked to give their collective opinion through the medium of the ballot box.

Where it is a question of choosing from several candidates, this system should offer no considerable difficulties, and even when promotion must necessarily refer to one particular man, his existing subordinates might be consulted with advantage as to whether he shall have the vacant post or a new man shall be obtained from outside.

It may be contended that the elective system would result in the appointment of men possessed of easy-going notions regarding work and discipline. There is no evidence, however, to show that such would be the case. A "slacker" is not usually popular with his subordinates for several reasons, amongst which may be mentioned the bad reputation he brings down on his department, and his inequitable treatment of those under him, the strong being leniently dealt with, whilst undue severity is meted out to the weak. Then, again, a man of this description does not properly protect the interests of his assistants, and, in case of blame being unfairly attached to one of them, he cannot be depended upon for a strong and effective defence.

For these reasons, which are now well understood by both office staffs and workmen, great care would be taken to select the best man for promotion where an election was resorted to, and it is probable that better men would be chosen than by the manager or directors from their necessarily limited knowledge.

The best men, when placed in charge of others, are always popular with their subordinates, and, if good results are to be obtained, it is essential that responsible posts should be filled by those who find favour with their office assistants or the workmen under them. The days are past when men could be driven, if, indeed, they ever existed in connection with skilled labour. Men must be interested in their work by some means or other, and the influence of a popular foreman or head of a department makes a great deal of difference.

In this connection two recent strikes are of particular interest. In one case the men turned out owing to the appointment of an unpopular official, who had to be removed before an agreement could be arrived at. In the other, a strike was quickly brought to an end by the influence of the works manager, who was deservedly popular with both the men and the directors.

The elective system of promotion would at least ensure the appointment of men approved by those who work under them, and a desire to promote the success of their selection would be engendered in the electors, who would consequently put forth their best efforts in this direction.

It is also more than probable that promotion by election would lead to greater interest in their work by all concerned, and it should have a salutary effect upon the few grumblers who cause trouble in every establishment.

The Proposed Aluminium Syndicate.—According to a Berlin communication to a Frankfort newspaper, the negotiations which have been proceeding for some time past with the object of re-establishing the International Aluminium Syndicate, can now be regarded, as was reported at a recent board meeting of the Neuhausen Aluminium Industry Co., as having entirely miscarried. Whilst it was formerly said that the demands of the Neuhausen Co. stood in the way of an agreement in connection with the efforts to form a convention, the resistance of the British Aluminium Co. is now held to be the reason for the failure of the negotiations. The Swiss company is declared, in the opinion of the directors, to have gone to the extreme in endeavouring to meet the case, as it was prepared to accept an allotment which would only have corresponded with 50 per cent. of the productive capacity of the works. As there is now no prospect of an understanding between the principal European producers being reached for some time, the Neuhausen Co. proposes to proceed with the scheme for the raising of fresh capital, which was postponed a little time ago, in view of a possible resuscitation of the International syndicate. It is intended to make an issue through a Swiss syndicate, headed by the Swiss Credit Anstalt and the Swiss Bank Verein, of £240,000 in 4½ per cent. bonds, the proceeds being devoted to defraying the cost of erecting new plants and extinguishing the bank debt. The company already has a loan which was raised to the amount of £240,000 in 1897 and 1899, but which had been reduced to £206,000 by the end of 1910.

ELECTRICITY SUPPLY AND EXHAUST STEAM HEATING.

By FRANCIS H. DAVIES.

The subject of steam heating from central stations has received very little, if any, attention in this country, despite the fact that there are some 400 plants operating on such lines in America. Of these, some were installed specially for the purpose, and employ live steam. Others utilise the exhaust steam from industrial plants, and a large number are operated in connection with electricity supply undertakings. Heating by low-pressure steam through the medium of radiators is well known to be a very popular system in America, and one which particularly suits both the climatic conditions and the prevailing ideas of comfort. On the other hand, British conservatism and preference for the open fire have militated against the introduction of the system to this country, although there can be no question that it is gaining ground, especially in office blocks, flats, public buildings and factories, for which situations it possesses many admirable features.

This being the case, the question arises whether it might not, in certain instances, pay central station engineers to investigate the possibilities which have so readily been taken advantage of in America. Conditions are, in the main, different. The British climate is erratic, and even in winter the demand for heat is by no means uniform. Still, under favourable circumstances, such as would obtain in the case of an electricity works centrally situated in a small and good class area, it seems quite possible that a well designed scheme might prove a highly remunerative investment. With few exceptions this has been found to be the case in America, where the combination of an electricity works and an exhaust steam heating installation is considered the best possible arrangement from the economic point of view. Fortunately, there is available a certain amount of data concerning the results attained by such plants, and Table I in the adjoining column summarises the working particulars of four combined undertakings instanced by Mr. C. R. Bishop in a paper read before the National Electric Light Association.

TABLE I.—Results of Combined Electric Power and S Heating Stations.

	Plant No. 1.	*Plant No.* 2.	*Plant No.* 3.	*Pla*
Annual electrical output, units	1,902,970	541,767	1,081,150	2,4
Coal used, lb.	16,383,649	6,768,661	14,448,399	21,8
Water used, all purposes, lb.	145,302,510	48,131,094	86,296,235	177,(
Coal cost	£4,330	£1,637	£4,703	
Water cost	£142	£95		
Oil and waste	£122	—	£116	
Boiler room labour	£507	£211	£473	
Engine room labour	£412	—	£261	
Dep. and int. on capital cost of heating installation at 10 %	£2,506	£924	£924	
Total cost	£8,019	£2,867	£6,477	
Revenue from sale of steam	£7,636	£2,566	£7,197	
Capital cost of heat installation	£25,065	£9,240	£9,240	£
Average price received per 1,000 lb. of steam	1s. 8d.	1s. 8d.	2s. 6d.	1
Approximate space heated, cb. ft.	10,000,000	—	7,976,976	16,(
Heating season	Oct. 1/08 to May 25/09.	Oct. 1/07 to May 1/08.	Oct. 1/08 to June 1/09.	Oct Jur
Population of town	17,500	10,000	10,000	4
Age of combined undertaking	3 years	5 years	8 years	

allowance for depreciation and interest by £720. capital cost of the heating installation is inclusive of st mains, services, trenching, repaving, street traps and me

The small population of the towns producing such ex lent results is very noticeable, and this fact alone empha the wide difference between British and American conditi The greatest optimist would not hope for even the m moderate success in English towns of from 10,000 17,000 inhabitants, and for the present, at any rate, future for central station steam heating lies only in popu districts.

In Table II some interesting particulars are given of operation of the combined electric light and exhaust ste heating plant installed at West Chester, Pa., a city of so 10,000 inhabitants. There are over 200 heat consume and the service was inaugurated in 1902. Approximat 100,000 sq. ft. of radiating surface is connected, and th are about 8,900 ft. of underground steam main, supplied

TABLE II.—Table Showing Results of Operating West Chester Central Station Heating Plant for 12 Months.

Month.	Lb. of coal burned.	Cost of coal. £	Total lb. of water evaporated.	Cost of water. £	Lb. of water evaporated per lb. of coal.	Electric output, kw.-hours.	Lb. of water per kw.-hour.	Lb. of steam sold for heat.	Steam not sold for heating. Total.	Steam not sold for heating. Per kw.-hour.	Income from steam sold for heat. £	Cost of boiler house labour. £	Total cost of coal, water, and boiler
July, 1907	476,885	110·56	3,646,433	7·18	7·66	58,440	62·4	—	3,646,433	62·4	—	30·18	147
Aug., 1907	516,325	111·27	3,046,065	6·01	5·90	63,994	47·6	—	3,046,065	47·6	—	30·18	147
Sept., 1907	540,094	113·42	3,897,980	7·67	7·20	69,680	55·9	—	3,897,980	55·9	—	30·18	151
Total non-heating months	1,533,304	335·25	10,590,478	20·86	6·91	192,114	55·1	—	10,590,478	55·1	—	90·54	446
Oct., 1907	756,866	161·41	5,451,120	10·75	7·20	76,739	71·0	2,280,000	3,171,412	41·40	187·72	30·18	202
Nov., 1907	885,570	176·27	6,053,119	12·01	6·84	72,520	84·6	3,640,000	2,413,119	33·75	299·11	30·18	218
Dec., 1907	1,157,940	255·34	7,322,804	14·43	6·34	82,365	89·0	5,340,000	1,992,804	24·24	437·93	30·18	299
Jan., 1908	1,180,005	312·59	8,207,054	16·16	6·96	87,620	93·8	5,780,000	2,427,054	27·72	474·56	30·18	358
Feb., 1908	1,233,560	327·92	8,694,744	17·14	7·04	79,430	109·0	6,540,000	2,154,744	27·17	537·53	30·18	375
Mar., 1908	886,240	235·59	7,091,419	14·18	8·01	78,070	90·8	4,710,000	2,381,419	30·58	387·05	30·18	279
Apr., 1908	668,460	168·33	5,310,542	10·47	7·95	66,023	80·4	2,950,000	2,360,542	35·80	242·36	30·18	208
May, 1908	509,167	128·21	5,302,341	10·45	10·40	65,248	81·2	1,258,000	4,044,341	62·00	103·42	30·18	168
June, 1908	487,053	109·81	3,820,806	7·53	7·86	58,164	65·7	635,000	3,185,806	54·80	52·24	30·18	147
Total heating months	7,764,861	1,875·48	57,254,241	113·12	7·37	665,179	86·1	33,123,000	24,131,241	36·27	2,721·92	271·62	2,260
Total 12 months	9,298,165	2,210·73	67,844,719	133·98	7·30	857,293	72·9	33,123,000	24,131,241	—	2,721·92	362·16	2,706

It will be noticed that after allowing 10 per cent. to cover depreciation and interest on the capital cost of the heating installation, the revenue from the sale of exhaust steam in three out of the four cases comes within a few hundred pounds of wiping out coal, water, oil and labour costs, while, in the fourth instance (plant No. 3), the receipts from steam exceed the above costs and the 10 per cent.

a pressure not exceeding 5 lb. per sq. in. in the cold weather. This gives 1½ lb. per sq. in. at the extre points of the system, a pressure which yields satisfacto results. The power house has 830 kw. of plant install With regard to Table II, it will be seen that during t non-heating months each unit generated required 55·1 of water, while during the remaining portion of the ye

en a heating load was carried, the corresponding evapora-
n figure was 86·1 lb. of water. The increase is due in
t to the admission of a percentage of live steam to the
ins when the heating load exceeded the electrical load,
l also to the increased steam consumption of the engines
en running under back pressure. However, it should be
ed that during the heating months about 33,123,000 lb.
water out of the 57,254,241 lb. evaporated were sold for
ting purposes, leaving 24,131,241 lb. of water charge-
e to the cost of electric generation and line losses in the
ting mains. During these months 665,179 units were
erated, and dividing this into the 24,131,241 lb. of
er, the result is 36·27 lb. of water chargeable to each
t generated during the heating months, as against 55·1 lb.
rgeable in the non-heating months.

As regards the financial results, it will be seen that the
me from the sale of steam more than covered the total
of coal, water and boiler-house labour. The running
ditions of this station were not favourable to steam
ting, since the electrical load was almost entirely lighting.
s necessitated the addition of live steam to the heating
ns during certain hours of the day, while at other times
amount of exhaust steam available was more than
ugh, and had partly to be thrown away to the atmosphere.
Fig. 1 shows graphically the results of 26 months' working

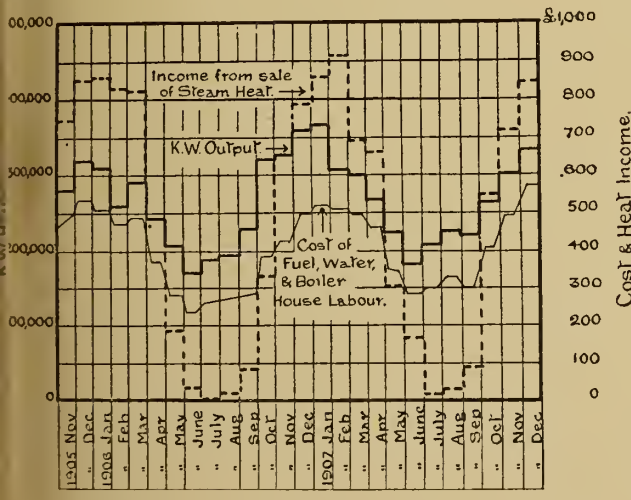


Fig. 1.

he Vine Street station of Johnstown, Pa. This is a more
nsive system than the previous one, as there are 13,340 ft.
underground steam main and 294 consumers, whose
nises aggregate to 15,458,028 cb. ft. of space heated.
power station contains five engines with a total of
)0 I.H.P., and during the period in question 6,856,950
s were generated, of which 5,252,347 were produced
ng the heating months. For the 26 months the total
of fuel, water and boiler house labour amounted to
,706, of which £8,413 was incurred during the 18
nths. As against this, the income from the sale of steam
e was £12,928 over the whole period, and £12,468
ng the heating months only. Thus the receipts from
m paid for all fuel, water and boiler house labour, and
ng into account the 18 heating months alone, left a
lus of £4,055. Concurrently with earning this surplus,
,252,347 units were generated from the same fuel, water
boiler-house labour.

These results are very good, and remarkable in that the
s charged for steam heat are stated to be the lowest on
rd. Mr. James A. White, who communicated the
res to the "Central Station" in May, 1908, makes the
wing significant comments :—"The results obtained
n this combination plant are such that the seeming
antage of power house sites placed away from the
kly built-up sections of our towns and cities for the sake
heap land, condensing water, or facility in the handling
coal entirely disappear, as does also the advantage of the
engine, with its much vaunted thermal efficiency, and
ineers in designing plants should look carefully into the
antages of such combination systems before making
enditure for power installations in locations where such a
ribution of the unused heat cannot be made."

In considering the question in the light of any particular set of conditions, it is important to take into account the age and quality of the steam plant installed. The equipment of numerous stations in this country is out of date and inefficient, and ultimately the question will arise of replacing it by more modern plant. This is the usual way; but it has been found in America that having regard to the excellent revenue to be obtained from a steam heating load, it is less expensive, and productive of greater profit, to retain the old plant, and to spend the sum it would cost to replace it upon an underground exhaust steam distributing system. The capital required would probably be less, and the combined profit derived from the electric and steam undertakings would be greater than that which would accrue from even the most modern electric plant working without a heating system. This is the view taken by authorities who have studied the subject at close quarters, and it opens out a very interesting branch of the question.

Before deciding whether or no a steam-heating scheme is a feasible proposition, and before entering into details of the equipment, it is necessary to investigate local conditions very closely, and to ascertain how far they are in conformity with certain essentials. For instance, the generating station must be within a comparatively short distance of the area it is proposed to serve, in order that capital expenditure and loss in transmission may be kept within reasonable bounds. This brings into prominence the question of the class of property which would be most likely to take a supply, and here it becomes necessary to ignore the American precedent altogether, and to reason the matter out on our own lines. There can be little doubt that the private householder would not at the commencement look favourably upon the proposition. Doubtless a few would be secured, and ultimately good business might be done in residential property, but at the start the most likely customers would be those who are already employing steam or hot-water heating, and generally the classes to which they belong. As before stated, these include flats, office blocks, public buildings, factories, churches, theatres and other similar places. Hundreds of such are now operating their own heating plant, and given a moderate rate of supply it should not be difficult to secure their connection to the mains. The convenience of an outside supply is obvious, and the arguments put forward would, on the whole, be similar to those advanced in the case of a private generating plant. Modern ideas of comfort and health now make some sort of heating installation imperative in such buildings, and it would therefore not be too optimistic to anticipate a fair amount of business among new erections. Experience has also shown that where there is a public low-pressure steam supply, it is taken advantage of for other purposes than the heating of buildings; thus hotels and flats employ it in connection with their hot water supply, and laundries are also possible consumers.

The end at which preliminary operations must aim is to secure at least enough business to utilise, at the time of minimum demand for heat, the whole of the exhaust steam from any one engine. To render this possible, it is necessary so to arrange the station exhaust piping that any single engine can be run either condensing, non-condensing, or connected to the heating mains, and under back pressure. The average back pressure that is carried appears to be about 5 lb. per sq. in., but in cases it is higher, and has even attained 35 lb., with a boiler pressure of 150 lb. This figure is certainly high, and indicates that the efficiency of the electrical side has been sacrificed to the heating load, owing to the highly remunerative nature of the latter. The extent to which this is sometimes carried is exemplified by the regular practice of the Erie, Pa., combined station of dissipating electrical energy in a water load in order to obtain exhaust steam to turn into the heating mains. According to Mr. J. Fogarty, of the Erie Co., who has read a paper upon the subject before the Pennsylvania Electric Association, it is more economical to do this than to turn a proportion of live steam into the mains in order to maintain the pressure on a rising load.

Turning now to the street distribution system, upon the correct construction of which the success of a steam heating system largely depends, experience extending over something like 30 years has shown that low-pressure steam may be transmitted as much as 1½ miles with no appreciable drop of

pressure, and with a condensation loss of from less than $\frac{1}{4}$ per cent. to $\frac{3}{4}$ per cent. of the total steam delivered. Proof of this lies in the fact that many heating companies operate several miles of mains at station pressures as low as $1\frac{1}{2}$ to 3 lb. per sq. in., although 5 lb. is the more usual pressure. Condensation loss is measured by installing traps and water meters at low points in the system of underground mains at distances of from 500 to 1,000 ft. As all services are taken off the top of the distributing pipes, no water of condensation is lost by being carried into the consumers' premises, and the method therefore gives correct results.

A good deal of ingenuity has been expended upon the design of underground mains and their lagging, particularly the latter. The changes have been rung upon asbestos, hair felt, mineral wool, magnesia sectional covering, cork covering, &c., as wrappings for the iron pipe, and all these have been tried in conjunction with conduits of brick, vitrified drain pipe, cement casing, boxing and round wood casing of



Fig. 2.

various thicknesses. Drain pipes and sectional earthenware conduit have been found unsatisfactory owing to their low heat-insulating value, and to difficulties with the joints. There are such a large number of these, and they are so easily broken by movement of the pipe when expanding or contracting, and also by settlement of the ground, which is almost sure to take place, that it is practically impossible to ensure the absolutely dry interior which is so essential. The broken cement joints allow water to find its way in, and soon the insulating material covering the steam pipe becomes thoroughly damp and loses all its value. Ultimately, it is dissolved or destroyed, and the pipe is left without insulation. Cement and brick conduits suffer from similar troubles and are not good heat insulators. In this respect a wooden covering is the best, but it must be of a special nature, calculated to withstand the onerous conditions obtaining underground. A

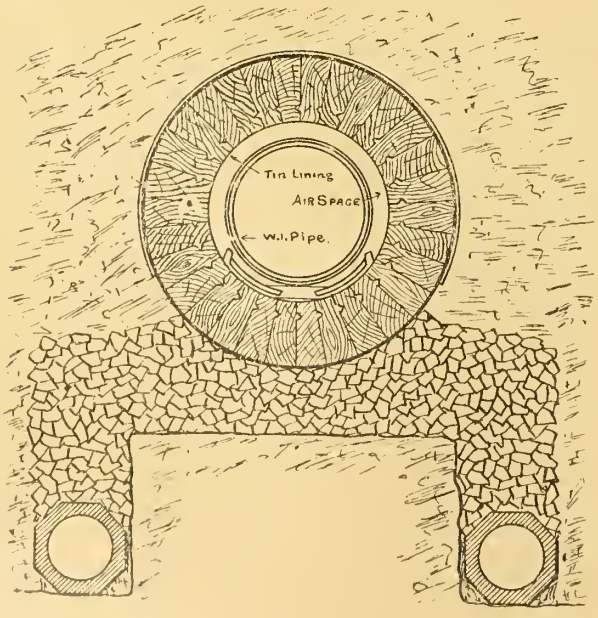


Fig. 3.

large number of American and Canadian installations have been laid down upon the system of the American District Steam Co., and the following details of their methods may be taken as representative of the best practice. The construction of the wooden casing employed is shown in fig. 2. It is built up of white pine staves free from sap, rot or shake, and air and kiln dried. The staves, which are 4 deep, are tongued and grooved along their entire length, after being assembled, are placed in a banding mach where they are bound together with a $\frac{3}{16}$-in. galvanised-s wire, wound at a pressure sufficient to embed the wire the wood and leave a smooth surface. The casing thus l up is supplied in various lengths not exceeding 8 ft., and length has, as shown, a 4-in. mortice and tenon cut on its e the former being $\frac{1}{2}$ in. greater in diameter than the latte ensure a tight fit when the lengths are driven toget Each joint is treated with a creosote compound, and outer surface of the casing is coated with asphalting pi and rolled in saw-dust. After being laid, a protection three-ply tar paper is placed over the conduit, reaching both sides to a point rather below the centre. An import point in this design of conduit is the interior tin lin which is inserted after the staves are bound together. consists of the best charcoal plate heavily tinned, materially assists heat insulation by radiating back the h given off by the pipe. It also protects the wooden cas from the effect of heat, and it is found in practice to re its polished surface indefinitely. The circular form of type of casing distributes the load from above proport ately to the various segments, and also prevents w forming in puddles to the detriment of the wood. manner of joining up the sections gives adequate strengt resist the effect of ground subsidence, and for all pract purposes the conduit may be looked upon as continuous no joints. The standard thickness of 4 in. was arrive by tests to determine the thickness which would reduce c densation and transmission losses to a minimum, with increasing the cost of the casing beyond a compar increase in efficiency.

Fig. 3 shows the manner in which the underground w is generally carried out. At the bottom of the trenc drainage system is installed, consisting of one or more li of porous pipe not less than 3 in. in diameter, with o

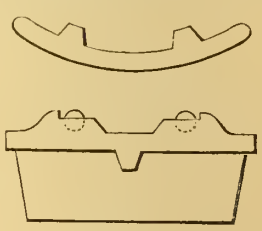


Fig. 4.

joints. These are properly graded and connected to sewer as often as practicable, where necessary, throu check valves. Next, a heavy course of broken stone, gra or clean cinders is laid, and on this the casing is bedd being threaded on to the iron steam-pipe length by len as the latter is installed. It will be seen from fig. 3 t there is a 1-in. air space between the pipes and the casi Dead air space is one of the best of heat insulators, and by conduction arising from circulation of air through easing is prevented by sealing the ends with metal coll at all possible points, such as junctions, &c. To allow free movement of the steam pipe under expansion and c traction, it is carried and centred by guides and roll placed in the casing about every 7 ft. The roller type shown in fig. 3, and two others in fig. 4. Of these, the fi is a plain guide used only with small pipes; the second p vides a ball seat, the balls lying loose in and projecti above the edges of the two boxes formed in the top of t casting.

It is recommended that only wrought-iron pipe of go quality should be used for the steam main. This is flan jointed in the ordinary way, and after being laid in place served with a covering of $\frac{1}{32}$-in. asbestos paper held in po tion by copper wire. Care in laying and grading is essenti and where natural conditions or obstructions cause low poin in the mains, provision should be made for trap connectio to handle the condensation. Expansion is a serious matte and is met in the following way:—The pipe is laid in se tions from 100 to 250 ft. long, and the centre of each se tion is firmly anchored by a special fitting placed on a bri or concrete foundation. Where the sections meet they a

oined up by a double expansion joint firmly anchored in he middle or stationary part, and it is at these points that ecessary changes of grade or deviations from the straight re made. The joints have a traverse of from $3\frac{1}{2}$ in. to in. in each slip, which is more than sufficient to take care f the pipe movement. Expansion bends have been mployed, but they are not satisfactory, being liable to reak, and costing more to install owing to the extra amount f trenching and paving. Further, they tend to some extent o obstruct the flow of steam, and at the low pressures used his is an important point.

The plan of a typical street junction and valve box is hown in fig 5. It will be noticed that the ends of the ooden casing are blanked off by the collars previously eferred to, and that the pipe itself is anchored at this oint by long iron bars bolted to fittings and running along

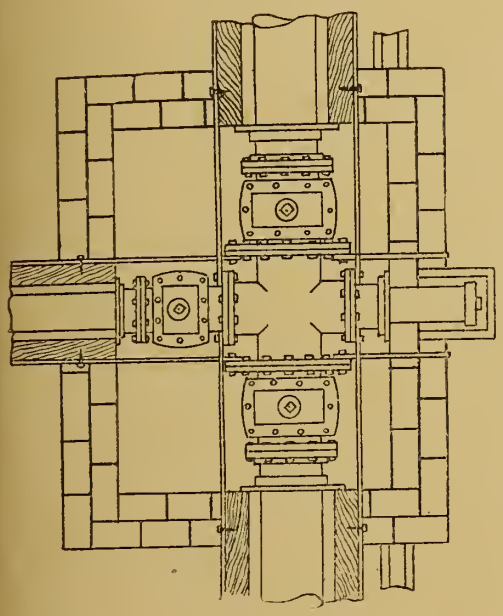


Fig. 5.

he casing, to which they are fastened by screws. The same ourse is pursued at all fittings, such as expansion joints, ervice connections, &c., unless provision has already been nade in the form of a special anchorage in a concrete oundation.

Considerations of space forbid mention of numerous pecial and interesting fittings used in conjuction with the nderground work, although it is upon these that satisfac- ory construction and freedom from trouble greatly depend. t remains only to deal with matters relating to the consumer, ow he is charged and how his installation is arranged. Prior o the days of efficient meters, the only course open was to ontract with each consumer on an agreed fixed charge per nnum, and there are still several undertakings working upon hese lines. It has, however, become recognised that the ieter system is highly preferable and far more remu- erative to the supplier, as it discourages waste. A con- ract rate is only applicable with safety to such buildings as ffices where the hours of heating are clearly defined. Such ates may be based upon the total square feet of radiation in he building or upon its cubical contents, the latter being enerally considered preferable. The charge varies from s. 3d. per sq. ft. upward for direct radiation per annum, nd from 1s. 8d. per sq. ft. for indirect radiation, according o the locality and the cost of coal. Where the consumption s metered the charge is made at so much per 1,000 lb. of team condensed. The rate, again, must vary with local onditions, but Mr. C. R. Bishop states that the average ase will be met by a charge per 1,000 lb. of steam of pproximately 10 per cent. of the cost to an individual user f 1 ton of anthracite coal, where that kind of fuel is in eneral use.

The condensation meter employed is simple in con- truction, the principle being that of a balance. On each ide is a receptable holding a given weight of water, and hen the uppermost one is full it falls and empties itself, he second vessel taking its place. The balance is connected to the dial through a train of wheels, and the number of pounds the meter discharges is thus registered.

Generally speaking, the condensed water is passed to the sewer, as in all but a small and compact area it does not pay to install the necessary return piping. Where used, this may with advantage be built of wood upon the same principle as the steam pipe casing minus the tin lining. Pipes of this class have a long life when used to convey water, and having excellent heat insulating properties save expense through requiring no lagging. Their walls are about 2 in. thick, and the several lengths are joined up by means of wooden thimbles fitting into sockets at the ends of the pipes.

No expansion or anchorage devices are used, and the whole construction is very simple.

RAILWAY RATES: OWNERS' RISK.

[COMMUNICATED.]

The owners' risk question is an interesting one, and to describe it as a vexatious question would also be correct, as there is probably more litigation over these rates than over any other class of railway rates governed by the Railway Statutes. Railway Acts are usually difficult to understand, and the clause on the Owners' Risk Notes, which is, of course, governed by the Railway Act, is probably the most vague clause in all the laws pertaining to rail- ways. To explain the matter properly it will be necessary to mention that the railway companies have two kinds of rates, viz. :—

1. One is the ordinary rate, when the railway takes the ordinary liability of a railway company.

2. The other class of rate is a reduced rate, adopted when the sender agrees to relieve the company and all the companies or persons concerned over whose lines the goods may pass, or in whose possession the goods may be during any portion of the transit, from all liability for loss, damage, misdelivery, delay or detention (includ- ing detention of traders' trucks) except upon proof that such loss, damage, misdelivery, delay or detention arose from *wilful misconduct* on the part of the company's servants.

Before the railway companies will agree to forward the traffic at the reduced rate, a form must be signed similarly worded to the second clause given above; this practically absolves the railway companies of all liability, unless the trader is fortunate enough to be able to adduce proof that the damage has been caused by the wilful misconduct of the railway company's servants. Seeing that the traders are unable to travel with the goods, it is seldom that they can prove their case. The agreement is evidently worded for the sole benefit of the railway companies, and unless goods are particularly liable to damage or loss, the railway companies take care that an owners' risk rate (at the reduced figure) is not put into operation, as, of course, it will pay the railway people, in the case of ordinary traffic, to take what slight risk there is in connection with such traffic, and charge the higher rate. On the other hand, should the traffic be either fragile or perishable, the railway companies are only too anxious to offer some slight inducement to the trader, so that the latter will take both the liability and the responsi- bility, and receive for doing so a reduction in the rate, which varies according to the class of goods and the price of rate charged. It often pays the traders to consign at the owners' risk rates, but one great defect in the matter is that the agreement is too one-sided, and the power of the railway companies with respect to these owners' risk rates should, to some extent, be curtailed. Although the railway companies are not compelled by law to make these rate concessions, they should not be allowed to make the bargain so that it prevents the trader from receiving fair treatment.

The railway companies must obtain a signed contract before they can legally compel the trader to adhere to the owners' risk conditions. Hence the reason why the owners' risk note has been introduced.

The existing law on the matter says :—

"Provided that no special contract between the companies and the parties respecting the receiving, forwarding and delivery of the goods, &c., shall be binding unless the same be signed by the person delivering such goods." Another interesting passage is :—"Nothing herein contained shall be construed to prevent the said companies from making such conditions with respect to the receiving, forwarding and delivery of goods, as shall be adjudged just and reasonable."

Seeing that the railway companies are not compelled to issue reduced rates, they are thus in the favourable position of practically being able to make, and also to enforce, their own terms, with the result that the conditions and terms of the present owners' risk notes are not as favourable to the trader as might be the case. Everything hinges on the term "wilful misconduct," and it is very difficult to prove that the railway people are to blame. However, it sometimes happens that the trader has eye-witnesses of the railway servant's carelessness, in which event the trader has a fair chance of winning the day.

The reader might ask the question : Why does the trader sign the owners' risk note when it is so disadvantageous to him when the goods are liable to damage ? The answer to the question is : That owing to the great disparity between the ordinary class of rate, and the reduced rate at owners' risk, it is better to take the risk than stand the loss of sale.

A custom prevalent over the railways in connection with owners' risk traffic is :—"When rates at owners' risks are provided for any article, both the 'owners' risk rate' and the 'company's risk rate' (whether for rates in the ordinary classes, or whether for special or exceptional rates) must be quoted. The higher rate must in all cases be quoted first, with the intimation that at that rate the railway company take the ordinary risk of a carrier ; but that, if the sender desires the goods to be carried at his risk, and will sign the prescribed form of risk note to that effect, the lower rate will be charged. The higher rate must be charged when the trader does not sign the risk note."

Many efforts have been made by the traders to amend and improve the owners' risk rate conditions (as witness the Bill, particulars of which are given hereafter), with, however, no result up to the present time, and it does not appear likely that the railway companies will willingly let go of their sheet-anchor clause "Wilful Misconduct," as they know very well that this term safeguards their interests as possibly no other term could do.

Time was when the restrictions and conditions in connection with the owners' risk scale of rates were not as rigidly enforced as they are to-day. In fact, a few years ago one could reasonably expect to get a claim for damage allowed, although the traffic travelled at owners' risk, and this claim was allowed without having to go to law. Now, owing to the Joint Claims Board being in operation, the railway companies have given the traders a nasty jar by withdrawing privileges and concessions which were in times gone by accepted by the trader as being usual.

The foregoing particulars describe the owners' risk question as it stands at the present time, and the examples hereunder show the difference between the ordinary rate and the owners' risk rate :—

Dynamos not packed : Ordinary rate, 45s. per ton ; owners' risk rate, 38s. 3d. per ton. The reduction in special rate varies from 10 to 20 per cent.

To amend the owners' risk rates, it is proposed to remedy matters by introducing a Bill into Parliament which will enable the trader to receive more equitable treatment.

An extract of the Bill is given hereunder :—

1. This act may be cited as the Railway and Canal Traffics Act, 1911, and shall be read with the Railway and Canal Traffic Acts, 1873 to 1894.

2. (i.) Every railway company and every canal company shall be deemed to be liable for the loss or deterioration of, and for any injury to, any goods, animals, or things in their custody or control which shall occur in the course of the receiving, forwarding, or delivery thereof by any such company, unless such company prove that such loss, deterioration or injury arose from some cause in respect of which the company is exempt from liability.

(ii.) The provisions of this section shall apply notwithstanding any notice, condition, or contract to the contrary.

3. It shall not be lawful for any railway company or canal company to make any conditions with respect to the receiving, forwarding, and delivery of traffic other than passengers and the luggage, whereby it is provided either expressly or by implication that the company shall not be liable for the loss of, or for injury done to, or for the delay of such traffic, in the receiving, forwarding, or delivery thereof occasioned by the wilful default misconduct of the company, or its servants.

8. In any action, suit or other legal proceedings of a civil nature (other than proceedings before the Railway and Canal Commissioners), which shall, after the passing of this Act, be brought by or against a railway company or a canal company, to enforce a claim in respect to the receiving, forwarding or delivery of goods and wherein the amount in dispute shall not exceed £20, the decision of the Court in which such proceedings are taken shall be final and conclusive, and without appeal on any question, either of law or fact.

The proposals embodied in the Bill are both moderate and reasonable, and the Bill would certainly receive a good measure of support in the House of Commons ; in fact, it is said that over 100 members have already promised to support the measure.

To sum the matter up, the principal objects of the Bill are as follows :—

1. To do away with the existing "wilful" misconduct clause, which has been described earlier on.

2. To prevent the railway companies from taking cases from Court to Court, and so handicapping the smaller trader who has not the funds to combat a case in the High Court.

In conclusion, it may be said that some revision in the owners' risk scale of rates is necessary, and it is to be hoped that all traders will give support to the aforementioned Bill, and by doing so assist in obtaining more equitable treatment from the railway companies. Finally, it may be mentioned that the railway companies not very long ago made some slight alterations in the Owner's Risk notes.

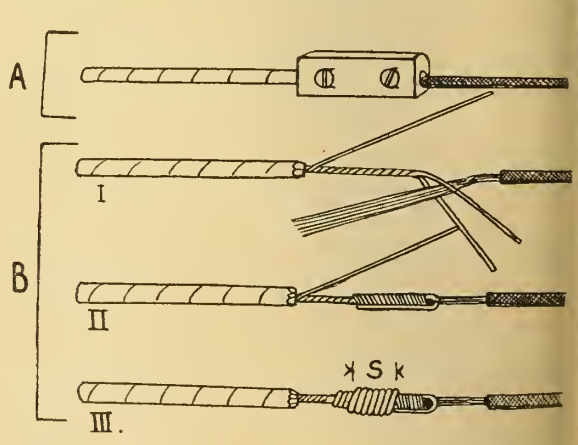
JOINTS FOR FLEXIBLES AND HARD WIRE

By DONALD SMEATON MUNRO.

The Institution Wiring Rule No. 53 states that connections between flexibles and hard wires may be effected only by means of screw terminals in porcelain or other connecting boxes, or ceiling roses, *and not by soldering*.

The above rule is one which is frequently ignored in practice, and many have difficulty in seeing a good reason for such a definite and sweeping regulation.

The rule is invariably acted on in the case of a ceiling rose, and there few would quarrel with the terminal method of connection. The ceiling rose is perhaps the most generally suitable fitment for its purpose in the whole



range of common wiring accessories. It is cheap and easily fitted ; it is adapted for loop or single wiring ; it has provision for relieving the connection of stress and the terminals are readily accessible at all times.

There are many situations, however, in which a ceiling rose cannot be used to connect hard wires to flexibles ; in practice these occur chiefly at bracket, ceiling fitting, and electrolier points, and in the interior of fittings.

In such places it is frequently exceedingly difficult to comply with the I.E.E. Rule, and whether the work

tended to have a long and efficient life, or merely to ıve the quality of cheapness, then in either case an sulated joint is usually preferable to the ordinary forms china connector. China connectors are always liable to eakage, and faulty threads on terminals are also frequent. Those who advocate the use of connectors in preference insulated joints have probably in view the work-an who does not clean the wires properly, and uses acid ıx for soldering. But such an incompetent workman is so likely to make defective junctions with china nnectors.

Any prejudice which exists against joints between hard res and flexibles has perhaps been intensified by the fact at there is no standard form of such joint. The small cuit hard wires to be connected to flexibles are generally 22 and 7/23 s.w.g. on modern work.

The writer asked several capable tradesmen to make up nts between flexibles and hard wires of the above sizes. e found a considerable variety of practice, but the most mmon form was some kind of end nt. That is to say, the joints were Y form, the two upper arms of the being respectively the flexible and the rd wire, and the tail being formed by e combined twisted ends; the method twisting was ingeniously varied. his kind of joint, however, while cupying little space, has no great nsile strength, and is difficult to insu-e neatly.

The writer considers that the joint own in illustration B is probably as od a form as can be devised. In e sketch a 3/22 wire is shown jointed a piece of flexible. The three strands e separated and cleaned, then two are isted together for more than half eir length, the ends being forked, as own in (I B). The flexible is then erted into the fork and twisted in e direction around the pair of wires; te two forked ends are then bent up, d the whole is neatly bound with the third strand of te 3/22 wire. The joint is then pulled straight and tight d soldered on the section S indicated in (III B). The sult is a strong connection with no sharp edges or ends, and e flexible is free to bend readily in any desired direction.

A large number of different samples of joints were tested ainst a spring. These were made up of 3/22 s.w.g. and /40 flexible. Joints, as described above, fractured on the erage at 35 lb. pull. End nts gave way at 20 lb., d china connectors of the nmon form, as in sketch), ruptured at only 8 lb. ll.

The strength of flexible very materially reduced the strands being bound der the connector ter-nal. Some of the strands nipped by the point of te pinching screw, and a y slight pull is sufficient produce a long, irregular ak, with loose springy ls, liable to make harm-contacts.

Some of the defects of te china connector would obviated if the brass rts were tinned, and if the nector itself were finally ulated, to guard against face leakage caused by ndensation and damp air; but many types of con-tor are difficult to insulate, and the practice is uncommon. The above-mentioned tensile tests were taken when the nctions were bare, and would be still more favourable to the dered joints, if taken in their final insulated condition.



Fig. 3.—Single Stage of Impulse Turbine and Section of Blading.

The same principle is, of course, followed in making joints between flexible and seven-strand wires. In this case, however, four strands are twisted together and forked two on either side for the reception of the flexible, the joint being finally bound with the remaining three strands.

PROCEEDINGS OF INSTITUTIONS.

Steam Turbines.

By H. Zoelly, of Zurich.

(*Abstract of paper read at the Zürich meeting of the* Institution of Mechanical Engineers., *July, 1911.*)

Relying chiefly upon his experience gained with water turbines, the author commenced about 15 years ago to experiment with steam turbines, considering that the steam turbine would resemble in most respects the water turbine, only using a much higher working pressure. For this reason he adopted the pure action or impulse type of steam turbine.

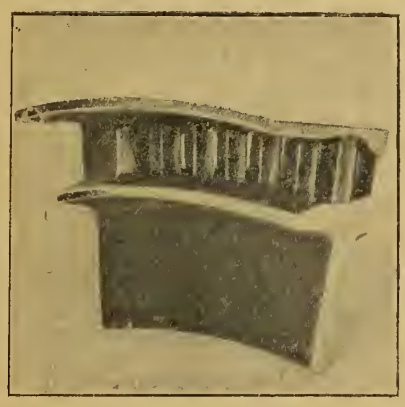


Fig. 1.—Guide Channels in Diaphragm Plate.

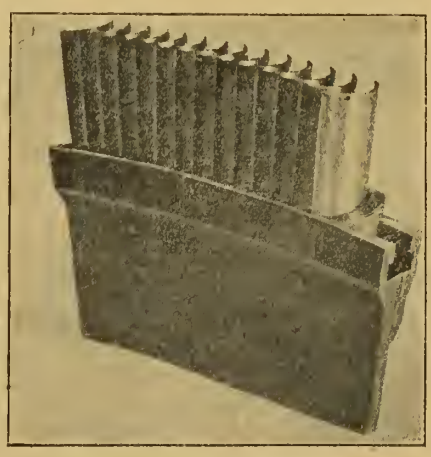


Fig. 2.—Section of Runner Wheel.

The most characteristic feature of the Zoelly turbine is the designing of the runner wheels and the guide channels in the diaphragms, figs. 1 and 2, the former of which, in spite of the high factor of safety that is necessary, are enabled to be given a relatively high circumferential velocity. Consequently greater latitude is permissible in regard to the number of pressure stages and the speed of the steam in each.

The pressure relation per stage $\frac{p\,1}{p\,2}$ (where $p\,1$ = the initial steam pressure and $p\,2$ = the final steam pressure in atmospheres absolute in the same stage) = 1·73 was chosen as representing the best combination of efficiency and practical constructional economy. Directly one wishes to utilise a substantially higher pressure fall per stage, it becomes necessary to depart from the simple construction of parallel guide nozzles which is peculiar to the Zoelly

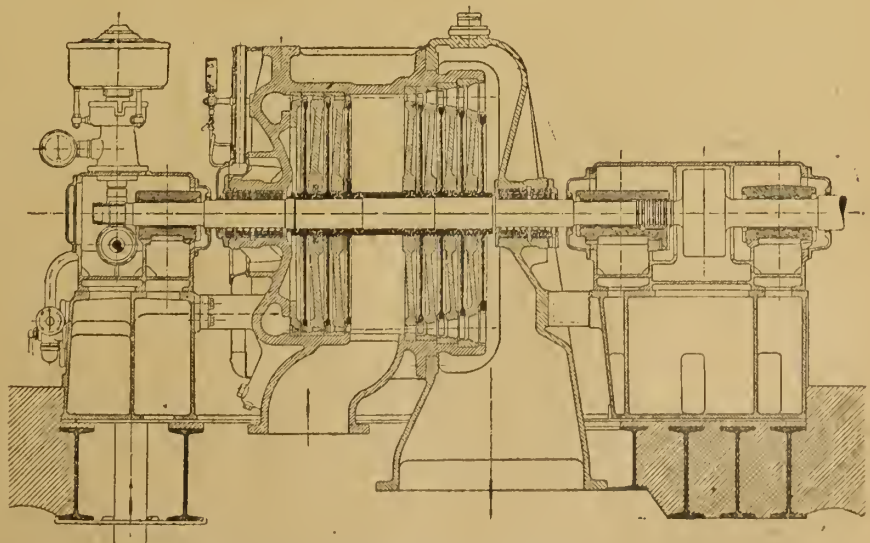


Fig. 4.—1,800-h.p. Mixed-pressure Turbine for "Zeche Dannenbaum" (Zoelly), 3,000 r.p.m.

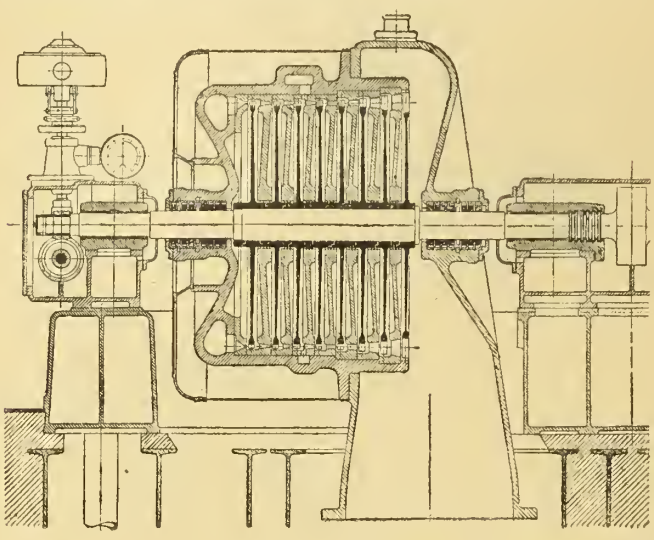
turbine, so that, instead of the simple parallel nozzle, one must adopt the expanding or "Laval" type of nozzle. The reason that Parsons employs such a small pressure fall per stage is entirely to keep down as low as possible the losses through leakage which are unavoidable in reaction turbines.

The author describes the Zoelly turbine as manufactured at the present time by Messrs. Escher, Wyss & Co. For turbines of 3,000 R.P.M. eight stages are usually employed; for 1,500 R.P.M. 12 stages; and for 1,000 R.P.M., 16 stages.

The first diaphragm plate (guide wheel) of the high-speed turbines has nozzles which extend for a portion of the circumference only in the bottom half of the diaphragms; whilst in the other diaphragms, the nozzles usually extend completely round the

design in the case of stationary turbines are the lower ste efficiency and the necessity of a complicated governing apparat in order to obtain a favourable consumption at partial loads. this type of turbine the governing has to be carried out by c trolling the number of nozzles through which the steam ent Experience has shown that this method does not satisfactor answer practical requirements, *i.e.*, continuous safe runni Besides, the governing is not so accurate, and is less suitable running in parallel with other machines.

The author for many years has experimented with turbi designed with a high steam velocity and compound wheels. T many series of tests which he has carried out at different peri have all gone to show that under the most favourable condition



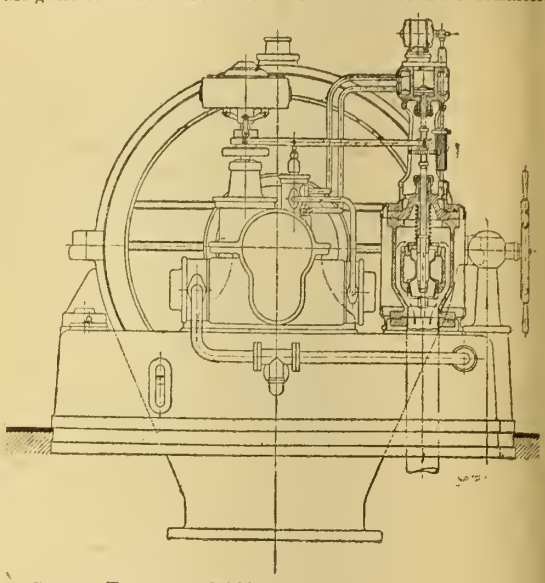


FIG. 5.—1,500-1,800-H.P. EIGHT-STAGE ZOELLY STEAM TURBINE, 3,000 R.P.M.

circumference. In the case of large units, however, steam is admitted through channels extending completely round the circumference for all stages.

The governing is effected simply by throttling the live steam and not by varying the number of channels through which the steam is admitted. The throttle-valve is actuated by oil under pressure in a small cylinder (servo-motor) by hydraulic action, the oil being supplied by a small pump directly driven from the shaft.

This is the same form of governing as that which has been found to work so successfully for water-turbines, and is now being universally adopted by nearly all the different makers of steam turbines on the Continent. Its inherent advantages are, that it is extremely simple and reliable, and, contrary to fears expressed by some engineers, this method of governing works particularly economically at partial loads, as is seen from the results shown

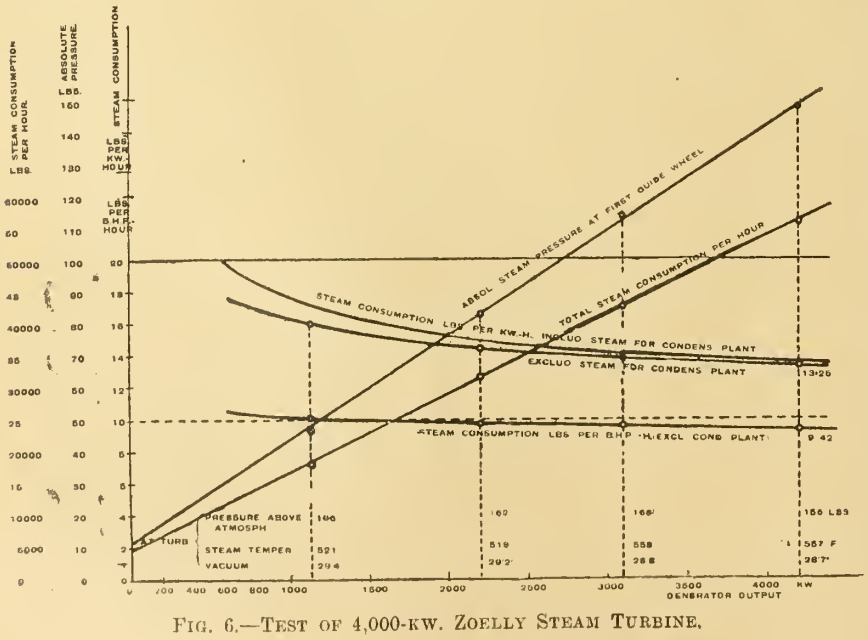


FIG. 6.—TEST OF 4,000-KW. ZOELLY STEAM TURBINE.

later. This, however, is only possible when simple velocity wheels are used in connection with parallel guide-nozzles throughout the whole turbine, and provided that the most favourable choice is made in regard to the sub-division of stages. Fig. 3 illustrates a simple velocity stage in a Zoelly turbine, showing section of blading. The conclusion arrived at is that the compound velocity wheel design is only advisable in special cases, as, for instance, in ship-building, where a lower propeller speed is absolutely necessary.

The chief reasons against the adoption of the compound wheel

is not possible to obtain a higher thermal efficiency with compo velocity wheels than 58 per cent., whereas with a turbine desig with entirely simple velocity stages it is possible to obtain efficiency of 73 per cent. and more. If, therefore, in an imp turbine it is found necessary to employ a combination desig compound and single velocity stages for such special cases exceptionally large units for land purposes, or where it is neces to work at low revolutions, the comparatively poor efficiency of high-pressure compound velocity stage or stages must be com sated for as well as is possible by obtaining a relatively hig efficiency in the subsequent low-pressure single velocity stages. this purpose almost as many pressure stages must, on the wh be provided for as in a design employing only single velocity sta

It is often objected to in the Zoelly turbines that too hig pressure and temperature exist in the first pressure stage; aga this it must be said that even with Zo turbines likewise large pressure-falls can utilised for the first stage within c paratively economical limits, provided t the lower pressure or subsequent stages h a correspondingly lower pressure-fall consequently work with a higher efficiency.

The Zoelly turbine has from the comme ment always been constructed with a h zontal shaft: experience with water-turbi has shown that by this method the simp form of bearing can be used, permitting e inspection at all times.

In the case of turbines running at 3, R.P.M., a flexible shaft is used, so that critical speed is sufficiently below working speed; but in the case of turbi running at 1,500 R.P.M. and under, contrary is the case, the shaft is ri and the critical speed is above the work speed. The shaft is supported by bearings which are lubricated by oil un pressure, and is connected by means o rigid or flexible coupling (usually rig to the generator or machine to be driv The casing is built up in two halves, joint being horizontal, so that the ro can easily be inspected without dismantl the bearings. An idea of the accessibi of all the important parts can be gai from the illustrations shown.

Actual results, obtained on trials (see tal by means of specially tested instrume and by impartial officials show the h economy that is obtained by this turbine, particularly at partial loa

Fig. 5 shows to scale a section of a normal eight-stage Zo steam turbine constructed to develop 1,500 to 1,800 H.P. 3,000 R.P.M., with a steam pressure of 170 lb. per sq. in. at 570° (300° C.) and with a vacuum of 95 per cent.

Fig. 4 shows to scale a section of a mixed-pressure Zoelly ste turbine constructed for "Zeche, Dannenbaum," to deve 1,800 H.P. at 3,000 R.P.M. with a main steam-pressure of 11 120 lb. per sq. in., using exhaust steam at a pressure vary

rom 5 lb. to 12 lb. per sq. in. and with a vacuum of 91 per cent. During the same period that the previously referred to experiments were being carried out, tests were in hand with a view to perfecting a design of slow-running turbine suitable for ship propulsion. The high-pressure portion of these marine turbines is fitted with a series of compound velocity wheels. The low-pressure portion consists of impulse drum blading. Messrs. Escher, Wyss and Co. recently built a set of two marine turbines, each of 7,500 H.P., which are now in operation in a torpedo-boat destroyer of the Imperial German navy.

SOME TEST RESULTS OBTAINED WITH ZOELLY STEAM TURBINES; NOVEMBER AND DECEMBER, 1910.

stallation.	Load in KW.	Steam pressure at stop valve. Lb. per sq. in.	Steam pressure at stop valve. Temp. ° F.	Vacuum.	Steam consumption. KW.-hour.	Steam consumption. H.P.-hour.	Thermal efficiency, per cent. Based on condition of steam. In front of stop valve.	Thermal efficiency, per cent. Based on condition of steam. Behind stop valve.
				%	Lb.	Lb.	%	%
-KW.	4,189	164·7	556·7	95·8	*13·25	9·36	68·7	71·2
bine	3,092	168·3	558·3	96·2	13·77	9·58	66·2	70·8
	2,199	161·9	518·5	97·4	14·40	9·84	63·2	70·75
R.P.M. fig. 6)	1,138	166·9	520·7	97·8	16·00	10·12	59·9	72·7
-KW.	2,052	179·0	584·6	94·9	13·04	9·18	70·5	73·0
rbine	1,514	181·7	563·3	95·5	13·67	9·52	67·2	72·8
	1,026	177·5	565·5	95·8	14·53	9·76	65·2	73·8
R.P.M.	510	171·8	543·0	96·6	17·33	10·68	58·8	72·8
-KW.	1,691	206·0	670·2	93·3	13·04	8·91	69·7	69·8
rbine	1,366	202·3	673·5	94·2	13·77	9·18	66·5	69·2
	851	205·2	662·0	95·2	15·52	9·81	61·0	66·9
R.P.M.	457·5	208·0	642·9	94·9	18·91	10·68	57·1	67·9
-KW.	—	—	—	—	—	—	—	—
rbine	1,235	162·3	451·0	94·0	15·34	10·77	67·0	68·3
	949	164·0	442·4	95·5	15·99	11·08	62·8	66·9
R.P.M.	606	166·7	427·4	96·5	17·1	11·48	59·0	66·6

* Not including steam required for condensing plant.

We give in fig. 6 a diagram of the characteristics of the 000-KW. Zoelly steam turbine running at 1,000 R.P.M. as built by essrs. Escher, Wyss & Co., for 165 lb. per sq. in. steam pressure. his diagram does not appear along with the paper read by Mr. elly at the Zurich meeting, and the additional information which gives will be of interest to our readers.

TRADE STATISTICS OF ROUMANIA.

HE following statement, showing the imports of electrical and nilar goods into Roumania in 1909, is taken from the official trade tistics which have recently been issued; the figures for 1908 are ded for purposes of comparison and notes of any increases or creases are given :—

	1908. Kilogs.	1909. Kilogs.	Increase or decrease. Kilogs.
ectric insulators of faience and porcelain en combined with other materials.—			
From Austria	52,000	32,000	— 20,000
,, Germany	88,000	37,000	— 51,000
,, Italy	24,000	—	— 24,000
,, Other countries ...	1,000	1,000	—
Total ...	165,000	70,000	— 95,000
ers.—			
From Great Britain ...	13,000	2,000	— 11,000
,, Austria	22,000	92,000	+ 70,000
,, France	27,000	30,000	+ 3,000
,, Germany	266,000	179,000	— 87,000
,, Other countries ...	1,000	20,000	+ 19,000
Total ...	329,000	323,000	— 6,000
n wire, galvanised, &c.—			
From Great Britain ...	356,000	62,000	—294,000
,, Austria	116,000	51,000	— 65,000
,, Belgium	51,000	15,000	— 36,000
,, France	—	2,000	+ 2,000
,, Germany	442,000	261,000	—181,000
,, Holland	21,000	86,000	+ 65,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	986,000	478,000	—508,000
Electric incandescent lamps.—			
From Austria	4,000	5,000	+ 1,000
,, Germany	10,000	13,000	+ 3,000
,, Other countries ...	1,000	—	— 1,000
Total ...	15,000	18,000	+ 3,000
Copper wire.—			
From Great Britain ...	2,000	—	— 2,000
,, Austria	22,000	20,000	— 2,000
,, Germany	129,000	104,000	— 25,000
,, Other countries ...	6,000	3,000	— 3,000
Total ...	159,000	127,000	— 32,000
Steam engines.—			
From Great Britain ...	241,000	30,000	—211,000
,, Austria	859,000	129,000	—730,000
,, Germany	1,105,000	1,415,000	+310,000
,, Russia	602,000	—	—602,000
,, Other countries ...	161,000	64,000	— 97,000
Total ...	2,968,000	1,638,000	—1,330,000
Petroleum engines.—			
From Great Britain ...	227,000	932,000	+705,000
,, Austria	259,000	475,000	+216,000
,, Germany	1,372,000	1,462,000	+ 90,000
,, Switzerland ...	164,000	237,000	+ 73,000
,, Other countries ...	24,000	135,000	+111,000
Total ...	2,046,000	3,241,000	+1,195,000
Gas, compressed air, &c., engines.—			
From Great Britain ...	29,000	45,000	+ 16,000
,, Austria	56,000	85,000	+ 29,000
,, Germany	133,000	343,000	+210,000
,, Switzerland ...	11,000	58,000	+ 47,000
Total ...	229,000	531,000	+302,000
Dynamo-electric machines, electric motors, converters, transformers, &c.—			
From Great Britain ...	1,000	2,000	+ 1,000
,, Austria	108,000	22,000	— 86,000
,, Belgium	151,000	15,000	—136,000
,, France	3,000	1,000	— 2,000
,, Germany	739,000	557,000	—188,000
,, Other countries ...	13,000	16,000	+ 3,000
Total ...	1,015,000	613,000	—402,000
Accumulators and spare plates.—			
From Great Britain ...	1,000	—	— 1,000
,, Austria	96,000	133,000	+ 37,000
,, France	1,000	1,000	—
,, Germany	81,000	34,000	— 47,000
,, Other countries ...	7,000	—	— 7,000
Total ...	186,000	168,000	— 18,000
Arc lamps.—			
From Austria	1,000	1,000	—
,, Germany	9,000	13,000	+ 4,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	10,000	15,000	+ 5,000
Electric apparatus for telegraphs and telephones.—			
From Austria	4,000	1,000	— 3,000
,, Germany	30,000	15,000	— 15,000
,, Other countries ...	7,000	7,000	—
Total ...	41,000	23,000	— 18,000
Ditto for transmission of power and light.—			
From Austria	2,000	1,000	— 1,000
,, Germany	17,000	12,000	— 5,000
,, Other countries ...	1,000	2,000	+ 1,000
Total ...	20,000	15,000	— 5,000
Interrupters, &c.—			
From Austria	7,000	7,000	—
,, Germany	66,000	63,000	— 3,000
,, Other countries ...	2,000	1,000	— 1,000
Total ...	75,000	71,000	— 4,000
Cables for transmission of electricity and insulated wire.—			
From Great Britain ...	—	27,000	+ 27,000
,, Austria	29,000	18,000	— 11,000
,, Germany	877,000	342,000	—535,000
,, Other countries ...	1,000	3,000	+ 2,000
Total ...	907,000	390,000	—517,000

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,745. "Safety brake mechanism for tramcars and the like." E. L. Wilson. August 21st.

18,759. "Electrical method of obtaining variable speeds between a driving and a driven shaft, specially suitable for the transmission gear of motor vehicles." P. L. Raeburn Fraser. August 21st.

18,763. "Meter-testing cut-out." T. E. Murray. (Convention date, October 25th, 1910, United States.) August 21st. (Complete.)

18,778. "Electric push-button switch." J. Brunner. August 21st. (Complete.)

18,785. "Antiseptic telephone mouthpieces." W. M. English, L. E. Boukofsky and S. M. Lichtenstein. (Convention date, August 29th, 1910, United States.) August 21st. (Complete.)

18,793. "Lead oxide agglutinant for increasing the strength and the porosity of the active material of the plates of secondary batteries." P. Marino. August 21st.

18,804. "Furnaces for the production of metallic sodium by electrolysis." E. Scheitlin. (Convention date, August 20th, 1910, Germany.) August 21st. (Complete.)

18,852. "Arc lamps." 1. Levy and F. Shepherd. August 22nd.

18,868. "Boosting transformers, voltage regulators, and the like." Siemens-Schuckertwerke G.m.b.H. (Convention date, August 22nd, 1910, Germany.) August 22nd. (Complete.)

18,879. "Wireless telegraphy apparatus." C. Wirth, C. Beck and H. Knauss. August 22nd. (Complete.)

18,881. "Tumbler switches." W. E. Lake. (Geb. Jaeger, Germady.) August 22nd. (Complete.)

18,893. "Electric traction systems." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts, Ges., Germany.) August 22nd.

18,901. "Certain kinds of fittings for electrical conduits." J. W. Brooks (trading as) Walsall Hardware Manufacturing Co., and A. E. Read. August 23rd.

18,906. "Electric lampholders." F. Booth and N. R. Booth. August 23rd.

18,908. "Electrical conductors." B. A. Pilkington. August 23rd.

18,911. "Driving-gear of electrically-operated winches." D. Wilson. August 23rd. (Complete.)

18,925. "Multiple arc lamps." J. Wetter. (Ges. fur Maschined-und Metall-Industrie m.b.H., Germany.) August 23rd. (Complete.)

18,949. "Wire-covering machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 23rd.

18,976. "Electrical means for igniting gas lamps." R. Hacking. August 24th.

18,981. "Apparatus for testing sparking plugs in internal-combustion engines." W. H. Story. August 24th.

18,997. "Electrostatic valves." O. Steels. August 24th. (Complete.)

18,998. "System of underground electric dispatch for mail and parcels." K. E. Stuart. (Convention date, September 9th, 1910, United States.) August 24th. (Complete.)

19,002. "Electric arc lamps." Ges. fur Maschinen und Metall-Industrie m.b.H. (Convention date, August 31st, 1910, Germany.) August 24th. (Complete.)

19,011. "Telephones." B. Gwozdz. (Addition to 11,234 of 1911; Convention date, June 17th, 1911, Germany.) August 24th. (Complete.)

19,026. "Magneto ignition for internal combustion engines." J. E. F. Cambessedes. (Addition to 13,633/11. Convention date, August 24th, 1910, Belgium.) August 24th. (Complete.)

19,034. "Electric horns." H. Lucas and W. H. Edwards. August 24th.

19,035. "Electric hords." H. Lucas and W. H. Edwards. August 24th.

19,047. "Methods and apparatus for shaping filaments for electric lamps and the like." R. W. Suman. (Convention date, May 31st, 1911, U.S.) August 24th. (Complete.)

19,062. "Adjustable insulator and clip for electric conductors." H. P. Allin and J. M. Allin. August 25th.

19,064. "Surface conduit system for electric railways." H. P. Allin and J. M. Allin. August 25th.

19,065. "Telegraph instruments." British Insulated and Helsby Cables, Ltd., and G. W. Moore. August 25th.

19,069. "Magnetic emanation." H. Harris. August 25th.

19,083. "Regulators for electrically-driven ring spinning and doubling machines." Siemens Bros. Dynamo Works, Ltd., and E. O. Kiefer. August 25th.

19,084. "Regulators for electrically-driven ring spinning and doubling machines." Siemens Bros. Dynamo Works, Ltd., J. F. Crowley and S. Gowan. August 25th.

19,085. "Regulators for electrically-driven ring spinning and doubling machines." Siemens Bros. Dynamo Works, Ltd., J. F. Crowley and S. Gowan. August 25th.

19,092. "Electrolytic refining of copper." S. O. Cowper-Coles. August 25th.

19,093. "Electro-deposition of copper." S. O. Cowper-Coles. August 25th.

19,097. "Electrical braking mechanism." K. Brull. August 25th.

19,108. "Electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States). August 25th.

19,109. "Electric lamps." British Thomson-Houston Co., Ltd., and H. H. Needham. August 25th.

19,114. "Submarine telegraphy." S. G. Brown. August 25th.

19,116. "Manufacture of electrical coils." W. E. Lake. (Weston Electrical Instrument Co., United States.) (Divided application on 9,000/11, April 11th.) (Complete.)

19,120. "Cut-out or fuse." N. Santo. (Convention date, August 25th, 1910, France.) August 25th. (Complete.)

19,160. "Machines for generating electricity and machines driven by electricity." R. Boyd. August 26th.

19,162. "Electric drive for machine tools." J. Feyer. August 26th. (Complete.)

19,182. "Electric lampholders." H. Lucas and F. Jenkins. August 26th.

19,185. "Circuit arrangements for automatic telephone exchanges." Siemens & Halske Akt.-Ges. (Convention date, August 27th, 1910, Germany.) August 26th. (Complete.)

19,186. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, August 27th, 1910, Germany.) August 26th. (Complete.)

19,187. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, August 27th, 1910, Germany.) August 26th. (Complete.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and 6 Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Joint-Boxes for Electric Wiring. A. Friedmann. 12,931. May 2 (December 1st, 1910.)

Electric Lighting for Vehicles. E. Gabreau. 18,035. May 28th.

Controllers for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Co.) 18,190. July 30th.

Apparatus for the Electrolysis of Fused Alkali Chloaides. Ges Chemischo Industrie in Basel. 18,300. August 2nd. (December 22nd, 1

Means for Controlling Dynamo-Electric Machines. Adams Mfg. (Cutler-Hammer Mfg. Co.) 18,306. August 2nd.

Propulsion of Vehicles by Combination of Prime Mover and Electr Storage. F. W. Lanchester. 18,631. August 8th.

Flexible-Cord Attachment for Electric Lamp Holders. C. A. M. Rer 18,656. August 8th.

Utilisation of the Silent Electric Discharge. E. N. Rideal. 18 August 8th.

Electric Time-Alarm Device. A. Girardelli and P. Holzman. 20 September 5th.

Combined Electric Switch and Fuse Distribution Boxes for use Electric Cranes. Electric and Ordnance Accessories Co. and M. I Mueller. 20,995. September 8th.

Electric Portable Lamps for use in Mines and other places. W Gray. 21,060. September 10th.

Electric Meters. British Thomson-Houston Co. and H. J. Martin. 2 October 5th.

Method of Supporting Electric Cables or Wires, and means therei Bullers, Ltd., and H. Dagnall. 23,153. October 6th.

Process of Treating Aluminium Articles for the Formation there of Galvanic Metallic Coatings. C. Rumpler. 23,359. October 8th

Sparking Plugs for Internal-Combustion Engines. A. E. Fletcher A. E. Dale. 23,807. October 14th.

Electric Heating-Irons. H. Hirst and C. H. Archer. 23,902. October (November 1st, 1910.)

Electrical Resistances. M. B. Field and Ferranti, Ltd. 24,485. October

Submarine Audible Telegraphy and Signalling. E. Klupathy and C. Be 27,144. November 22nd. (July 30th, 1910.)

Electrical Insulators for use in Mines. C. W. Speakman. 2 November 29th. (November 29th, 1909.)

Electric Furnaces. V. Popp. 30,890. December 31st. (May 6th, 1910.)

1911.

Portable Electric Lamps. A. Lobel and British Ever-Ready Electric 9,050. April 11th.

Electrodes for Electric Furnaces. O. Imray. (Shawinigan Carbid 9,633. April 20th.

Production of Quenched Electrical Spark Discharges. R. Galletti. 1 May 2nd. (May 3rd, 1910.)

Alternating-Current Block Circuits for Railway Signalling. Sie Bros. & Co. (Siemens & Halske Akt.-Ges.) 10,834. May 4th.

Electric Hammers. H. F. Whalton. 12,742. May 26th. (May 26th, 191

Switchgear for Overhead Railway. W. G. Webb, W. G. Brettel Adamson. 279. January 4th.

Electric Tightening Devices for Cable Conveyors. H. O. Adam. January 25th. (January 26th, 1910.)

Device for Continually Rolling About a Number of Articles by of Endless Bands for Electrical or Mechanical Treatment. K. 4,724. February 24th.

Construction of Electromagnets for Indicators, Relays and Si Apparatus. E. A. Parkes. 4,806. February 25th.

Insulating Material. British Thomson-Houston Co. (General Electri 5,167. March 1st.

Electric Ignition Device for Gas-Burners. W. Wasserzier. 6,182. 11th.

Arc Lamps. Siemens-Schuckertwerke Ges. 7,501. March 25th. (March 1910.)

Control Systems for Alternating-Current Electric Motors. L. W. I 8,783. April 8th.

Electricity Meters. Chamberlain & Hookham, Ltd., and S. H. H 10,080. April 26th.

Electric Shutter Indicators. J. Zickel. 10,545. May 1st. (May 2nd Addition to No. 26,502 of 1908.)

Semi-Automatic Telephone Exchange Systems. Siemens Bros. (Siemens & Halske Akt.-Ges.) 12,117. May 19th.

Automatic Regulators for Electric Circuits. Siemens-Schuckert Ges. 14,432. June 17th. (June 17th, 1910.)

Hydro-Electric Works.—It is announced from B Pesth that Ganz & Co. have been entrusted with the contrac the carrying out of a large power transmission works for the pany for the Utilisation of the Hydraulic Powers in Dalmat Trieste. The Hungarian firm has previously equipped for the company a transmission plant of 32,000 H.P. by the use o water-power of the Kerka river near Jaruga and Manojlovac power being employed for the operation of the carbide wor Sebenico. The new installation proposes the utilisation of water-power of the Cetina river in the neighbourhood of Aln the available power exceeding 200,000 H.P. It is, however, inte only to make use of 40,000 H.P. as a first instalment. The w will be provided with two units each of 20,000 H.P., and rotary current transformers of 18,000 H.P. will be arranged i station, and two of the same power at the end of the transmi line, for raising and reducing the voltage respectively. The t mission will be effected at 55,000 volts over a distance of n 16 miles. It is claimed that the generators will be the larg far constructed in Europe, and that the hydraulic turbines an transformers will be the largest in the world. The firm of and Co.-Danubius, will undertake the hydraulic portion of the as represented by turbines, pipes and sluices.

THE

ELECTRICAL REVIEW.

VOL. LXIX. SEPTEMBER 15, 1911. No. 1,764.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

RAILWAY COMPANIES AND MANUFACTURING.

PUBLIC attention has been for some time past acutely directed to the functions and methods of railway companies, and at such an important juncture it is not amiss to speak of specific reforms which might be advantageously considered. It is generally accepted that institutions as well as individuals, without occasional stimulative criticism or special incentive in the shape of competition, are apt to fall into methods of working which are neither good for the institutions themselves nor for the public which they serve. In some respects the railway companies have been affected with lassitude, while in others they have permitted themselves a freedom in methods of competition which are wholly indefensible on commercial grounds. Travellers to various parts of the country served by competing lines have often been struck by the fact that three, and sometimes four, trains have left a London terminus within a few minutes of each other, bound for the same town, and this arrangement has been persistently followed for some years. Then, again, in the collection of merchandise there has been an extraordinary degree of competition, and often four and five companies have been struggling to secure a certain freight. In this respect we must give the railway companies full credit for employing agents who are remarkably active and hardworking in securing business for their respective companies, but while the system may have developed the activity and keenness of the railway employé, it is generally admitted to be a wasteful system, and one which must have seriously affected the cost of carriage. In this respect it would be extremely interesting to know what the cost of collection and haulage to the railway terminus really is, for we strongly suspect that it constitutes a very serious proportion of the total cost of carriage. The experience of the railway companies in the United States is that the cost of haulage to the terminus is far in excess of the cost of the railway haul.

It is fortunate, however, that a good deal of this duplication of trains and the unnecessary competition for goods traffic has been very much modified, and by virtue of agreements arrived at between the different companies, very important economies have been effected in these two directions. While, however, many of the officials have been fully alive to their wasteful methods, the reform has not come from the inside, and it has been entirely due to the combined efforts of the shareholders that the companies have been driven into making some sensible arrangement with one another. If, therefore, the railway companies have been lacking in instituting such obvious reforms as we have indicated, it is highly probable that great improvements could be accomplished in other directions, and it is hoped that the pressure of the new conditions which may arise in regard to labour may result in a careful and sustained effort being made to effect economies. Certainly before any

attempt is made to burden the already harassed trader with higher freight charges, the possibility of which has been already indicated by the railway companies, a close examination should be made into every possible reform.

It is not our intention now to say anything further with regard to the labour question, for the whole case of the companies and their servants is undergoing the closest investigation, but while this examination into the working of the railway systems is being conducted, it is highly opportune to draw very serious attention to certain functions which the railway companies are carrying out, and which, we think, are open to grave criticism.

Railway companies in this country have been for the most part manufacturers of their own plant and machinery. In this respect they differ from all the great shipping companies and from most of the great railway companies abroad. We are prepared to hear a great deal said in favour of this policy, but we fear that in many respects it has proved to be a very unsound one, and the failure of a manufacturing policy on a railway might influence a much wider circle than the railway interests. The manufacturing policy of many of the railway companies has not been confined to one or two special branches of railway work. Most of the companies build their own locomotives and rolling stock, but some have gone much further than that ; indeed, one company, probably the mos ambitious of all the lines, rolled its own rails, and went so far as to build electric lighting machinery. Yet this same company, in spite of its comprehensive manufacturing programme, for a time at least fell hopelessly behind the rest of the world in its design of locomotives.

On broad grounds we are strongly inclined to the view that railway companies should never have been permitted to undertake manufacturing of any description. We have been told that railway companies knew their own requirements in respect of locomotives better than outsiders, and consequently they built exactly what they required. There s ıa good deal of fallacy underlying this view, and it is llustrated by the fact that whenever a mechanical engineer of a great railway line has laid down his work his successor has designed a new type of locomotive. To demonstrate still further the unsoundness of this contention, locomotives designed to meet the conditions of one line have been tried on other systems, and in more than one instance the strange locomotive has proved to be better than the home-made machine. Not for a moment are we arguing against the skill of locomotive engineers or the honesty of railway officials, in suggesting that locomotives designed outside the railway companies' works should be superior in design and cheaper in cost. It is clear that a manufacturer of steam locomotives who wishes to succeed must not only manufacture cheaply, but his designs must embody the latest ideas suggested by experience. It follows, therefore, that if railway companies were buying outside they would gain the benefits of the accumulated experience of a number of manufacturers without the heavy expenses necessary to the development of a new type of machine. There would have been a great national gain if railway companies had been purchasers instead of manufacturers, because under such circumstances there would have been developed in this country vast industries which would have dominated the Colonial and many of the foreign markets. If, for instance, locomotive builders had received the support of the home railways they would have become the suppliers fo world, instead of being a very poor second to the U States. In regard to this particular industry, it is too to apply a remedy, but in the next few years the rai will be to a large extent electrifying their lines, an sincerely hope that the electrical manufacturers are n be called upon to carry out the original work, which is us of an experimental nature, with the prospect of all subse work being done by the railway companies thems We regret to note that in at least one instance this c has been adopted, and the railway in question is act making its own motors and kindred apparatus. If ra companies are wrong in manufacturing steam locomot they are likely to be still more so in the case of elec machinery and apparatus, which if not undergoing ra changes is bound to be subject to minor improvements, clearly these are best obtained in the workshops of the cou On such a vital matter as this the electrical industry sh be heard, and if the large manufacturers of the country carefully watch events, they can make combined repre ations in the proper quarter, which should do much to pre in electrical work a repetition of what has occurred in c directions.

Technical Exhibitions.

Technical exhibitions, particu when international in character, exe broadening influence on the ideas knowledge of all visitors, no less important than that dr modern facilities for travel and the intercommunicatio news. The latest products of the most advanced worke every field are brought together at a central spot and pl at the disposal of every *bona fide* inquirer. By no c means could the latter obtain so much current knowle however wide his travels, many of the exhibits woul inaccessible, the cost of viewing even a fraction of the w would be enormous as compared with that of visiting exhibition, and under no other circumstances could latest developments in so many fields be accessible at time and place.

As a preventive of scientific and technical "provinc ism," exhibitions are invaluable, and in many respects are efficacious and far-reaching. The language bar prevents many engineers from fully appreciating the la developments in other countries, but, at an internati exhibition, the best of the latest apparatus is actually pla before him. Added to the concrete demonstration of ap ratus of every description, there is sometimes arrange series of papers and discussions which, by reason of cosmopolitan assembly present at their delivery, are of gr value to every participant.

To an important international Exhibition, most civili countries send competent delegates ; on their return, latter prepare detailed reports of their observations and c clusions—thus affording the best substitute for an act visit to those who were unable to attend the Exhibition, providing a permanent expert record of the latter as affect the current technical position of the various nations or co munities concerned.

Words can hardly do full justice to the universal value exhibitions ; the mere congregation of numbers of expe in every field should alone be a sufficient inducement to p suade every worker to avail himself of the exceptio facilities—personal and professional—at his disposal. T forthcoming Electrical Exhibition at Olympia is confiden expected to excel that of 1905 ; yet, if it were far below t standard of the latter, none but the most weighty reas should prevent any electrical engineer from attending it at least one date.

RELESS CONNECTORS FOR COOKERS.

By DONALD SMEATON MUNRO.

ST supply engineers are anxious to encourage the ension of electrical cooking, and in every town where re is a supply there are to be found more or less complete mples of electric kitchens. Reliable and cheap elec- al cooking utensils are now obtainable, and energy for purpose is charged for at a specially low rate. Modern ools of cooking teach their pupils the use of electrical ters, but before cooking by electricity becomes universal, s necessary to make the working arrangements so simple, and strong, that there is little chance of danger or nage to apparatus n in the hands of common cook or eral servant.

Everyone who has experience of ctrical heaters ws that the flexible nections are a petual source trouble. It is al to employ an inary wall socket plug for flexible; on the ends to ich the heaters are attached are fixed various forms of socket nectors. These are made of china, vulcanite, marble, fibre l various other materials which are apt either to break, o melt when heated, or which are affected by damp. The hod of fixing the ends of flexible cord into these con- tors is almost invariably bad, with the result that bare e ends come out at awkward moments, or the wire breaks re it enters the socket. The insulation of the flexible oon destroyed by the heat, grease, and water associated h cooking, and while flexible stands fairly well on lamp ndards, &c., it soon succumbs to the constant moving of king utensils. Lengths of cable connections are always cing in the way of dishes, and are the cause of much etting.

f the flexible cord does not contain an earth wire, or is armoured, the risk of accident is very considerable, and-

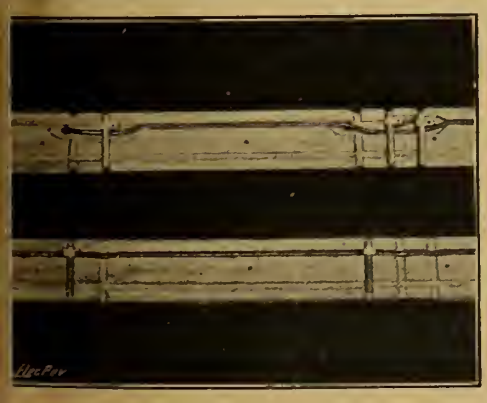


Fig. 1.



Fig. 2.

lock or flash may mean the abandonment of the whole trical kitchen.

Considering the nature of the work, it is inevitable that asionally there is leakage on some of the apparatus, and le it is possible to fit a wall socket with an earth connec- n, it is awkward and clumsy to fit such a contrivance on the little heaters which may be used.

When leaking utensils connected by flexible are kept on a earthed metal surface, they are comparatively safe, but en they are lifted up and the cook is also making contact h a metal surface or stone floor, then there is apt to be uble. It should be remembered with regard to shock, t electrical cooking is most popular in districts where the ltage is comparatively high, as the mains are less costly. Together it would appear extremely desirable, indeed vital, to the general adoption of electricity that flexible cords should be got rid of altogether. They are eliminated if ordinary utensils are laid on an electrically-heated hot plate, but such a method of heating is very wasteful.

Mr. Gray, in his paper read before the Institution of Electrical Engineers, referred to the awkwardness of flexible connections, and proposed a neat method of disposing of surplus cord by passing it through holes in the table and around weights on the telephone jack principle. He also mentioned that there was no wireless method of connection on the market.

The following description of a method of wireless connection recently devised by the writer may be, in view of the foregoing facts, of interest :—

The qualities aimed at were that the connector should be

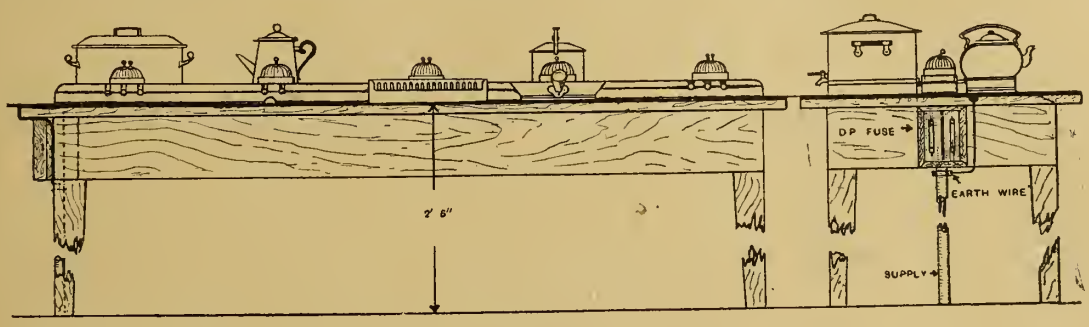


Fig. 3.

of the simplest character, that it should be practically unbreakable, and that it should be possible to clean it with soap and water; that the earthing arrangement should be such that a shock would be extremely unlikely, that it be adaptable to different sizes of heaters, and that a multiplicity of different sizes of switches and sockets be avoided.

Single heaters with two plugs or triple heaters with three plugs may be used, and it is necessary to fit the heaters with standardised parallel prongs, say, $\frac{1}{4}$ in. diameter and with centres $\frac{3}{4}$ in. from the base. The prongs, for a reason given later, may be about $2\frac{3}{4}$ in. long for big heaters and $1\frac{1}{2}$ in. long for little ones, and have, say, $1\frac{1}{2}$-in. centres.

A metal or wood table, or shelf, may be used, so long as the surface is faced with metal, usually zinc. The surface is "earthed." On the top of the table are screwed two lengths of grooved and polished slate. These form a casing and cover for the cables, and also carry the contact sockets. Tube contacts are fixed at intervals across the seam between the two slabs of slate. These contacts consist of pieces of tube brazed to small terminal blocks. The blocks are held in the grooves of the slate, and hold the contacts firmly without further fixture. The tubes present a perfectly smooth and uninterrupted channel for cleaning-out purposes. The negative cable is carried in a groove in the lower slate, and is looped through its negative contact terminals. The positive is carried in a groove in the upper slate, and is looped through the switches which sit on the top of the slate. Switch wires pass through holes to the positive contact tubes.

The method of wiring a single circuit feeding one two-socket and one three-socket connection is shown in the illustration, fig. 1. The two lengths of grooved slate are shown screwed together and fixed to a small experimental table in fig. 2. The slate may, of course, be grooved to contain additional circuits if desirable, and each local plug switch may have its own protecting fuse. The switches also may, in some cases, be of small rheostat pattern, and it is desirable that their cases be watertight.

Fig. 3 shows a cooking table prepared for kitchen use, with replaceable D.P. fuse and "earth" connection. The

inner surfaces of the two slates are so cut that when they are screwed together and to the table, there is no possibility of water getting through the seam into the cables.

The upper slate has vertical grooves to guide the prongs of cookers into their sockets, and, of course, as the prongs are inserted the metal bottom of the vessel makes a sliding and good electrical connection with the earthed table top. The ends of

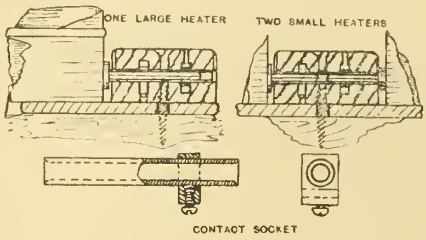


Fig. 4.

the contact tubes do not project to the surface of the slate, so when the vessel is withdrawn it is quite free from contact with the circuit, even should the switch be accidentally left in the "on" position. There is, therefore, no possibility of shock, as the utensil cannot be lifted till it is clear of the contacts, and the supply pressure might even be 500 volts with safety—with a corresponding reduction in size and cost of supply cables.

The design of the tube contact sockets is shown in fig. 4. The positive and negative tube sockets are of the same simple type and are interchangeable. They are easily replaced without fixing screws, should they in time become fused at the ends owing to neglect of use of the switch.

A special feature of the design is that heaters may be supplied from either side of the plug socket, and the apparatus is economical in cost and space owing to the ability to use one pair of plug sockets for two utensils.

Overloading of a circuit is automatically and simply prevented by adopting two standard lengths for prongs. The larger heaters have the longer prongs, and when these are inserted they project so far through their tube sockets that a heater cannot be inserted from the other side. Small heaters have prongs less than half the length of the tube socket; two small heaters may, therefore, be in connection at once on the same contacts. This device enables the switches to be uniform and tends to keep the fuse within control.

The sale of heaters will gain considerable impetus from the Olympia Exhibition, and the writer offers to manufacturers the above suggestion for getting rid of some of the chief drawbacks to electrical cooking.

ELECTRICALLY-DRIVEN AUXILIARIES FOR SHIPS PROPELLED BY DIESEL ENGINES.

By A. P. Chalkley, B.Sc.

All engineers are at the present time taking a keen interest in the question of the application of the Diesel engine to marine propulsion, the solution of which threatens to cause a greater revolution in marine engineering than any of the last 50 years. It is well known that any great change draws in its train a host of minor modifications, which are in themselves of vast importance, and upon the success of which the possibilities of the main question may to a very large extent depend.

The point could hardly be better exemplified than in the case of the Diesel marine engine. The advantages of its employment, instead of the steam engine, need not be entered into here, but in view of all that has been written on the subject, all the work which is being carried out to perfect the Diesel engine, and all the hopes which are being expressed as to its possibilities, it cannot be too strongly urged that more attention should be devoted to all the apparently minor details involved, which perhaps as much as anything else will determine the success or failure of the Diesel-propelled ship.

More and more has it been realised in the last few ye by marine engineers what an important bearing on the s cessful running of a ship, particularly in the case of lar vessels, the auxiliary machinery is capable of possessing, a yet it cannot be denied that in all the discussions relating the employment of Diesel engines for marine propulsion, t question has been kept steadfastly in the background. fact, so consistently has this been the case, that several sh owners and others interested have been forced into t impression that there is some difficulty in the matter of t operation of auxiliaries in a Diesel vessel, and it is evid that the spreading of such an impression may have a v detrimental effect on the future development of this n motor for marine work. This is all the more to regretted, as a proper examination of the question auxiliaries can only lead to the conclusion that they can be every way more advantageously and economically opera in a vessel propelled with Diesel engines than in steamship.

The applications of electricity at sea have in recent ye been steadily enlarging their sphere with the greatest succ both from the point of view of economy and also of conve ence of operation, and even if the steam engine or turb is to be generally retained for main propulsion, the tende to employ electricity for all auxiliary drives and other u bids fair to increase to such an extent as to render steam-driven auxiliaries unnecessary for all purposes. W ships employing Diesel engines for propulsion, where steam is in the ordinary way available, it seems natural expect that the step which is now being made with so caution in steamships should be hastened, and el trically-driven auxiliaries should without question beco universal.

The employment of electricity at sea, however, has had be pushed forward by its advocates against the m strenuous opposition of the more conservative mar engineers, and this feeling of distrust has had its effect the design and arrangement of the auxiliaries for some of Diesel engine boats which are now under construction. T result is that some of these vessels are employing compres air for the auxiliary drive, whilst others are even be equipped with small donkey boilers to provide steam for auxiliaries—an arrangement for which it is difficult to f an excuse.

It is known by long experience that there is no us auxiliary on any ship which cannot be satisfactorily dri by electricity—pumps, winches, windlasses, fans, steer gear, cranes, lifts, hoists—and all the further auxilia introduced by the Diesel engine itself are likewise suita for the electric drive. It is true that a large amount compressed air is necessary for the main engine, and most cases a separate air compressor is provided, dri independently of the main engine. For this reason in sm vessels the use of compressed air for the very few auxiliar even though the economy is of the worst, due to the air being expansively, may not be considered irrational, inasm as it saves a certain amount of initial expense. But introduce a steam boiler, as has been done in one or t instances with fairly large vessels, is a conservative pol such as would not have been expected from any ship ow who has the temerity to employ Diesel engines at all.

It may be mentioned without comment that t largest Diesel-propelled boats now being built in Germa and notably the Hamburg-America liner of 9,000 t with Diesel engines of 3,000 h.p., are employing electri solely as the motive power for auxiliary drive. T economy in operation which can thus be obtained is so gr as to be comparable with the economy due to the m engines. The dynamos for the supply of power are dri by Diesel engines of the most efficient and well-tried la type, and it is not difficult to realise how important t economy may become when it is considered that in ste vessels of moderate size, about 20 per cent. of the ste raised in the boilers is required for the auxiliaries. Agai this arrangement of the exclusive use of electricity, it can even be urged that Diesel-driven dynamos are in any sens novelty at sea, inasmuch as they have been employed battleships for the last six or seven years. Apart from ot considerations, the fact of their readiness to start up at minute's notice is at least a matter to be borne in mi

ıce with steam auxiliaries on a Diesel-propelled ship the ain engine loses its advantage of readiness for immediate eration owing to the necessity of raising steam for the xiliaries.

The question of the auxiliary compressor for the main gine is the most interesting and important matter in nnection with the general aspect of auxiliary driving : Diesel ships. This compressor must necessarily be of nsiderable power, and in most cases for this reason is preferable in any case to drive it by a separate Diesel other oil engine, rather than by electricity. An arrange-nt which has, however, been adopted, and is very useful certain cases, is to have it capable of being driven from e of the electric generating engines, either direct or by lt, the dynamo being out of operation when the compressor is work, and *vice versa*, for it must be remembered that for g periods the compressor is not required.

That electricity will eventually be universally employed all auxiliary driving in Diesel-propelled vessels cannot be nsaid, and it is to be hoped that some endeavour will be de to cause the British shipowners, who are now consider-the question of the employment of the Diesel engine, to that this would be of immense utility and great economy.

CORRESPONDENCE.

ters received by us after 5 P.M. ON TUESDAY *cannot appear until he following week. Correspondents should forward their communi-ations at the earliest possible moment. No letter can be published nless we have the writer's name and address in our possession.*

Lift Accidents.

At frequent intervals the Press reports lift fatalities, ich vary in their nature from those to porters in large ds lifts to those to children in apartment houses, and a dict is generally brought in of "Accidental death," with der from the jury suggesting some additional safeguards. When we consider that the number of people carried tically bears a considerable ratio to those transported izontally, and that lifts may be deemed public convey-es, it would seem advisable that the details of lift struction should come under the supervision of some erning body, such as the Board of Trade or the London nty Council. All railways must receive a certificate n the Board of Trade, following a careful inspection, ore they can be opened for public traffic, and in the case the tube railways the lifts, as an essential part of the em, were carefully inspected and passed upon by a super-ng officer of the Board of Trade.

The majority of lifts are constructed to the specification under the supervision of either architects or their con-ing engineers, and in most cases do not come within the view of one who is an expert and authority on such ters. Were a governing body to prepare a set of con-ions with the help and advice of lift experts, covering the ous conditions met with under different forms of lifts, I certain that lift manufacturers would welcome such ulations, that the architects and others involved would be ved of a grave responsibility, and that the public in eral would be far better safeguarded.

Gilbert Rosenbusch.

London, S.W., *September 9th*, 1911.

Quartz in Electrical Heaters.

am preparing a paper on "Electrical Heating and king Apparatus," and shall be much obliged if any of r readers can inform me what firm or individual was the to employ quartz or silica in the construction of this l of apparatus. I am, of course, aware that these sub-ces have been used for this purpose in this country, and Continent, and America, for some years, but I have not able, so far, to ascertain definitely who was the first to e use of this material for this purpose. Thanking you nticipation—

M. Taylor.

dinburgh, *September 11th*, 1911.

PRIVATE BILL LEGISLATION OF THE PAST SESSION.

[BY OUR PARLIAMENTARY REPORTER.]

With the promotion of a large number of Bills for powers to run railless trolley systems of tramways in different parts of the country, it looked at the beginning of the past session as if there would be a revival of interest in electrical matters in the Committee Rooms of Parliament ; but these hopes were quickly shattered when the Duke of Bedford's Committee of the House of Lords, charged with the consideration of a group of Bills promoted by private persons, threw out the Matlock district scheme, which was fiercely opposed by the local authority, largely on the ground that a heavy cost would be thrown upon them in connection with the repair of the roads. This decision led to the dropping of practically all the privately promoted Bills, although the Brighton, Hove and District Bill, which was brought forward by the Brighton, Hove and Preston United Omnibus Co. was eventually passed in an emasculated form. The Bills dropped were the Croydon and Southern District Railless Traction, the Macclesfield and District, the Malvern Electric Traction, the Oldham and Saddleworth District, the Rotherham, Maltby and District and the Western Valleys (Monmouthshire). Of the railless traction Bills promoted by local authorities, Rotherham obtained powers to run trackless trolley vehicles on specified routes after January 1st, 1912, and Northampton, Halifax and Chiswick after January 1st, 1913, on the certificate of the Board of Trade. All these Bills came before the Police and Sanitary Committee, whose object in delaying the powers is to give time to test the working of the systems sanctioned last year to Bradford and Leeds, which are now in operation with satisfactory results. In one case only, that of Rotherham, do the specified routes extend beyond the boundaries of the local authority, and each of the authorities on the intended routes supported the proposal.

Two of the local authorities who obtained railless traction powers also applied for an extension of their existing tramway powers. Northampton Corporation, for instance, got considerable powers for new tramways, and successfully fought the railway company with regard to the carrying of the rails over a level crossing on one route, after the Committee considering the matter had mainly endeavoured to bring about an agreement between the parties for the construction of a bridge. Halifax Corporation obtained authority to spend nearly £80,000 on new tramways. A Welsh local authority, the Aberdare U.D. Council were empowered to construct both tramways and the railless traction system in their portion of the "Happy Valley," after several previous unsuccessful attempts. The Paignton U.D.C. obtained conditional powers regarding a piece of tramway authorised to be constructed by the Torquay and Paignton Co., and the Newcastle-on-Tyne Corporation obtained part of the powers they applied for as regards the construction of tramways. As usual, the London County Council brought forward an ambitious programme, and it followed as a matter of course that a number of the proposed routes had to be dropped owing to the lack of consent on the part of different road authorities. However, a number of proposals for new lines were agreed to, including a junction line in the Seven Sisters Road, which will provide a through service between the County Council's lines and the system of the Metropolitan Electric Tramway Co. The Newcastle-on-Tyne Corporation also succeeded in getting authority to provide a number of extensions, but failed in regard to some of the suggested routes. The Southampton Corporation had a few modest tramway proposals which went through unopposed, and the Hull Corporation were also successful in their promotion. The Belfast Corporation obtained powers to extend the Holywood Tramway, and the Dover Corporation got an extension of time for the construction and completion of street works and tramways already authorised. Other tramway Bills carried were the Bristol Tramways for an extension of time, and the South Lancashire Tramways for additional tramways in Little Hulton, Farnworth and Worsley. The Brighton and District Tramways Bill for the

incorporation of a company with a capital of £210,000 and construction of about 10 miles of tramway was dropped early in the Session, after a prolonged discussion before the Examiner with regard to the standing orders of Parliament being complied with. The Metropolitan Electric Tramways Co. obtained useful powers in respect to the construction of a new bridge over the Lea at Walthamstow, which will enable the undertaking to be worked with greater convenience, and the Nottinghamshire and Derbyshire Tramways Co. obtained a rectification of an omission in their previous Acts in regard to the compulsory acquisition of land, which has prevented the company from proceeding with the construction of their authorised tramways. The London United Tramways Co. received an extension of time for the acquisition of land and the completion of authorised tramways, and similar powers were granted to the Middlesbrough, Stockton-on-Tees and Thornaby Tramways.

Six electric railway Bills were dealt with, all but one of which related to London. The exception was the Liverpool Overhead Railway Bill, which sought to consolidate its capital powers, and received the required authority. The Metropolitan Railway Co. successfully applied for powers to make various widenings, and also to construct a new railway at Mount Pleasant which will enable the company to cater for the large body of men employed at the Post Office there. The London Electric Railway Co. obtained powers to construct new works at St. Martin-in-the-Fields, which will give better access to other tube railways, and the company was also jointly concerned in the Bill promoted by the Metropolitan District Railway Co. for the creation of a joint Committee to purchase the Lot's Road generating station on terms set forth. Both Bills were carried, as was the Bill of the Central London Railway Co., which, amongst other things, provides for the construction of a line to join the authorised Ealing and Shepherd's Bush line of the Great Western Railway Co., and so give another direct route to the City for the growing Ealing District. The London, Tilbury and Southend Railway Co. obtained authority to raise £750,000 additional capital.

Only two measures dealing with electric lighting companies were promoted, and, curiously enough, whilst one was for the purchase by a local authority of the undertaking of a company, the second was for the purchase by a company of the undertaking of a local authority. The first was the Winchester Corporation Bill, under which the municipality are taking over the undertaking of the Winchester Electric Light and Power Co. on agreed terms, whilst the second related to the acquisition by the Metropolitan Electric Supply Co. of the undertaking of the Acton Urban District Council. The Sidmouth Gas Co. obtained authority to supply electricity, and the Ashbourne Gas Co. power to apply for an electric lighting order. Later in the session one electric power bill was introduced, viz., the East Kent, but it merely dealt with matters of domestic concern.

THE BRITISH ASSOCIATION.—II.

The first business of the Engineering Section on Monday morning (September 4th) was a paper by Mr. Berriman (technical editor of *Flight*) on "The Principles of Flight," at a joint meeting with Section A (Mathematical Sciences). As a matter of fact, engineers and meteorologists did all the talking, and they had a large and appreciative audience. As the paper does not deal with electrical engineering, we do not publish or comment upon it further than to say that the opinion was expressed that many fatal accidents had been due to gyroscopic action of motors and propellers. Mr. Kilburn Scott made the suggestion that a solution of the difficulty would probably be found in building aeroplanes with two engines and two propellers, each pair rotating in opposite directions, with the frames rigidly connected together, so as to keep the shafts always in line.

Radio-telegraphy.—Prof. G. W. O. Howe's paper, entitled "Recent Developments in Radio-telegraphy," an excellent description of the latest improvements, was much appreciated by a large audience. He said that the magne detector of the Marconi Co. is ideal in its simplicity a reliability, but is not so sensitive as the electrolytic or mineral contact detector. The Telefunken Co. has recen however, given up the electrolytic detector in favour o mineral contact. It appears that the detector which Pr Howe uses is simply a piece of zincite in contact w a pencil of pyrites. He finds zincite much better t galena.

An aerial wire, attached to the top of the Portsmo Town Hall tower by a single telegraph line insulator, v brought in through the window of the lecture room, a exactly at 12 noon the audience heard weather rep signals from Norddeich and from Wilhelmshaven, Germany.

The signals from Norddeich gave a very clear musi note due to the use of Prof. Wien's spark gap. In this sp gap, not only is the spark quenched by an air blast, but electrodes are comparatively large and the gap short, so t no part of the spark is far removed from a large mass cold metal. This tends to cool the heated air a condense the metallic vapour, thus lowering the conductiv of the spark, and making it easier to quench.

Captain Riall Sankey then described, with the help lantern slides, the details of the portable wireless plant the Marconi Co. The engine and dynamo are carried one horse, and all that is required, after lifting them to ground, is a length of flexible shafting to connect across wh the horse's body was. Another horse carries the two ma which can be extended to 60 ft. high. They are pla 350 ft. apart, and a horizontal conductor is stretched betw them. Two other horses carry the smaller apparatus, it is all most ingeniously arranged so that work can carried on during wet weather, without risk to the insu tion, &c. With skilled men the time required to erect the plant ready for working is 9 minutes, and to dismantl 6 minutes. The power of the alternator is 400 watts, a the range in mountainous country 20 miles, and over the about 100 miles. A more powerful equipment having alternator of 1,500 watts, and masts 80 ft. high, ha range of 200 miles.

Mr. Kilburn Scott opened the discussion by asking Ca Sankey whether nitrogen peroxide gas had given any trou in the enclosed sparking chamber or the aluminium or me parts. He asked this because when visiting the Marc factory some time ago there was evidence that a good of nitrogen was fixed from the air by the high-tens apparatus. Capt. Sankey was understood to state tha fan was provided to get rid of the gas. Discussing P Howe's paper, he mentioned that a spark lasting one-twenti of a second would set up a wave that in that time wo have traversed 9,500 miles. Regular communication wo shortly be established between Coltano, in Italy, and Argentine, a distance of about 6,000 miles.

Prof. Dalby asked what were the longest and short wave lengths in commercial working, and whether an ap ratus set for a 2,000-ft. wave length would tune out wa lengths of, say, 2,100 ft. or 1,900 ft. Prof. Howe said trans-Atlantic service used a wave length of 20,000 whilst the shortest wave length in general use was ab 1,000 ft. Ships generally used wave lengths of 1,000 2,000 ft. As to how far waves could be tuned out, mu depended on the plant at the transmitting station. If gave a well-sustained wave it was possible to tune out, the explosions transmitted by some stations, especially th in France, gave some trouble.

Prime Movers.—The papers on "Economical and Relia Power Generation by Over-type Superheated Steam Engine by W. J. Marshall; on "Suction Gas Engines and P ducers," by W. A. Tookey; and "Diesel Engines," by Ch Day, were read in abstract and discussed together. M. Day rested his case on a table giving average costs B. of T. unit sold in all the electricity supply stations havi a plant capacity not exceeding 1,000 h.p., and having average load factor of about 15 per cent. These figures given on page 370 of the Electrical Review, but it n be useful to repeat the total works costs. For steam it 1·02d., for gas engines 1·04d. and for Diesel engines ·5 As these are from actual working conditions extending o long periods of time, they are of much greater value th

sts at makers' works or on site. The meeting seemed very uch impressed with them, and although Mr. W. Marshall nd Mr. Tookey were encouraged by Prof. Biles to upset the npression, they failed to do so, although in reply to Mr. Marshall, Mr. Day did admit that the Diesel engine results ere from newer engines than the steam results.

Capt. Riall Sankey gave some useful notes and curves on ie determination of "rated output." He mentioned that ie Engineering Standards Committee had decided, but not ublished, that the rated horse-power should be 85 per cent. what the engine could possibly do. The overload capacity internal combustion engines was generally lower than for eam engines. Mr. Day stated that his firm usually aranteed 10 per cent. overload for two hours.

Mr. W. J. Lewis raised the question of utilising exhaust eam, and it was pointed out that as the efficiencies of the ree types of engines were 10 to 11 per cent. for steam, to 20 for gas and 40 per cent. for Diesel engines, the ore efficient engines naturally gave less possibilities of haust heat. For sugar works and paper factories, where ere was boiling to be done, the steam system had advanges. At the same time, Mr. Day stated that the exhaust Diesel engines was being used for heating.

Mr. Kilburn Scott referred to the fact that a leakage in e piping, &c., of a steam engine system could be readily en; but a leakage of gas could not be seen, and as carbon onoxide was exceedingly poisonous, many cases of gassing d occurred. This was worst in pressure producers, but en suction producers, as he knew by experience, could also ve off bad gases. Regarding the viscous oil used for Diesel gines, a leakage was most unlikely to occur, and the oil uld be easily stored, whereas coal and coke and the boilers d gas producers in which they were burnt took up much om. He mentioned that at Chichester, only a few miles ay, the electricity supply station had Diesel engines, and his asking the engineer if he had any objections to them, e latter, whose previous experience had all been with am plant, said that they ran so sweetly that there was thing to do.

A reference to the limited number of firms who were at esent supplying Diesel engines, as compared with steam gine makers, and the relatively higher prices of such gines, brought out the statement from Mr. Day that all ential patents had run out, and that 30 new firms started e manufacture of Diesel engines in Germany last year. Also had recently been to a Hungarian town for an order, and nd that there were five makers of the engines there eady.

Mr. Wimperis and Capt. Riall Sankey referred to the ssibility of internal combustion engines using both steam d gas.

Mr. H. S. Russell championed the Diesel engines, and of. Marchant referred to the omission from the figures oted of capital costs, which, he said, were frequently half much again as works costs. They should, therefore, be eading factor in deciding what type of plant to install.

Nitrogen Products.—On Wednesday morning the first per was by Mr. E. Kilburn Scott, on "Manufacture of trogen Compounds by Electric Power." The paper was ustrated by lantern slides, and samples of the various trogen products mentioned in the paper were shown.

The President of the Association, Sir William Ramsay, ened the discussion. He expressed the opinion that the ture of this country lay in the direction of manufacturing ch products as the author had described, and that the tories for such manufactures should be established in the ighbourhood of coal mines. He thought the most econoal way of using coal was to turn it into gas and by-oducts and to use the gas for driving engines to generate ctricity, which could then be cheaply distributed. This uld avoid the cost of long piping to distribute gas, for at we now paid for coal gas was not so much the cost of s itself as the cost of distributing it. If that were cut wn and the gas used economically in large electrical power d chemical works placed in convenient positions for fuel pply, it would be a great relief to the economic conditions the country. He thought it was a Government question, possibly one even beyond Government, on which all rties should agree to take expert advice. To his mind ere was very little doubt that a policy of that sort would largely lengthen the coal supplies of the country and cheapen our commodities, enabling us also to manufacture electrochemical and metallurgical products which we now imported.

Dr. Ernest Erkhardt congratulated the author on the way he had dealt fairly with all the various furnaces and methods. As a rule, when an author is interested himself in one or other method, that method is apt to be given undue prominence. He himself was connected with the Badische Anilin und Soda Fabrik, which had established works at Christiansand to make nitric acid and sodium nitrite. As mentioned, this was done by means of the Schonherr furnace. Also it was true that the financial interests controlling the Birkeland-Eyde furnace and the Schonherr furnace had become amalgamated, and a 250,000-H.P. plant was now being built by them at Rjukan. The first 125,000 H.P. would be ready by the middle of next year, and the first of the furnaces were now being set to work. Four-fifths of the furnaces were of the Schonherr type, and the rest were Birkeland-Eyde furnaces.

They would decide on the type to use in the second half from the experience gained with the present plant; much experimenting would, no doubt, be necessary. Regarding the manufacture in this country, he had made inquiries, and could not find any power as cheap as that available in Norway. It was quite true that Great Britain received its supplies very largely from overseas, especially from Chile, but it would be the duty of the Navy to protect the Chile nitrate fleet. If the Navy could not do that, then it could not protect the food supplies, which were even more important.

Sir William White remarked that it was of great advantage to any country to have the means of producing from sources of supply within its own borders anything it wanted. This was especially the case with explosives and other requirements for national defence. He mentioned that when basic steel first came on to the market, making it possible to use the phosphoric ores of this country in place of imported ores, he was one of the first to recognise the national importance of encouraging the new steel, and gave effect to this by specifying it for battleships, &c. He referred to the splendid enterprise shown on the Tyneside, where electric power was being supplied from large power stations for use in electrochemical factories, ironworks, and shipbuilding yards and collieries. That part of England had fully recognised that the generation and supply of electric power was a business of itself. Many works and mines had closed down quite large power plants of their own because they saw clearly that it was better to buy in bulk from a Power Company experienced in utilising coal economically and which also was in a position to make use of waste heat.

Mr. Wimperis mentioned that it was estimated that over one million horse-power was going to waste in this country in the way of waste gases, which could be made to produce electric power.

Prof. Petavel said that he had tried to improve the percentage of nitric oxide gas formed by the direct process by having the gases under pressure. He found a distinct improvement, but other work took away his attention.

Mr. Haigh wished to know how much of the fixation was due to thermal action, and how much to electrical discharge.

An agricultural expert, Mr. Collins, said that he had experimented with the manures made by the electrical processes, and could speak as to their great value.

In his reply, Mr. Kilburn Scott said that it was hardly fair to hump all the work of looking after us on to the Navy. Where we could easily do so, we should manufacture as much as possible in this country, and certainly explosives ought to be made in their entirety here. If it could not be done by private enterprise, then the Government should step in.

Regarding waste heat stations, as the great advantages became known, the number would increase rapidly, and this was going to have a profound influence on the cheap electric power problem. At the present time, the prices asked for electric power were too high, but we were so accustomed to lavish expenditure on little municipal stations working on low load factors, that it was hardly realised what could be done with economically designed large power plants working on high load factors. The day of the small power station was past. He hoped Prof. Petavel would proceed with his experiments,

as it was quite clear that the one to one and a-half per cent. of nitric acid coming away from the furnaces could be improved upon. Probably by introducing the gases nitrogen and oxygen under high pressure and in exactly the right proportion to combine and not in the proportions in which they were in the atmosphere, there would be marked increase in the output.

As to Mr. Haigh's query, it was evident that the action was not merely thermal, because a silent brush discharge at ordinary temperatures formed nitric oxide gas. A high temperature hastened the chemical combination. The gas had to be suddenly cooled directly it was fixed, and it was to provide for this that the skill of the designer of the furnaces was required. In the calcium cyanamide process this sudden cooling was not necessary.

Smoke.—The next paper was on "Smoke Abatement," by Dr. J. S. Owens. The present legal standard, which says "black smoke in sufficient quantity to be a nuisance," is very unsatisfactory, because *black* smoke is rarely seen: blackness alone is no measure of the amount of the pollution, nor even of the amount of soot per ton of coal burnt. The author suggested that the standard should take account of the density, that is, the amount of soot per unit volume of flue gas. He had devised an instrument to give a fair basis of comparison with a standard density.

Sir William White said that there was a feeling in manufacturing districts that the more smoke there was in the atmosphere, the better the business was. He thought the fines should be substantial.

Mr. Mark L. Sykes, a manufacturer from Leeds, made an amusing speech. He asserted that the best method of preventing black smoke was the prosecution of the rascally manufacturers. Small fines were of no use, so offenders should be kept in gaol until they changed their ways. The only causes of black smoke were the use of bad fuel, careless or stupid stoking, the lack of proper mechanical stokers, and want of proper boiler power.

Screw Transit.—The concluding paper was by Mr. W. Y. Lewis, entitled "Continuous *versus* Intermittent Service in Passenger Transportation." The author and a Mr. Adkins have got out a method of working light passenger coaches on busy lines by means of a continuous screw about 2 ft. in diameter rotating between the rails. The pitch of the thread varies considerably, being about 8 ft. between stations, so as to give 20 to 30 miles an hour, and shorter at the stations, so that the train travels at about 3 miles per hour past the platforms. The author claimed that collisions would be impossible; there would be no signalling: the passengers would be handled in streams, instead of intermittently: the average speed of travel would be higher than at present: labour would be minimised, and power would be low because the system would be regenerative.

Capt. Sankey, who had examined the experimental track at Ransome & Rapier's works, said he was surprised to find that about 80 per cent. of the energy was returned during retardation of the cars.

Prof. Dalby said he had known of the system for several years, and complimented the inventors on the engineering skill put into it.

The Origin and Production of "Corrugation" of Tramway Rails.

By W. Worby Beaumont, M.I.C.E., &c. (*Abstract.*)

Few of the phenomena of the behaviour of materials employed in tramway construction have given rise to so much inquiry, speculation and diversity of opinion in the last few years as the phenomenon known as "corrugation" of tramway rails.

The subject has hitherto been treated mainly from the general point of view suggested by the practical experience of the tramway manager and engineer, and has seldom attracted or received the considered reasoning conjointly of the mechanic and the physicist.

It is, however, one which in a marked degree demands the patient application of the attributes of both, and in this paper I may repeat the words of Mr. H. R. A. Mallock and say, "it is often useful to have a simple, even if incomplete, theoretical treatment of a subject, provided that the theory is correct as far as it goes, and is kept within bounds by comparison with actual observations."

In a surface of a homogeneous solid under compressive stress in orthogonal directions in the plane of the surface, every particle tends to cause every particle surrounding it to recede in every direction.

If one surface of a free flat bar of steel or iron, as fig. 1, be rolled or hammered, the material of that surface is subjected to a compressive stress. Of this stress it is relieved in the direction of length of the bar, so far as the stress is no greater than that which is necessary to bend the bar, and to cause it to keep the bent form of fig. 2.

If of wrought-iron, the molecular surface stress will in part be relieved by flow of the material or detrusion along the edges of the hammered surface, and the longitudinal bending be less than if the bar be of rail steel, in which the detrusion will be less.

If when a bar has been bent by surface compression of one side, it be forcibly straightened, the compressive stress will be increased and a tensile stress impressed on the opposite side sufficient to eliminate the difference of dimensions of the two sides caused by the compression. To remove the difference permanently, the stress on the uncompressed side must reach the character of strain, equally



Fig. 1.



Fig. 2.

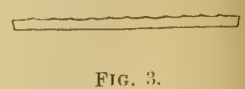


Fig. 3.

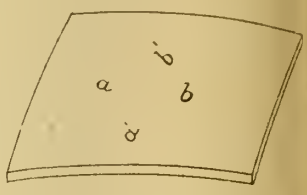


Fig. 4.

distributed throughout the whole length of the bar. At the same time an increase is made in the compressive stress on the rolled or hammered surface. This cannot be relieved by a single pucker or extrusion of the surface about the centre of length of the bar, as the stress is uniformly distributed. Hence at distances apart (or pitch) depending on the elastic and cohesive properties of the material there will result incipient surface crumblings or corrugations, as shown exaggerated in fig. 3.

The bearing of this fact on the tramway or railway rail will appear hereafter, but here it may be observed that a bar which is bent by compression of one side, and caused to retain the bent form by that resident molecular stress, is not in the same condition as to stress throughout its structure as a similar bar bent and maintained in a bent form by mechanically imposed distributed load.

In the bar bent by compression of the material on one side there is molecular tensile stress immediately below the hammered surface. The compression differentiates in intensity from the surface, to a zone or couche under tensile stress resulting from

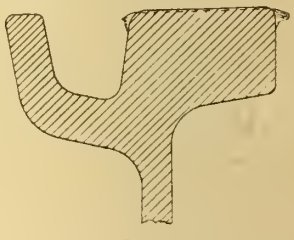


Fig. 5.

the molecular cohesion which has prevented the compressed and extended surface from separating itself by shear. Below the tensile stress differentiates into a neutral zone, and therefrom into the compressive stress which remains resident in the bar so long as it is bent by these internal forces.

In a surface such as that of an iron plate which has been rolled or hammered on that surface only, the particles of the hammered surface are, as previously mentioned, restrained by cohesion of and with the subjacent particles which are less and less under compression as they are remote from the compressed surface film.

If any two points a b or a' b', fig. 4, be taken in such a surface film, it will be seen that all the particles round each point press towards it with forces proportional to some function of their respective distances from such points. In a line drawn from a to or a' to b' there are, therefore, equal and opposite forces tending to separate those points, and when their amount exceeds the elastic resistance of the material, deformation or crushing or crumpling must occur, if change of form of that of which the surface is part be restrained. If the surface be that of a deformable plate then the forces are in part relieved by bending the plate in orthogonal directions. The distance between a and b at which any given material will reach the yielding point, or at which the accumulated forces will be sufficient to cause either the bending of a plate, or give rise to destructive stresses in any other form of which the compressed surface is part, will be dependent upon the relation between the elastic resistance of the material to compression and its elastic tensile strength and its hardness.

In dealing with these stresses as occurring in practice, and in such forms as those of a railway or tramway rail, it will be seen from the foregoing that the values of the stresses in orthogonal directions soon reach inequality, because while they become cumulative in the direction of length of the rail, the distance transversely separating the points a and b earlier reaches the limit of dimensions at which the forces can arise, because relief of the stresses is found in lateral deformation or detrusion at the edges. (Fig. 5.)

There is a further view of the physical conditions to be considered, which under the mechanical conditions of the rolling or

heel on the plane surface of a rail under pressure greater than or pproaching its elastic resistance, gives rise to that which results n what is known as corrugation.

A loaded circular surface as of a roller or wheel, resting upon a eformable straight plane surface, has but a line contact with that rface until either or both the circular and flat surfaces of contact e so deformed by loading the roller as to increase the area of ntact. The deformation will continue until the resistance to eformation equals the force producing it. If the materials of ie two surfaces be equally resistant, the circular surface will be attened and the flat surface will be depressed or indented.

If the roller be of the more resistant material the deformation ay be chiefly in the material of the flat surface. If the roller be ade to roll along the surface which it can so deform, it presses efore it a wave of deformation. The depression giving rise to this ave may (as in the case of the tramcar wheels and rails) approach exceed the limit of elastic deformation of the material of the rail. hen this is the case, continuation of the movement of the roller pon the surface demands the translation of the crest of the wave, id this would involve the destruction of the cohesion between the

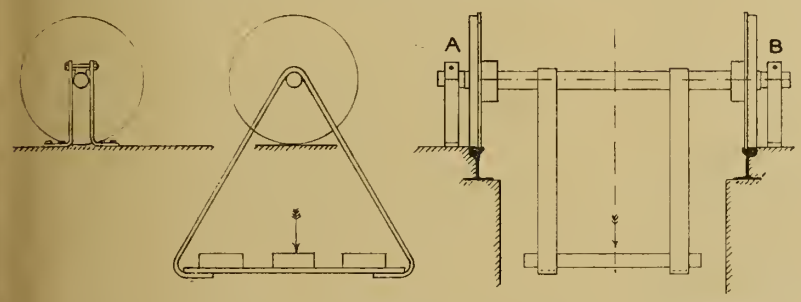
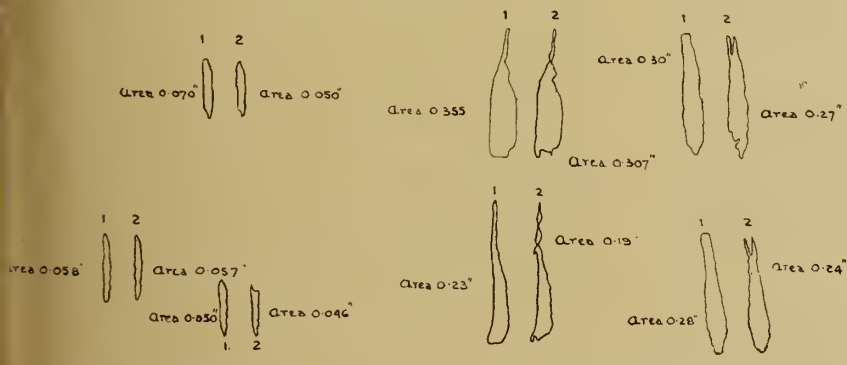


Fig. 6.—Area of Contact of Tramcar Wheels on Rails. Experimental Apparatus.



Pony Wheels.

A		B
0·070	Average of 3	0·050
0·058		0·057
0·050		0·046
3)0·178		3) 153
Average = 0·059		0·051

Diameter of wheels, $21\frac{3}{16}$ in.
Load on axle, $3\frac{1}{4}$ tons.
Average load over area of contact, 31·8 tons per sq. in. (static load).

Driving Wheels.

A		B
0·355	Average of 4	0·307
0·300		0·190
0·230		0·270
0·280		0·240
4)1·165		4)1·007
Average = 0·291		0·251

Diameter of wheels at A, 31 in.
" " at B, $31\frac{5}{8}$ in.
Load on axle, 6 tons.
Average load over area of contact, 11·96 tons per sq. in.

Fig. 7.—Diagrams of Contact Areas.

lled compressed surface wave-crest and the material supporting it id of which it is a part. The result, therefore, is that tensile stress ises *pari passu* with the wave formation between the wave rticle and the subjacent particle of the material supporting it, id the point is reached at which the tensile resistance to the crease of the wave height prevents further increase. The roller ien must rise upon the minute crest, and in doing this with its eavy load upon the extremely small area, compresses it to extreme rdness.

The roller (wheel) in its continued progress repeats the process id continuously adds to the rearward dimensions of the hardened ot.

The foregoing then shows that the rolling and hammering of ie upper surfaces of a rail originates a condition of intense com-ressive stress, the elimination of which produces, or tends to pro-uce. modification of form. It also shows that areas of maximum ompression are originated at points separated by distances which re determined mainly by the relation between compression, resist-nce and elastic strength of the material rolled, but in part by the elative hardness of the roller and rail, and by the mechanical onditions which affect the area of the roller and rail contact.

The area of contact of hard tire tramway wheels on steel rails very small, is less than on ordinary railway wheels. On the tter it has been found to vary, with wheels 4 ft. 6 in. to 5 ft. diameter and carrying a steadily applied static load of from 2,000 to 14,000 lb. per wheel, from 66,000 to 48,000 lb. per sq. in. f contact area. The minimum and maximum areas of a larger umber of observations gave loads per square inch of contact area f from 26,607 to 85,961 lb. The former, however, was the inimum pressure, as it was taken with an engine standing on a level rail, and the wheel gently lowered on to it. With an engine moving at speed, and heeling over as on curves, this pressure would be much greater. It must further be noted that the central part of the area of contact would be much more severely pressed than the borders of the area.

By the courtesy of Mr. A. L. C. Fell, M.I.E.E., the author has been enabled to give measurements, made at his request, of the pressure of the wheels of a standing car on clean rails of standard type. These measurements were made by loading the axles of the larger and the smaller wheels of the bogie of one of the large standard London County Council double bogie trucks.

For the purpose of the experiments a sling was made, as shown on the sketch, fig. 6; this consisted of flat bars, to which were bolted three pieces of timber, on which the load was placed.

The rails were carefully cleaned and the wheels turned to the correct standard taper, but with a finer cut than that usually adopted in practice. The rails showed very little sign of wear, and the experiments were made at the end of a shop which had not been very much used.

The load used was as follows in each case:—Driving wheels, 31 in. diam., 6 tons; pony wheels, 21·56 in. diam., 3·25 tons. These weights approximate closely to the actual weights on a standard bogie car when loaded.

The wheel on the side marked "A," see fig. 6, was on the rail where it was continuously supported. On the side marked "B" the wheel rested immediately above the centre of a pier 14 in. wide, where the rail was not quite so rigidly carried. The diagrams obtained, marked 1 (fig. 7), were slightly larger on this side.

At each end of the axle a guide bracket was fixed to the ground, as shown on the sketch; between these brackets and the axle journal taper pieces of wood were fixed to prevent lateral movement.

The axle was lifted at the extreme end by means of a jack and lowered carefully on a piece of tissue paper on thin carbon paper placed on the rail under the wheel. The impressions made are shown by the diagrams herewith, fig. 7.

The rails were of British standard hardness, and the tires were manufactured to the specification, for the following extract from which the author is indebted to Mr. Fell:—

Tensile strength not less than 55 and not more than 70 tons per square inch—minimum elongation of 11 per cent. to 8 per cent. in 2 in., and of the following composition:—

Carbon	...	0·65 to 0·75 per cent.
Silicon	...	0·32 "
Manganese	...	0·6 to 0·8 "
Sulphur	...	0·035 "
Phosphorus	...	0·035 "

The tires are thus of harder material than the rails, which have 0·40 to 0·55 per cent. carbon.

The areas of contact carefully measured from these diagrams are given in fig. 7, the areas and pressures given being those obtained from the smaller diagrams marked 2, measured on the inner edge of the black lines made by the carbon paper.

The loads given per square inch are the average loads over the whole area of the diagram when the tire had pressed into the rail and the tire itself also microscopically deformed until the area of support given was obtained. The pressure per unit of area in the centre of the area of support would, of course, enormously exceed this average, and I estimate the maximum static pressure to be not less than 35 tons per square inch under the driving wheels. When the car is running at ordinary speed the pressure would rise to not less than double this as impact pressure, and when the car runs at speed round curves, and the greater part of the load with the heeling over of the car is visited on the wheels on one side, the pressure might easily reach at least 100 tons per sq. in.

On the pony wheels the average pressure of the whole area of contact under static loads reached 31·8 tons per sq. in. The maximum pressure in the centre of area of contact was probably not less than 50 tons. This with the car running at ordinary speeds would probably reach 90 tons per sq. in., and when running at speed round curves, and the car heeling over so that the greater part of the load rested on the wheels on one side, the maximum pressure would probably reach 120 tons per sq. in.

It is clear, then, that the pressure per unit of area exceeds the limit of elastic compression of the material of the average rail, and that flow or deformation would occur were it not that the area pressed is supported by the surrounding material and held *encastrée*, so that flow cannot occur. One result of this is the detrusion of one or both of the rail edges, as shown by fig. 5, by which cumulative disruptive forces are in part dissipated, and the extruded material on the groove edge of the tread is removed by the car wheel flanges. Another result is corrugation, and a third is the minute crumbling and pitting of the rolled surface.

Under some circumstances and conditions corrugations may decrease as the raised hardened surfaces approach by lengthening, and as corrugation and the surface become more uniform by the

removal of surface material by crumbling or minute flaking, especially of the harder rails with up to 0·66 of carbon, which best resist the causes of corrugation. The removal of corrugations, however, by grinding only prepares the rail surface for quick recommencement of corrugation or for lengthening the hardened part of the corrugations.

If the preceding be accepted as the origin and production of corrugation, then the question remains, What are the remedies?

The mechanical originating conditions being the weight on the wheels and the increase of that weight, more especially on outside curves by car heeling at the higher speeds, then:—

The first and most effective remedy is the reduction of the great destructive weight on the wheels of the modern car.

The second is the use of larger wheels than can be used with the present design of car.

The third is the maintenance of moderate speeds; of much lower speeds than are common on curves, even those of large radius, and moderate speeds on lines that may be classed as straight, but which have such departure from straightness, horizontal and vertical, as will encourage boxing or wandering of the cars from side to side.

Fourthly, the use of harder rails than the hardest at present employed.

The reduction of weight is possible, the reduction of speed is possible, the use of larger wheels is possible with future cars, and

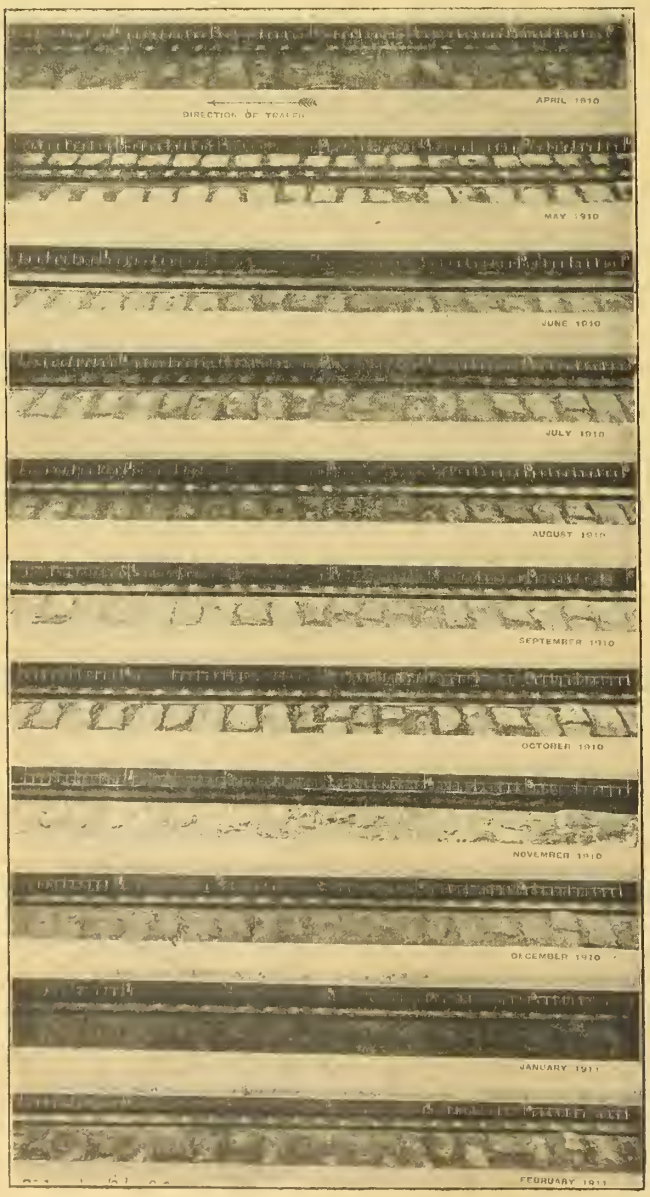


Fig. 8.—Rail of Leeds City Tramways.—Horsforth.

Opposite pole 204.	Up gradient, 1 in 50.
Incoming track.	Pitch of corrugations, 2½ in.
Inner rail.	In use four years.
Straight track	B.S.S. No. 4

the use of harder or more resistant rail materials may be possible, but they would have to be produced by methods more costly than those now adopted.

The remedies will involve modifications in the views at present prevalent as to the place, purpose and working of tramway services, but even the most ardent advocates of tramway ubiquity will ultimately be constrained to admit that tramways, like all other things that have and offer desirable ends and convenience, have also their economic and expediency limits



Fig. 9.—Railway Rail.

The occurrence of corrugation of electric tramway rails recorded by many tramway engineers and managers, and as fou by my own observations extending over some years at home a abroad, is everywhere associated with the following bro generalisations of facts.

1. That it occurs on straight lines and on curves.
2. That it is most prevalent and generally commences on curv of large radius—flat curves.
3. That it never or rarely occurs on curves of small radius, *e.* from 40 to 80 ft.
4. That on hills, and especially on slight gradients, it is m prevalent on the down line.
5. That its occurrence as to date or length of time after layi the rails varies broadly with (*a*) the position of the rail on straig or flat curve or down gradient, (*b*) the frequency of the service, the mechanical properties and composition of the rails as shown more or less outer edge detrusion.
6. That it occurs with all types of truck.
7. That it is most prevalent where the speeds are highest.

The author is enabled by the courtesy of Mr. J B. Hamilt the general manager of the Leeds Tramway, to show photograp of rails in that city (fig. 8).

A small photograph is also exhibited of a rail in a straig piece of track on the Midland Railway, Sheffield, on a falling gradie of 1 in 100 (fig. 9). This shows a much worn rail with the brig hard spots about the centre of the tread, and shows that what called corrugation is not confined as to the nature of origin production to street tramway rails, although it is necessarily mu more general and severe on tramways and other rails where hea vehicles with small wheels and high speeds are used, as, f example, on some of our tube lines and the Metropolitan of Pari

Recent Developments in Radio-Telegraphy.

By Prof. G. W. O. Howe. (*Abstract.*)

The principal cause of the difficulties experienced to-day in mai taining satisfactory communication by means of radio-telegraphy to be found in the phenomenal growth of this means of tra mitting intelligence. The difficulties are mainly due to interferen between different stations working simultaneously. Formerly t only disturbance was that due to atmospheric influences, but the are now becoming of less comparative importance, due to the gre multiplication of radio-telegraphic equipments and the increasi power used in their sending apparatus. These difficulties prom to increase steadily in the future, and it is therefore a matter some importance that we should consider the recent developmer in the apparatus employed and in the principles involved.

Nearly all the developments, both in the sending and in t receiving apparatus, have had as their objective the decrease in t interference caused to, or suffered from, other stations. This is, the present moment, of far greater importance than efficiency even reliability.

Since the earliest experiments in radio-telegraphy, it has be sought to decrease the decrement of the train of waves whi accompanies each spark. The sending apparatus in common use the present day differs, however, but little in principle from th used with the earliest coupled aerials. The spark-gap is eith stationary and provided with a powerful air-blast or the electrod are rotated at a high speed, thus causing movement of the air, a at the same time bringing cold metal surfaces to act as electrode The production of undamped or slightly damped trains of waves b means of Poulsen or Lepel arcs has not made the revolution in radi

egraphy which was predicted, while the quenched spark between ne metal surfaces a fraction of a millimetre apart falls far short the long open gap in reliability. The unquenched long gap cessitates very loose coupling, and therefore very low efficiency if ts in the emitted waves are to be avoided. If the coupling is de tighter than about 5 per cent., undue interference with other tions will probably ensue.

A great improvement has taken place in the nature of the note t out by most large stations. In the earlier arrangements the rks followed each other so irregularly, or the spark frequency s so low, that the signal heard in the telephone was nothing re than a crackling noise, very similar to, and easily confounded h, the noises due to atmospheric disturbances. It is not ential to tune out all other signals and extraneous noises, if the nals which have to be received have a distinctive musical note. is has led to the frequency being increased from 10 or 20 to 500 1,000 sparks per second. The difficulty of getting, with any ularity, 1,000 sparks per second with an ordinary gap and a ver of several kilowatts will be apparent. If the use of a certain e became general, much of its advantage would be gone, but it uld still be a great improvement in combatting atmospherics.

Although the receiving arrangements have been made very con- ient for rapid tuning, no radical change has been made in the ectors employed. One has still to choose between reliability l sensitiveness. If extreme sensitiveness is not desired, the gnetic detector is ideal in its simplicity. For the reception of ck signals we have the Fleming valve, the electrolytic and ious crystal detectors, if necessary, in conjunction with the wn telephone relay. Attempts have been made to obtain ctive working by tuning the reed of the relay, but the general ity of the station so equipped would be greatly reduced, to say hing of the adjustment and manipulation required.

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periments for Improving the Construction of Practical Standards for Electrical Measurements.

port of the Committee, consisting of Lord Rayleigh (Chairman), Dr. R. T. Glazebrook (Secretary), Professors J. Perry, W. G. Adams, and G. Carey Foster, Sir Oliver Lodge, Dr. A. Muirhead, Sir W. H. Preece, Professors A. Schuster, J. A. Fleming, and Sir J. J. Thomson, Dr. W. N. Shaw, Dr. J. T. Bottomley, Rev. T. C. Fitzpatrick, Professor S. P. Thompson, Mr. J. Rennie, Principal E. H. Griffiths, Sir Arthur Rucker, Professor H. L. Callendar, and Messrs. G. Matthey, A. P. Trotter, T. Mather, and F. E. Smith.

e Committee have to regret the death, since the last meeting he Association, of Dr. G. Johnstone Stoney, F.R.S. He had been ember since 1861, and up to a few years since continued his ve interest in the work. In its earlier stages his skill in nition and his admirable choice of nomenclature had proved luable to the Committee. The collected Reports, which are to ssued shortly, will indicate how large a share in the establishit of the C.G.S. system of units is due to him.

epublication of Reports.—The republication of the Reports is yet completed, but this should be done within the present year. proofs of the Reports from 1862 to 1883 have been finally ised, and the remaining proofs will soon be ready.

orenz Apparatus.—The progress made has been satisfactory. liminary experiments have shown that the apparatus is uninflued by changes in the earth's magnetic field, and that the thermal F.s at the brushes on the two disks very nearly balance. With form of brush in use at present there are sudden changes in difference of the thermal E.M.F. amounting to 2×10^{-7} volt, it may be difficult entirely to eliminate these. With other ns of brushes, *e.g.*, those made of gauze, the difference was n 1,000 times as great. It was this difficulty which led Lord leigh in 1883 to amalgamate the edge of the disk, and as a her improvement Prof. Viriamu Jones and Prof. Ayrton used cury jets instead of brushes. Since in the present apparatus changes are only 1 in 10,000 of the difference of potential pro- ed in one arrangement of the brushes and less for a second ngement, it is hoped that mercury contacts will not be neces- . Further experiments will be made in order to obtain greater ection, if such is possible.

esistance Standards.—The construction of new mercury stanls of resistance in accordance with the specification of the don Conference is being proceeded with, and some of the dards will be completed this year. Similar work is in progress rance, in Germany, in Austria, and in the United States. In latter country four standards have had all of their constants rmined, and the resistance unit so obtained is in very close ement with that obtained from the old National Physical oratory standards.

n the Committee's Report for 1908 it was shown that many nganin resistance coils—some of which were purchased by the mittee in 1895—were very changeable in resistance, and in sequence frequent comparison with mercury standards was ssary. In 1908 it was shown at the Bureau of Standards, and firmed at the National Physical Laboratory and at the Reichstalt, that these changes were largely due to the effect of sture on the shellac covering the wire. To eliminate this source trouble, many of the coils were hermetically sealed in 1909, and satisfactory to record that they are now much more constant. The importance of this hermetical sealing is so great when nganin resistances are to be sent to such places as cable stations the tropics, that the attention of instrument manufacturers is wn to the matter. Standard coils are readily sealed, and boxes of coils may be sealed in metal cases. The following figures for standard coils of manganin show the advantage of hermetical sealing :—

Nominal value ...		100 ohms		1,000 ohms	10,000 ohms
—		No. 2,450	No. 740	No. 2,449	No. 2,448
Open coils	Oct. 1903	99·995$_9$	1,000·15$_8$	1,000·01$_2$	10,000·2$_4$
	1904	100·000$_2$	·17$_2$	·24$_4$	2·4$_0$
	1905	·004$_8$	·21$_8$	·49$_4$	3·5$_7$
	1906	·009$_2$	·24$_8$	·66$_8$	3·8$_2$
	1907	·013$_2$	·26$_6$	·81$_4$	3·7$_4$
	1908	·028$_8$	·30$_2$	1·13$_0$	3·8$_5$
Hermetically sealed in paraffin oil	June 1909	·036$_9$	·36$_5$	1·04$_6$	5·5$_3$
	1910	·038$_4$	·35$_7$	1·07$_5$	5·5$_5$
	1911	·039$_9$	·35$_9$	1·06$_9$	5·6$_1$

It will be noted that the changes during the last three years are very small.

Silver Voltameter and Standard Cell.—Although the actions which take place when a current passes through a solution of silver nitrate as in a silver voltameter are now well understood, the effects of septa—such as silk, filter paper, and porous porcelain—are by no means clear, and experiments have, therefore, been made to decide whether any septum at all should be used in a voltameter. Such experiments were suggested at the Washington meeting in 1910. The results of the experiments made at the National Physical Laboratory indicate that a septum of any kind is usually a source of trouble, and may produce secondary reactions during the electrolysis which affect the weight of the silver deposit. Fortunately, voltameters have been designed which render a septum unnecessary, and these may be useful, not only in precise current measurements with the silver voltameter, but for the deposition of metals other than silver.

The reproducibility and constancy of the Western normal cell are still being carefully examined. The chief anomaly is the hysteresis effect mentioned in last year's Report: for this effect we have no explanation although one is much needed, as probably it would enable cells to be made so as to remain even more constant in E.M.F. than at present. It is necessary to point out that while the effect is called a hysteresis one, the E.M.F. does not lag behind the temperature. Briefly put, with ascending temperatures the E.M.F. changes in close agreement with the temperature—E.M.F. formula, but with descending temperatures the E.M.F. changes too rapidly, corresponding to values at temperatures lower than the temperature of the cell, by from 3° to 15°.

The Committee had hoped to have made this their last Report, but in view of the fact that the republication is not complete they ask for reappointment, with Lord Rayleigh as chairman and Dr. R. T. Glazebrook as secretary.

The Present Position of Electric Steel Melting.

Report by Prof. Andrew McWilliam, A.R.S.M., M.Met.

Section B. (*Abstract.*)

The melting of steel by means of electricity has passed the merely experimental stage and become one of the commercial processes by means of which steel is manufactured for the market. The general impression gathered from much conversation with users is that the arc furnace product from slightly impure materials, purified to Swedish standard, just about takes its place by Swedish open-hearth and Bessemer steels, and that the induction furnace product skilfully made from pure materials equals anything but the very highest qualities of crucible steels. The special feature of the Héroult and Röchling-Rodenhauser types is that with an oxidising purification phosphorus can be eliminated to almost any extent that will pay, and after removing the slag, and forming another, by a reducing purification sulphur can similarly be removed.

The Kjellin induction furnace acts as a melter of materials much after the manner of the crucible, and has one advantage over the crucible in that there is no absorption of sulphur during melting. Recent experiments with covering slags specially calculated by the writer to give a minimum of change in composition during melting, show compositions in the ingots practically equal to those by calculation from the constituents. One fact must never be forgotten: the electric furnace of whatever design will not make good steel automatically. The same metallurgical skill required by the older processes must be expended on the proper killing and finishing of the steel, by whatever type of electric furnace it is being melted, and the fact that in electric as in other furnaces bad steel may be made from good materials, increases the difficulties of finding the exact place of any steel in the world's work. Several cases where the electric steel has been found unsuitable, especially in the earlier days, have been investigated, and it has been found that the steel has been wrongly made. In other cases no such explanation could be given.

One point of importance is that this production of electric steel has introduced a new competitor into the field by giving great impetus to the use of the large waterfalls, mostly far removed

from coal, and much energy is now being used that formerly ran to waste, whilst the successful application of electric power to the production of charcoal pig-iron allows of a much-reduced consumption of charcoal. The rapidly increasing price of charcoal in Sweden is quite a serious situation which this application of electric power may help to relieve.

The Stassano furnace is an independent arc furnace, with three carbon electrodes. The Héroult steel-melting furnace is a direct arc type, in which the charge forms one pole of the arc. The Girod furnace is a direct arc furnace, but one or more electrodes of like polarity are maintained above the bath, and soft steel pieces embedded in the hearth of the furnace are in direct contact with the molten metal for the negative electrode. These lower pole-pieces are water-cooled. Large quantities of ferro-silicon, ferro-chrome, &c., as well as of ordinary carbon and special steels are made in this furnace. The Keller steel furnace is a direct arc furnace, very much like the Héroult. The Grönwall is of the arc type; the current enters by two electrodes through the roof, and when once the bath is heated so that the lining becomes a conductor the current from both electrodes passes through the lining to a graphite block underneath, and hence to a common wire. The Nathusius, like the Grönwall, is a combined arc and resistance furnace.

In the Kjellin induction furnace the metal charge is placed in an annular hearth, and the primary coil of 24 turns is placed in the centre round a core of laminated iron. The bath or ring of metal acts as a secondary circuit of a single turn, and the heat is thus produced in the charge itself without contact with electrodes.

The Röchling-Rodenhauser furnace is based on the Kjellin principle but has an important addition. In its simplest form for single-phase current there are two grooves or heating channels corresponding to the annular crucible of the Kjellin, but these join to a central open-hearth, the whole hearth forming a kind of figure 8. In the central open-hearth all the distinctly metallurgical operations take place, so that this form can be used for refining work for which the Kjellin is not very suitable. Not only so, but a distinct secondary winding is provided in which a secondary current is induced, and these windings are joined to steel terminal plates which are embedded in the refractory material of the furnace at the ends of the central hearth. At high temperatures the refractory material becomes a conductor of electricity and thus the currents induced pass through the bath in the central hearth, heating it still further.

There are many others, some only on paper, but these are the principal varieties that have been tried with any considerable degree of success. The loss in melting is an important point, and I am informed that this amounts to about 1½ per cent. in the Kjellin, about 4 to 5 in the Röchling-Rodenhauser, and 7 to 8 per cent. in arc furnaces.

So far as one could ascertain, about June, 1910, there were about 118 furnaces of all types, of which 70 were in use, 10 not working, and 38 being built. There were 77 of the arc furnaces recorded, of which 29 were credited as Héroult, 17 Girod, 13 Stassano, 6 Keller and 9 others; besides one furnace at Domnarfvet, Sweden, for the production of 2,500 tons of pig-iron per annum, with one in Norway and one at Trollhättan, Sweden, both in course of construction and each designed to produce about 7,500 tons of pig-iron annually. Of the Héroult furnaces the total capacity per charge of those working was about 80 tons and of those in course of construction about 50 tons. The Girod furnaces, the great competitors of the Héroult, were recorded at about 38 tons in work and 26 tons being built. Similarly the figures for the Keller were 13 tons and 5 tons, and for the others 20 tons and 13 tons respectively.

Of the induction furnaces the Kjellin furnaces erected totalled 14 with 35 tons capacity, the Röchling-Rodenhauser 15, with 30 tons in work, 1 ton not in work, and 17 tons capacity being built, all others about 18 tons in work. That gave a total capacity of about 250 tons for the arc furnaces and 100 tons for the induction, or a grand total of 350 tons per charge for all electric steel-melting furnaces. About June, 1911, there were 43 Héroult furnaces, with a total capacity of 242 tons.

The output of electric steel in Germany, the United States and Austria-Hungary in 1910 amounted to almost 112,000 tons, which is an increase of 63,000 tons over the figures for 1909. These are the only countries for which the exact output of electric steel is published, but there is no doubt that the figures for Sweden, France, Belgium and Italy would also show large gains. The increase will probably be more than maintained in 1911, as more than 30 new furnaces of various types should be started during the year, and many which only started towards the end of 1910 will put in a full year's work in 1911. England will also for the first time appear as a regular producer. Before the beginning of the present year the Héroult furnace at Edgar Allen's, in Sheffield, was the only arc one in steady operation. In January three Héroult furnaces were commenced in England, at Vickers, and Thos. Firth and Sons, in Sheffield, and at Lake & Elliott's, in Braintree, Essex. A Grönwall furnace, for demonstration and manufacturing purposes, also started at about the same time in Sheffield, and the output of England for 1911 should amount to about 13,000 tons. A 15-ton Héroult furnace is to be erected at Skinningrove shortly, and is expected to turn out 200 tons per day. About the same period Kjellin induction furnaces have been working satisfactorily at Vickers & Jessop's, in Sheffield, and an experimental furnace at the University of Sheffield.

Great progress will be made in Germany with electric furnaces during the next year, when Héroult furnaces of 25 and 22 tons capacity are to be constructed. At present the largest size are the two 15-ton Héroult furnaces at South Chicago and Worcester, belonging to the United States Steel Corporation, who have recently acquired the Héroult patents for America, and will probably erect several more furnaces shortly.

The electric furnace can be used either for melting scrap direct or in combination with some other form of furnace, in which case it simply acts as a refiner. The majority of the recent furnaces have been employed in this way, in conjunction either with Bessemer or open-hearth furnaces. The latter are usually of the basic tilting type, part of the charge being removed to the electric furnace after the pig is melted and the bulk of the phosphor removed, leaving some phosphorus and the oxygen and sulphur to be eliminated by the electric furnace. In this case the time required for the electric furnace is from one hour to two hours according to the degree of refining required and the original condition of the steel when removed from the basic furnace. The energy used varies from 100 to 300 KW.-hours per ton. When cold scrap is melted the time required is about six hours, and the energy consumption is said to be from 650 to 750 KW.-hours; but really, I am told, more probably 800 to 1,000 per ton. Of the 44 Héroult furnaces in operation or construction, 21 are to melt scrap, 20 to take molten steel from the basic open-hearth, one from a Talbot furnace and two from converters.

Electric furnaces are being employed in the following cases:—

1. To replace crucibles. The gain is then one of cost of production.

2. For foundries. Electric furnaces are being used in many foundries. At Georg Fischer's & Schaffhausen they are the only furnaces employed, and Lake & Elliott, of Braintree, are now making most of their steel electrically.

3. To replace Swedish Bessemer steel, and for steel of axle and tire quality.

4. For weldless tubes. The Mannesmann Co. have Héroult furnaces in Germany and Italy.

5. In combination with Talbot furnaces. Owing to the fact that the heat need not be sufficiently great for teeming on transfered to the electric furnace, the output of the Talbot, and the life of the lining and roof are said to be largely increased. This will be the procedure at Skinningrove for making rails.

6. For melting turnings, especially high-speed turnings. These make excellent scrap for the electric furnace. Nickel scrap can be melted without any loss of nickel.

Tables are given in the paper representing the furnaces, capacity and kind of work done by all the furnaces under the care of the two principal firms already named. The Kjellin furnace has been adopted for melting the metal for the manufacture of culinary vessels of pure nickel.

PROCEEDINGS OF INSTITUTIONS.

Some New Types of Dynamometers.

By Dr. Alfred Amsler, Schaffhausen.

(*Abstract of paper read at the Swiss Meeting of the* Institution of Mechanical Engineers, 1911.)

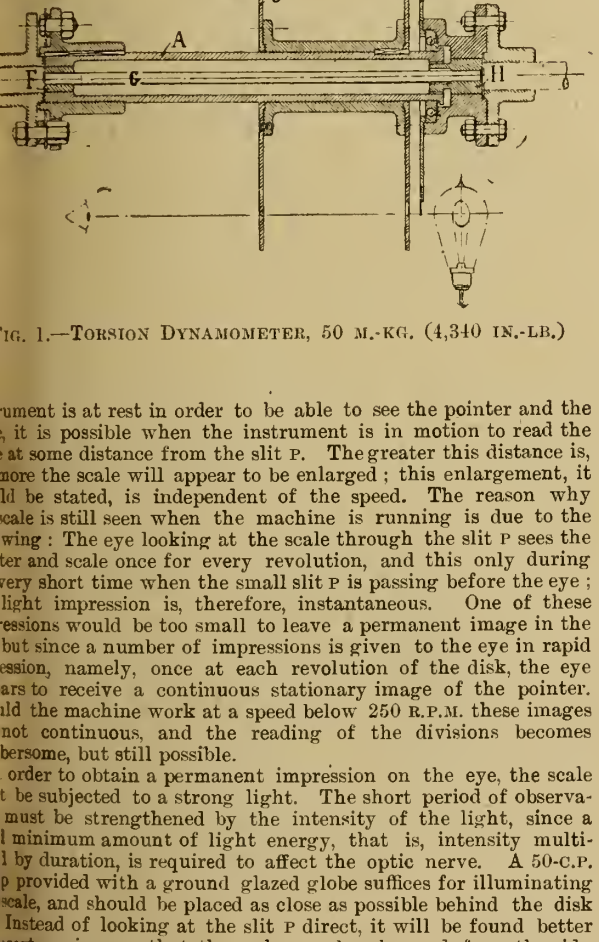
The author deals with two types of transmission dynamometer constructed by his own firm, the one type—the torsion dynamometer—being designed for measuring the power transmitted to from high-speed machines, where the torque is fairly constant and therefore need not be recorded in a diagram; the other type—the hydraulic dynamometer—being intended to be used for measuring and recording the energy absorbed by slow-running machines of variable resistance.

Fig. 1 illustrates a dynamometer which couples the shaft of the driving engine direct to the driven machine. The two shafts are coupled together by means of the shaft G; this shaft is therefore to transmit the entire power from one machine to the other, and is subjected to torsion, the angle through which the opposite ends are turned being proportional to the twisting moment and to the power transmitted. If the shaft is made of a special spring steel of very high yield-point, that is, above 6,000 kg. per square centimetre (90,000 lb. per square in.), it can be twisted to a considerable degree without breakage or permanent distortion. For example, in the example shown in fig. 1 the twist of the shaft, 40 cm. long is for a twisting moment of 20 mkg. (1,736 in.-lbs.) is about 20°. The shaft has a cross-section of 12 by 12 mm., and is therefore, subjected to a stress of 5,200 kg. per sq. centimetre (78,000 lb. per sq. in.), which is well below the yield-point. The various parts attached to the shaft G serve partly for indicating the angle of twist and partly to prevent it from being twisted excessively, so that it cannot be overloaded.

For reading the angle of twist, three disks M, N and O are used. M is fixed firmly to the end H of the shaft, N and O are fixed firmly to the end F of the shaft. The disk O is provided with a radial slit P. To the disk M a transparent rim U made of celluloid is fixed, on which the divisions are cut. Opposite to the slit a small window has been cut out in the disk N and is provided with a fine slit T.

When the eye Q looks through the slit P the slit T will be seen as a streak of light and the divisions will show black on the scale U. The slit T serves as a pointer for indicating the relative motion of the two disks N and O as compared to the disk M. The line of vision is perfectly defined by the two slits P and T; parallax is, therefore, impossible when reading the scale, and the observation is therefore independent of the distance between the scale U and the slit T.

hen the apparatus is stationary it will be clear that, if the shaft isted, the angle of twist will be shown by the movement of the er T over the division U. But this pointer and division will be visible when the instrument is running, in fact it will be er and more defined than when the instrument is at rest, for t it is necessary to place the eye close to the slit P when the



IG. 1.—Torsion Dynamometer, 50 m.-kg. (4,340 in.-lb.)

rument is at rest in order to be able to see the pointer and the , it is possible when the instrument is in motion to read the at some distance from the slit P. The greater this distance is, nore the scale will appear to be enlarged; this enlargement, it ld be stated, is independent of the speed. The reason why cale is still seen when the machine is running is due to the wing: The eye looking at the scale through the slit P sees the ter and scale once for every revolution, and this only during very short time when the small slit P is passing before the eye; light impression is, therefore, instantaneous. One of these essions would be too small to leave a permanent image in the but since a number of impressions is given to the eye in rapid ession, namely, once at each revolution of the disk, the eye ars to receive a continuous stationary image of the pointer. ld the machine work at a speed below 250 R.P.M. these images not continuous, and the reading of the divisions becomes bersome, but still possible.

order to obtain a permanent impression on the eye, the scale t be subjected to a strong light. The short period of observa- must be strengthened by the intensity of the light, since a l minimum amount of light energy, that is, intensity multi- l by duration, is required to affect the optic nerve. A 50-C.P. p provided with a ground glazed globe suffices for illuminating cale, and should be placed as close as possible behind the disk Instead of looking at the slit P direct, it will be found better sert a mirror so that the scale can be observed from the side, own in fig. 1. In order that the eye be not dazzled by other t, the daylight should be screened off.

ie observations can be best carried out in a dark room, and only eye should be used. The angle of torque observed shows the t-strain in the shaft, since the slit P passes the eye at regular rvals.

nce the shaft and the other parts which are connected to its emities have no tendency to move, due to centrifugal force, the ings of the dynamometer are independent of the speed. The rument can, therefore, be run at any speed desired, provided, of se, no forces are set up greater than can be resisted by the erial of which the disks M, N and O are made. The instrument ade generally for high speeds of about 4,500 R.P.M., but some ruments have already been made for speeds of 7,000 and even 0 R.P.M. The coefficient of elasticity of the shaft can be deter- ed when at rest by fixing a lever of known length at one end loading this with weights.

he largest instrument at present made can measure torques up 1,500 mkg. (130,200 in.-lb.) and the smallest up to 8 mkg. in.-lb.). The instrument suffers from but one defect, namely, air-resistance of the rotating parts, but the influence of the s very small, especially when the dynamometer is so inserted the disk M is placed nearest to the machine, the power of ch is to be measured. The instrument can be run in either ction without any alteration having to be made.

he hydraulic type of dynamometer, which is used for measuring recording the power absorbed by machines subjected to a able load, is driven from the engine by means of a belt, and smits the power by means of a second belt to the driven hine. The driving and driven pulleys are connected by nders filled with oil and pistons exerting a pressure on the oil. s oil-pressure is transmitted through a hollow shaft to a fixed ng, to which on one side a pressure-gauge is fixed and on another the recording apparatus. The pressure-gauge indicates the ue with which one pulley drives the other.

his dynamometer is not nearly so simple and does not indicate power as directly as the torsion dynamometer; it is consequently less accurate and needs watching. On the other hand, measurements can be made which are impossible to obtain with the torsion dynamometer—namely, the power is continuously recorded on a strip of paper, and can be accurately determined, however much it may vary.

Experiments with Turbines.

By Prof. Dr. Franz Prasil, Zurich.

(*Abstract of paper read at the Swiss Meeting of the* Institution of Mechanical Engineers, 1911.)

In this paper the author gives particulars of the methods and results of a series of tests on Francis and Pelton turbines, made by four firms not named. He remarks on the enormous sizes which have been attained since 1900, as high as 16,000 H.P. per wheel, and states that the limits of attainable dynamic efficiency and perfection in governing have nearly been reached. The Francis turbine is used for falls from 1 to 150 m. (3·3 to 492 ft.), and the Pelton wheel for falls of 40 to 950 m. (131 to 3,116 ft.)

In most of the open Francis turbines tested, the maximum efficiency was reached between 70 and 80 per cent. of full load, and in all four cases the efficiency was over 85 per cent. at about 80 per cent. of full load. The highest efficiency observed was 88·6 per cent. These turbines were tested on falls of 4·4 to 10·4 m., at 100 to 160 R.P.M., with outputs of 158 to 1,250 H.P. at full gate.

Greater differences were found between the turbines with closed spiral wheel cases; the maximum efficiency was reached between 80 and 90 per cent. of full load, and ranged from 79·6 to 87·6 per cent. The outputs of four turbines of this class were between 2,620 and 4,000 H.P., the head of water being from 60 to 147 m., and the speed 400 to 601 R.P.M. The largest turbine was tested only to $\frac{2}{3}$ full gate.

Governing tests were also made on two of the latter class of turbines, fitted with oil relay-motors; one, provided with a heavy fly-wheel, showed about 6 per cent. maximum variation from normal speed with a change of load of 1,800 KW. (normal full load 2,696 H.P.), while the other, without special fly-wheel, showed variations up to 18 per cent. with 2,100 KW. thrown off (normal full load 3,458 H.P.).

Four Pelton wheels were tested, and showed efficiencies between 84 and 85 per cent. at 55 per cent. of full load; with one exception, all showed efficiencies between 83·5 and 88·9 per cent. at full load, and one reached 89·3 per cent. at $\frac{7}{8}$ full load. The efficiency was maintained above 80 per cent. in all cases down to 30 per cent. of full load. The head varied from 90 to 850 m., the speed from 180 to 630 R.P.M., and the output from 300 to 6,050 H.P., the results showing remarkable uniformity, in spite of these wide differences. All were fitted with needle nozzles controlled by governors, and tests on two showed speed variations of the order 9 to 12 per cent., with $\frac{3}{4}$ load thrown off.

High-Pressure Water-Power Works.

By L. Zodel, Zürich.

(*Abstract of paper read at the Swiss meeting of the* Institution of Mechanical Engineers, 1911.)

The author reviews the progress made in high-pressure water-power plants of recent years, and brings forward the relative merits of different designs for different purposes.

It is to the pipe-lines that too little attention is usually devoted. Not a few engineers consider that the pipe-line is a secondary part of a hydraulic power plant, so long as the thickness of the pipe allows a good factor of safety against the pressure, and a continuous line has been laid over the ground from the intake to the turbine. Hence it is that pipe-lines are often built by engineers who are experts in the choice of material and in the manufacture of a pipe, but who do not understand the essentially important functions which a complete pipe-line, and especially a high-pressure pipe-line, has to fulfil. The general arrangement, the relative dimensions of different parts of the pipe-line, the methods of anchoring and placing of fixed points, are all such important factors that they can only be properly determined by the turbine builder, because on them depends to a very great extent the proper working of the turbine, and hence the success of the whole plant.

The works of the original Necaxa power station of the Mexican Light and Power Co. have been fully described in various technical journals*; during the last two years, however, very great enlargement of the plant has taken place.

The company have greatly increased the water available by diverting the Texcapa, Tenango, Nexapa and Xaltepuxtla Rivers into the Necaxa reservoir by means of an extensive system of tunnels through the dividing ridges. The catchment area has thus been raised to 154 sq. miles, and can shortly be further increased by another 77 sq. miles by bringing in the large Laxaxalpan stream. The additional storage volume required has been obtained by the construction of a series of earth dams of very great size, forming reservoirs on each of the streams, with a total capacity of 1,220 million cb. ft.

Further schemes provide for an ultimate development of the Los

* See Electrical Review, September 4th, 1903.

Reyes, Laguna and other reservoirs, which would bring up the total capacity to over 300 million m^3., and, at the same time, considerably increase the catchment area.

As a first step towards the enlargement of the power house plant the company decided to increase the capacity of the existing six 8,200-H.P. turbines to 11,000 H.P. each, by fitting new runners and new nozzles. This was successfully carried out, and is an interesting case, since the velocity of the water in each of the six pipe-lines supplying the six turbines was thereby increased to 18 ft. per second. This is an exceptionally high figure, but was not found to be injurious in any way. The capacity of the station thus became 66,000 H.P.

The next step was the erection of two new units of 16,000 H.P. each, built by Escher, Wyss & Co. They are similar in design to

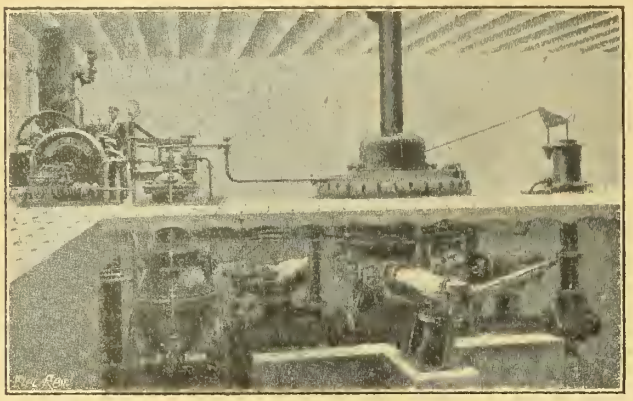


FIG. 1.—RIO DE JANEIRO: 9,000-H.P. TURBINE AND GOVERNING GEAR.

the old machines, and are supplied with water through a new pipe-line system which has been just recently erected. The capacity of the power station is now 98,000 H.P.

The power works of the Rio de Janeiro Tramway, Light and Power Co., which now supplies the entire city, having a population of 812,000, with light and power, is situated on the Lages River at a distance of 50 miles from the metropolis. The useful watershed comprises an area of 193 sq. miles, and has an average rainfall of 59 in. a year. The Rio das Lages pursues a course through a tortuous valley having a very slight fall for a great distance, and then suddenly descends in a succession of falls and rapids a height of over 984 ft. in a distance of only a few kilometres. This gives a very favourable situation for a hydro-electric station combined with a storage reservoir. The natural flow of the Rio das Lages varies between a minimum of 70-88 cb. ft. per second and a maximum of 21,190 cb. ft. per second, with an average of 460 cb. ft. per second, which is sufficient for 40,000 H.P. continuously with a head of 310 metres.

An artificial storage reservoir, with an area of 8 sq. miles, and mean depth when full of 37·2 ft., has been formed by building an arched concrete dam across the narrow valley above the place where the rapid fall begins.

This lake is the largest artificial reservoir formed by a dam wall at present in existence. It has a total volume of 7,840 million cb. ft., and a total useful volume of 7,206 million cb. ft., obtained with a maximum variation of water level of 19 metres, which represents the difference in elevation of the water intakes. The length of lake is 17 miles, and the total circumference about 137 miles, owing to the extremely tortuous character of the contours. The steep sides of the valley gave an excellent site for the dam, which is thus of very economical proportions for the water storage volume obtained.

The power house is situated at an elevation of 308 ft., giving a gross maximum head of 1,015 ft. The loss of head by friction in the feeders is reckoned at 6·6 per cent., so that the maximum net head at the turbines becomes 952 ft. The difference in the head when the reservoir is full and nearly empty is less than 6 per cent.

The pipe-line has a great similarity to that of Necaxa, and is made in two sections, consisting of two upper low-pressure pipes and of six main high-pressure pipes for the lower portion leading to the power house. Connection is made between these sections by means of a receiver pipe, which serves the purpose of a penstock chamber in power works having an open conduit to convey the water to the pipe-lines.

The power house is constructed entirely of steel and concrete, 72 metres long, 29 metres wide and 24 metres high; 2,500 tons of steel were used.

The six turbines are impulse-wheel machines built by Escher, Wyss & Co., with vertical shaft and four needle-nozzles symmetrically arranged round the cast-steel wheel-disk, which has an effective diameter of 84 in. and is provided with 18 cast-steel buckets. They are designed for a head of 273-290 metres and generate 9,000 H.P. at 300 revs. per min. (fig. 1). An oil-pressure thrust-bearing supports the turbine and generator rotors, which amount to 40 tons dead weight. These bearings are supplied with pressure-oil by three-throw pumps, which also feed the turbine governors. A pressure-relief valve is arranged to limit the rise of pressure in the pipes to 10 per cent. on throwing full load off the turbine. Two exciter units of 400 H.P. each are provided.

The generators supply three-phase current at 6,000 volts at 50 cycles, which is stepped up through transformers to a line voltage of 88,000 for transmission to Rio de Janeiro, the distance being 55 miles.

Up to the present time turbines developing a total of 54,000 H.P. have been installed, and sanction has just been given for a further increase of two units of 19,000 H.P. each.

Power works of very special interest have been recently erected in Norway, and of these one will be mentioned by reason of the difficult work carried out on the pipe line. This is the power plant at Tyssedalen, near Odda, in the Hardanger Fjord on the west coast, where 33,600 H.P. are now utilised and transmitted to carbide, cyanamide, and other factories at Odda, a distance of about 6 km.

The source of power is the Tysse River. The Ringedals Lake provides an ideal natural storage reservoir for the power works at an elevation of 1,426 ft. above, and 2·17 miles distant from the Fjord, at whose edge the power house is situated. This lake has an area of 2·22 sq. miles, and has now been tapped by a regulating tunnel of 64·5 sq. ft. area at a depth of 52 ft. below the normal level; by this means a useful storage capacity of about 2,[illegible] million cb. ft. has been obtained by allowing the level to be drawn to this depth during the winter months when the flow of the river is at a minimum. A dam has also been constructed to raise the water-level by 44·5 ft. to a maximum elevation of 1,470, and the useful storage volume is thus 6,000 million cb. ft. The catchment area of 146 sq. miles is sufficient, with the ample rainfall in this mountainous district, to give about 100,000 H.P.

The regulating tunnel from the Ringedals Lake discharges into the little Vetle Lake, immediately below, which forms a second small regulating basin on the river, whose level is adjusted by a needle dam. A tunnel of 11,200 ft. length starts from this lake and passes through the mountain to the penstock chamber, from which the pipe line leads down to the power house. This tunnel was driven through granite for the whole of its length, the work having been carried on simultaneously from 13 adit levels, and completed within two years. The rock was left rough inside the tunnel, the cross section being nowhere less than 102 sq. ft.

The penstock chamber is cut out of the solid rock to a depth of about 49·3 ft., and the tunnel emerges into the bottom of this at an elevation of 1,303 ft. The sill of the overflow of the penstock

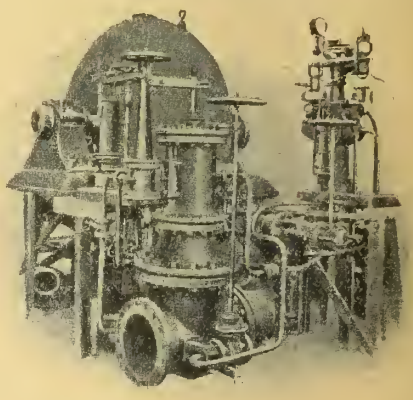


FIG. 2.—TYSSEDALEN: 4,800-H.P. TURBINE AND REGULATING GEAR.

is at elevation 1,353 ft., and the maximum possible water-level due to the head in the tunnel is 1,360 ft.

Two pipe lines of 63 in. diameter connect with this penstock chamber through a short tunnel, and are fitted with sluice valves of 47 in. diameter placed in a valve house at the exit. Flap valves are also arranged over the end of the pipes in the chamber in such a way that the chains which hold them open may be released by electric current from the power house, in case of accident to the part of the plant. The intake would then be closed immediately by shutting the flap. The usual air pipes are fitted to prevent the formation of a vacuum on emptying the pipe line.

The erection of this pipe line was of difficult character, the difficulties being further increased by the necessity of carrying out a large part of the work during the winter months, the erection period being between August and March. All workmen had to be slung with ropes over the face of the rocks, and the pipes reached an inclination of 55° to the horizontal.

A valve is fitted at the bottom of each pipe-line with a safety plate so arranged as to break in case the pressure in the pipe should rise above 50 per cent. in excess of the normal. In such case the sluice-valve behind the safety-plate could be slowly closed by hand, or the flap-valves over the pipe-line end in the penstock chamber could be instantly closed and the pipe allowed to empty itself of water, when a new safety-plate would be fitted and the line refilled. This safety-plate has been fitted to many high pressure pipe-lines, and is a surer means of safeguarding the pipe in case of unforeseen disturbances than the spring safety-valve sometimes employed, although it causes greater inconvenience if it should come into action. The pipe-line water velocity in the lower portion is 15·4 ft. per second.

The two pipe-lines each feed three Escher, Wyss impulse-wheel turbines of 4,800 H.P. maximum output running at 375 R.P.M., with a net head of 1,260 ft., and a seventh machine is held in reserve. These are machines with horizontal shafts and a single ne[illegible]

e; they are provided with pressure-relief valves for relieving ure oscillations in the pipe-line (fig. 2). The generators work in lel directly on to the 12,000-volt transmission line of 6 km. h to Odda.

e whole station was built in the very short period of slightly two years from the end of 1905 to March, 1908.

enlargement of this station is now taking place, and a third line is being erected to supply two turbines of 13,500 H.P. each. is station has now 7 × 4,800 = 33,600 H.P. installed, 13,500 = 27,000 H.P. being erected, giving a generating total .600 H.P., and exciters 400 H.P., or a grand total of 61,000 H.P. e plans for the enlargement of the station arrange for seven sets of 13,500 H.P. each, of which the two now being built are

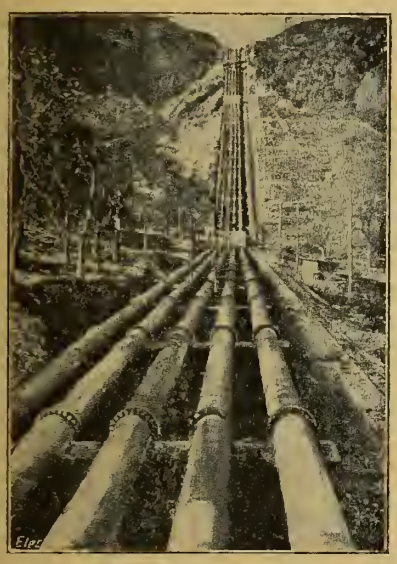


Fig. 3.—Brusio: Pipe Line and Main Anchorages.

the first instalment. When these are finally erected, the on will have a capacity of 125,000 H.P., and the generating will be 150 metres long.

ypical high-pressure power station in Switzerland is that of Kraftwerk Brusio Co., which utilises the water power of the iiavino river in the Poschiavo Valley in the Canton Grisons, e south side of the Alpine Chain between the Bernina Pass the Italian frontier near Tirano. About 55,000 H.P. are oped, the greater part of which is transmitted to the industrial cts of Northern Italy over a transmission line 93 miles in h. The total head available is about 3,280 ft., and this is used vo stages. The upper lies between the Lago Bianco, in the ina Pass, and the Lago di Poschiavo, giving an effective head)70 ft. for the Robbia station; and the lower is between the hiavo Lake and the Italian frontier at Campo Cologno, where iead obtained is about 1,375 ft. The lower station was built

e minimum average volume of water available from the iiavino river has been found to be 264 cb. ft. per second ig a run of 12 hours, and this quantity is equalised by the of Poschiavo, which acts as a natural storage basin of 1·25 sq. area. A variation in level of 275 ft. is allowed by the con- on, and this is obtained partly by tapping the lake below its al level, and partly by raising the level with sluices built across outlet. This gives a regulating volume of about 530 million . The lake is about 1,428 ft. above the power house. The e from the lake is effected by means of a siphon leading into haft from which the tunnel starts. The tunnel has a length 250 m., with a gradient of 1 : 500, and leads the water into the ock chamber, excavated out of the rock, from which five pipe descend to the power house.

straight sections the pipes were bedded on masonry pedestals, e very heavy reinforced concrete anchorages were provided at ngle points, one of these (No. X) near the power house having al weight of 3,300 tons.

valve with the usual safety plate has been fitted, so as to break, d the pressure in the pipe line system accidentally rise above r cent. in excess of the normal.

relve main turbines are installed in the power house. They are er, Wyss impulse tangential machines fitted with horizontal and single needle nozzle, with the exception of two Girard nes which will shortly be replaced by the tangential type. turbines are of 3,500 H.P. and two of 4,600 H.P., all designed 00-m. head and 375 R.P.M. Four exciters of 250 H.P. each bring ie total power to 45,000 H.P. Most of this power is transmitted 00 volts across the Italian frontier to the transformer station e "Compagnia Lombarda," 500 yards distant, and there stepped ith oil-cooled transformers to 50,000 volts for the long-distance mission system to the sub-station at Lomazzo, which supplies and the neighbourhood of Milan. During the daytime the e station is under full load, but only a small part of it is kept ing at night.

ry shortly after the completion of the Brusio Station, the nd for power grew so rapidly that the company was obliged to a second station to utilise the upper portion of the head to be ned in the Poschiavo Valley.

The waters of the Cavagliasca have been impounded for the Robbia power station, and the Lago Bianco, which discharges into it, has been dammed up so as to act as a storage reservoir over winter months when the stream is frozen. Thus it was possible to obtain a head of 1,970 ft. at the power station, and to ensure sufficient water to generate about 7,000 H.P. Three turbines of 3,500 H.P. are therefore intended for the station, of which two are now installed and one is on order.

The turbines of this plant are fitted with the new deflecting nozzle operated by an oil-pressure governor. Similar machines are installed at the Adamello hydro-electric power station.

The River Siagne rises in the Alpes Maritimes to the north of Cannes; the power station utilises a fall of about 1,142 ft. The water is taken from a weir on the upper reaches of the river by a conduit and tunnel to a balancing reservoir above the power house, partly blasted out of the rock and partly formed by a large retaining wall. The Siagne discharges an average volume of about 105 cb. ft. per second at the intake weir, and thus, with the fall of 1,142 ft., provides an absolute output of 14,000 H.P. The Compagnie de l'Energie Electrique du Littorale Méditerranéen has developed this power by means of 5 units of 2,000 KW. maximum each, of which one is held as a reserve.

The Siagne power station provides a specially interesting and most instructive case of high-pressure pipe-lines, and has demonstrated in a most drastic manner what the consequences of incorrect design can be. The original pipe-line had to be abandoned after a few months' running on account of unsatisfactory working of the plant, and an entirely new pipe-line had to be built on totally different principles, in spite of the fact that the chief dimensions of the pipes were perfectly correct and amply sufficient for the conditions of head and discharge, and, moreover, were not altered in the second pipe-line.

The principal faults in the arrangement of this line were as follows:—

1. Too great a length of the upper portion, under low pressure, with pipes of small thickness, whereby a continual working or respirating phenomenon became apparent in this part of the pipe-line.

2. Insufficient fixing or anchoring of the pipes in the lower portion of the line, and a most curious position of the distributing pipe, in which very harmful vibration combined with displacement of the pipes could take place, on sudden variations of water-velocity or shocks in the pipe-line; this might easily lead to a burst, especially in the case of riveted pipes.

3. Unsuitable dimensions of the connecting pipes between the distributor and the turbines, with their length too great and their diameter too small, resulting in considerable accentuation of the pressure variations.

Each pipe-line formed one single rigid piece from top to bottom, and no provision was made to allow for expansion and contraction, such as the insertion of expansion joints. Expansion due to temperature changes in an exposed pipe-line is, however, unavoidable, and if no arrangements are made to allow of longitudinal motion, then additional stresses will be set up in the pipe walls that will be difficult to foresee, and will cause resultant stresses which may under certain conditions have a fatal effect.

Shortly after starting up the works a burst occurred about the middle of one of the pipe-lines, probably owing to some sudden variation in the water velocity. A longitudinal riveted joint was torn open for a length of 2 metres, and the water suddenly streamed with such velocity from the gap that a large part of the upper section of the pipe was completely flattened by the vacuum which was produced, in spite of large air-pipes at the penstock chamber. Exhaustive investigation led to the final decision to replace the entire existing pipe-lines by others over a quite different route.

The new line has been in continuous operation since the spring of 1908. It consists of two parallel pipe-lines of almost the same dimensions as the old, but differs therefrom in that it passes straight down the side of the mountain from the penstock chamber to a point about 30-40 metres above the power house, when it turns round and passes towards the latter through a tunnel.

The upper part of the pipe-line was made as short and as steep as possible and the lower arranged longer in proportion. The whole line is divided into six straight sections; the angle points between them are formed into main anchorages (fixed points) of solid concrete masonry into which the pipe bends are rigidly bedded. An expansion joint is placed below each fixed point.

These pipe lines were riveted together *in situ*, the upper portion, up to 13 mm. thickness, being of riveted pipe, and the remainder of pipes lap-welded by the water-gas process.

The erection of the new pipe line was finished in six months. The result as compared with the old pipe line was as expected. The extraordinary surges and resonance effects of the pressure shocks, especially the visible movement and trembling of the pipes, completely disappeared. No disturbance or irregularity could be observed in the pipe line even with severe and sudden load variations during running.

The five 2,000-KW. (max.) machines installed in the power house run at 375 R.P.M. The turbines are Escher, Wyss & Co.'s impulse wheels of 2,800 H.P. maximum output, having each one regulating needle-nozzle. They are fitted with automatic speed regulators and pressure-relief valves, both operated by the pipe-line water, which is exceptionally clean and could therefore well be used. The rigid coupling which connects turbine and generator is arranged as a fly-wheel to increase the rather small fly-wheel effect of the generators, in view of the exceedingly close governing guarantees required.

The Siagne power station is used as one of the hydro-electric plants which feed the high-tension system supplying power to Nice and Cannes.

NEW ELECTRICAL DEVICES. FITTINGS AND PLANT.

An Electric Water Heater.

A novel form of water heater has been introduced by Electric Water Heaters, Ltd., of 30, Gordon Street, Glasgow. It consists of one or more porcelain tubes packed with carbon granules, so arranged that water flows through them freely; the granules are of uniform size, carefully packed, and are prevented from escaping through the ends of the tubes by carbon blocks. On passing a current through the granular resistance, water which is led through the tube is efficiently heated, and, at the same time, sterilised; the latter feature has been verified by Prof. David Ellis, who carried out experiments with contaminated water containing one and a-half million bacteria per cm^3. This was passed through the heater, and within a few seconds the out-flowing water, heated

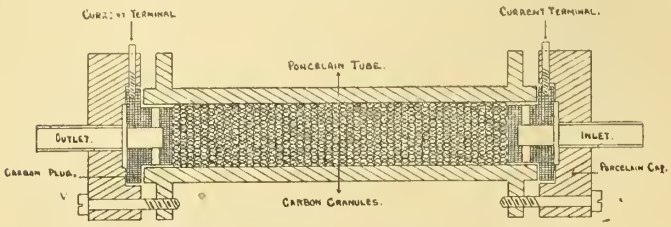


Fig. 1.—Electric Water Heater (Section).

to 125° F., was collected and found to be free from pathogenic organisms—two out of three samples being, in fact, "absolutely sterile," and the third containing only 30 bacteria per cm.^{3}, of a harmless character. Among the other advantages claimed for the heater are its quickness of operation, ease of control and of fixing to any cold water supply, and freedom from waste. The heaters at present made take 3,000 and 6,000 watts, and have respectively an output of 25 and 50 gallons of water per hour at 110° F. The water does not come into contact with charged metal, and therefore there is no danger of poisoning by electrolysis.

"Handgrip" Heavy-power Fuses.

The latest Home Office Regulations for factories and workshops provide, among other things, that fuses must be so constructed as to prevent danger from arcing, overheating, or from the scattering of hot metal when the fuses come into operation. Further, they must be so arranged that the fusible metal may readily be renewed without danger. To meet these conditions, the British Central Electrical Co., of 84, Hatton Garden, E.C., are supplying a range of fuses and fuseboards for use on motor and other circuits at pressures up to 600 volts. The fuse carriers are known as the "Handgrip," and are of tubular form, with clear central hole lined with asbestos to take the fuse wire. They are of porcelain, arranged so that the contacts are entirely shielded, a

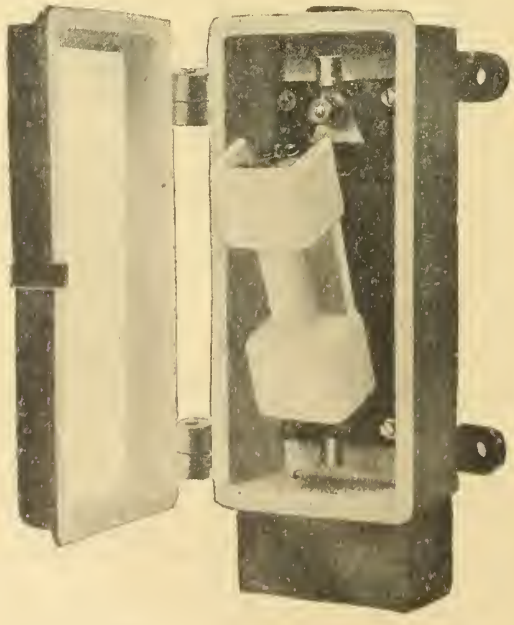


Fig. 2.—"Handgrip" Service Fuse.

space being left between the tubular part of the carrier and the porcelain back, of sufficient size to accommodate the fingers. It is thus impossible inadvertently to touch live metal with the hand when withdrawing the carrier or replacing it after it has been removed from the board. The company lists tubular fuses made up in single, double or triple-pole form on enamelled slate or mica-insulated iron boards, with front or back connections. They are also made up in cast-iron boxes as main service fuses, as shown in the accompanying illustration. These cases are watertight, and can be supplied with or without sealing chambers for the supply cables. These "Handgrip" fuses are also made up in iron cases as distribution boards for heavy-power circuits, and are supplied in five sizes, to deal with currents from 50 to 500 amperes.

LEGAL.

Milne v. Municipal Council of Sydney.

This case has been occupying the attention of the Australian Courts, Supreme Court, in Banco, before the Chief Justice, Mr. Justice Pring and Mr. Justice Sly. The report is from a Sydney newspaper:—The plaintiffs, Alexander Martin Milne, William Milne, Andrew Milne and Martin Luther Milne, had commenced an action against the Municipal Council of Sydney, and the declaration set out that in consideration that the plaintiffs would execute and complete the mechanical repairs to the Council's plant at the electrical power house, Pyrmont Street, for the term of 12 months, at certain prices, and in accordance with certain conditions agreed upon between them, the Council promised plaintiffs, amongst other things, to allow them to do the work referred to, and for the period stated; but, although certain repairs to the mechanical plant were required during the 12 months, the defendant did not give the work to plaintiffs, but to other persons, and refused to be bound by the promise, whereby the plaintiffs lost the benefit of the promise and the profits they would have derived from the performance thereof, and the expense incurred by them in preparing to carry out the agreement on their part. Damages were laid at £2,000.

In reply to this declaration the defendants set out as their plea in defence the articles of agreement of April 20th, 1910, between plaintiffs and the Council, instructions to firms tendering general conditions, the specification, plaintiffs' tender, and other documents. To this plea the plaintiffs demurred, on the ground, mainly, that under the agreement set out in the plea and during its currency the plaintiffs were entitled to carry out all the work of repairs referred to in it, and that the plea admitted the breaches complained of, and that the agreement was no answer to their claim.

Argument had not concluded.

Breach of Electrical Regulations.

At the Jarrow-on-Tyne Police Court on September 7th, the Palmer Shipbuilding and Iron Co. were proceeded against by Mr. W. Lauder, Chief Inspector of Factories, on behalf of the Home Office, for an alleged offence under the Factory and Workshops Act, on July 7th. Mr. Gibson, of Messrs. Clayton & Gibson, Newcastle, appeared for the defendant company, and pleaded guilty.

Mr. Lauder said that the company was charged with a breach of the electric regulations made in pursuance of the Factory and Workshops Act for the protection of life and limb in factories. Regulation 21 provided that, where necessary to prevent danger, adequate precaution should be taken either by earthing or other suitable method to prevent any metal from becoming charged. In that case they were concerned with the death of a man named James Byers, who was employed as a driller on July 7th last. He was engaged at a radial drilling machine, drilling a steel plate 24 ft. long × 12 ft. wide. The drill was driven by an electric motor. Byers had been employed from 5 p.m., and about 9 p.m. he was observed lying over the handle of the machine with his feet stretched over the plate. A workman named Atkinson attempted to release Byers, and received such a shock that he was incapacitated for some time. Another man named Wilson also attempted to free him, and received a slight shock. The current was then switched off, but all efforts to revive Byers proved futile. Mr. Lauder said that the charge against the company was that they had not taken adequate means to prevent danger, by earthing or other method. He added that it was possible at any time for a puncture to occur in the cable, but if the motor were earthed, any leakage would not affect the machine. As it was, the whole of the machine and the steel plate became charged so that the man received a full voltage of 440 volts alternating three-phase, which was sufficient to kill anyone. In regard to this machine, no steps had been taken to comply with the regulation. The machine had been erected two months before the accident, in the absence of the foreman electrician, who, on his return, did not examine it to see if it was erected properly. As to how the leakage occurred between the cable and the motor frame was not material to the case, but they could take that the leakage had occurred through a very slight flaw in the cable. As the company admitted the offence he did not propose to ask for the extreme penalty (£100), although it was a most serious thing.

Alfred Baker, of Jarrow, the foreman electrician to the Palmer Co., stated that after the accident he examined the drilling machine. There was no earthing; if there had been the whole of the machine would not have become charged.

Mr. Lauder: There were three other machines of a similar kind in the yard; none of them earthed?—Yes.

They had been erected in your absence?—Yes.

Witness, in reply to questions, stated that they had been erected by his assistant.

The Chairman (Alderman Johnson): Can you account for ving three machines not earthed?—They were not earthed at time.

The Chairman: Do you think it was an oversight or was due to want of judgment?—I would say it was pure neglect.

The Magistrate's Clerk: Was it not your duty to examine machine on your return after your temporary absence?—I uld have examined it.

The Chairman: You thought you had a qualified man in charge, d that he would do his duty?—Yes.

Mr. Lauder: Were there other machines working without being thed?—Yes.

Mr. Gibson, for the defence, said he had no option but to admit e offence. The company greatly regretted the serious consequences at had resulted. The machine was erected in the absence of . Baker, who, on returning, saw it working, and he considered thing was such an elementary principle in electrical work that did not go to see if the machine was earthed. The only possible planation of the accident was that there was a very small ncture in the cable. Since the accident his clients had appointed qualified electrician to take charge of the whole electrical chinery of the works. He thought H.M. inspector was satisfied th what the company were going to do, and they were willing to opt any suggestion that Mr. Lauder might make. It was certainly t the wish of his clients that any of their workmen should work danger.

A fine of £10 and costs was imposed.

Balmain Electric Light and Power Supply, Ltd., v. Cormack.

interesting case was recently before the Australian Courts. aintiff company sought an injunction to restrain defendant, till e hearing of the suit, from installing or using any form of motive wer for his works other than the motive power supplied by the aintiff company. According to plaintiffs, defendant agreed on ptember 29th last to obtain electric power from them for carry- on his extensive cooperage works at Long Nose Point, Balmain, d gave an undertaking in writing that he would not install or e any other power for a period of two years. Plaintiff company en went to great expense in erecting a sub-station, and extending e mains to defendant's works. Defendant, however, had recently stalled a steam plant, and was using that as the motive power r his works. Plaintiffs had asked defendant to take the power m them, but he had refused, and neglected to do so, whereby ey had suffered great loss and damage.

Defendant, in an affidavit, said he had been carrying on business Balmain as a master cooper and sawmiller up to December 20th t, on which day he sold the business and the assets and goodwill reof to A. W. Cormack, Ltd., a company duly registered and corporated under the Companies' Act. Since that date he had not rried on, nor was he carrying on, the said or any business at lmain or elsewhere. He denied that he had recently installed a am plant for the purpose of supplying motive power for the rks mentioned, or for any purpose, and also denied that he in- ded to use steam for such purpose. The said A. W. Cormack, d. had installed a steam plant, and he, as a servant of the com- ny, and not otherwise, used the plant. A denial was also given other statements of plaintiff company. The matter was allowed stand over for a fortnight, to enable A. W. Cormack, Ltd., to be ned as a defendant.

RADFORD RAILLESS TRACTION SYSTEM.

. C. J. Spencer, Corporation tramways manager at Bradford, mitted the following report on the proposed extension of lless trolley system, to the Tramways Committee:—

'I have pleasure in reporting on this matter in accordance with following minute:—'*Railless Trolley System—Proposed New utes.*—It was decided to recommend the Council to apply to the ard of Trade at the earliest practicable date for a provisional er authorising the Corporation to use trolley vehicles on the lowing routes within the city, namely, from Laisterdyke to nction Hotel, Bolton, *via* Killinghall Road and Idle Road; and m Dudley Hill to Bankfoot, *via* Rooley Lane. The general nager was requested to consider what districts of the city might profitably served by an installation of the railless trolley tem, and to report generally thereon, dealing particularly with following routes, namely, Odsal to Oakenshaw, and Forster iare to Frizinghall, *via* Canal Road.'

'Sec. 17 of the Bradford Corporation Act, 1910, reads (*inter alia*) under:—'If at any time hereafter the Corporation desire to use lley vehicles upon any road as defined by the Tramways Act, 0 (other than the streets or roads in this part of the Act cified), they may make application to the Board of Trade, and Board of Trade shall be, and are hereby empowered, to make a visional order authorising the use of trolley vehicles upon any te or routes within the city to which such application relates.' Certain procedure, which is stated at length in the Act, has, of rse, to be observed.

'From an engineering and operating point of view the railless lley system has been an unqualified success

"No serious difficulties of any sort have cropped up during the few weeks of running on the Laisterdyke-Dudley Hill experimental section, such as might have reasonably been expected in connection with a new installation of this description.

"Several minor details require attention by the contractors who are fully responsible for the same, and these will in due course be put right by the contractors under the terms of their contract.

"From the traffic revenue point of view, I am sorry to say, the returns are not quite up to the figure I anticipated. We had, of course, no experience of the traffic value of a cross-town route in Bradford, and I am surprised to find that instead of a 10 to 20 minutes' service being required for the district, a 15 to 30 minutes' service seems to be ample to meet normal requirements.

"The route is, of course, very short, and hardly serves a sufficiently wide area to fairly test the traffic possibilities of the district. In all probability the traffic revenue will improve very considerably when the route is extended, as I have already suggested, with suitable overlapping stages.

"The proposed route from Odsal to Oakenshaw, *via* Low Moor, would undoubtedly be a suitable route if arrangements could be made with certain authorities outside Bradford to continue to Cleckheaton, &c., but without that it seems to be somewhat doubtful, having regard to the fact that a portion of the route would be over the bridge and approaches at Low Moor now maintainable by the Lancashire and Yorkshire Railway Co.

"There is some reason to believe that in the near future it may be possible to have through communication with the Cleckheaton district in the way suggested. It is, therefore, a question for the Committee to decide whether this route should be applied for until some understanding has been arrived at with the authorities concerned.

"I beg to recommend the following extensions of this system, all of which are inside the city boundary:—

"(*a*) From the existing terminus of the railless route at Dudley Hill, along Rooley Lane to Bankfoot, 1 mile, 1,322 yd., and from the existing terminus of the railless route at Laisterdyke along Killinghall Road and Dudley Hill Road to the Bolton Junction, a distance of 1 mile, 1,352 yd.

"(*b*) From the junction of All Saint's Road and Laisteridge Lane along All Saint's Road, Grange Road, Ingleby Road, Whetley Lane, Marlborough Road and Queen's Road to Peel Park, a distance of 3 miles, 494 yd.

"(*c*) From Forster Square, along Canal Road to city boundary at Frizinghall, a distance of 2 miles, 365 yd.

"The total route mileage recommended is 9 miles, 13 yd., and would cost approximately £13,500 for street equipment.

"Assuming an average service of 15 minutes, 12 cars would be required including spares, at an estimated cost of £9,000.

"Depôt accommodation would be required at an estimated cost of £4,000. The total amount of capital required, therefore, would be £26,500, and the annual charges approximately £2,247.

"The amount of revenue from traffic from the routes mentioned is very problematical. The routes are well known to the Committee, and I am of opinion that the cross-town traffic will be ample to pay working and capital expenses, with some profit, but it is impossible to deduce traffic possibilities to even approximate figures in the usual way of estimating population, &c.

"Subject to the opinion of the city engineer (Mr. Dawson), the roads along which it is proposed to run appear to me to be very suitable for railless trolley traction, and I see no special difficulties of an engineering character in the project."

The foregoing report was considered by the Committee on Monday last, and was adopted. The recommendations will be placed before the City Council in due course.

BUSINESS NOTES.

Catalogues and Lists.—The British Thomson-Houston Co., Ltd., Rugby.—We have received from this company a batch of new literature just issued regarding a number of its manufactures. Price list No. 304 is devoted to "Mazda" holophane reflectors of the domestic type, which have been specially designed for use in houses where artistic appearance is essential, combined with efficiency. No. 305 is a 40-page list with many good half-tones and line diagrams, and a great deal of descriptive material concerning the B.T.-H. ironclad oil-break switchgear, made for operating under severe requirements of service on systems of 3,300 volts or less. Price list No. 306 (four pages), non-luminous radiators, shows a new type of radiator suitable for public building and hall heating, office heating, ships' state rooms, tramcars, shop-windows, &c. In No. 307 the "Magnetite" arc lamp for continuous-current circuits is particularised. We understand that the largest single order for arc lamps has just been placed, being for 6,000 of the latest type "Magnetite" lamp. Finally, in list No. 308, the B.T.-H. drawn-wire filament "Mazda" lamp is very fully-covered, tables of sizes, consumptions, candle-powers and prices being given, together with typical views of interiors where these lamps are rendering effective service. All of this literature is issued in the familiar standard B.T.-H. style and size.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—Price leaflets relating to voltmeters and ammeters, liquid starters and controllers.

The Brush Electrical Engineering Co., Ltd., 1, Kingsway London, W.C.—Coloured showcard to impress upon all and sundry that the "Metallum" lamps turn night into day. The picture, which is in colour, represents an aviator, holding a mammoth Metallum lamp suspended by flex, lighting up the waste places of the earth.

The Benjamin Electric, Ltd., 117, Victoria Street, London, S.W.—Section lists Nos. 41 and 42, the former illustrating, describing and pricing, reflectors for shop window showcase lighting, &c., the latter dealing similarly with patent lampholders and adaptors.

Messrs. Litholite, Ltd., 55, Hackney Grove, London, N.E.—Some new sheets have been issued for inclusion in the firm's catalogue. No. 16 is a reprint with additional patterns of insulating bushes, nipples, &c., which is to take the place of the existing No. 16; Nos. 18 to 23 show sketches and prices of brush-gear insulators, and H.R. grade insulators.

Electrical Power Storage Co., Ltd., 4, Great Winchester Street, London, E.C.—Folding leaflet containing illustrated information regarding the E.P.S. miners' electric safety lamps, fitted with "Osmi" filaments, and giving prices of five different models. Copies of the bulletin can be obtained by the trade on application.

The Forest City Electric Co., Collier Street, Greengate, Salford.—Eight-page pamphlet entitled, "The Bonding of Girder Tram Rails," in which the efficiency of short bonds is pointed out, notes being given on the fixing of bonds, describing the use of the double-screw rail bond compressor, and giving illustrations, brief notes and prices, of the "Protected" bonds, the "Forest City" flexible cable bonds, and solid wire rail bonds.

British Central Electrical Co., 84, Hatton Garden, London, E.C.—16-page catalogue of various electrical manufactures, including "Handshield" fuseboards, adaptors, plugs, &c., also cut-outs, ironclad switches, watertight fittings, shop lighting fittings, main switches, flexible cords, bell and telephone and other wires, "Handgrip" ironclad main service fuses, and other lines.

Messrs. Johnson & Phillips, Ltd., Victoria Works, Charlton.—New 72-page price-list of switchgear. It is full of detailed and well-illustrated descriptions of such manufactures as oil switches, isolating switches, current and potential transformers, choking coils, measuring instruments, accumulator switchboards, battery charging and other types of switches, ironclad switches and fuses, distribution boards, power distribution boards, circuit-breakers, rotor starters, auto-starters, &c. Copies of the list will be sent to any firm in the trade making application.

Messrs. W. and R. Jacobs, 39c, King William Street, London, E.C.—24-page catalogue of pocket flash lamps, torches and electric novelties for the 1911-12 season. The list is fully illustrated and priced.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, near Manchester.—New 20-page booklet, containing a description of the Cyclone oxy-acetylene process of autogenous welding. The parts are illustrated, prices of complete plants are stated, and other contents included comprise useful data tables, a list of uses to which the process may be put, and instructions for working the acetylene generator and for welding with the Cyclone blowpipe.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—Pamphlet No. 20 (20 pages) contains illustrations and notes of prices of a variety of designs and styles of glassware and enamelled iron shades for electrical fixtures.

The Franco-British Electrical Co., Ltd., 50, Oxford Street, W.—New catalogue of 16 pages containing descriptive details of their "Franco" signs, motor flashers, time switches, parallel and flexible strip, &c. A number of the signs are illustrated and prices are quoted. A lengthy list appears of places where "Franco" signs may be seen in London.

The Electrical Co., Ltd. (Meter Department), 122 and 124, Charing Cross Road, London, W.C.—This is a fine art paper publication of 90 pages in which is contained a general review of the company's various types of electric meters for all conditions of service. From the illustrator's point of view the work is very impressive, for at periodical stages there are included fine representations in colour admirably showing the mechanism of the different types with covers removed; also half-tone views of departments of the works showing the various processes in meter manufacture in progress, diagrams of constructional details, and numerous curves. As to the general arrangement of the contents, these are set out in seven sections as follows:—Continuous-current ampere-hour meters; continuous-current watt-hour meters; single-phase A.C. meters; polyphase A.C. meters; various types of meters for special systems; various types for miscellaneous purposes; testing equipment, calibration, and connections of meters. Notes on testing and calibration, also diagrams of connections appear at the end.

Bankruptcy Proceedings.—Alfred Sitch, metal worker and electrical engineer, described as of 77, Brecknock Road, N. A sitting of the London Bankruptcy Court was held on Tuesday, before Mr. Registrar Giffard, for public examination. The statement of affairs showed total liabilities £1,349 (unsecured £239), and assets "£2,450 ordinary shares in W. Sitch & Co., Ltd.," returned as of uncertain value. Questioned by Mr. Walter Boyle, Assistant-Receiver, the debtor stated that on the death of his father, who carried on business as a metal worker and electrical engineer, he continued the business on behalf of his mother, who died in November, 1908. The business was left equally to witness and his sister; they carried it on together in partnership until January, 1909, when she retired, and in the following March, witness sold it to W. Sitch & Co., Ltd., which was formed with a capital of £1,000 in debentures and £4,000 in ordinary shares. Witness received as purchase money £250 in debentures and £2,500 in shares; he transferred the debentures to certain creditors in satisfaction of their claims, and he acted as managing director of the compan a salary of £250 a year. Owing to the loss of several l customers, and to £950 by bad debts, the company was not cessful, and on January 4th last a debenture-holder appoint Receiver, by whom witness was now employed to manage business at a weekly salary. In March last judgment was obta against him for £55, balance of a loan of £100 borrowed behalf of the company, and a petition was subsequently filed, u which the receiving order was made. Witness attributed his fai and insolvency to the failure of the company, and the liabil incurred by him on its behalf. Proper books of accounts kept prior to the sale of the business to the company. examination was concluded.

G. V. B. Barker, electrical engineer, Leeds and Harrogat September 23rd is the last day for receipt of proof for dividend the trustee, Mr. D. S. Mackay, The Red House, Duncombe P York.

Book Notices.—*La Nouvelle Industrie des Lam Electriques à Filaments Métalliques.* By C. Mourlon. Brus J. Lebègue & Cie. 1911.—In this volume the author reviews history and development of the metallic-filament lamp, special reference to the "Z" lamps, originally made by a comp in Belgium, and now manufactured in eight countries to the of about 12 millions a year. The process of manufacture is br described, and numerous tests on various types of incandes lamps are quoted; particulars and illustrations of the various w where the "Z" lamp is made are also given.

The Bioscope Electrician's Handbook. By J. W. Barber. Lond Ganes, Ltd. Price 1s.—This is a "waistcoat pocket-book," gi in the briefest form such information as the bioscope operat likely to need; diagrams of connections for various arrangem with and without motor-generators, &c., a dictionary of elect terms (which appears to be very reliable), sections on elect units, the projector arc, automatic arc lamps and resistances, various wiring tables. It is a useful little book, and should fi want very satisfactorily.

Small Switches, &c., and their Circuits.—A book bearing title, by Mr. Perren Maycock, M.I.E.E., will be published in a weeks' time by Messrs. S. Rentell & Co. This new book is intended to supersede Mr. Maycock's two recent publicati "Electric Wiring, Fittings, Switches and Lamps," and "Elec Wiring Diagrams," but will form a kind of supplement thereto.

"La Propagazione e lo Smorzamento delle Sovratensioni." Ing. G. Campos. Extract from the Atti della Associazione Elet tecnica Italiana. Milan: from the author.

"The Physical Review." Vol. XXXIII, No. 2. August, 1 Lancaster, Pa.: The *Review* offices.

"Atti della Associazione Elettrotecnica Italiana." Vol. No. 7. Milan: Stucchi, Ceretti & Co.

"Manual of Wireless Telegraphy for the Use of Naval I tricians." By Com. S. S. Robison, U.S. Navy. 1911. London Rentell & Co. Price 7s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Lond E. & F. N. Spon, Ltd. Price 5s.—The issue for August, 1911, tains the following papers:—"The Laying of Transmis Cables," by C. Vernier; "Battery Economics," by A. M. Tay "Printing Telegraphy," by Donald Murray; "Chemical Actio the Windings of High-Voltage Machines," by A. P. M. Fle and R. Johnson; "The Non-Salient Pole Turbo-Alternator," S. P. Smith.

"Electrical Ignition for Internal Combustion Engines." M. A. Codd. 1911. London: E. & F. N. Spon, Ltd. Price 3s.

"*Proceedings* of the Sydney University Engineering Socie Vol. XV. 1910-1911. Sydney: The Society.

Enamelled Plates.—The Flitton Engineering 4, New Cross Road, London, S.E., who specialise in the manufac of enamelled-iron signs, have sent us a sample of one of thes supplied for attachment to buildings, indicating that electricit used on these premises for such and such purposes, and it is furnis by —— Supply Co.

Model Exhibition.—The third exhibition of sm power engineering appliances, models, and scientific appara organised by the proprietors of the *Model Engineer*, will be hel the Royal Horticultural Hall, Vincent Square, Westminster, S from October 13th to 21st next. As usual, it will contain a col tion of high-class working and stationary engineering model all kinds, as well as a display of small-power steam, gas and engines, lathes and light machine tools, electrical appliances, scientific novelties. A feature of the show will be a comple equipped model engineering workshop, in which demonstration metal-working processes and small engine building will be gi daily. Working model railways and numerous other interest trade and private exhibits will be provided. Full particulars be obtained from the organisers, Messrs. Percival Marshall & 26-29, Poppin's Court, Fleet Street, London, E.C.

Trade Announcements.—In a paragraph under heading last week the name Farraway was given instead Harraway, the latter being the correct title of the firm mentio

Messrs. Feld Bros. & Co., Ltd., have removed to more c modious offices and stores on the ground floor of 25, Budge R Cannon Street, E.C. Their telephone number is altered to "1 London Wall" (two lines).

Messrs. W. T. Glover & Co., Ltd., have removed their Glas offices and stores to 158, Hope Street, Glasgow, and the teleph number has been changed to "3856 Douglas, Glasgow," their t graphic address remaining as before, viz., "Conductors," Glasgo

Mr. Horace Sloman, late of the Starlight Electric Co., has commenced business as an electrical engineer at 3, Horace Road, Southend-on-Sea.

Mr. Wm. Scholes, of 23, Church Road, Eccles, has taken over the electrical department of Messrs. J. O. Hart & Co., Ltd., lately carried on at the above address, and at Bank Street, Bolton.

Mr. J. G. Wilson has severed his connection with Messrs. Lind and Co., Ltd., Liverpool, and is starting on his own account at 2, Sandon Street, Liverpool.

The Electrical Engineering and Agency Co., Ltd., has been formed with Mr. C. Leven as managing director, and in the premises, 109-111, New Oxford Street, W.C., formerly occupied by the Lahmeyer Electrical Co., Ltd. The directors are the same as formed the board of the latter company. The firm will shortly be issuing a new catalogue of electrical specialities in power and lighting machinery and apparatus.

Installation Contracts.—Among installation contracts recently booked by Mr. H. Moss is one for a generator and motor, with switchboard and wiring for 150 lights, for Messrs. R. Heanland & Co., Ltd., of Huddersfield, and others for complete lighting installations for the new offices of Messrs. Ira Ickringill and Co., Ltd., and the Saxone Shoe Co., Ltd., both of Bradford.

A Question of Trade Practice.—Referring to "Importer's" letter on this subject in our issue of September 1st, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, write that it has been their invariable custom to supply pure rubber type of the full weight ordered *exclusive* of paper, and this point is specially emphasised on p. 14 of their Price List No. 27.

Liquidations.—La Plata and Ensenada Tramways Co., Ltd.—A meeting is to be held on October 9th at 28, Basinghall Street, E.C., to hear an account of the winding up from the liquidator, Mr. J. H. Swinburn.

Acoustic Patents, Ltd.—First meeting of creditors and contributories are called for September 26th at Carey Street, W.C.

Publicity Literature.—Referring to our correspondents' comments on this subject in the last two issues of the Electrical Review, Mr. R. Borlase Matthews points out that excellent literature prepared by experts is now obtainable, so that there is no need any longer for the putting forth of amateur efforts in a business which lends itself so well to co-operation, for each electricity supply undertaking has practically a monopoly in its own territory, since it does not compete with other electricity supply undertakings.

Mention has been made of the fact that there is need for an elementary book that would deal authoritatively with the cost of using electric light, the saving to be effected, the advantages it possesses over other methods of illumination, &c. In this connection Mr. Matthews refers to his book entitled "Electricity for Everybody" (published by the Electrical Press, Ltd.), which was expressly written to cover such points as these, and not only to give general information on a logical basis to the general public, but also to serve as a handbook for central station engineers and their assistants, in their efforts to popularise electricity. The original MS of this book has been edited by the Association of the American Electricity Supply Companies, and adopted as their official handbook; eight editions have already been published—a fact which illustrates the demand for definite information regarding the costs and advantages of electric service.

LIGHTING and POWER NOTES.

Atherton (Lancs.).—Owing to the great increase in the number of consumers in the centre of the town, larger transformers have to be installed, and tenders are to be invited.

Australia.—Sydney.—At a recent meeting of the Electric Light Committee of the City Council, the city electrical engineer stated that the Council had undertaken to supply electricity in 13 municipalities as follows: Woollahra, Randwick, Annandale, North Botany, Botany, Glebe, Erskineville, Darlington, St. Peters, Alexandria, Waterloo, Drummoyne, and Redfern. Several other municipalities, Mr. Forbes Mackay added, would probably decide within the next few weeks to take their supply from the City Council. The majority of the Councils named had only come to a final decision within the last few weeks. The City Council had been compelled by competition to do its utmost to induce these municipalities to take their supply of electricity from the Council, and to come to a decision quickly. Up till recently, the officer considered that with the generating plant recently installed, the Council would have been able to supply all possible demands up to the winter of 1913; but the sudden advent of customers had completely altered the situation. It was now necessary to provide more generating plant to meet the emergency, and he therefore recommended that a duplicate set of the two 4,000-kw. sets recently installed be ordered from Messrs. Dick, Kerr and Co., on certain conditions, at a cost of £17,285. The Committee had some doubt about giving an order in the way suggested instead of calling for tenders for the plant. The matter was accordingly postponed for a few days.

The Redfern Council has accepted the offer of the Sydney City Council to pay it £20,000 for its electric light installation, poles and wiring only. The Council expect to realise £6,000 by the disposal of the machinery, plant and land. The Sydney Council will erect a sub-station at Redfern.

The *Sydney Telegraph* states that the electric light was turned on at Moree late in July. The delay is explained by many unforeseen mishaps, including the loss of machinery by shipwreck, and the refusal of the Minister to grant the company a lease till May 16th

Bendigo.—"Renewed attention is being given in the Bendigo district of Victoria to a plan mooted some years ago for the supply of electricity for haulage and other purposes at the various mines. The cost of firewood is becoming an increasing burden, due partly to the increasing depths at which the mines are being worked, and the great extension of the underground workings generally, and partly to the fact that the timber areas near the mines have been cut out, necessitating the carting of firewood from greater distances. Many years ago Mr. G. Smith Morison, M.E., M.A.I.E.E., suggested electrification in place of steam power, and that one central station should be erected from which the necessary power could be supplied to all the mines within a given radius. Mr. Morison, who is the Melbourne manager for Siemens Bros. Dynamo Works, Ltd. (of Berlin, Sydney and Melbourne), Mr. Walter Tuerk (a central station engineer), and Mr. Hoffman (a geological expert of the Prussian Government), who is at present "loaned" to Messrs. Siemens Bros., has visited Bendigo and revived the proposal. In company with Messrs. H. E. Mills and W. Honeybone (town clerk), he visited the Hustler's Royal Reserve, Garden Gully, Koch's Pioneer and New Moon Mines, and the impression the experts gained was that the Bendigo field was most suitable for the application of electric power. The system which it is proposed to install is the Siemens-Ilgner, and it is believed that by it all necessary power can be supplied at half the cost at present incurred by each company. Fuel will be required only at the central station, where current for distribution amongst the mines which enter into the agreement will be generated. Nothing definite has yet been decided, but some such modernising step is inevitable if the mines are to continue in operation. The costliness of fuel is not the only consideration which will compel the companies to abandon the antiquated system which has been absurdly adhered to through all these years. There is a persistent demand for higher wages, and whatever increase may eventually be decided upon, it will be such as will make economy in another direction absolutely necessary."—*Australian Mining Standard.*

The same contemporary says that Corowa, which is just "over the road," as it were from Victoria in the New South Wales territory, has decided to install electric light and an electric pumping plant. The Council has agreed to a scheme which was prepared by Mr. G. A. Julius, consulting engineer. It is proposed to install a 50-kw. set, probably in two units, driven by either a suction gas engine or a Diesel oil engine, and to install an electrically driven model three-throw pump. The cost of the scheme will be about £6,000. It is believed that the proposed system of pumping will effect a big saving over the present plant, in fact, sufficient to provide the electric lights for the town, and interest on the capital invested and depreciation.

Ayr.—Mr. Roland Marshall, Corporation electrical engineer, reported to the Council on Monday, that the total income in his department for the year was £14,851. Private lighting brought in £8,282, power £1,122, public lighting £3,020, and tramways £2,123. There was a surplus at the close of the year of £2,256, of which £1,146 had been allocated to the credit of the rates, and £1,110 to reserve fund, which now amounted to £2,931. It was proposed that the charge for current to private consumers be reduced from 4d. to 3½d. per unit, and this was agreed to. The annual report on the tramways showed a record revenue in that department. The net credit balance on the year's working was £2,884. The total revenue was £15,492, as compared with £15,000 last year. The working costs were 7·27d. per car-mile.

Bacup-Rochdale.—At the Bacup T.C. on 6th inst. it was resolved that application be made to the L.G.B. for sanction to the borrowing of £1,250 for electricity purposes, to be repaid in 25 years. A letter was read from the Rochdale Corporation tramways engineer, certifying that the sum of £10,569 was due to the Rochdale Corporation for payments made to date on account of the Bacup Light Railway (electric tramway between Bacup and Shawforth). Rochdale Corporation offered to lend the amount required for capital cost, and it was resolved that it be left with the town clerk and borough accountant to arrange the loan. It was resolved that a list of ordinary and special services for electric lighting be approved, and that the work of laying them be given to Messrs. W. T. Glover & Co., Ltd., to execute under the terms of their contract.

Bampton.—The Urban Council has sealed an agreement with Mr. Purves, Exeter, for the provision of electric light to the Council for £49 a year for seven years. He will start the installation of the scheme in three months and complete it in nine.

Bath.—The accounts of the electricity department for the year ending March 31st have just been published. The revenue account shows total expenditure of £10,718, and total receipts of £20,435. The income is made up of £18,033 from sale of current, including £4,622 from public lighting, and £1,493 from the rental of meters, and other apparatus on consumers' premises. The net revenue account shows that

last year's adverse balance of £580 had been converted into a balance carried forward of £1,196, although the actual deficit last year had been met by a contribution from the rates. The amount tranferred to the sinking fund from the net revenue account was £5,621.

Bexhill.—In his annual report on the municipal undertaking, the engineer (Mr. W. T. Le Feuvre) says that the most satisfactory feature is the reduced coal bill for the year. Although 50,000 more units of electricity were sold, the amount paid for coal was £51 less than in the previous year. The coal bill was £537 less than it was two years ago, which is regarded as conclusive proof of the efficiency of the new chain grate stokers, condenser, cooling tower, and induced draught plant. The net income on the year's working was £561. Altogether a sum of £71,000 has been invested in the business. Last year the revenue from all sources amounted to £10,908, the gross profits being £5,074, representing a dividend of 7 per cent. on the capital borrowed. Capital repaid amounts to £17,680, of which £2,611 was repaid last year.

Blackpool (St. Annes).—The lighting of the northerly side of the road between Lytham Road and Middle Lane has been discussed at a joint meeting of representatives of the Blackpool Corporation and St. Annes U.D.C. It was recommended that an agreement be entered into for 15 years, electric light being adopted, the mains to be laid as far as possible in the highway. One-half of £2 17s. 6d. per lamp per annum is to be paid by St. Annes to Blackpool, the charge being subject to revision at the end of 10 years.

Carnarvon.—The T.C. is considering the advisability of improving the lighting of the town by electricity. The National Electric Construction Co. has presented a scheme by which lamps equal to 9,000 C.P. could be installed, double the present light, with no additional burden on the rates. The matter is to be gone into fully at a special meeting.

Cape Town.—The total number of units supplied from the Corporation electricity works during the five months ended May 31st, 1911, was 1,455,249 units, compared with 1,270,223 units during the same period of 1910, or a net increase of 17·55 per cent., the revenue accruing being £23,983, compared with £21,856, or a net increase of 12·07 per cent.

A fire recently occurred in the electric light storeroom in the railway terminus. The store, which was of brick, lined with matchboarding, was considerably damaged inside. Two of the firemen received shocks through coming in contact with "live" wires.

Continental Notes.—France.—La Société d'Eclairage Electrique de la Sologne is the name of a new company which has just been formed in Toulouse with a capital of £6,000 to establish a small central electric lighting station at Motte-Beuvron (Loir-et-Cher).

A new company has lately been formed at Chalons-sur-Marne with a capital of £8,000 and the title La Société Generale Electrique de la Marne, Force et Lumière, to establish an electricity generating station for the supply of current for lighting and power purposes in the Chalons district.

Darlington.—The T.C. has received the sanction of the L.G.B. to a loan of £6,000 for electricity purposes, £5,200 being for mains and £800 for services.

Darwen.—The need for extensions of the Darwen electric light undertaking, in connection with which an application was recently made to the L.G.B. for sanction to borrow £7,600, has been caused chiefly by the increased number of consumers for lighting purposes, and the demand for energy for power purposes, the Corporation having entered into an agreement to supply a further minimum of 120,000 units per annum (probably increased to 150,000 units), to the new colliery now about to be sunk at Hoddlesden, an outlying portion of the borough. Inquiries have also been made by several smaller concerns, who are seriously considering the application of electrical driving to their works, which, if adopted, would mean a further increase of 100,000 units per annum. The principal items of expenditure in the scheme of extensions submitted by the borough electrical engineer (Mr. C. Garnett) are £2,025 for high-tension cables, and £675 for a motor-generator, both being required for the supply to the colliery at Hoddlesden; £1,450 for the provision of services, meters, &c., for new customers; and smaller items for the "strengthening" of three mains which have become unequal to the demand originally anticipated, and for new mains in districts where building developments are taking place.

Dewsbury.—Owing to a breakdown, the Yorkshire Electric Power Co. has applied to the Corporation for a temporary supply of current for the Dewsbury and Ossett tramways. The Corporation has agreed to the supply being given on terms to be arranged.

Dover.—The T.C. has decided to hold an electric cookery demonstration next week.

Dudley.—Additions are to be made to the air and circulating pumps at the electricity works, at a cost of £390.

Dunfermline.—The Lighting Committee recommend that the Town Council should enter into an agreement with the Fife Electric Power Co. for the lighting of Kingseat for a period of 15 years, at £31 per annum.

Ebbw Vale.—The Education Committee has decided to obtain a local estimate for installing the E.L. in the town schools.

Elland.—The question of lighting Huddersfield Road by means of arc lamps has been deferred. The Lighting Committee has resolved that the engineer prepare an estimate for converting the present gas lamps to electric.

Farnham.—Last week the U.D.C. considered the report by the Public Works Committee, upon the proposal to substitute suction gas plant for the steam power at the sewage pumping station. It was stated that the Committee had considered the offer of the Farnham Gas and Electricity Co. to supply the necessary motors and electric current for sewage pumping. Provided the company would reduce their terms from £240 to £210 per annum (which latter amount the Committee estimate as the annual cost of a suction gas plant), and provided an agreement with the company for a term of 10 years could be satisfactorily arranged, the Committee recommended the Council to make the substitution in question. The recommendation was adopted, and it was agreed failing an agreement with the Gas and Electricity Co., that suction gas be re-considered and also the Diesel engine.

Handsworth.—The annual report of the electric supply department shows a satisfactory year's trading. An increase is shown on the units sold for lighting, heating and power purposes, but as regards traction there is a decrease in units used owing to the reduced service of cars on the Birchfield Road section. The capital expenditure during the year was £1,158, making a total of £74,636. The total revenue from all sources amounts to £8,3[illegible] as against £7,812 in the previous year, an increase of £4[illegible]. Lighting shows an increase of £518, heating and power a decrease of £4 18s.; tramways a decrease of £223, public lighting a decrease of £11 19s., and sundries an increase of £140. The total expenditure on revenue account amounts to £4,152, as against £3,895 in the previous year, an increase of £346. The gross profit for the year is £4,078, which is equivalent to 5¼ per cent. on the total capital expenditure, the same percentage as in the previous year. The net result, after deducting from gross profit of £4,078 the loan interest charges £2,752, and the instalment for the redemption of loan £1,881, shows a deficit on the year's working of £555. The profit balance brought forward from last year, as shown in the revenue appropriation account, was £197, and after deducting from this the deficit mentioned there is a deficit of £357.

Hawes (Yorks.).—For some years the town has been lighted by acetylene gas, but an offer was recently received to light the town by electricity. Two tenders were submitted, one from the gas company and the other from Mr. E. Chapman, the latter offering to provide the district with electric light at a cost of 2[illegible] per week, which was 5s. per week cheaper than the company's offer. After some discussion at a meeting of electors, a resolution in favour of electricity was carried by a large majority.

Herne Bay.—The B. of Trade has extended for a year the E.L. order of the U.D.C., on the understanding that at the end of that period something substantial has been done towards carrying it out.

Holmfirth (near Huddersfield).—A meeting of ratepayers has approved of the scheme of the U.D.C. for providing the district with electricity.

Ilkley.—The D.C. has decided to apply to the B. of T. for a provisional order to supply within the urban district of Ilkley and the township of Myddleton in the rural district of Wharfedale.

India.—The *Indian and Eastern Engineer* quotes a Ceylon paper to the effect that steady progress is being made with the installation of electric light in Nuwara Eliya. The power station at Black Pool is nearing completion, and the laying of the main, which is to convey the water from Lake Gregory to work the turbine, has been completed. The dynamo, turbine and other machinery have arrived, and will be sent up to Nuwara Eliya as soon as the power station building is complete. The posts on which the cables are to be run have been erected along the different routes and a good length of cable has also been laid. Mr. T. Muttucuma is supervising the construction works of the power station, and Mr. R. F. Morgan is in charge of the putting up of the posts. Mr. Rylands, Government electrical engineer, pays frequent visits. Nuwara Eliya is expected to be lit up with electricity before the end of the year.

Leigh (Lancs.).—The Corporation is spending £4,5[illegible] on an engine, dynamo, condenser and switchboard at the electricity works, and £711 on buildings and steel work. Permission to borrow the money has just been received from the L.G.B.

Lewes.—At a meeting of the T.C. on September 6th, it was recommended that the tender of the Lewes and District Electric Supply Co., Ltd., for lighting 127 public lamps be accepted, and that the contract with the Gas Co. be terminated. There was opposition on the ground that the Gas Co. paid five times more rates than the Electric Supply Co. did, but it was pointed out that the tender of the latter was still from £40 to £50 below that of the Gas Co., who had reduced their estimate by about £90. Ultimately it was decided, by 10 votes to 6, to refer the matter back for re-consideration.

Llandilo.—Mr. Bowen, of Llandrindod, who has been consulted by the U.D.C., has reported that to change the present installation for a Diesel oil plant would cost £900, and for a suction gas plant £600. The capabilities of the present plant, he says, where by no means exhausted, and he advised the Council for the present to allow the engineer to make further improvements. This course has been adopted.

Londonderry.—At a meeting of the Londonderry Harbour Commissioners on Monday, the engineer submitted particulars regarding the proposed installation of electrically-controlled signals on certain lighthouses of Lough Foyle. The matter was referred to a committee.

Melbourne (Derbyshire).—The P.C. has accepted the tender of the Melbourne E.L. and Power Co. for energy for two luster lamps at 30s. each per annum, and for 26 tantalum lamps at 5s. each.

Porlock.—During the past week a public and private supply of electric lighting has been inaugurated at Porlock, near Minehead, Somerset. The light was switched on by Sir F. Carruthers Gould, the celebrated cartoonist, who resides near. There are two dynamos, one worked by water-power and the other by a Campbell oil engine of 18-24 H.P. Messrs. Crompton & Co. Ltd., were the contractors for the engine, dynamos, switchboard, &c., and the batteries were supplied by the D.P. Battery Co. The main wiring was undertaken by Callender's Cable and Construction Co., Ltd. The whole of the work has been carried out under the supervision of Messrs. J. & W. Purvis, who have been represented by Mr. C. H. Steel.

River Plate.—The *Review of the River Plate* says that the Rosario Electricity Co. is endeavouring to obtain a prorogue of its concession for a further period of 25 to 30 years. This has given rise to considerable opposition, and the general feeling is that the company should make considerable modifications in its tariff if the concession is to be granted. It is maintained that the company has only one tariff for every class of lighting, heating, &c.

Salford.—In a report to the T.C., Mr. T. H. J. Hawkins, the borough electrical engineer, recommends the installation of the following plant, &c. :—Modernised coal-handling plant, £3,100 ; displace, as required, eight existing boilers by seven of the water-tube type, £14,000 ; install an additional turbo-generator, £12,500 ; remove store and fitting shop, and erect travelling crane for turbo plant, £750 ; erect new fitting shop and store, £1,500 ; extend switchroom and build new switchboard for power and lighting, £3,500 ; replace, one at a time, four engine sets of 750 to 900-KW. capacity by turbo-generators of 1,600 KW. each, £50,000 ; total, £85,350. The increased capacity of the plant would reduce the capital expenditure per KW. from £90 to approximately £54. Of the £85,350, £12,500 could be borrowed for the turbo-generator, and the other £72,850 would have to come from the renewals fund, which, however, only amounts at present to £19,144.

Extra cable connections are to be provided to the generators at the electricity works at an estimated cost of £200.

Simla.—A Bombay paper quotes the *Civil and Military Gazette* to the effect that the engineering works at Basantpur in connection with the Simla hydro-electric installation are making excellent progress. The long flume from Nautikhud to the bank of the Sutlej river is approaching completion, and of the two tunnels which carry the channel through the hills, one is altogether finished and the other has about 120 ft. still to be dug near the end of the flume. A large reservoir is being constructed in which the water of Nautikhud will be collected, and therefrom it will be carried in pipes to the bank of the Sutlej, where there will be a fall of 550 ft. It is this fall of 550 ft., which will supply power to generate electricity for Simla and to pump up its water supply.

Stourport.—On the recommendation of a special sub-committee, the Council has decided to give permission to the Kidderminster and Stourport Electric Co. to supply electric light to Stourport by means of overhead wires.

United States. — Two exhaust steam turbines of 5,500 KW. each have been added to the Commerce Street station of the Milwaukee Railway and Light Co. ; they will take steam from the eight vertical cross-compound engines already installed. The installation of two 14,000-KW. high-pressure steam turbines has been begun.

Six gas engines being installed in the new power house of the Indiana Steel Co. at Gary, Ind., are said to be the largest units ever constructed, having a rating of 3,200 KW. each. The engines are of the twin tandem double-acting Allis-Chalmers type, with cylinders 44 in. × 60 in., and will operate on blast-furnace gas, driving alternators delivering 6,600-volt, 25-cycle, three-phase energy to the power network of the Gary mills.

Whitworth.—The General Purposes Committee of the U.D.C. has resolved that the question of electric lighting and power supply be referred to the Tramways Committee for immediate consideration, with authority to invite engineers' reports, &c., and to prepare the fullest report on the matter with a view to exercising the powers already secured.

Wimbledon.—The Town Council has received sanctions from the L.G.B. to the borrowing of £2,993 for high-tension mains ; £3,600 for low-tension mains and house services, and £110 for meters. With regard to the sum of £756 applied for by the Council for sub-stations and transformers, the Board has decided to defer its decision on this point until information is received as to what arrangements have been made for the acquisition of sites for the former.

TRAMWAY and RAILWAY NOTES.

Australia.—The *Australian Mining Standard*, just to hand, states that the increase in population in Sydney and suburbs, within recent years, the consequent increase in the number of persons carried by the tramway service, and the fact that the western suburbs are now thickly populated, have necessitated steps being taken by the New South Wales Tramway Department to install more power plant. As showing the demand on the service, Mr. J. Kneeshaw, tramway traffic superintendent, recently stated that, for the year ended June 30th, 1910, there were approximately 187,000,000 passengers carried in the cars, and up to June 30th this year the total was about 230,000,000. The revenue last year was £1,090,000. At present all the electric power generated for the service is obtained from the Ultimo power house ; but it is absorbed readily—so much so that on certain special occasions the output has been hardly sufficient to maintain an efficient service. The Ultimo power house is already equipped with an up-to-date plant, but the question of present excess needs and prospective heavy requirements had to be considered. With this end in view, one of two things had to be decided—either to increase the already extensive plant at Ultimo or to establish a new power house which would be absolutely independent of the head station, and at the same time have its own independent tramway service. It was decided to erect a new station, and the site has been fixed at Rozelle, which place is centrally situated in the western suburbs. The proposed plant will be the largest and finest in Australia ; it will embrace all the latest improvements known in electrical practice, and all the newest methods introduced into labour-saving appliances. There are to be ten turbo-alternators, with an output of 5,000 KW. each, making a total of 50,000 KW. The complete number of sets is not to be installed at once, but probably when the first five are erected, or are in progress of erection, contractors will be asked to supply the remaining quantity. As yet the work is only in its initial stages, one of which is the calling of tenders for the first five turbo-alternators ; these are due to close on October 30th next, and full particulars and specifications are obtainable at the Electrical Engineer's Office, Hunter Street, Sydney.

Ayr.—The working expenses of the Corporation tramways last year, excluding power, amounted to £6,429, or 3·99d. per car-mile, and including power charges, to £8,492, or 5·29d. per car-mile. The percentage of working expenses to receipts was 54. The total number of miles run by the cars during the year was 386,434, and the number of passengers 3,760,746.

Bingley.—The U.D.C. has agreed to meet the Bradford Tramways Committee with reference to the extension of tramway facilities to Bingley, with a view to arranging terms.

Birkenhead.—The Tramways Committee recommended the T.C. to sanction the purchase of six additional cars for the New Ferry route, at an estimated cost of about £3,900. The Council has decided, however, to refer the matter back to the Committee, in order that the type of car may be considered.

Blackburn.—At the T.C. on September 7th, a letter was read from the secretary of the Tramway Men's Union respecting the covering of ends of certain cars as a protection for the drivers against the weather, and as to the brakes on certain cars. The matter was referred to a sub-committee.

Bolton.—The Tramways Committee has had the road at Burnden lowered so that double-decked cars can travel on the Moses Gate, Farnworth and Clifton route, the South Lancs. Co. running in conjunction with the Corporation between Bolton and Clifton.

Colwyn Bay.—It is stated that very good progress has been made with the duplication of the electric car track between Rhos and Penrhynside. Part of the new line is already in use, and the whole scheme will soon be completed.

Continental Notes. — GERMANY. — Reuter's agent at Homburg states that the district committee has adopted a scheme for the construction of a mono-rail railway between Homburg and Königstein, a distance of about seven miles.

AUSTRIA.—The *Financial News* says that negotiations have been opened at Vienna between the Traffic Commission of Vienna and the Länderbank, the Union Bank and the Boden-Creditanstalt, concerning the Vienna Underground Railway, the construction of which, it is estimated, will cost at least 120,000,000 kr.

Didsbury.—The Manchester Corporation Tramways Committee proposes carrying out important extensions in this residential neighbourhood.

Doncaster.—An order made by the Light Railway Commissioners, and confirmed by the B. of T., has just been issued, authorising the construction of a light railway, 4 furlongs 1½ chains in length, in the rural district of Doncaster, at a total cost not to exceed £6,400.

The Corporation has decided to extend the tramway system on the Balby route to Warmsworth, and to include this extension in the application to the B. of T. for power to extend the line to Brodsworth.

East Kent.—The B. of T. has confirmed the order authorising the construction of light railways from Eythorne to Great Mongeham, from Coldred to Maydensole and Stone Hall, and from Eastry to Hammill, in the proposed colliery district.

Edinburgh.—The Tramways Committee of the Corporation has asked the Edinburgh and District Tramway Co. to instruct their drivers to take particular care when rounding curves on the various routes throughout the city.

Glasgow.—At the last meeting the T.C. discussed the proposals—published in last week's Review—in connection with the application to Parliament for a provisional order for power to extend the present tramway system. Numerous objections were intimated, including those from shopkeepers on the proposed route, members of the general public and ward committee, and also from a deputation of carting contractors, to a new route across the river Clyde to the west of the present Glasgow Bridge and up Buchanan Street, demolishing, on the way, the present St. Enoch parish church, and erecting a new bridge across the river. Bailie Russell was inclined to pooh-pooh the opposition, and stated that to his knowledge not 50 per cent. of the shopkeepers in Buchanan Street were antagonistic. He argued that the route proposed was the only feasible one, and on being pressed as to the ultimate cost, estimated the figures at—for construction of track, £22,864; for new bridge, £60,000; and for removing the St. Enoch Church, &c., £13,000. It was agreed not to continue the discussion of the whole of the proposed extensions pending the preparation of a memorandum by the convener, this including the renewed application of ratepayers in Coatbridge to be linked up with the T.C. system.

Japan.—According to the *Daily Telegraph*, public feeling in Tokio has been greatly exercised as to whether the tramways of the city should pass under municipal control. "After much heated argument on both sides, the new arrangement has actually come into force, and the service has begun. The *Jiji*, one of Japan's most influential papers, fears that it will be but the beginning of the wholesale municipalisation programme comprising electric lighting and gas supply, and that the citizens will have to suffer a double burden on account of heavy municipal debts and the increase of the tariff. Electric lighting will be the first to be transferred to the city, for the Tokio Electric Tramways have their own electric lighting department, which the city has to keep up, whether it will or not. There was obviously strong public feeling against the change, for there seemed a general fear that the practical result would be a raising of the fares. After the meeting at which the decision of the city assembly was announced there was fear of rioting, and a force of armed troops of the 2nd Infantry Regiment of the Imperial Guards was stationed in Hibiya Park."

A new electric tramway between Otsuka and Oji, in the suburbs of Tokio, has lately been completed and opened for traffic.

Liverpool.—It was officially announced on Saturday, by Mr. Mallins (general manager), that only 95 of the men who went out on strike remained to be reinstated. A meeting was held on Sunday, under the auspices of the National Transport Workers' Federation, and a resolution was passed demanding the immediate reinstatement of the tramway strikers not yet taken back.

A daily paper reports that on the afternoon of the 5th inst., on the electric line between Sandhills and Bankhall, on the Lancashire and Yorkshire Railway, during shunting operations, the coach of a steam train fouled the metals. It fell over on to the down and up electric lines to Southport, and traffic between Liverpool and Southport was stopped for 1½ hours.

Manchester.—A new scheme of tramway extensions is being brought forward by the City Corporation.

Morley.—The B. of T. has confirmed the order authorising the construction of electric tramways on the overhead system in South Queen Street and Fountain Street, with power to borrow £10,500. A loan of £11,000 is to be applied for, for the construction and equipment of tramways in Bruntcliffe Road and Bridge Street.

Nelson.—The Nelson Tramways Committee has renewed its agreement with the Colne and Trawden Light Railway Co. for another term of through running, and has decided to purchase two more cars.

Plymouth.—At Monday's T.C. meeting Mr. Stephens moved the report of the Tramways Committee, in which there was a recommendation that the maximum wages of all tramway employés be increased by the sum of 1s. a week. Mr. Stephens explained that this was proposed not only because the cost of living had increased, but because the wages were below the amount paid for similar work in other towns. Mr. Willis proposed to add: "and that in addition the drivers of the demi-cars shall be paid an additional 1s. a week." He did this because the men in charge of these cars had to act as conductors as well as drivers. Mr. Stephens promised to bring this proposal before the Committee, but it was seconded. On being put to the meeting as an amendment it was lost, and the minute was agreed to.

South Shields.—The manager of the Corporation tramways has been instructed to prepare a report upon the cost of extending the tramways from the Pierhead to Mowbray Road, and as to the advisability of carrying out the work before next summer.

Wakefield.—The Yorkshire (West Riding) Electric Tramways Co., Ltd., has applied to the B. of T. for consent to the abandonment of the proposed lines from Wakefield to Alverthorpe, and portions in the parishes of Horbury, Ardsley, and from Rothwell to Oulton.

TELEGRAPH and TELEPHONE NOTES

The "Acrophone."—The lay Press has manifested keen interest during the past week in the doings, and more particularly the sayings, of Mr. H. Grindell Mattbews, a "young scientist" "deeply versed in the science of electricity," who claims to have devised a new system of wireless telephony. To call a man "young scientist" is usually sufficient to damn his chances of being taken seriously by technical men, and when we add that he is said to be in close touch with the War Office, it will be seen that his case is well-nigh hopeless. However, in spite of these drawbacks we are willing to keep an open mind on the subject of his alleged invention—though the additional facts that he draws inspiration from a recent novel by Miss Corelli, and is convinced that "a great force of energy could be collected from the atmosphere," are not easily condoned. Mr. Matthews claims to have spoken with his system over a distance of 5½ miles, and "hopes to speak 40 miles shortly." We hope he will, too.

Anglo-Belgian Telephony.—The new Anglo-Belgian telephone cable has been successfully laid for the Post Office by Messrs. Siemens Bros. & Co.

Australia.—Mr. H. W. Ramsay-Sharp, the special telephone commissioner appointed to investigate the Sydney telephone system, has furnished another report to the Chamber of Commerce stating that he had made in all 23 tests, of which 10 were bad, some very bad—three unsatisfactory, and 10 good. Of the 10 best calls, one occupied 10 min. 18 sec., a second 5 min. 40 sec., another 25 min. 30 sec., others 4 min. 45 sec., and 6 min. 57 sec.

International Telegraph Union Monument.—The international jury dealing with this matter has selected the design submitted by Signor G. Romagnoli, of Bologna; it will be erected at Berne, at a cost of 170,000 fr. It will be remembered that the first competition brought forward no design of sufficient merit for the purpose; the second competition has resulted more satisfactorily.

Long-Distance Telephony.—It is announced that the establishment of direct telephonic communication between Berlin and Stockholm is impending, if it is not already an accomplished fact, by the use of the Egner-Holmstrom microphone. The trials with the apparatus in question are declared to have been successful. Telephonic messages have been exchanged between Stockholm and Hamburg for a long time past, whilst Berlin is already able to communicate with nine Swedish towns.

Pacific Cable.—The report and accounts of the Pacific Cable Board for the year ending March 31st last have been issued, and show that the net traffic receipts were £136,14[illegible] making with minor receipts a total of £138,678. The expenditure was £109,343, leaving a balance of £29,334 towards meeting the annuity of £77,544 in respect of interest and sinking fund on the capital of two millions sterling, an increase of £11,378 on the balance in 1909-10. The amount to be provided by the Imperial and Dominion Parliaments to make up the deficiency is, therefore, £48,210 for the past year. Net traffic receipts showed an increase of £24,677, about half of which was due to increase of business.

The Board's repairing ship *Iris* is occasionally chartered by other authorities, and as the extra receipts from this source are irregular and fortuitous, the Board proposes to carry them to reserve account, in order not to disturb the comparison between the ordinary accounts of successive years. The renewal fund stood at £264,236 at the end of the year in question.

No interruption occurred during the year. The Canadian land line service was taken over by the Board in September last year with satisfactory results, the average time of transmission between Great Britain and Australia being reduced by 15 to 18 minutes and the accuracy of transmission being improved.

The forthcoming introduction of a system of deferred messages at reduced rates is mentioned; the P.M.G. has made such progress with the necessary negotiations that there is every prospect that within a few months it will be possible to send messages in plain language at half the existing rates, subject to their being deferred if necessary, for not more than 24 hours.

The number of international messages handled last year was 129,154, representing 1,849,613 words; there was in addition considerable inter-Colonial traffic, keeping the Southern sections of the cable fully occupied.

Telephone Transfer.—The Nottingham City Council has agreed to sell to the National Telephone Co. the whole of the wires belonging to the Corporation, which cost £2,600, for £800.

The Dundee Corporation observes that as the Post Office will not pay the taxes that are at present paid by the company, the town will lose £800 a year, besides £200 in wayleaves. The T.C. has taken counsel's opinion as to whether it can take action against the company for breach of contract!

Similarly Bradford Board of Guardians is perturbed at the prospect of losing rates on a value of £4,000, and is asking the Government to continue to pay the local rates, and doubtless other local authorities will follow the same course, with the absolute certainty of meeting with a refusal. Public ownership may not prove all that it has been expected to be—but these things are never thought of till the mischief is done.

Wireless Telegraphy.—Mr. Marconi has just completed the installation of a new wireless station at St. John's, Newfoundland, and direct communication has been opened with England.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—October 3rd. 42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" August 25th.

November 21st.—One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—October 25th. Cable and paper sleeves for the P.M.G. See "Official Notices" September 1st.

Tasmania.—October 2nd. Porcelain insulators for the P.M.G. See "Official Notices" September 1st.

Sydney, October 30th.—Five turbo-alternators of 5,000 kw. each, for the New South Wales Government Railways. Full particulars from Electrical Engineer's office, 61, Hunter Street, Sydney. This contract was advertised in the *Sydney Telegraph* of July 29th and the matter is referred to fully in our "Tramway Notes" to-day.

The *Australian Mining and Engineering Review* for August states that the Home Affairs Department will shortly invite tenders for the installation of an electric power plant at the Federal Capital site.

Launceston.—It is stated that Mr. A. G. M. Michell, consulting engineer, Melbourne, has recommended the installation of a horizontal steam turbine, direct coupled to a 300-kw. high-tension three-phase alternator and exciter, and two water-tube boilers, each capable of raising 8,000 lb. of steam per hour at a pressure of 160 lb. per square inch, with superheaters, &c. The cost will be £9,890, and an Australian engineering paper states that tenders for the plant will be invited immediately.

Austria.—September 19th. The authorities of the Austrian Northern Railway, in Vienna, are inviting tenders for an installation of electric lighting at the railway station at Floridsdorf.

The authorities of St. Veit, on the Glan River, in Carinthia, have decided to adopt the scheme of Prof. Wendelin, for the erection of a water power station and the institution of the electric light in the town, and are prepared to consider suitable offers from contractors.—*Der Elektrotechniker.*

September 25th.—Tenders are invited for the supply of 10 1,500-kg. capacity electric cranes and two of 3,000-kg. capacity for the Franz-Joseph Hafen at St. Audrea. Particulars of No. 3388 ex. 1911, K. K. Lagerhäuser, Trieste.

Batley.—Tenders for 3,000 tons of (*a*) best slack (*b*) smudge, for the electricity works.

Belgium.—La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply of the electrical connections required for the rails in connection with the light electric railways belonging to the company during the 12 months ending September, 1912.

Birmingham.—September 20th. Coal (85,000 tons), for a year, for the Corporation Electric Supply Department; R. A. Chattock, city electric engineer, 14, Dale End.

Bray (Ireland).—September 19th. 2,500 yd. of concentric, paper-insulated and lead-covered cable, 2,000 volts, for the U.D.C. See "Official Notices" September 8th.

Bristol.—October 2nd. One 10-ton and eight 2-ton high pedestal travelling jib cranes, electrically driven, Royal Edward Dock, Avonmouth, for the Docks Committee of the T.C. W. W. Squire, Engineer, Cumberland Road (returnable deposit of £5).

France.—The Chemins de Fer de l'Etat propose to acquire 450 electric motors for the electrification of the suburban tramways. Particulars from Le Service Electrique, 43, Rue de Rome, Paris.

Halifax.—September 26th. Electrical fittings for six months, for the B.G; A. T. Longbotham, clerk, Carlton Street.

Hastings.—October 18th. Electric lighting of the workhouse, Ore, for the B.G. See "Official Notices" to-day.

Hungary.—The authorities of Mór, in Hungary, have decided to erect a generating station at a cost of 195,000 marks, which will be offered on lease to the constructing firm. Ground will be provided free, the authorities stipulating for three arc and 180 glow lamps.

Keighley.—September 25th. Coal-handling plant, storage reservoir for 200,000 gallons of water, and two circulating pumps, for the Corporation Electricity Works. See "Official Notices" September 8th.

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" to-day.

Hackney.—The Electricity Committee is about to invite tenders for 100,000 pairs of white open-type arc lamp carbons.

September 27th. Extension of the telephone systems at the Guardians' buildings at Homerton. See "Official Notices" to-day.

Stratford, E.—Electric light installation at Artillery House, for the Essex Territorial Force Association. Col. F. F. Johnson, secretary, Bank Chambers, Chelmsford.

Manchester.—September 25th. The Corporation is inviting tenders for electrical machinery, plant, and wiring for Elm Street Cold Storage Warehouse. Specifications and forms of tender from the Superintendent, Markets Department, Town Hall.

October 4th.—One 4,000-4,500 kw. low-pressure exhaust type turbo-alternator, for the Corporation. See "Official Notices" to-day.

Radcliffe.—Proposed new fire alarm system, about £400.

September 18th.—Water softening and purifying plant at the electricity works for the U.D.C. Electrical Engineer.

South Africa.—Port Elizabeth.—October 19th. The T.C. requires tenders for the supply of (*a*) electric motors, and (*b*) electric motor starter panels. Specifications from the Municipal Electrical Engineer. Tenders to Town Clerk.

Spain.—September 20th. The Spanish Ministerio de Fomento, in Madrid, are inviting tenders for the concession for the construction and working of an electric tramway in the province of Guipuzcoa, from El Renteria to the French frontier.

September 29th.—Tenders are being invited by the municipal authorities, of Grazalema, for the concession for the electric lighting of the town during a period of 20 years.

September 30th.—The Ministry of Public Works (Fomento de Obras Publicas), Madrid, is prepared to receive tenders for the construction and working of an electric tram service from Renteria to the French frontier. Deposit, 8,832 pesetas.

York.—September 23rd. Supplies for a year, for the City Electricity Department. See "Official Notices" to-day.

CLOSED.

Australia.—We learn from the *Australian Mining Standard and Electrical Record* that the following contracts have been placed:—For the P.M.G., New South Wales, four electric adding machines (£620), and for the P.M.G., Victoria, two adding machines (£340), from the Burroughs Adding Machine Co.

For Queensland P.M.G.:—

Copper binders, sleeves, tapes, and 15 tons of phosphor-bronze wire at £75 10s. per ton.—Laurence & Hanson Electrical Co., Ltd.
Copper tapes.—British General Electric Co., Ltd.
Galvanised-steel wire.—Webster & Co., Ltd.
5,280 yards of cable, at £186 per mile.—W. T. Henley's Telegraph Works Co.

For the P.M.G., Victoria:—

Earth plates, screws, &c.—I.-R., G.-P. and Teleg. Works Co., Ltd., £144.
Magnets, microphones, &c.—J. Bartram & Son, £428.
Dessicating plant.—Cameron & Sutherland, £135.
350 Duplex translators.—Western Electric Co., £182.
Petrol-driven winch.—Lacy, Hulbert & Co., Ltd., £164.

For the N.S.W. Railway and Tramway Construction Branch, the contract for the welding of steel tramway rails for one year has been placed with the Australian Thermit Co., Ltd.

Blackburn.—The T.C. on September 7th approved of the following contracts:—

Wigan Coal and Iron Co., Ltd.—Steam coal for the electricity works.
Messrs. J. Wright & Co.—Water treatment plant for the electricity works.

Bradford.—The following tenders were recommended for acceptance by the City Council at Tuesday's meeting:—

Messrs. Babcock & Wilcox, Ltd.—Two water-tube boilers, stokers and superheaters, with steam and drain piping and accessories, for Valley Road electricity works, £3,995.
Messrs. Royce, Ltd.—12-ton electrically operated overhead travelling crane, £495.
Messrs. Ferranti, Ltd.—Extra-high-tension switchgear, for Valley Road Works, £295.

Buenos Ayres.—According to the *Review of the River Plate*, the tender of S. Motta for an electric light station at General Paz (province of Buenos Ayres) has been accepted.

Dudley.—The T.C. has accepted the tender of the Worthington Pump Co., at £390, for additions to the air and circulating pumps of the condenser plant at the generating station.

Dewsbury.—An order has been placed by the Corporation with the Union Cable Co. for ½ mile of ·1, ¼ mile of ·05, and ¼ mile of ·025 cable, at the inclusive price of £126.

France.—The French Post and Telegraph authorities in Paris have just placed a contract with Messrs. Geoffroy & Delorc, of that city, for the supply of 500 kilometres of rubber and fireproof cotton-covered copper wire with two conductors, and 70 kilometres with three conductors.

Gateshead.—Messrs. Chamberlain & Hookham, Ltd., have received an order from Gateshead for meters to equip all their cars—namely, 10.

Glasgow.—The T.C. Committee has recommended the acceptance of tenders from the following:—

Double cotton-covered wire.—London Electric Wire Co. & Smith's, Ltd.; and British Insulated and Helsby Cables, Ltd.
Scrap metal, &c., for disposal.—(*a*) Lead: Thos. B. Campbell & Sons, Ltd.; (*b*) copper, (*c*) brass turnings and borings, (*d*) vulcanised cable: R. M. Easdale & Co.

London.—The tender of Messrs. Falk, Stadelmann & Co. has been accepted by the Metropolitan Asylums Board for the supply of "Efesca" lamps to the Grove Hospital.

Nelson.—The T.C. on September 7th considered a report on the improvement of the draught of the electricity works' chimney. The tender of Messrs. Davidson & Co. was accepted for the supply of one 40-in. induced draught fan for fixing on the fluc.

Salford.—The T.C. has accepted the following tenders :—

Crompton & Co., Ltd.—Supply and erection of a continuous-current generator at Ladywell Sanatorium, £139.
Johnson & Phillips, Ltd.—Installation of electric light in Health and Water Offices, £124 and £12 for contingencies.
Messrs. Aiton & Co.—For cast-iron discharge pipes for circulating water for the electricity works, at £20.

The Electricity Committee has placed an order with the Clifton and Kearsley Coal Co., Ltd., for 20,000 tons, best washed slack, at 9s. 9d. per ton, and Messrs. Andrew Knowles & Sons, Ltd., for 10,500 tons, best washed slack, at 9s. 10d. per ton.

Stockport.—The T.C. has aecepted the following tenders ;

Messrs. McClure & Whitfield. Spare motor, £38 10s.
Dussek Bitumen Co. Bitumen, £5 10s. per ton.
Messrs. Evershed & Vignoles, Ltd.—Recording meter, £8 16s. 10d.
British Insulated and Helsby Cables, Ltd.—Trolley wire, 32-in. bonds, £8 18s. 6d. per 100 ; 8-in. bonds, £5 per 100.

War Office.—Messrs. Pritchetts & Gold, Ltd., have received an order from the War Office for a battery for the Royal Military College, Sandhurst.

Wolverhampton.—Subject to the sanction of the L.G.B. being obtained to the necessary loan, the T.C. has accepted the tender of Messrs. G. Cave & Son for the erection of the additions to the electricity generating station, Commercial Road. The Council has also, subject to the same sanction, accepted the following tenders for electrical machinery and apparatus :—

Chloride Electrical Storage Co.—230-cell storage battery, £9,260 ; maintenance, per annum, £670.
Phœnix Dynamo Manufacturing Co.—Motor-driven boosters, £1,590.
Electric Construction Co., Ltd.—Switchgear and instruments, £1,058 ; high and low-tension switchgear, £239.
Bruce Peebles & Co., Ltd.—Rotary converter, £1,060.

FORTHCOMING EVENTS.

Electrical Exhibition—Olympia.—Friday, September 22nd. At the Trocadero. At 7.30 p.m. Inaugural banquet.
Saturday, September 23rd.—Opening ceremony at Olympia.

NOTES.

Municipal Tramways Association.—The tenth annual Conference of this Association is to be held in Glasgow, on Wednesday, Thursday and Friday, September 27th, 28th and 29th. After the reception in the Council Chamber by the Lord Provost, Mr. J. Dalrymple, Glasgow's tramway manager, will deliver his Presidential address, and Councillor W. Nelson, sub-convener of the Glasgow Tramways Committee, will read a paper on "The Common Good of the City of Glasgow, its origin, history, and present position in relation to the Tramways Undertaking." After luncheon, Councillor J. H. Rodgers, of Newcastle, will read a paper on "Tramway Finances and Policy," the discussion on which will be opened by Mr. W. J. Squires, vice-chairman of the L.C.C. Highways Committee. In the evening of the first day there will be a dinner in the City Chambers. On Thursday, the meeting of the managers' section will be held in the Newlands Depôt, after which the Conference will resume there at 10.30 for papers, &c. Messrs. R. G. and J. G. Cunliffe, technical assistants to the Manchester Corporation Tramways, will read a paper on "Tramcar Meters," and Messrs. T. B. Goodyer and W. Clough will open the discussion. A report on "Tramway Track : Methods of Construction and Maintenance," by the representatives of Glasgow, Manchester and Leeds Corporation tramways will follow. Light luncheon and the annual business meeting having been duly dispatched, there will at 3.15 be a visit by reserved cars to Rouken Glen, and the Association dinner will take place at 7.45 p.m. at the Grosvenor Restaurant. Friday will be devoted to an excursion to Ayr and the land of Burns. The headquarters of the Association during the Conference will be at the Grand Hotel, Charing Cross. A handbook has been issued giving the foregoing and many other arrangements made in connection with the Congress for the comfort and convenience of members and visitors. Mr. A. R. Fearnley, Division Street, Sheffield, continues as secretary of the Association.

The National Electrical Manufacturers' Association (Incorporated).—The Council of the above Association announces that the proposals for the reorganisation of the work of the Association, which has been in contemplation for some considerable time, and with the details of which members are already familiar, have now been successfully carried through, and will shortly be put into effect. They include the alteration of the title of the Association (which will in future be known as "The British Electrical and Allied Manufacturers' Association, Incorporated)," the appointment of a new secretary, giving his whole time to the work of the Association (vice Mr. F. O. B. Hawes, resigned), and of a larger working staff ; the leasing of commodious offices in a central position ; certain necessary amendments of the constitution of the Association to meet the new conditions, including the revision of qualifications for members, associate members, and associates ; and alterations in the bases of subscription and voting powers. The new Secretary of the Association is Mr. D. N. Dunlop, who is already well known to the industry as the energetic sales manager of the British Westinghouse Co.'s supply department, manager of the publishing department, and superintendent of the Printing Bureau, at Trafford Park, Manchester.

Mr. Dunlop, who was unanimously elected at the meeting of th Council held on the 7th inst., has been empowered, as from tha date, to begin the reorganisation of the Association for its ne activities, the present secretary's time being entirely engaged i connection with the forthcoming Electrical Exhibition. M Dunlop, whose appointment dates as from January 1st, 1912, wi have the hearty goodwill and co-operation of every member of th industry. The present Council of the British Electrical and Allie Manufacturers' Association, and in particular, Mr. Nalder (chai man), and Mr. Longbottom (vice-chairman), are to be congratulate on their success in bringing members to realise the position o advantage which they occupy, and the importance of the wor which by their united efforts can be done to enhance the prosperit of the British electrical and allied industries. In wishing th Association increasing success, we commend it to the attention o every manufacturer who has not yet joined.

The Secretaryship of the National Electrica Manufacturers' Association.—In announcing that the abov position has now been filled, the Council of the National Electrica Manufacturers' Association (Incorporated) beg to return their be thanks to all those gentlemen who were good enough to respond t their recent advertisement inviting applications for it.

Educational Notes.—BATTERSEA POLYTECHNIC.—Th calendar for the new session, which opens on Monday, Se tember 25th, gives full details of the numerous courses and classe held at the institution. In the Day Technical College full tim courses are arranged in Mechanical and Electrical Engineerin covering a period of three years. Concurrently with the diplom courses, students can take the degree courses in Science an Engineering of the University of London. In addition to th scholarships already existing, the governing body has institute one of £40 a year for three years, tenable at the Day Technic College. Full evening courses are provided in the Departments Mechanical and Electrical Engineering, &c. The governing bod has arranged a course of lectures on Illuminating Engineerin In the Electrical Engineering Department special attention being given to the subject of electric traction, and new machine and apparatus are being purchased in order that the subject ma be more fully and thoroughly dealt with. See our advertisemen pages to-day.

L.C.C. SCHOOL OF BUILDING (Brixton).—A new departure ha been made at this School, in the shape of a special course lectures on Structural Engineering and Reinforced Concrete, b Mr. H. K. Dyson. The course was inaugurated last winter, an proved so successful that its scope has been extended, and practic work has been added to the lecture course. The session begins o September 18th, and particulars can be obtained from the Principa Mr. H. W. Richards.

EAST LONDON COLLEGE.—Session 1911-12. Complete courses instruction in civil, mechanical and electrical engineering ar given. See our advertisement pages to-day.

THE POLYTECHNIC (Regent Street).—The new session opens Monday, September 25th ; a special course of lectures will be give by specialists on Illuminating Engineering, and courses in Ele tricity and Electrical Engineering are provided.

Water-Power in Sweden : The Effects of th Drought.—Although lying so far north, Sweden has been feelin the effects of the general drought, and the dwindling of mountai lakes, streams and waterfalls is having an effect on the working o the electric power stations established at various points. Thus, th power station at Yngeredsfors, in the Varberg district, has had t put the steam reserve station in operation, and the Ramnäs chai works have had to stop working during a portion of the week owing to the lowness of the water in Lake Kolbäck. This is als the case with the works at Fagersta, Surahammar and Hallsta hammar. The wood-pulp mills are especially affected, and th effect of the partial working which has been occasioned is show in the prices of wood pulp, which have risen considerabl on this account. The latest report is that the power station a Falkenberg has stopped, and the fear is general that this will b followed by further stoppages in many other parts of Sweden Many of the large rivers in central Sweden are so low that onl the most abundant rains can ward off a general disaster.—*Affärsvärlden.*

Electric Power for Bombay Mills.—*Commercia Intelligence* states that the Tata Hydro-Electric Supply Co., Bombay has received 24 applications from local mill owners for the supply of electric power aggregating about 27,000 H.P.

Train Lighting.—A financial paper quotes the *Frankfürter Zeitung* to the effect that in future passenger cars of the Prussian Railways will be lighted by electric light instead of gas. Each car will be equipped with a dynamo of the Rosenberg patent.

Reunion of Old Cromptonians.—A few of those associated with Messrs. Crompton & Co. in the earlier days have arranged to hold a dinner of Old Cromptonians in London on October 14th next, with the object of giving those who were at one time closely associated, and have since drifted apart, an opportunity of renewing friendships and of spending a pleasant evening. The arrangements are in the hands of a Committee consisting of Messrs. W. A. Chamen, S. Dobson, E. J. Fox, H. M. Leaf, W. L. Pakenham, C. Peel and A. H. Pott, and already some 75 old members have intimated their intention of being present at the dinner. Col. R. E. B. Crompton, C.B., has accepted the Committee's invitation to preside at the dinner, and Mr. W. A. Chamen will act as vice-chairman.

Anyone who has been associated with the firm, and has not already received notice of the dinner, can obtain full particulars by applying to the hon. sec., Mr. E. J. Fox, Winchester House, Old Broad Street. E.C.

International Electrical Congress. — On Sunday last the International Congress on Electrical Appliances was opened. The inaugural address was delivered by Signor Calissano, Minister of Posts and Telegraphs, who was elected honorary President of the Congress. The honorary vice-presidents include the British, American, French, German, Swiss, Belgian and Danish representatives.

At the opening meeting the following were among those appointed to offices in connection with the Congress :—

As Vice-Presidents of the Congress.—Mr. Alexander Siemens, Dr. S. P. Thompson, F.R.S.

As President of the Section of Telegraphy and Telephony.—Major W. A. J. O'Meara, C.M.G. engineer-in-chief, G.P.O.

As Vice-President of the Section for Accumulators and Electrochemistry.—Mr. W. Duddell, F.R.S.

Engineering Exhibition at Baku.—The *Financial News* states on the authority of Dr. P. Dvorkovitz, 1, Broad Street Place, E.C., that the Baku branch of the Imperial Russian Technical Society has decided to organise an international exhibition of internal combustion engines, automobiles, air compressors, electrical motors, &c., to be held next April at Baku, Russia. The exhibition is to be under the patronage of the Viceroy of the Caucasus, and, with the intention of securing the representation of as many British manufacturers as possible, the Russian Government has arranged special concessions. Exhibits will be admitted duty free into Russia, and on the Batoum-Baku Railway line a specially low charge has been arranged, while, after the exhibition, the exhibits will be delivered from Baku to the exporting port of Batoum free of all railway freight charges. The exhibition is to remain open for six weeks ; Dr. Dvorkovitz is the official honorary representative.

German Labour Troubles.—A Reuter dispatch from Berlin last week stated that, at a meeting of electricians affiliated with the German Metal Workers' Union, it was decided, by 504 votes to 37, to stop work everywhere on the 5th inst. on the ground that the employers refused to enter into negotiations with the Union for the drafting of an agreement governing a scale of wages.

One Electric Sign in Leeds.—The following notes, culled from a recent issue of the *Southern Electrician* (Georgia, U.S.A.), should provide food for thought to business houses, electrical contractors and supply authorities alike, in Leeds :—

"The city of Leeds is lacking in modern electric display signs. There is only one sign of that order. There are many of the stationary-light style, enclosed or open, but the attractive display signs of most progressive cities are not seen. *Some American concern might find it profitable to develop this field.*" (The italics are our own.)

"The streets of the business section are somewhat narrow and congested, and when stores are closed are dark and dismal in appearance. The electric lighting system is owned by the Corporation, but it does not seem to have sought increased business. The Corporation also owns the gas plant, which may explain a continued use of gas where electricity would be more beneficial."

These two short paragraphs constitute sweeping indictment, much of which is fully justified, though we believe the implied reproach on the staff of the electricity department is undeserved. Confining our attention to the lack of modern electric signs alone, it is surely time that all our great cities took up a form of advertisement which is widely adopted even by the smallest stores in the smallest towns of the States.

Electricity in Agriculture.—It is stated that a portion of the sum of £50,000 a year allotted to the Board of Agriculture by the Development Commissioners for agricultural research will be devoted to experiments on the use of electricity in agriculture. It is to be hoped that the statement is correct, for, in view of the important results already obtained, there are strong grounds for believing that, in many cases valuable improvements can be effected in the yield of crops.

Absolute Zero—Nearly.—Experiments carried out by Prof. Kamerlingh Onnes on the electrical resistance of mercury, at the very low temperatures obtained when liquid helium boils under reduced pressure, have shown remarkable results. The resistance of the mercury filament used was 173 ohms at 0° C. ; at an absolute temperature of 3°, the resistance was less than 3 microhms, suggesting that at absolute zero the resistance would be practically zero. The resistance of constantan, however, remained practically constant between the same limits of temperature.

Honour to Ampère.—In the village of Poleymeux, in the Rhone department, a bronze statue has been set up in honour of Ampère. The inventor is represented standing in an attitude of meditation, the right hand raised to the forehead, the left clenched. On the side is inscribed "La Science," suggestive of the subject of his meditation. The statue has been erected by a committee under the sponsorship of the Association francaise pour l'Avancement de la Science and other learned societies and local public bodies.—*Revue Pratique de l'Electricité.*

Fatality.—The body of a young electrician named A. Wilson, of the Modder B Gold Mine, was recently found in a drain-pipe hole near New Kleinfontein Gold Mine, Benoni, Transvaal. Alongside the hole was Wilson's bicycle, and it was evident that whilst cycling along the footpath in the direction of the Modder B Gold Mine, Wilson had fallen into this hole and broken his neck.

Manufacturing in Russia.—According to the *Elektrotechniker*, there has been in Warsaw for a number of years a steady inquiry for dynamos of various capacities. It is thought that there is a good opening there for the establishment of a manufacturing branch of a large firm, and enterprising English houses might do well to note the fact.

Institution and Lecture Notes.—At a joint meeting of the Scottish branches of the Association of Mining Electrical Engineers and the National Association of Colliery Managers, a paper was read by Mr. A. B. Muirhead, Lenzie, on "Exhaust Steam Utilisation." The author at the outset submitted that it was not sound policy to keep one more boiler in use at any colliery than was absolutely necessary, even if fuel had little value ; that it was a mistake to purchase electrical energy for power purposes, if it could be generated at much less cost on the colliery ; and that it did not pay, in many cases, to generate electric power from live steam if exhaust steam was available, and could be utilised for the purpose. He stated that the steam consumption of the mixed-pressure turbine, when using live steam only, would compare favourably with that of the purely live-steam type. If they took a unit of 300-KW. capacity running at 3,000 R.P.M., supplied with live steam at a pressure of 75 lb. per sq. in., and exhausting into a vacuum of 27·5 in., they found the steam consumption in lb. per KW.-hour of "live" and "mixed-pressure" turbines, as under :—

	Live steam turbine.	Mixed-pressure turbine.
Full load	25·7 lb. per KW.-hour.	27 lb. per KW.-hour.
Three-quarter load	28·2 „ „	29·5 „ „
Half load	31·6 „ „	33·6 „ „

The following table gave the difference in steam consumption between a purely low-pressure and a mixed-pressure turbine of 300-KW. capacity, with exhaust steam at a pressure of 16 lb. absolute, and a vacuum of 27·5 in.

	Low pressure.	Mixed-pressure.
Full load	34·5 lb. per KW.-hour.	36 lb. per KW.-hour.
Three-quarter load	36·3 „ „	38·5 „ „
Half load	39·9 „ „	43·5 „ „

It was generally accepted that this size of unit was somewhat uneconomical in steam consumption, as well as high in first cost, but a marked improvement in both directions had lately been effected. As the undernoted table would show, this size of unit compared very favourably with a totally-enclosed high-speed standard 300-KW. three-crank compound reciprocating unit, supplied with steam at a pressure of 75 lb. per sq. in., and exhausting into a vacuum of 20 in.

Full load	30·34 lb. per KW.-hour.
Three-quarter load...	33·3 lb. „ „
Half load	37·9 lb. „ „

Finally, a fourth table showed the steam consumption of a 600-KW. mixed-pressure turbine at 3,000 R.P.M. when supplied with live steam at a pressure of 70 lb. per sq. in. and exhaust steam at 16 lb. per sq. in. absolute, exhausting into a vacuum of 28 in. under live steam conditions and 27·5 in. under exhaust steam conditions : —

	Live steam.	Exhaust steam.
Full load	23·5 lb. per KW.-hour	33·8 lb. per KW-hour
Three-quarter load ...	25 „ „	36·3 „ „
Half load	28 „ „	42·8 „ „

Fires.—The *Times* states that a telegram was received from Johannesburg on Saturday morning by the London secretary of the Roodepoort United Main Reef Co., stating that a fire in the transformer house caused a stoppage for 10 hours of the battery on Friday, but that now all is working well again.

The *Daily Telegraph* reports that on Monday evening a fire occurred at the London County Council generating station, Prestons Road, Blackwall, where a long gallery, used for conveying electric wires, was damaged before the brigade extinguished the outbreak with one hydrant, a chemical extincteur and sand.

It is reported that at 7 p.m. on Monday, traffic in the Blackwall Tunnel was brought to a standstill through fusion of electric light wires throwing the place into darkness while thousands of workers were wending their way homewards, and while many vehicles were passing through. When the tunnel had been emptied of its groping traffic, police had to guard the entrances at both ends. The reader will probably be able to connect this occurrence with the fire mentioned in the previous paragraph.

The reports regarding the fire which occurred on Monday at the premises of the Imperial Lighting Co. appear to have been exaggerated in the daily Press. We are informed that the fire which occurred at their Pocock Street premises was practically confined to the packing department. The damage was limited to a large quantity of electrical signs and illuminating material, intended for the Delhi Durbar. As the wood-working and other shops escaped with very little damage, all this material will be speedily replaced. The whole of the machinery was running again at midday on Tuesday, and consequently business will be carried on as usual

Appointments Vacant.—Two assistant electrical engineers, for the Government gun-carriage factory, Jubbulpore, and the cordite factory, Aruvankadu, India, respectively (Rs. 280 per month). Junior mains assistant for the Bexley Council Tramways (27s. 6d.). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Electricity and Tramway Board has altered the salary of the general manager, MR. BLACKMORE, from £450 and commission, to £900 per annum, with two annual increments of £50 each, with consulting fees, half of which will be taken by the Board.

MR. CHARLES T. COLE, mains assistant at Dewsbury Corporation Electricity Works, having been appointed to a similar position at Devonport, has resigned. His successor is MR. S. H. FOWLES, of Newcastle-on-Tyne.

The Hackney Electricity Committee recommends that the minimum salary of the works superintendent be £200, rising by annual increments of £10 to £250. MR. T. DALBY at present occupies the position, and has reached the previous maximum of £200 in 1907. Advances are also being granted to MR. E. MATHEWS, testing engineer, and MR. E. WILKINSON, deputy generating engineer.

MR. H. N. WARBURTON, late manager of the Winchester Electricity Works, has presented a clock to MR. W. WILLIS, a member of the staff, as a token of appreciation of his services to the Electric Light and Power Co., Ltd. Mr. Willis is retaining his position under the T.C.

MR. BROWN, of Swindon, has been appointed to the position of chief assistant engineer recently vacant at the Ilkeston Corporation Electricity Department.

Tramway Officials.—The Tramways Committee of the Wolverhampton T.C. has appointed MR. J. OWEN SILVERS, of the Tudor Accumulator Co., Ltd., and formerly of the tramways staff, as tramways engineer and deputy general manager, at a salary of £200 per annum.

MR. HERBERT VICKERS, deputy manager and tramway engineer of the Wolverhampton Corporation Tramways, has been appointed chief assistant and electrical engineer to the Bournemouth Tramways, the vacancy being caused by the promotion of MR. IGNATIUS BULFIN to the general managership, vice MR. C. W. HILL, who has resigned. There were 160 applicants for the post.

On September 7th the marriage took place at Fulwood Road Wesleyan Church, Sheffield, of MR. H. E. YERBURY, son of the late Mr. E. G. Yerbury, of Bath, engineer in the Sheffield Corporation Tramways Department, and Miss Dorothy Elizabeth Wood, younger daughter of Mr. W. W. Wood, of Sandygate, Sheffield.

At Queen Street Church, Morley (Yorks.), on September 7th, the marriage took place of MR. DOUGLAS GRAY, manager of the Keighley Corporation Tramways, and Miss Elsie Mary Rhodes, eldest daughter of the Mayor of the borough, Ald. S. Rhodes.

General.—According to an Australian exchange, MR. G. W. CANSDELL HIRST has been appointed demonstrator in electrical engineering at the Sydney Technical College.

On the occasion of his marriage, MR. W. FOX RATHBONE has been presented by the staff of the Norwich Centre of the National Telephone Co. with fish knives and forks and a case of fish carvers and serviette rings, and by the Tunbridge Wells staff with a silver tea kettle and sugar tongs.

MR. E. E. SHARP, of Messrs. Venner & Co. and Messrs. Chamberlain & Hookham, sails to-day from Liverpool in the ss. *Virginian* for Canada, where he will carry out an extended business tour. Mr. Sharp will also visit the United States and attend the Street Railway Convention in October. We wish him all success and a safe return.

The marriage took place on September 9th, at St. Mark's Church, Wandsworth Common, of MR. P. S. HAWKINS, A.M.I.E.E., chief electrician at the Langham Hotel, and late senior charge engineer at the power station of the Woking Electric Supply Co., Ltd., and Edith Matilda, eldest daughter of Mr. and Mrs. John Miles, of Wandsworth Common.

After nearly four years' connection with the Electrical Co., Ltd., MR. E. O MULLER is about to join the Electrical Engineering and Agency Co., Ltd., of 109-111, New Oxford Street, in the capacity of a manager for the Motor and Cable Department. He will take up his new duties very shortly.

Obituary.—MR. W. DICK.—The death has occurred at Westcliff-on-Sea of Mr. Wm. Dick, founder in 1874 of the firm of Dick's Asbestos Co., of Canning Town and Fenchurch Street, E.C., Deceased gentleman was 65 years of age.

We regret to state that MR. T. HURRY RICHES, formerly a president of the Institution of Mechanical Engineers, died on September 4th, at the age of 65 years. Mr. Riches was locomotive superintendent of the Taff Vale Railway.

NEW COMPANIES REGISTERED.

Berg, Shepherd & Co., Ltd. (117,425).—This company was registered on August 28th, with a capital of £1,250 in 1,000 6 per cent. preferred shares of £1 each, and 5,000 deferred shares of 1s. each, to carry on the business of electrical engineers, contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of electric, magnetic, galvanic, railway, tramway and other apparatus, &c., to acquire the business carried on at 12 East Road, London, as J. Berg, and to adopt an agreement with J. Berg and F. H. Shepherd. The subscribers (with one deferred share each) are:—B. F. Bourno, 38, Old Jewry, E.C., clerk; A. C. Godsmark, 40, Hailsham Road, Streatham Hill, S.W., clerk. Private company. The number of directors is not to be less than three or more than five; the first are J. Herman, C. A. Lageson, J. Berg and F. H. Shepherd; qualification, £50 shares. Registered by Jenkins, Baker, Reynolds & Co., 38, Old Jewry, E.C.

Oriental M.T.C., Ltd. (117,469).—This company was registered on August 30th, with a capital of £10,000 in £1 shares (4,000 pref., 4,000 ordinary and 2,000 founders') to carry on the business of financiers, concessionaires, bankers, electricians, engineers, suppliers of electricity, &c., and to adopt an agreement with the Radio and Electric Power Co., Ltd. The subscribers (with one share each) are:—A. C. Grover, 102, Fenchurch Street, E.C., accountant; J. E. Burman, 207, Underhill Road, East Dulwich, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are W. J. Van Hoytema and A. C. Grover; qualification, 100 shares. Registered by A. J. Greenop & Co., Bush Lane House, Cannon Street, E.C.

Birmingham Private Telephone (New System) Co., Ltd. (117,443).—This company was registered on August 29th with a capital of £2,500 in £1 shares, to carry on (so far as they lawfully can) the business of makers, sellers, maintainers, and workers of private telephones, telegraph and electrical apparatus, &c. The subscribers (with one share each) are:—A. Gunz, 12, Livery Street, Birmingham, gentleman; F. T. Jackson, 64, Leadenhall Street, E.C., agent. Private company; the number of directors is not to be less than two or more than five; the first are A. Gunz (managing director and chairman), and F. T. Jackson. Registered office, 12, Livery Street, Birmingham.

Grosart & Kay, Ltd. (7,976).—This company was registered in Edinburgh on August 28th, with a capital of £1,000 in £1 shares, to acquire the business of Grosart & Kay, electrical and engineering merchants, Glasgow. The subscribers (with one share each) are:—W. J. Grosart, 101, St. Vincent Street, Glasgow, electrical engineering merchant; A. E. R. Copeland, 196, St. Vincent Street, Glasgow, chartered accountant. Private company. The first directors are W. J. Grosart and A. E. R. Copeland. Registered office, 196, St. Vincent Street, Glasgow.

Canadian Power Tramways Construction Syndicate, Ltd. (117,482).—This company was registered on August 31st, with a capital of £20,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—G. Dickson, 20, Lovelace Gardens, Southend, clerk; E. J. Alldis, 18, Macdonald Road, Forest Gate, E., clerk. Private company. Table "A" mainly applies. Registered office, 6, Prince Street, E.C.

Phœnix Telephone and Electric Works, Ltd. (117,562).—This company was registered on September 6th, with capital £50,000 in 49,000 6 per cent. preference shares of £1 each, and 11,800 ordinary "A," and 8,200 ordinary "B" shares of 1s. each, to carry on the business of manufacturers of electrical, mechanical, scientific, and telephonic apparatus and appliances, &c. The subscribers are:—E. J. Reid, 12, Wharf Road, N., engineer, 1,000 preference, and 333 "A" shares; H. Oppenheimer, 6, Chatsworth Road, Brondeshury, N.W., engineer, 1,200 "B" shares: S. Fordsham, 49, Finsbury Pavement, E.C., merchant, 1,000 "B" shares; Mrs. O. Epskin, 6, Milverton Road, Brondesbury Park, N.W., 3,000 "B" shares; Mrs. H. Stoog, Sunnyside, Pierremount Avenue, Broadstairs, 3,000 "B" shares; R. Tayler, 75-76, Lombard Street, E.C., director, 1,000 preference, and 333 "A" shares. Private company. The number of directors is not to be less than two or more than five; the first are E. J. Reid, H. Oppenheimer (chairman and managing director), and R. Tayler; qualification (except H. Oppenheimer), 1,000 preference shares; remuneration of managing director, £50 per annum; of other directors, £50. Registered office, 6, Chatsworth Road, Brondeshury, N.W.

Ingleby & Co., Ltd. (117,463).—This company was registered on August 30th, with a capital of £10,000 in £1 shares, to take over the business of electrical and general engineers carried on by J. C. B. Ingleby, H. S. Ingleby and E. C. Ingleby, at Elland Road, Leeds. The subscribers (with one share each) are:—J. C. B. Ingleby, Woodville, Old Park Road, Roundhay, Leeds, electrical and mechanical engineer; E. C. Ingleby, Woodville, Old Park Road, Roundhay, Leeds, electrical and civil engineer; H. S. Ingleby, Woodville, Old Park Road, Roundhay, Leeds, electrical and civil engineer. Private company. The number of directors is not to be less than two or more than five. The first are J. C. B. Ingleby, H. S. Ingleby and E. C. Ingleby; qualification, £500; remuneration, £15 per annum. Registered office, Elland Road, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Uxbridge and District Electric Supply Co., Ltd. (62,706).—A memorandum of satisfaction in full on or before August 15th, 1911, of mortgage debentures dated from September 26th, 1904, to January 28th, 1908, securing £50,000 has now been filed.

C. F. Casella & Co., Ltd. (106,869).—Issue on August 28th, 1911, of £500 debentures, part of a series of which particulars have already been filed.

Warren, Beattie & Co., Ltd. (70,585).—Charge on the company's undertaking and property, present and future, including uncalled capital, dated August 16th, 1911, to secure all moneys for which the mortgagees, as guarantors, may become liable to company's bankers. Holders: Dr. D. Drummond, 6, Savile Place, Newcastle-on-Tyne; and G. Jones, Meadowcroft, West Hartlepool. A memorandum of satisfaction in full on August 16th, 1911, of debentures dated May 7th, 1907, and November 30th, 1908, securing £1,500 and £500, has also been filed.

Metalite, Ltd. (110,919).—Mortgage on freehold hereditaments and premises at Osmaston, Derby, and the company's undertaking and property, present and future, including uncalled capital, dated August 11th, 1911, to secure all moneys due or to become due from the company to London, City and Midland Bank, Ltd.

Electric and General Investment Co., Ltd. (31,506).—Particulars of debentures to secure an amount not exceeding the uncalled capital (£201,500 to date), created August 18th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £22,500. Property charged: the company's undertaking and property, present and future, except uncalled capital. The debentures are issued to E. Garcke, of Ditton House near Maidenhead, and J. C. Bull, of 1, Great Winchester Street, E.C., as trustees for the holders of the stock to be created by virtue of the debentures.

T. E. Smith & Co., Ltd. (102,251).—Debenture dated August th, 1911, to secure £50, charged on the company's undertaking and property, resent and future, including uncalled capital. Holder: Mrs. M. Smith, 7, avendish Street, Keighley.

English Electrical Co., Ltd. (112,639).—Issue on August 29th, 11, of £750 debentures, part of a series of which partioulars have already en filed.

Veritys, Ltd. (49,784).—Return dated July 4th, filed July 6th, 11. Capital £210,000 in 7,000 5 per cent. cumulative first preference, 7,000 6 r cent. cumulative second preference and 6,980 ordinary shares of £10 each d 200 management shares of £1 each. 7,000 first preference, 7,000 second eference, 5,630 ordinary and 200 management shares taken up. £10 per share lled up on 4,670 first preference, 7,000 second preference and 1,430 ordinary, d £1 per share on 30 management. £131,030 paid. £65,470 considered as id on 2,330 first preference, 4,200 ordinary and 170 management. Mortgages d charges, £58,999.

Siemens Bros. Dynamo Works, Ltd. (88,928).—Return dated ne 29th, filed July 5th, 1911. Capital £300,000 in £1 shares. 20,000 shares ken up. £10 per share called up on 7. £70 paid. £199,930 considered as id on 19,993 shares. Mortgages and charges, £200,000.

Sheerness District Electric Power and Traction Co., Ltd. 5,749).—Return dated June 28th, filed September 4th, 1911. Capital £75,000 in 0 shares (2,500 preference). 5,000 ordinary and 2,473 preference shares taken). £10 per share called up. £74,730 paid. Mortgages and charges, £15,300.

Trafford Power and Light Supply (1902), Ltd. (72,601).—eturn dated June 13th, filed June 15th, 1911. Capital £80,920 in £1 shares 3,120 preference). All shares taken up. £80,920 paid. Mortgages and harges, £54,807 11s. 1d.

CITY NOTES.

German Electrical Companies.

HE E. H. Geist Elektrizitäts Gesellschaft, of Cologne-Zollstock, hich decided to go into liquidation last December, is still carrying n business for the purpose of disposing of stocks of raw and semi- inished materials and in anticipation of the sale of the works. ccording to the accounts for 1910-11, the loss of £24,000, which as ascertained on passing into liquidation, remains unchanged. nce this decision was arrived at, gross profits of £7,200 have been rned, although the amount has been absorbed by management penses and interest charges. The financial position of the com- ny has improved, and the abundance of orders recently received ld out the prospect of the further working up of the stocks of aterials.

The Brandenburg Carbide and Electricity Works Co., of Berlin, hich is an amalgamation of the Brandenburg Carbide Works and e East German Water Power Co., reports that the year 1910-11 as characterised by an improvement in the manufacture of carbide calcium and the supply of electrical energy. As a result of the rmation of a syndicate in the carbide industry, as was announced this journal some time ago, a moderate increase in prices has ken place, although it will only become fully operative when the iexpired contracts at low rates have been completed. The incipal portion of the manufacture of carbide was centred at the rager works of the Norsk Elektrokemisk Aktieselskab, in hristiania, which were constantly fully employed and yielded vourable results; and the Steinbusch Works were used for the me purpose. A portion of the output of carbide was worked up the East German Nitrogen of Lime Works, of Berlin, the shares which are held by the company. After referring to the com- ny's electric supply business, the report states that the gross ofits amounted to £9,400, as compared with £7,000 in 1909-10. ie net profits are returned at £5,700, as contrasted with £400 in e previous year, and it is proposed to pay a dividend of 4 per cent. the share capital of £175,000, as against no distribution in 09-10.

The report of Brown, Boveri & Co., of Mannheim, which is the bsidiary of the Swiss firm of the same name, states that the uation of business in 1910-11 was substantially the same as in e preceding year. Although the demand considerably increased, ices continued depressed owing to keen competition, and no indi- tions of any improvement were perceptible at the end of the year. ie unfavourable conditions specially affected the chief branch as presented by the construction of turbines. Many firms who had cently taken up the branch endeavoured to find a market under ly circumstances, whilst the low prices induced other firms to tend their plant so as to develop the output. This would result a further depreciation of prices, which had already fallen so low at probably no firm more than covered its prime costs at present. he recognition that large central stations were able to supply power such low rates that even large establishments found it advan- geous to obtain a supply from them, had led to the construction stations of still greater capacity and the erection of units as rge as possible in order to effect economies in the consumption of eam and in attendance. The company had, therefore, taken up ie building of steam turbines for outputs of from 15,000 to),000 H.P., and the Rhenish-Westphalian Electricity Works had dered a steam turbine of 22,500 H.P., and the Mark Electricity orks, of Hagen, one of 19,000 H.P. After referring to ship rbines, the report states that the other departments for elec- ical machinery were also abundantly provided with work, and the nstruction of small motors had been transferred to the works of ie Saarbruck Electricity Co., which had been acquired for the rpose of separating the manufacture of them from the Mannheim orks. Activity was also manifested in the improvement of the ngle-phase motor for traction purposes. The main-line electric comotive ordered by the Prussian State Railways for the Halle- itterfeld section, was almost completed, and negotiations were pro- eding in regard to other locomotives. Various railway installa- ons for mines and other transport purposes had been carried out.

The accounts show that the sum of £16,000 has been allocated to depreciation, as against £15,000 in 1909-10, and the net profits and balance forward amount to £17,500, as compared with £17,000 in the previous year. It is proposed to pay a dividend of 4 per cent. on the capital of £300,000, being the same rate as in 1909-10.

United Electric Car Co., Ltd., Preston.

THE report of the directors for the year ending June 30th, 1911, expresses regret that during the year there has been a great stagnation in the car-building trade of this country. The directors are pleased to state, however, that the works are now well employed. The works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £2,367, and charging £5,886 for depreciation, the profit for the year is £4,420, to which is added £4,062 brought from last year, making a total of £8,482; deduct preference dividend for the six months ending December 31st, 1910, £3,000, leaving an available balance of £5,482. The directors recommend that this amount be dealt with as follows:—To pay the preference dividend, less income-tax, for the half-year ending June 30th, 1911, £3,000, carrying forward £2,482. The Hadley and Trafford Park works, which have been an anxiety to the directors for some years past, have now been disposed of. The directors much regret that a loss of £46,171 has been incurred which they propose shall be written off as follows:—From general reserve £10,000; from depreciation reserve £36,171, leaving a balance of £7,329 standing to the credit of the depreciation reserve account.

A Sydney Electricity Supply Company. — The Electric Light and Power Supply Corporation, Ltd., Balmain, Sydney, held its half-yearly meeting in Sydney on August 4th. The directors' report, as abstracted in the *Australian Mining and Engineering Review*, states that the business of the company still continued to expand in a satisfactory manner. The consumers in Balmain totalled 299 and in Newtown 178. An agreement has been entered into with the municipality of Petersham for the supply of electric light and power, and several large applications had been received, and there is a good prospect of profitable business being obtained. Owing to the great increase in the demand for current, the directors had found it necessary to call for tenders for additional machinery, and these would be opened in the course of a few days. The large extension of the company's area of operations, together with the purchase of additional machinery, had necessitated an increase of capital, and a very satisfactory arrangement had been made with the company's bankers for advances from time to time as required up to £25,000, the security for this being a debenture for £25,000, issued subject to the same terms and conditions as the first issue of debentures for £25,000, excepting as to interest, which was to be at the rate current from time to time upon secured overdrafts. The gross profit for the half-year was £2,281. After the deduction of interest on debentures, £1,404, there was put to reserve for depreciation of assets £531, and a dividend at the rate of 5 per cent. per annum absorbed £1,075.

Halifax and Bermudas Cable Co., Ltd.—As summarised in a financial newspaper, the accounts for the year ended June 30th show a profit of £8,168. The directors recommended a further dividend of 2½ per cent., making 5 per cent. for the year, leaving £5,668 to be carried to credit of revenue account, raising it to £26,095 The report was adopted at the meeting held on Wednesday.

British Insulated and Helsby Cables, Ltd.—The directors are reported to have announced an interim dividend on the ordinary shares for the half-year ended June 30th at the rate of 8 per cent. per annum.

National Electric Construction Co., Ltd.—The directors' report states that the accounts for the year to December 31st, 1910, after deducting expenses of admistration, debenture interest, &c., and including £6,322 brought forward, show an available balance of £7,350, which is to be dealt with as follows:—Transfer to debenture redemption fund, £1,550; depreciation on three-wired installations, &c., £644, carrying forward £5,156. The annual meeting was held on Wednesday. Our report will appear next week.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—A dividend of 1¼ per cent. on the common shares for the quarter ending September 30th is announced.

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from September 18th to 30th for the preparation of interest warrants payable October 1st.

Canadian General Electric Co.—A dividend of 1¾ per cent. on the common stock for the three months to September 30th, being at the rate of 7 per cent. per annum, is announced.

Stock Exchange Notice.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—Cuban Telephone Co.—£441,620 5 per cent. first mortgage convertible bonds, Nos. 1 to 598 of £200, 6,501 to 9,413 of £100, 12,501 to 13,536 and 14,501 to 15,000 of £20 each.

MARKET QUOTATIONS.

Wednesday, September 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£82	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	68/-	3/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	8¾d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	8d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	7½d.	..
c „ Tube (brazed)	„	9d.	½d. inc.
c „ „ (solid drawn)	„	7½d.	½d. inc.
c „ Wire, basis	„	7d.	¼d. inc.
c Copper Tubes (brazed)	„	9⅜d.	..
c „ „ (solid drawn	„	8⅜d.	..
g „ Bars (best selected)	per ton	£71	..
g „ Sheet	„	£71	..
g „ Rod	„	£71	..
e „ (Electrolytic) Bars	„	£58	10/- dec.
e „ „ Sheets	„	£74	10/- dec.
e „ „ Rod	„	£61	10/- dec.
e „ „ H.C. Wire	per lb.	7⅜d.	..
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
b Gutta-peroba, fine	„	8/6	..
b India-rubber, Para fine	„	4/10½	½d. inc.
l Iron Pig (Cleveland warrants)	per ton	46/9	3d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£14 12 6 to £14 15	2/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8⅜d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£183 to £184	£9 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£33	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Dumbarton Burgh and County Tramways Co., Ltd.—Mr. George Balfour, the chairman, in moving the adoption of the report at the annual meeting held at Edinburgh, stated that the traffic receipts were fully £1,000 in excess of those for the preceding year, and that the increase had been obtained notwithstanding the fact that the receipts were behind those of the previous year until the middle of October. Since then the receipts had shown a very satisfactory increase, and judging from the results since the close of the financial year the improvement would be maintained.

Direct West India Cable Co., Ltd.—A financial daily says that for the year ended June 30th the accounts show a profit of £6,323, out of which the directors recommend a further dividend of 3 per cent., making 6 per cent. for the year, leaving a balance of £1,523 to be added to credit of revenue account, increasing it to £36,249. The annual meeting was held on Wednesday.

Manila Electric Railroad and Lighting Corporation, Ltd.—A dividend of 1¼ per cent. ($1.25 per share) for the quarter ending September 30th has been declared.

STOCKS AND SHARES.

Tuesday Evening.

For weeks past it has been our engaging occupation to write o consistent weakness in the Stock Exchange markets due to troubl abroad, trouble at home, and general want of confidence all round Unhappily, the tale has still to be continued this week. There ar really no fresh reasons to account for the shrinkage in value beyond the fact that the Berlin Bourse has been in the throes of semi-panic. This, due to the Morocco "incident," as it is politel termed—exercised a most depressing effect upon markets on thi side already disposed to flatten for any cause. Recovery of a mil type set in to-day, Tuesday, but the air remains charged wit nervousness and uncertainty.

How long this miserable state of affairs is likely to last is problem we must leave to prophets who have more knowledge tha ourselves. It may be remarked, however, that one of the mos curious phases in finance is the rapid manner in which confidenc returns time after time to the Stock Exchange, however sever may be the blow struck at its base by factors which owe thei influence to extrinsic rather than to intrinsic considerations. Th cheapness of money is in favour of the Stock Exchange when th foreign political situation becomes more settled, and that prices hav been driven down to unduly low levels is as evident, as it is pro bable they will recover when the atmosphere grows clearer all th way round.

The panic in Berlin already alluded to made itself felt in Ele trical stocks and shares through the medium of the Latin-Canadia group. Mexico Trams, Mexican Light and Power, Rio Tram Canadian Generals, and others of this group are largely held on th Continent. In the offices of the Berlin brokers one usually se reports, balance-sheets and other literature relating to some these companies. Hence, in the general bouleversement in Berli the prices of these securities got upset with Canadian Pacifics an other issues that have an inter-Bourse flavour. The flatness, how ever, did not last. Shares offered on behalf of Germany were take by Brussels as well as London, so that, on balance, the changes a mostly in favour of holders.

For instance, Mexico Trams regained a point after their drop 3 last week. Rio Trams at 115¾ are ½ higher on the week. Mexica Light and Power Common shows no change, although the pri fell at one time to 85, and the Preferred stock is ½ to the goo The company's first mortgage bonds, however, lost a point at 9 and Mexico Tramways 5 per cent. are ¾ lower at 96¾. Rio Tra way Mortgage bonds fell ½, and from these alterations it is obvio that the movement continues to which we have drawn attentio several times lately, namely, the realisation of sound investme stocks in order to pay for losses brought about by the fall in mo speculative markets.

The Home Railway market has had a very bad week, and pric are not far from the lowest levels from which they started on the big rise which culminated in the latter part of the spring this yea For example, London, Brighton and South Coast Deferred droppe to 92½ on Monday, which compares with the 113½ recorded at t end of April. Other steam stocks followed the same track. Ele trical railways, however, have kept comparatively firm. They, course, have had substantial falls, but, on balance this week, t changes are slight. Central London Ordinary at 67 is a poi lower; City and South London at 29½ shows no change. Distri Ordinary has gained ¼, after its drop of last week, and Metropolita keeps steady. East London Ordinary is down to 4½, but the fou Debenture stocks remain at 98, 40½, 16½ and 10, for the variou issues in their alphabetical order.

The feature in the Telegraph market has been liquidation Anglo-American Deferred Ordinary, though this had no ultima effect on balance, while the Preferred is ¼ down on the week Direct United States are ⅛ up. The Eastern group holds the im provements registered last week, except that China shares a 2s. 6d. down, and Reuters continue to creep up steadily. We India and Panama are a rather weaker market. Lively dealings Marconi shares ran the price up at one time to 47s. 6d., took down again to 45s., and on the week there is no change at 46s. 3d.

National Telephone Deferred shed a point to 117½, busine having been marked at 116 this week. The Third Preference ke firm at 5 7/16, and the other issues are unchanged. America Telephone and Telegraph Capital stock, in spite of the slump American Rails, shows a rise of 1, and the only quotable alteration in the South American Telephone descriptions are falls of 1/16 Oriental Ordinary and United River Plate Ordinary. Angl Portuguese Telephone 5 per cent. Debenture stock has started recover the interest deducted on August 31st, and is a point to th good.

The changes in English electricity supply shares are small, bu rather against holders. For instance, Brompton Ordinary an County Preference each lost ⅛, and Westminsters fell 3/16, whil Urban Preference and Edmundson's Preference have not recovere any of the fall of last week. County Second Debenture, however rose ½, and it is in these Debenture stocks that firmness is chiefl noticeable. The list is exceedingly quiet as a whole, and busines remains at a minimum. Nor is there much doing amongst manu facturing shares. Here, again, the difficulty is to find goo Debenture stocks yielding a reasonable rate of interest. Castne Kellner Debenture rose 1½, and for several other issues there ar buying orders which cannot be satisfied. Shares, however, are dul Callender's Ordinary eased off to 9¼. Aron Ordinary shows a loss o 7½d., and a seller of British Westinghouse Preference put the pric down to 5s. middle. A hardening tendency in the price of ra rubber is reflected in very steady quotations for the leading rubbe shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5⅛	5⅛	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7⅝ — 8⅛	— ⅛	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅜ — 7⅝	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5	3⅜ — 4½	..	5 19 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4⅛	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½ xd	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11⅜ — 12¼ xd	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅝	..	6 7 0
Do. 6 % Pref.	10	6	6	10¾ — 11¼	— ⅛	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100½—103½	+ ½	4 7 0
Edmundson's, Ord.	5	Nil	Nil	1/2 — 3/4	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	5½	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	10)	4½	4½	95 — 98	..	4 11 10
Hove	5	8½	9	6⅞ — 7⅜	..	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅜ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅞ xd	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾ — 4½	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7¼	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 — 1 1/8 xd	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87⅜ — 89⅜	..	5 0 7
Westminster, Ord.	5	10	10	7½ — 8	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	— 3/16	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜ xd	+ ⅛	5 6 8
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4¼ — 5¼ xd	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	105 —110	—2	6 7 3
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	3/4 — 7/8	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85 — 87 xd	..	5 14 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	7/32 — 9/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101¼—103½	..	4 16 7
Madras, Ord.	5	Nil	..	2¾ — 3¼	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87½ — 89½	— ¼	5 11 9
Mexican Lt. & Power, Common	$100	4	4	86 — 88	..	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	106½—108½	+ ½	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	—1	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	— ½	5 11 1
Montreal, Lt., H. and Power	$100	6	7	165 —170	..	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 41	..	12 3 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	114 —116	..	3 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	+1	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	+ 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105 —107 xd	..	5 12 2

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7¾	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98½—100½	..	4 19 6
American Telep. & Teleg., Cap.	$100	8	8	137 —139	+1	5 15 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3⅞	67½ — 69½	..	5 7 11
Do. 6 % Pref.	Do.	6	6	111½—112½	— ½	5 6 8
Do. Def.	Do.	25/-	30/-	24¼ — 25	..	6 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103 xd	+1	4 17 1
Chili Telephone	5	8	7	6 15/16 — 7 3/16	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10½ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅜ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4¼	4½	7⅞ — 8⅜	+ ⅛	5 7 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 3½ % Prcf. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102 —104	..	3 16 11
Eastern Extension	10	7	7	13½ — 14	— ⅛	5 0 0
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10⅝ — 11⅛	..	5 5 7
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	30½ — 31½	— ½	5 14 3
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	86 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	76 — 78	..	5 2 7
Marconi's Wireless Telegraph	1	Nil	Nil	2¼ — 2⅜	..	..
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	116 —119	—1	5 0 10
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 7/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	98½—100½	..	3 9 8
Do. 4 % Deb.	Do	4	4	98½—100½	..	3 19 7
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1 5/16 — 1 7/16	— 1/16	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5	8¾ — 9¼	+ ⅛	4 3 9
Submarine Cables Trust	Cert.	6	6	132 —135	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16 — 7 5/16	— 1/16	5 7 7
Do. 5 % Cum. Prcf.	5	5	5	5½ — 5¾	..	4 10 11
West Coast of America	2½	2½	2½	1⅞ — 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2½ — 2⅞	..	2 14 7
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 12th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/4		Nil
Do. 5 % Pref.	1	5	5	3/8 — 3/4		6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83		5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	3/4 — 1¼		Nil
Do. 6 % Pref.	10	1½	1½	3 3/32 — 3 5/32		3 17 5
Do. 5 % Deb.	100	5	5	93 — 96		5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	1	5 15 5
Central London Railway, Ord.	100	3	3	66 — 68	1	4 8 3
Do. Pref.	100	4	4	85 — 87		4 12 6
Do. Def.	100	2	2	49 — 51		3 18 5
Do. 4 % Deb.	100	4	4	102 —104		3 16 11
City & South London, Ord.	100	1¾	1½	29 —30		5 0 0
Do. 5 % Pref., 1891	100	5	5	108 —110		4 11 0
Do. Do. 1896	100	5	5	104 —106		4 14 4
Do. Do. 1901	100	5	5	103 —105		4 15 3
Do. Do. 1903	100	5	5	102 —104		4 16 2
Do. 4 % Deb.	100	4	4	102 —104		3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 1/32 — 12 1/32		4 16 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1 1/8		Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..		Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80		5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2 3/4 — 3		4 3 4
Do. 4 % Deb.	100	4	4	77 — 82		4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82		6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98		4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3 1/32 — 3 3/32		Nil
Do. 4 % Deb.	100	4	4	72 — 76	+1½	5 5 3
Metropolitan Railway Consol.	100	1	1⅜	43 — 43½		3 3
Do. Surplus Lands	100	2⅜	2⅜	64 — 66		4 3
Do. 3½ % Deb.	100	3½	3½	92 — 4		3 14
Do. 3½ % Pref.	100	3½	3½	88 — 90		3 17
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89		3 18
Metropolitan District Ord.	100	Nil	Nil	24 — 24½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	145 —147		4 1
Do. 4 % Deb.	100	4	4	96 — 98		4 1
Do. 4 % Prior Lien	100	4	4	100 —102		3 18
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	1	3 14
Do. 3½ % Gtd.	100	3½	3½	74 — 76		4 9
Metropolitan Elec. Trams, Ord.	1	5	5½	7/8 — 1 1/32		5 6
Do. Def.	1	Nil	Nil	3/32 — 5/32	— 1/32	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1		5 0
Do. 4½ % Deb.	100	4½	4½	99 —101		4 9
Do. 5 % Deb.	100	5	5	102 —104		4 16
Potteries, Ord.	1	2	2	7/32 — 11/32		
Do. 5 % Pref.	1	5	5	3/4 — 3 1/32 xd		7 12
Do. 4½ % Deb.	100	4½	4½	88 — 91		5 18
South Metro. Trams, 6 % Pref.	1	3	6	1/32 — 1/32		10 3
Do. 4 % Deb.	100	4	4	73 — 78		5 15
Underground Elec. Railways 5 % Prior Lien		5	5			4 18
Do. 4½ % Bonds	100	4½	4½	98 —100		4 10
Do. 6 % Income	100	Nil	1	59 — 61		1 12
Do. Power House Debs.	100	..	4	101 —103		3 17
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/4		Nil
Do. 6 % Pref.	5	Nil	Nil	2 3/4 — 2 7/8		Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85		5 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16 — 5 5/16		5 3 6
Do. 2nd Pref.	5	5	5	4 3/4 — 5		5 0 0
Do. 4 % Deb.	100	4	4	94 — 96		4 8 4
Do. 4½ % Deb.	100	4½	4½	101 —103		4 7 5
Do. 5 % Deb.	100	5	5	101 —103		4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105		4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11 1/4		5 6 8
Do. 4½ % Deb.	100	4½	4½	96 1/2 — 98 1/2		4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99		5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6 7/8 — 7 1/8		5 12 3
Do. 5 % Pref.	5	5	5	5 — 5 1/8		4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105		4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	137 —141		5 13 6
Do. Pref. Ord.	100	6	6	119 —123		4 17 7
Do. 5 % Pref.	100	5	5	106 —109		4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103		4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104		4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	103 1/2 —105 1/2	+ ½	4 5 4
Calcutta Trams, Ord.	5	4½	6	5 3/4 — 6 1/4		4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/4		4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105		4 5 9
Cape Electric Trams	1	Nil	Nil	7/16 — 9/16		Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 1/8		4 12 6
Do. 4 % Deb.	100	5	5	95 — 98		5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100		5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103		4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	3/16 — 5/16		Nil
Do. 5 % A Deb.	100	5	5	92 1/2 — 95 1/2		5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67		7 9 3
La Plata Elec. Trms, Prf.	1	6	6	1 3/32 — 1 1/8		5 13
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1 1/8		4 8
Do. 6 % Pref.	1	6	6	1 — 1 1/4		4 16
Do. 5 % Deb.	100	5	5	97 —101		4 19
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98		5 2
Manaos Trams & Lt., 1st Deb.	100	..	5	88 — 91		5 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	+ ¼	5 0
Mexico Trams Com.	$100	7	7	117 —119	+1	5 17
Do. Gen. Con. 5 % Bonds	..	5	5	96 1/4 — 97 1/4 xd	— ¾	5 2
Do. 6 % Bonds	100	6	6	98 3/4 —100 1/2		5 16
Para Elec. Rlys. & Lt., Ord.	5	..	10	6 7/8 — 7 1/4 xd		6 17
Do. 6 % Pref.	5	6	6	5 1/8 — 5 3/8 xd		5 6
Do. 5 % 1st Deb.	100	5	5	99 1/2 —101 1/2		4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1 3/16 — 1 5/16 xd		2 7
Do. 5 % 1st Deb.	100	5	5	101 1/2 —103 1/2		4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 3/4 — 5 7/8		5 6
Do. 4½ % 1st Deb.	100	4½	4½	98 —101		4 9
Rio de Janeiro Trams	$100	1	4½	115 1/4 —116 1/4	+ ½	3 17
Do. 1st Mort. 5 % Bonds	..	5	5	101 1/4 —102 1/4		4 17
Do. 5 % Mort. Bonds	100	5	5	97 1/2 — 98 1/2	— ½	5 1
Sao Paulo Tram, Lt. and P.	$100	10	10	177 —180		5 11
Do. 5 % 1st Deb.	$500	5	5	102 1/2 —104 1/2		4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87		5 15
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 1/2 — 97 1/2		5 2
Un. Elec. Trams Monte Video	5	5	6	5 3/4 — 6		5 0
Do. 6 % Pref.	5	6	6	5 — 5 1/2		5 3
Do. 5 % 1st Deb.	100	5	5	102 —105		4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109		4 2

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	1/32 — 3/32	— 1/32	Nil
Do. 6 % Pref.	1	12	9	1 1/16 — 1 3/32		7 7 8
Babcock & Wilcox	1	24	26	5 3/4 — 5 7/8		4 14 6
Do. Pref.	1	6	6	1 3/4 — 1 7/8		4 0 0
B.I. & Helsby Cables	5	10	10	6 3/4 — 7 1/8		6 15 7
Do. Pref.	5	6	6	5 3/4 — 6 1/4		4 16 0
Do. Deb.	100	4½	4½	102 —104		4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97 xd		4 12 9
British Westinghouse, Pref.	3	Nil	Nil	1/8 — 3/8	— 1/8	Nil
Do. Deb.	100	4	4	59 — 62		6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104		5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-		Nil
Do. Pref.	1	Nil	Nil	5/- —6/-		Nil
Brush, Ord.	2	Nil	Nil	1/16 — 1/8		Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/8		Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61 xd		7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44		10 4 6
Callender's Cable	5	15	15	9 — 9 1/2	— 1/8	7 17 11
Do. Pref.	5	5	5	4 15/16 — 5 1/16		4 16 5
Do. Deb.	100	4½	4½	101 —103		4 7 5
Castner-Kellner	1	14	17½	3 1/2 — 3 5/8		4 17 0
Do. Deb.	100	4½	4½	103 —107	+1½	4 4 1
Crompton & Co.	3	Nil	Nil	1/8 — 3/8		Nil
Do. Deb.	100	5	5	57½ — 67½		7 8 2
Dick, Kerr	1	6	5	1 3/16 — 1 1/8		5 6
Do. Pref.	1	6	6	1 3/32 — 1 3/32		5 9
Do. Deb.	100	4½	4½	95 — 98		4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	3/8 — 1/2		Nil
Do. fully paid	5	Nil	Nil	1 3/4 — 2 3/8		Nil
Do. 4 % Deb.	100	4	4	67 — 71		5 12
Do. 5 % Second Deb.	100	5	5	78 — 81		6 3
Electric Construction	2	Nil	2½	2 3/32 — 2 5/32		6 8
Do. Pref.	2	7	7	1 13/16 — 1 15/16		7 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4		8 5
Do. Deb.	100	5	5	94 — 96		5 4
General Electric, Pref.	10	5	5	8 3/4 — 9		5 11
Do. Deb.	100	4	4	88 — 93		4 6
Henley's, Ord.	5	15	15	12 — 12 3/4 xd		5 17
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16 xd		4 5
Do. Deb.	100	4½	4½	106 1/2 —108 1/2		4 2
India-Rubber, G. & T.	10	10	10	13 — 15		6 13
Do. Pref.	10	5	5	9 7/8 — 10 3/8		4 16
Telegraph Construction	12	17½	20	34 1/2 — 36 1/2		6 11
Do. Deb.	100	4	4	100 —102		3 18
Willans & Robinson	1	Nil	Nil	1/32 — 1/16		Nil
Do. Pref.	5	1½	Nil	1/2 — 7/8		Nil
Do. Deb.	100	4	4	55 — 65		6 3

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

COAL-CUTTING AND CONVEYING MACHINERY IN MINES.

There is no doubt that those responsible for the introduction of the Eight Hours' Act had some idea that the extended application of machinery for undercutting and handling coal would be accelerated, and make up for the less number of hours worked by the miners, and though this is the proper way of looking at the matter, one very serious consideration must never be overlooked, and that is the price of labour relatively to the selling price of the coal. Now the selling price is fixed by the market, and no coal merchant can say he will not take *less* than, say, 10s. per ton, if others are willing to take—and may be glad to get it—say, 8s. per ton, other things of course, being equal. Very well; then the colliery-owner has to pay out of this all his standing charges, such as rates and taxes, compensation, salaries of the staff, railway charges, royalty charges, dock dues, pumping costs, all machinery and other stores, and wages to the miners, before he can get a penny piece towards any return upon the capital invested in sinking and equipping the mine. As to the actual price of coal at the pit mouth, it may be of interest in passing to quote from the report of Mr. Gerrard, H.M. Inspector of Mines for the Manchester and Ireland District, who says: "Again the owners have courteously enabled me to give the value for almost the whole of the output, the value at the mine having been ascertained for 10,759,581 tons of coal. The values for several years past are:—

1910.	1909.	1908.	1907.	1906.
8s. 10·135d.	8s. 10·308d.	9s. 8·811d.	9s. 0·415d.	7s. 10·14d.
1905.	**1904.**	**1903.**	**1902.**	**1901.**
7s. 8·84d.	7s. 9·93d.	8s. 3·725d.	8s. 3·75d.	10s. 2·67d.

. . . ." Mr. Gerrard, in fact, gives the prices back to the year 1892, when the price averaged 7s. 6·4d.; but the above are interesting as showing the variation in price, and they will, perhaps, cause the town dweller to wonder why it is that he has to pay so much? This latter point is explained by the fact that the above price is the average obtained for the whole output, including all the various classes of coal. The price obtained for "round" coal will be much higher than that obtained for "nuts," and this again higher than for "small," and so on. Some collieries, in fact—especially those which depend upon the "house" coal trade—may make from five to twenty-five different sizes or classes of coal, to meet the various idiosyncrasies—for they are nothing more—of their customers, which all entails a serious cost to be borne by the colliery-owner.

Wages includes not only the cost of "hewing" or "getting" the coal—though it is this cost which is so much before the public—but also that of removing the coal from the face, hauling it to the pit bottom, winding it to the surface, cleaning and sorting, loading into trucks, and finally handing it over to the railway company for carriage to its destination. The cost of producing and raising to the surface may be anything from 4s. to 6s. or more per ton, and for handling on the surface from 1s. 6d. to 2s. 6d. per ton; hence one district in a mine may pay well, another may only be kept open at the expense of the other; hence very often the colliery-owner's lot is, like the policeman's, "not a happy one." In a hard coal seam the hewing price is, of course, higher than where the seam is soft, but this cost is again influenced by the thickness of the seam, and if the seam is both thin and hard, unless the quality is such that it will command a high enough price, it will not pay to work it. Here, then, is the opening for the introduction of machinery; but the first thing the owner has to consider is the capital cost and the probable return on the outlay. If the price of labour is high, there is a much better chance of securing this return than if labour is cheap and plentiful. The machine merely cuts the coal, after which it has to be got down and filled into tubs, and this can only be done by manual labour. Consequently, we have on one hand the cost of hewing, which is saved, and, on the other, interest on capital cost of machinery, plus cost of power, plus drivers' wages, plus cost of maintenance, and when these are added together it is found there is very little margin, in many cases none at all, and in others there is an actual loss.

As regards the remaining work there will, in all probability, be no saving in getting the coal down and filling, but on what is known as a "long wall" face this cost may be reduced by putting in conveyors so enabling the fillers to easily load the coal, and further reducing the cost of making "gateways" as a fewer number of these will be required. But, here again we have to take into account the capital cost, &c., of the conveyor plant. Finally, as the last advantage in favour of mechanical coal-getting, there will be a larger proportion of "round" coal which will raise the value of the product from the seam. There are, however, other factors which influence the question, such as the state of the roof and floor, whether the seam is troubled with numerous "faults" or "hitches," inclination of the seam, &c.; hence, taking everything into consideration, it is not to be wondered at that coal-cutting has not advanced as quickly as might have been anticipated.

If, however, the miners persist in their demands for a higher rate of wages and get them, as they probably may do, the selling price must increase, and this will increase the margin between the present rate for hand holing and machine holing, and will undoubtedly lead to a great extension of coal-cutting plant.

As regards the present position of coal-cutting plant, the reports of H.M. Inspectors of Mines for last year contain some interesting statistics, from which we extract the following:—In No. 1 District (Scotland) Mr. Walker reports "there is a large increase both in the number of coal-cutting machines and conveyors at work in the district, as compared with the previous year. The increase in the number of machines is no less than 82, and of conveyors 18." The following table shows the number and type of machines at work, together with the quantity of mineral obtained:—

Type of machine.	Number driven by		Statute tons cut.				Number of conveyors at coal face.
			Electricity.		Compressed air.		
	Electricity.	Compressed air.	Coal.	Other minerals.	Coal.	Other min'rls.	
			Tons.	Tons.	Tons.	Tons.	
Disk ...	269	114	3,177,220	45,857*	1,139,903	—	
Bar ...	137	—	1,295,665	2,051*	—	—	
Chain ...	19	—	96,094	—	—	—	
Percussive	—	41	—	—	115,284	—	92
Rotary heading	—	1	—	—	—	1,381†	
Totals ...	425	156	4,568,975	47,908	1,255,187	1,381	
	581		5,873,455				

* Ironstone. † Blacksand, ironstone.

The total output for the district of coal and ironstone was 41,983,547 tons, so that the proportion of machine-mined mineral is about one-seventh. The extra 82 machines were responsible for an increase of 1,403,491 tons. In addition to coal and ironstone, however, there was an output of 758,294 tons of fire-clay and 3,130,280 tons of oil shale, neither of which are machine-mined. There appears, therefore, to be a good opening for a machine to cut the oil shale, if one could be built powerful enough without being unduly massive and heavy. The following table shows the amount of mineral obtained per machine for the various types:—

Type.	Number.	Quantity of mineral.	
		Total for year.	Per machine.
Disk	483	4,362,980 tons	9,033 tons
Bar	137	1,297,716 ,,	9,473 ,,
Chain	19	96,094 ,,	5,057 ,,
Percussive ...	41	115,284 ,,	2,810 ,,
Rotary header ...	1	1,381 ,,	1,381 ,,

Carrying the analysis of the long-wall machines (which includes the first three) a step further, we find that the electrically-driven machines gave an output of about 865 tons of coal per machine more than the compressed-air-driven

machines, which speaks well for the mechanical efficiency of the electric machines, to say nothing of the very much greater increase in transmission and power efficiency, which would be at least 30 per cent. better than that of compressed air. As regards the percussive machines, these can only be driven by compressed air, as there is no satisfactory electrically-driven machine of this type. They are "heading" machines, and, like the rotary header, are only used for "narrow" workings.

In No. 2 District (Newcastle) the machines are only used in the coal mines, the number and type being shown in the following table :—

Type.	Number driven by		Statute tons of coal cut by		Number of conveyors at coal face.
	Electricity.	Compressed air.	Electricity.	Compressed air.	
Percussive	—	209	—	587,588	37
Disk ...	21	38	204,677	328,757	
Bar ...	10	—	140,900	—	
Chain ...	4	4	56,460	68,695	

Analysing this table, we get as the quantities obtained per machine :—

Compressed-air percussive machines	...	2,811 tons
Compressed-air disk machines	...	8,651 ,,
Electric ,, ,,	...	9,746 ,,
Average for ,, ,,	...	9,041 ,,
Electric-driven bar machines	...	14,090 ,,
Compressed-air chain machines	...	17,174 ,,
Electric ,, ,,	...	14,112 ,,
Average for ,, ,,	...	15,644 ,,

This is interesting as showing the apparent superiority of the "chain" and "bar" types of machine over the "disk," while each electrically-driven disk produces 1,095 tons more than the compressed-air machine.

In No. 3 District (Durham), Mr. Nicholson reports :— "Compared with the preceding year, there were 25 fewer machines driven by electricity and an increase of nine driven by compressed air. Electrically-driven machines have been taken out at eight collieries, and compressed air substituted in some cases," which is a little difficult to explain, but it looks as though the managers in this district have become somewhat nervous about using electricity in the "coal-face." It is very satisfactory to note, however, that "14 conveyors were used as compared to six in the previous year, and all were worked by electricity except two."

The following table gives particulars of the machines and output :—

Type.	Number driven by		Statute tons of coal cut by		Number of conveyors at coal face.	
	Electricity.	Compressed air.	Electricity.	Compressed air.	Electricity.	Compressed air.
Disk	20	18	194,997	125,423	12	2
Bar	11	11	120,435	105,633		
Chain ...	11	4	38,429	2,256		
Percussive ...	—	44	—	104,046		
Total	42	77	353,861	337,358	12	2

And the following shows the output per machine :—

Compressed-air percussive machines	...	2,364 tons
,, disk machines	...	6,968 ,,
Electric ,, ,,	...	9,750 ,,
Average for ,, ,,	...	8,359 ,,
Compressed-air bar ,,	...	9,603 ,,
Electric ,, ,,	...	10,949 ,,
Average for ,, ,,	...	10,276 ,,
Compressed-air chain ,,	...	3,439 ,,
Electric ,, ,,	...	546 ,,
Average for ,, ,,	...	1,992 ,,

The average for all the electrically-driven long-wall machines is 8,425 tons per machine, against 7,070 tons for the compressed-air machines, a difference of 1,355 tons per machine in favour of the former. It is only fair to add, however, that these figures may be somewhat misleading, there was very great industrial disturbance in both t and the Newcastle districts during the earlier part of year.

That machine mining will take the place of hand holing the cost of the latter increases, is supported by Mr. Pickeri H.M. Inspector of No. 4 District (Yorkshire and No Midland), who says :—"The increased cost and difficulty obtaining skilled miners has again resulted in the substi tion of coal-cutting machines and conveyors for hand labo As compared with the preceding year there was an incre of 71 in the number of machines used, and of 542,889 the number of tons raised. The number of face convey increased from 23 to 38." But probably the most import statement is the following :—"No doubt the use of c cutting machines and face conveyors working together ha tendency to *reduce* the dangers of falls of roof and si for it reduces the number of gate roads and requires s tematic work, with the corollary of systematic timberin The italics are ours, and seeing the largest proportion accidents in mines is from falls of sides and roof, this st ment, coming from such an authority as Mr. Pickeri should not be without effect when the question of introduc machines is being considered.

In addition to coal, "fire-clay" and "ganister" were a cut by machines, so that there should not be any gr difficulty in designing a machine to cut the Scotch oil sha the principal difficulty of which would, no doubt, encountered in the "clogging" of the cutters. Pickering, however, does not give the separate quanti cut by each separate type of machine, so that we are una to compare the work of these for this district. The follow table shows the number of machines at work and the t quantity of mineral obtained :—

Type.	No. driven by electricity.	No. driven by compressed air.	Statute tons cut.				Number of
			Electricity.	Compressed air.			
Bar ...	38	24	2,461,861 Coal	2,503,303 Coal	7,193 Fire-clay	18,676 Ganister	
Chain ...	52	10					
Disk ...	144	148					
Percussive	1	64					

It is interesting to note that one of the percuss machines is electrically-driven, and therefore it would h been all the more interesting if the quantities obtained fr each class of machine had been given. There was, ho ever, an increase of 21 electrically-driven machines a 50 compressed-air machines, and the output per mach works out to 10,476 tons each for the former, and 10,1 tons for the latter, showing 300 tons each in favour electrical machines.

In No. 5 (Manchester and Ireland) District, details of quantities mined by each class of machine are also not giv but the number of machines is as follows :—

	Disk.	Bar.	Chain.	Percussive.
Electrically-driven ...	3	7	2	—
Compressed air ...	28	3	1	109

The tons cut are : By electric machines, 100,812 ; by co pressed-air machines, 405,549 ; and 37 conveyors were work.

The 12 electric machines cut 8,401 tons per machine, against 2,876 for each compressed-air machine, the lown of the latter figure being due to the large proportion of p cussive machines.

In No. 6 District (Liverpool and North Wales) there i decrease in both the number of machines and the outpu there were 10 fewer machines at work and 50,013 less t were produced than in the year 1909. The number of el tric machines, however, increased from 13 to 18, and t reduction of 15 compressed-air machines was due "i large measure to the stoppage of mines in which coal cutt were employed." The number of conveyors increased fr one to five, but four of these were operated by man labour.

The types of machines employed are as follows :—

	Disk.	Bar.	Chain.	Percussive.
ctrically-driven	8	8	2	—
ns produced (coal)	37,948	61,392	5,250	—
mpressed air	66	7	1	37
ns produced (coal)	662,886	165,551	1,673	48.524
ns per electric machine ...	4,743	7,674	2,625	—
ns per compressed-air do. ...	10,044	23,650	1,673	1,312

Average for each electric-driven machine ... 5,810 tons
" " compressed-air " ... 7,916 "

The remarkable feature of these figures is the enormous put of 23,650 tons for each compressed-air "bar" type l-cutter.

In No. 7 District (South Wales) there were :—

	Disk.	Bar.	Chain.	Percussive.	Rotary heading.
ctrically-driven machines	10	34	7	—	—
ns of coal cut	66,860	205,555	45,600	—	—
mpressed-air machines	6	24	4	20	2
ns of coal cut	21,826	180,944	5,731	29,887	3,388
ns per electric machine	6,686	6,046	6,514	—	—
ns per compressed-air machine	3,637	7,540	1,433	1,494	1,694

Average per electric-driven machine, 6,235 tons.
Average per compressed-air machine, 4,317 tons.

In this case again, the lower average for the compressed- machines is due to the number of percussive machines th their low capacity. There were 50 coal face conveyors work.

In No. 8 District (Midland and Southern), in addition to al, 56,085 tons of ironstone were cut by electric machines, d in the following table this quantity is included in the nnage given :—

	Disk.	Bar.	Chain.	Percussive.	Rotary heading.
ectrically-driven machines	29	16	10	—	—
ns produced	349,039	142,061	114,297	—	—
ns per machine ...	12,036	8,880	11,430	—	—
mpressed-air machines	8	3	3	31	3
ns produced	109.716	59,560	44,452	64,414	3,102
ns per machine ...	13,714	19,853	14,814	2,078	1,094

Average for electrically-driven machines, 11,007 tons.
Average for compressed-air machines, 5,859 tons.

Here, again, the compressed-air-driven "bar" type achine scores with an average output of 19,853 tons. hy this should be so is difficult to understand, as the fact at it is driven by compressed air ought to have no bearing this point, and there is no reason why electrically-driven achines should not to have done equally well. No ubt, however, this point will be made much of by our mpressed-air friends. Probably the real explanation is at in both cases where large tonnage is shown the machines ere working in soft mineral.

There was only one face conveyor at work in No. 8 istrict.

It is, of course, impossible to take the above comparative gures as a basis on which the output of any type of long- all machine may be estimated, but they show clearly that here one type of machine will do well, another type may o very badly ; hence it is very necessary to take into careful onsideration all the conditions relating to the seam to be it. They do, however, show conclusively that electricity eminently suitable for the work of coal-cutting, and that herever long-wall machines can be installed they should ave preference over the percussive type of machines. In l probability, a machine of the latter type would consume iore power with its limited capacity than a long-wall achine with at least five times the capacity for output.

Joints for Flexibles and Hard Wires.—Referring to he article on page 396 on this subject by Mr. D. S. Munro, Mr. arsfield W. Martyn sends us some samples of flexibles joined to ard wires with the "M.P." cable connectors, to show how simply nd satisfactorily this work can be carried out in accordance with he Institution Wiring Rule No. 53. The connector is about the ame diameter as the 3/22 cable, and has a V-shaped vice grip at ach end which grips every strand, even all the strands of the lexible. The insulation of the connectors is carried out in the isual way. These "M.P." connectors are made in various sizes, nd any of our readers who are interested in this matter can btain a sample for inspection if they will write to Mr. Martyn, at 1, Pratt Street, Camden Town, London, N.W

REVIEWS.

The Ventilation of Electrical Machinery. By W. H. F. Murdoch. London : Whittaker & Co. Price 3s. net.

Whenever the transformation, from one form to another, of energy takes place, a certain percentage is inevitably found in a form which is more or less objectionable. In electrical machinery this "lost" energy largely appears in the form of heat, and one of the many problems the designer has to face is this production of wasteful heat. From the point of view of the designer, its objections are many ; by increasing the resistance of the copper conductors it affects the regulation of the machine in an adverse manner, it reduces insulation to matter not very dissimilar from dust, causes bearing troubles, and by expansion effects the buckling of commutators.

The advent of the turbine-driven high-speed generator has rendered this problem a very serious one. Roughly speaking, the output of a generator is proportional to its volume, *i.e.*, to the cube of its linear dimensions, but its radiating qualities are only proportional to its superficial area or the square of its linear dimensions. This fact, of course, accounts for the absolute necessity for the artificial cooling of transformers above a certain output, and while rotating machinery operates under better conditions, in that the windage caused assists the natural radiation in cooling the machine, a point is reached beyond which natural cooling is commercially impossible.

Bearing these facts in mind, there can be no question that a book written specially on the subject of ventilation for electrical machinery is a desideratum.

The book under consideration opens with an algebraic discussion as to the effect of increasing the output above the normal on the efficiency of a machine, and proves that, conditional to the ratio of the constant losses to the variable ones, an overload will improve the efficiency. By means of an adaptation of Fourier's method, it is proved that beyond a certain speed of an enclosed machine, the temperature rise is independent of the speed, which of course is not the case with open-type machines. Other interesting formulæ are worked out by means of elementary differential calculus.

The next section deals with natural cooling. The author gives Poisson's equation for the flow of heat in a fluid, but apparently has not been able to discover any solution of use in the subject under investigation. The reviewer is not surprised at this. There can be little doubt that though it is comparatively easy to form a partial differential equation for a given problem, it is very considerably more difficult to solve it for practical conditions, and the reviewer has found that the converse generally holds for ordinary differential equations. Some good information is given on the Stefan-Boltzman fourth power law of radiation, and so on. The book being written on the lines that it is, Lord Rayleigh's, Sir J. J. Thomson's and Planck's formulæ might have been given and described with advantage.

The following four pages treat of heating and cooling curves, and some interesting curves are given from tests on open, semi-enclosed and closed motors. The flow of heat through insulating coverings is well treated, and some of Dr. Russell's results taken from his important paper before the Physical Society in 1909 are quoted.

The next section discusses the ventilating effect of an armature. Various formulæ are given, and also some experimental data on a 7-B.H.P. variable speed motor. This is the longest and perhaps the best section in the book.

The ventilating action of fans occupies the succeeding 12 pages, three being taken up by dimensions, &c., of a series of fans, while the rest is largely mathematical. This chapter would have been considerably improved had a method of proportioning the blades commonly used on induction motor rotors been given.

The following section enters on a discussion as to the use of a refrigerator as a cooling agent, and the author "is very hopeful that refrigeration may form a useful adjunct to the generator." Personally, the reviewer thinks it will be rather a long time before we find an ammonia or carbonic acid refrigerator used to cool turbo-generators.

The concluding sections deal with practical methods of

ventilating armatures and data for thermal calculations. The former gives some more formulæ, a small amount of description, and six illustrations very obviously of the catalogue type. The data consist principally of four pages of elementary physics.

On page 4 the author states that at the present time the generator output limits the output of the turbine, owing to temperature rise. If by this he means that the turbine can carry larger overloads than the generator, the reviewer concurs, to a certain extent. It is true that, by admitting live steam to the low-pressure blading, enormous overloads can be carried, provided that not only the generator but the condenser can stand it. If generators of greater output are to be connected to existing turbines, then, in many cases, new condensers will be required.

Throughout, the book would have been improved by the inclusion of a fair number of numerical illustrations of the large number of formulæ proved and quoted. On the whole, the book is decidedly good. It gives a large number of methods and ideas, and a designer who possesses sufficient knowledge of elementary mathematical analysis will benefit by a perusal of it.—H.G.S.

Practical Electricity. By W. E. Ayrton, F.R.S. Revised and largely rewritten by T. Mather, F.R.S. London : Cassell & Co., Ltd. Price 9s. net.

Owing to the premature death of Prof. Ayrton, the second of the two volumes, in which it was intended to issue the second edition of "Practical Electricity," was not completed ; but it was arranged that the book should be rewritten and published in a single volume of somewhat larger size in the joint names of Profs. Ayrton and Mather. The result is the present work, which deals with the matters treated of in Vol. I of the 1896 edition, as well as those which the second volume was intended to contain. The arrangement of the book follows, in the main, that of the original work, but an attempt has been made to illustrate in greater detail the intimate relations that exist between electrical and mechanical quantities, and to show how the practical system of electrical units is founded on the C.G.S. system of mechanical units.

This mechanicalising of electrical text-books is becoming quite fashionable. Nearly every author claims it as his special prerogative. No doubt there is much to be said for it, but it holds the serious disadvantage that a student must be well up in mechanics before he is able to appreciate the analogy. Still, there can be little doubt that students of electrical science would do well to obtain a good grounding in the principles of applied mechanics, anterior to their study of electricity proper. It must be remembered that human beings have no special electrical sense. We possess senses of heat and cold, lightness and heaviness, &c. We have, from earliest infancy, an intuitive or sub-conscious appreciation of mechanical and physical properties, hence the study of these subjects is simply a matter of tabulating experiences. But when we come to electricity, the human mind is all at sea. It has nothing to work on, and must laboriously analyse and work up its quantitative results with no inborn experience to help. Therefore, the study of electrical phenomena by the aid of mechanical analogy is certainly justifiable, but the method involves some systematic study of applied mechanics in the first place.

The chief features in which the present work differs from the earlier editions are as follows : The experimental proof of Ohm's law is improved by using a zero electro-dynamometer to measure current strengths, instead of a calibrated galvanometer ; many new figures and new examples are included ; there are new chapters on the potentiometer, on the induction of electric currents, and on the magnetisation of iron. Further space is given to the subject of electric meters ; a table of the legal standard wire gauge is printed in an appendix ; other tables, giving the number of wires per lineal inch or centimetre, the number of turns of wire per sq. in. or per square centimetre of windings, as well as the resistances per cb. in. or per cubic centimetre for the various sizes of copper wire insulated in several different ways, are added ; the "Short History of the Absolute Unit of Resistance, &c.," written by the late Prof. Ayrton, is reprinted and extended by a statement of the work done since 1896, and of the resolutions adopted by the "International C ference on Electrical Units and Standards," held in Lon in October, 1908.

The book is chiefly intended for students following a fi year lecture and laboratory course in electrical engineeri A good feature is the great number of clear and often no diagrams. These are beautifully got up, and, for clearnes detail, surpass anything we have seen for a long ti Especially is this conspicuous in the pages dealing with elec meters. Everyone interested in the subject is painfully aw of the usual type of diagram that accompanies descriptio this kind ; of the fearful jumble of parts and connections t it is supposed to illustrate, but in reality only confuses. I a positive pleasure to examine the diagrams with which t part of the subject is illustrated in the present volume.

The chapter on potentiometer measurements has gr merit. The subject is treated in a clear, easy, and logi manner, and the various connections made on the inst ment are shown in numerous simple figures, and not all thro together into one awful mass of intricacy.

That difficult matter for most students, the study magnetomotive force, is treated in a masterly manner.

Taken all round, the work is all that a student electrical engineering, in his earlier years, can possi require.

Engineering Mathematics. By C. P. Steinmetz, A. Ph.D. London : Hill Publishing Co. Price 12s. net.

We are told that this work embodies the subject matter a lecture course given by the author during a numbe years to junior and senior electrical engineering students Union University.

The object of the author has been to supply a gap that has found by experience to exist in the teaching of mat matics to engineering students. He considers that for st students some branches of mathematics are of fundame importance—such as the algebra of the general number, exponential and trigonometric series, &c.—and that these seldom adequately treated, and often not taught at all, the usual text-books of mathematics or in the college cou of analytical geometry and calculus.

However matters may be on the other side of the Atlan we certainly cannot agree that such a general statem holds good on this side. Within recent years, in this count there has been much development in the scientific teach of mathematics. Indeed, in the great technical schools, a to a less degree in the Universities, the teaching of mat matics to engineering students is becoming a fine a Witness Prof. Perry's book on the calculus, which gave t lead to a host of works aiming to give the budding engin just the right kind and amount of mathematics necessary him ! Indeed, there is great danger that the thing is, or going to be, overdone, and that that which, if treated in spirit of moderation, is a natural process, may become, unc the hands of devotees who quickly develop into fanatics. forced and unnatural one.

However, with these reservations, that we have no dear in Great Britain of works specially thought out for t mathematical enlightenment of the embryo engineer, a that Prof. Steinmetz's book is certainly not unique here its objects, it is fair to say that his volume contains infc mation and methods somewhat unusual to see brought und one set of covers.

Chapter I deals with the general number. The first fe pages would seem somewhat childish with their illustratio about adding, subtracting and multiplying *horses*, if it we not for the consciousness that a student of *practical* math matics requires *practical* examples. On arriving at involuti and evolution, we begin to understand the process adopt by the author. For instance :—

We have $4 \times 4 \times 4 = 64$;
this is written as $4^3 = 64$,
or, in general, $a^b = c$.

Again—

$$\frac{4^1}{4} = \frac{4}{4} = 1 = 4^0.$$

These results are quite clear, of course, if we have go

through a general course of mathematics to begin with, but it is doubtful whether such a method of derivation is of much use to a student who starts *ab initio*.

Irrational numbers are treated in the same way.

"Eq. $\sqrt[3]{64} = 4$,

$\sqrt[2]{4} = 2$.

but what is $\sqrt{2}$?

If we attempt to calculate it, we get 1·4142135 . . . ."

and so on.

This leads up to a consideration of quantities of the type $2\sqrt{-1}$. Positive and negative quantities having then been dealt with, the way is prepared for a consideration of simple vector diagrams, which aim at giving to negative quantities a sort of concrete existence. An interesting vector diagram of $a^4\sqrt{-1}$ and another of points determined by $\sqrt[8]{-1}$ are given. This portion of the subject is treated in a somewhat novel and convincing fashion, inasmuch as there is given a real meaning to that bugbear of the student of small mathematical attainments, the negative root.

Section B of the first chapter deals with algebra of the general number, and includes rectangular and polar co-ordinates, addition and subtraction, multiplication of general numbers, division of general numbers, involution and evolution of general numbers, and logarithmation. For an example, a long-drawn-out calculation on the steam path in a turbine is worked out.

Chapter II deals with the potential series and exponential function. This is treated in an arithmetical rather than in a strictly mathematical sense, and it must be confessed that this arithmetical illustration gives a more concrete idea of the meaning of convergent and divergent series than the usual symbolical method. Section A of this chapter is general, Section B is on differential equations. This is a somewhat startling jump, and it illustrates the old trouble with mathematics specially designed for engineers. For whereas many pages in the earlier portion of the book are given up to the most elementary stuff and to a prolonged and tortuous leading up to all statements, we arrive at differential equations with great suddenness. There is no preliminary skirmishing. However, with regard to this portion of the subject, the engineer has so much difficulty in finding suitable text-books, that he must welcome the treatment given in the present volume. But let no one be led away with the assumption that he can begin the study of differential equations here. The student must, of course, have a good general knowledge of the calculus, and even of differential equations, before he begins. But granted that he has this general old-fashioned knowledge of the subject, he will find in the present treatment just what he will desire to know, and to know *thoroughly*.

Chapter III deals with trigonometric series; Section A with trigonometric functions, section B with trigonometric series in general, section C with reduction of trigonometric series by polyphase relation; and section D is on calculation of trigonometric series from other trigonometric series. The whole question of series is treated in an extraordinarily extended way, and the man who thoroughly works through this chapter ought to have a first-class knowledge of this important part of his study.

Chapter IV is on maxima and minima, and is illustrated by a great many diagrams and examples from electrical engineering practice. Chapter V is on methods of approximation. Chapter VI deals with empirical curves.

Chapter VII is on numerical calculations, and indicates the best methods to be pursued in attacking any given problem. There are some appendices dealing with general functions, special functions, exponential, trigonometric and hyperbolic functions (the last including functions of real variables, functions of imaginary variables and functions of complex variables), relations among the functions, and tables of exponential and hyperbolic functions.

It will be seen, therefore, that the book rapidly assumes an advanced aspect. The university or technical student who has previously had a good mathematical training, and who wishes to specialise on the mathematics of electrical engineering will, if he has time to go through it thoroughly, find it of much assistance.

THE PREMIUM PUPIL: AN ECHO OF THE CONFERENCE.

By a University Lecturer.

From July, 1910, to July, 1911, we had, in this country, perfect orgies of conferences. There was the unique effort on the part of the politicians. That—aided by the half-penny Press—made the word conference so familiar that the following few months found all sorts and conditions of men infected with the mania. The writer only attended two—the Imperial Education Conference, held under the presidency of the political expert on education, and the Conference on Engineering Education, for which the Council of the Institution of Civil Engineers was responsible. It is only fair to mention some of the other conferences, because, possibly, they were not all so abortive as the three enumerated. There was the conference on Town Planning, held by the Institution of Municipal and County Engineers. By a grim stroke of humour that was held at West Bromwich, of all places. (You have to know West Bromwich well to appreciate the joke—for if God made the country, and man made the town, then most certainly the devil had a hand in planning some of the towns in the Black Country.) Also the Institution of Naval Architects had a conference, to which our national friends and foes sent delegates, all of whom obligingly informed each other of the special methods which they have evolved for blowing up their rivals, in case of a naval war. Of course there was the Conference of Colonial Premiers, but they only agreed to let the present Government appoint another Royal Commission, which nasty people say is their way of shelving awkward questions. All of these other conferences, however, fade into insignificance before the wonderful effort of that most ponderous of Institutions, the Civil Engineers. As by no stretch of imagination could the Council, collectively, be accused of a desire to be funny, we will suggest that the genesis of the comical farce called a conference on engineering education was something as follows:—

"The Backwoodsmen."

Some of the wild young spirits of the Institution—aged anything from 40 to 60—have been, during the past two or three years, agitating for reform. Somebody even had the astounding temerity to collect signatures for a petition to the Council. Then there were hints in the technical Press that the Institution, as a body, was suffering from senility. Somebody was actually unkind enough to point out the absurdity of some of the examination questions, and the correspondence columns of at least one technical periodical contained protests from those who had been disappointed in the results. (Judging from the knowledge on engineering subjects of some of the candidates the writer has been privileged to successfully coach for the said examination, it passes his understanding how it is that any of those examined can possibly fail.) Things began to look serious when the technical Press began to revolt. Although Mr. Balfour, a politician, may act as Prime Minister, and loftily say that he never reads a newspaper, no engineer could exist if he did not subscribe to the technical Press. Probably you, dear reader, only purchased this admirable journal to scan the "Appointments Open" or "Situations Vacant" columns; but still, you must take in a technical paper if you call yourself an engineer. And, what with the editorials and the correspondence columns, the rumble of the reformers reached the Council table of the Institution. We can imagine that, at first, it caused good-humoured contempt, then some annoyance, and finally a spur to action. What bone was to be thrown to the wolves? Possibly some acute observer said to his fellow-councillors, "Here are young engineers complaining that they are never given an opportunity for discussions, and there are the respectable journals carping because we won't supply them with free 'copy,' as they must not report our papers and discussions. How shall we satisfy these critics? Ah! Capital notion. Engineering education. Let 'em blow off steam on that subject. There will be no lack of speakers and no lack of free copy for the journals." It was a master stroke of genius. The conference was held. We all came together—

the writer was sucked into the maelstrom—and most of those present aired their own views. You may meet engineers who know little about politics, and nothing about religion, but you will never come across one who is not an expert on engineering education. The schoolmaster, the professor, the works manager, the consultant, the director—they all laid down the law. Of course most of the audience only held together in the hope of adding their *ego*. It is only fair to himself for the writer to say that he failed, dismally, to get in a word, and that very probably accounts for his pessimistic view of the whole thing. He waited patiently on to the end, and, as he could not speak, he thought the more. For days, nay weeks, afterwards, the futility of the whole business worried him. Why could not these men agree on some common course of action? It is possible that the reasons are outlined below. They are the only ones that occur to the writer as being feasible.

The Point of the Story.

Man is an argumentative animal, and it may be that engineering education is to the engineer what politics is to the demagogue, or religion to the revivalist. But that is not the moral of the Conference. The great thing which it revealed was the presence of the "No surrender" party. There were present representatives of two diametrically opposed ideals. It was as if the Little Baptists and the High Church party had met together to discuss theology. On the one hand, there were the professors, who want all would-be engineers to attend the colleges. On the other hand, there were the consultants, who want all would-be engineers to find salvation in the premium system. And these latter were, to borrow a political or military metaphor, "Dying in the last ditch." For the premium pupil system is, like another political matter, "Not only doomed, but damned." It is beginning, just faintly, to be recognised that there is an art in teaching. It very often happens that the man who possesses the faculties essential for designing or carrying out a piece of engineering work is quite incapable of writing about it or of teaching students the elements of engineering science. Moreover, the successful engineer is usually a specialist, and the student requires to build his career upon a broad base of principles.

In the whole history of engineering science there is no blacker chapter than that in which is written the history of the training given to some of the premium pupils. Many a parent has paid some hundreds of pounds in order that his son may have the privilege of doing a labourer's work at nothing per hour. Others have paid premiums that their sons may attend an office in Victoria Street to act as a genteel office boy—again at no wage. There are, of course, many cases in which the engineer has conscientiously trained the pupil, but they are badly marred by those in which something very near to fraud has been perpetrated. In support of the contention that the premium pupil in an office often obtains no real training, a reference may be made to the recent circular sent out by the Council of the Institution of Municipal and County Engineers. In it the members were begged to give close attention to the training of pupils, because of the many complaints which had been received about the ignorance of premium pupils who had gone on elsewhere as assistants.

The writer once had a student who had been a premium pupil under a borough engineer. The only thing he seemed to know anything about was the mixing of concrete. He was utterly ignorant of the elements of engineering, or any science, could not use a slide-rule, and was a very bad hand at arithmetic. He was certainly lazy; but the spur of competition with his fellows at college had a useful result.

It seems a fairly obvious thing that the right place to train a man in the scientific principles which underlie all engineering work is a college, and the correct establishment in which the use of tools may be learnt is a factory. It is quite probable that the Professors who attempt to arrange for workshop instruction at colleges make quite as big a hash of that part of the training as do the men who take premium pupils. We have to make many studies in our facilities for training young engineers, especially in the direction of getting them practical experience under commercial conditions, but surely the time has come when somebody should speak out about the iniquities which have existed, and possibly even now exist, under the name of "the premium pupil system." It may be argued that at some of the colleges the students learn nothing. This is said to be the case at institutions where the professors are allowed to run separate consulting offices, and are appointed for any reason except that most essential—the ability to teach. But it is seldom that the student learns nothing. If such is the case, it may unhesitatingly be said to be his own fault. For there is always some member of the staff who will keep the genuine worker busy, and the equipment is always available. In an office there is no equipment, and the "instructor" is usually an engineer who is either too busy or too idle to import much of the knowledge of scientific principles to the pupil.

ERRORS IN METERS.

[FROM OUR LEGAL CONTRIBUTOR.]

There is one question which is frequently a cause of trouble between supply company and consumer—namely, What is the true value of the meter record? Is it final and binding on both parties? To solve the problem, one naturally turns to the Electric Lighting Acts. They shed but a dim light on the question, but apparently meter readings are to be the measure of the consumer's liability; subject to this, that he may have them inspected and tested from time to time. If it can be shown that the meter is wrong, the company puts in a new one, and comes to some arrangement as to what shall be paid for current supplied in the past. There is no reported case which defines the legal rights of the parties with regard to such past supply; and the reason presumably is that the matter is always amicably settled. Whether the meter is wrong or right, is a matter capable of direct ascertainment: the dispute could only be as to *when* it began to register incorrectly.

"The amount of energy supplied by the undertakers to any ordinary consumer under a special order, or the electrical quantity contained in the supply shall, except as otherwise agreed between the consumer and the undertakers, be ascertained by means of appropriate meter duly certified under the provisions of the Special Order, and fixed and connected with the service lines in some manner approved by the Board of Trade." So runs the Statute; and it will be seen that this section leaves it open to the company and consumer to agree as to the method of charging. They are not bound to accept the method of paying by measurement, but may agree together that payment shall be according to the number of lamps used, &c.

The provisions as to the certification of a meter are as follows: A meter shall be considered to be duly certified under the provisions of the Special Order, if it be certified by an electric inspector appointed under the Special Order to be a meter capable of ascertaining the value of the supply within such limits of error as may, as respects meters of the class to which the meter belongs, be allowed by the Board of Trade, and to be of some construction and pattern approved by the Board of Trade, and every such meter is hereinafter referred to as a "certified meter": Provided that, where any alteration is made in any certified meter, that meter shall cease to be a certified meter under the provisions of the Special Order.

An electrical inspector, on being required to do so by the undertakers or by any consumer, and on payment of the prescribed fee by the party so requiring him, shall examine any meter used for ascertaining the value of the supply, and shall certify it as a certified meter if he considers it entitled to be so certified, and the inspector shall, on the like requisition and payment, examine the manner in which any such meter has been fixed and connected with service lines, and shall certify that it has been fixed and connected with the service lines in some manner approved by the Board of Trade, if he considers that it is entitled to be so certified.

Apart from cases which arise between company and consumer, there are but few cases in the law reports concerning

he legal rights of those who make use of electric meters.)ne case, however, merits attention, namely, Gravesend Tramways, Ltd., *v.* Gravesend Corporation (1910, 74, J.P., 56). It there appeared that the tramway company agreed o take a supply of electric power for its trams from the 'orporation. The amount of the current was to be ascertained by the average reading of three wattmeters to be upplied by and to remain the property of the Corporation. The agreement went on :—"Such meters shall be calibrated nd fixed in the power station of the Corporation, and shall be onnected in a manner to be reasonably approved by the company, and so as to measure the amount of energy actually supplied by the Corporation for use by the company to the switchboard mentioned in the said indenture. . . . Provided that if nd when any meter shall show a difference of more than 3 per ent. from the mean reading of the two meters whose readings re the closest, such meter, at the option of either party to his agreement, notified in writing to the other party during he week in which any such difference of more than 3 per ent. shall have occurred shall be disregarded, and shall be emoved and recalibrated, or, at their option, the Corporation nay provide a new meter in place of that removed, and in he meantime, the amount of electrical energy supplied to the ompany shall be ascertained by the mean reading of the two emaining meters until such time as the third meter shall ave been placed in position. If one of the remaining meters s working manifestly incorrectly, one-fourth of the electrical nergy supplied in the last four consecutive weeks in which he mean reading of the three meters was binding and conlusive, shall be considered to be the amount supplied in each ucceeding week until the Friday immediately after which hree reliable meters had been fixed . . . . the said meters, efore they are fixed, and any meter proving unreliable as efore mentioned, or any new meter provided in place of an nreliable meter, shall be calibrated or recalibrated by the Board of Trade, or some other independent party to greed upon between the Corporation and the company at heir joint expense. The company shall pay to the Corporation such a sum per annum as shall be equal to 10 per ent. upon the original cost of providing and fixing three neters."

The agreement also provided that :—"On written notice rom one party to the other, the three meters . . . . shall e recalibrated *in situ* by the Board of Trade or by some ther approved standardising institution, agreed to in vriting between the parties to this agreement, the cost of uch recalibration being borne by the party requiring the ame."

On several occasions, covering a long period of time, it vas found that the meters were inaccurate, and were egistering fast as compared with an Aron meter. The laintiffs contended upon the facts that they were entitled o have three meters installed which were capable of neasuring the exact amount of energy consumed by them. They accordingly brought the action, claiming an injunction rdering the defendants to supply three accurate meters. The defendants contended that the plaintiffs were bound by he wattmeters, as and when recalibrated in accordance vith the terms of the contract.

Mr. Justice Hamilton, who tried the case, held :—(1) That the meters could not be condemned as long as the emedy by recalibration *in situ* remained open to the laintiffs; (2) that if the error of any meter could be neasured and was constant, and did not arise from any lefective adjustment, the necessary rectification of the readngs could be made in accordance with ascertained and constant error; (3) that there could not be held to be any breach of any express or implied term of the agreement until he plaintiffs had applied for recalibration and it had been refused; and (4) that the agreement did not amount to a warranty that the instruments installed should measure the amount of energy actually supplied, nor did it impose any express obligation on the defendants to keep the instruments up to the measure of accuracy, which could show the amount of energy actually supplied.

In the event judgment was given for the defendants. This case shows that it is not impossible to devise some form of agreement by which the sole arbitrament of the meter can be avoided in cases where there are large quantities of current passing through the terminals.

TELEGRAPHY WITH SECRET TYPE.

Mr. A. N. Hovland, Commander in the Norwegian Navy, has, in his capacity as a Naval officer, frequently had the opportunity of observing the different drawbacks of wireless telegraphy, and especially the difficulty experienced in keeping the messages secret, and preventing them from being received by stations for which they are not intended. The most perfect method in use in order to achieve this purpose is that of cryptography, *i.e.*, transforming the usual type into secret type by the aid of a special apparatus, the cryptograph. But although perfect in one sense, this method has the great drawback of being very slow, which prevents its adoption in all cases where speed is a necessity.

With the view of obtaining some better means, especially in connection with the use of wireless telegraphy for military purposes, Mr. Hovland in 1907 got the idea of transforming telegrams from the usual type into secret type automatically, acting on the fundamental principle that it would be of no particular consequence whether stations not concerned were receiving messages, if it only

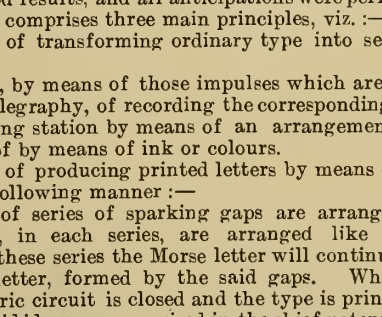


Fig. 1.

were possible to prevent them from deciphering them. He then constructed an apparatus with a keyboard, by means of which it became possible to send messages and simultaneously transform the type into secret type automatically. But this represented only the solution of the problem of transmitting, not of receiving.

In 1907 the inventor succeeded in obtaining the necessary financial support, after which he commenced the construction of a combined transmitting and receiving apparatus. The experiments, which were carried out with this apparatus for line telegraphy, gave very good results, and all anticipations were perfectly justified.

The system comprises three main principles, viz. :—

1. The idea of transforming ordinary type into secret type, and *vice versâ*.

2. The idea, by means of those impulses which are sent by wire or by radio-telegraphy, of recording the corresponding Morse letters at the receiving station by means of an arrangement with metal type instead of by means of ink or colours.

3. The idea of producing printed letters by means of these metal types in the following manner :—

A number of series of sparking gaps are arranged above each other, which, in each series, are arranged like Morse letters. Passing over these series the Morse letter will continue until reaching its own letter, formed by the said gaps. When this takes place an electric circuit is closed and the type is printed.

The aforesaid ideas are comprised in the chief patent claim, which briefly expresses the method to be : "A receiving system, according to which it becomes possible by a combination of short or long impulses of the current to carry out any number of various actions at a distance, as, for instance, the typing of letters, steering of torpedoes or ships, firing mines or torpedoes, producing certain acoustic, optical or electrical signals, drawing maps, charts, &c."

As space does not permit of giving a detailed description of the latest improved apparatus, the following will be limited to a brief description of the second apparatus, by means of which the inventor succeeded in realising his ideas and methods.

The object of the construction of this apparatus was :—

1. The printing of radio-telegrams on the tape with ordinary type instead of secret type.

2. The solution of the problem with the aid of one wave-length, by means of which it would be possible to take advantage of sharp tuning.

3. To make the apparatus adaptable to all systems of wireless telegraphy.

He first divided a Morse letter into different impulses, taking the dots and the spaces into account as 1 unit of time, and the dashes as 3 units (see fig. 1).

He then had the Morse letters cast into metal type, which were arranged and placed in a frame as shown in fig. 2 ; underneath the type was placed a moving electromagnet, by the aid of which the type might be pressed upwards.

When the electromagnet now is moving with uniform speed, and impulses are regularly conducted through its winding, it becomes possible to get any Morse letter printed, provided only that there are 17 metal pieces.

With the view of transforming the Morse code into ordinary type, a series of contacts and gaps were arranged so as to form Morse letters. By connecting these series with conductors, an electric battery and an electromagnet, the circuit was closed when any of the metal letters was made to pass the gaps. In this case it is, however, assumed that the metal type would close the circuit through all the gaps in the series in question. If not, no effect whatever would be produced.

As shown in fig. 2, the letters have been arranged according to their lengths, so as to prevent more than one, and that the right one, from being printed. The type R, for instance (. — .), may

be conveyed under the long series without being able to close the circuit before reaching the corresponding letter; but, arrived at its destination, the circuit closes and the letter R is printed by the electromagnet on the tape, after which the circuit is broken automatically. If this did not happen, the metal type would pass on,

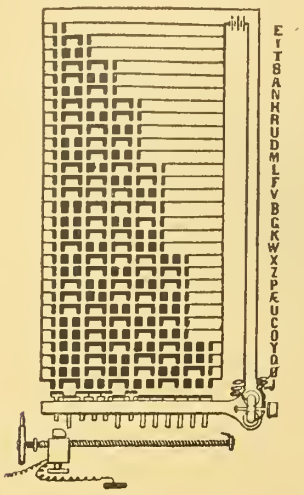


Fig. 2.

the result of which would be the printing of all shorter signs, the gaps of which it would be capable of covering.

The Morse code is by no means the only system adaptable, and any other system may be used. The one used in the first apparatus constructed was adjusted to a number of impulses equal to seven, while one based on a principle of four impulses maximum, two auxiliary and one immobilisation impulse, has been adopted for the latest construction. The principle, however, is the same, the difference depending only upon the construction.

In fig. 3 is shown the combined transmitting and receiving apparatus, which was constructed in 1907, and in figs. 4 and 5 a schematic drawing is given of each apparatus separately.

The most characteristic feature of this apparatus (fig. 3) is this: that the above-mentioned contact series have been arranged around a drum in such a manner that each series forms a separate piece of metal, which can easily be removed and replaced. By means of this arrangement it was made possible to obtain an interchange of

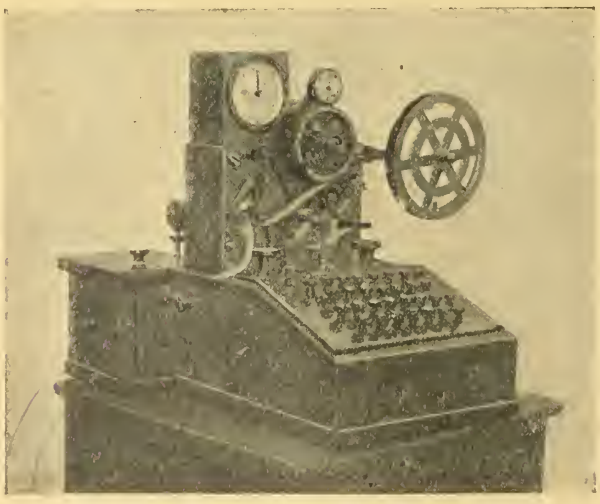


Fig. 3.

the long and the short signs, in order to produce secret type. The type wheel might also be turned round its axle, and thereby it became possible to place different letters opposite to the various Morse signs on the drum. The slightest turning of the type wheel might thus cause secret type to be produced.

An electromagnet served to push upwards the metal pieces or contact brushes, of which the Morse sign was formed. It also acted on a movable stop, fixed to a metal piece, which was kept moving with uniform speed along the underside of the other metal pieces by means of worm gear. The mechanism which worked the contact arm of the transmitting apparatus was driven by the exterior end of the worm.

In fig. 4, *a* represents the worm, *c* the contact arm, moving above a ring with eight metal segments insulated from each other. These are connected with the contact springs *d*, which are placed underneath the keys A B C D, and each key has thus a separate contact arrangement, which forms a special sign.

The connections may be seen from the drawing. If a key is pressed so as to bring it into contact with the springs *d*, the contact arm *c* will be coupled to an axle by means of a special mechanism. This axle is kept in constant rotation by the toothed wheel *b* and the worm *a*, and the contact arm will move round once, thereby brushing the ring of contacts.

When the key A is pressed, the segments Nos. 1, 2, 3, 6 and 7 will be charged, and it may be seen that an electric current will be admitted through the electromagnet *g* each time the arm *c* passes a live segment, and each time the key will be attracted and send an electrical impulse through the transmitting arrangements placed underneath the key, through which a short wave train will be transmitted into space.

If A is pressed, electromagnetic waves will radiate in the three first units of time, as well as in the sixth and seventh, while there is an interval for the fourth and fifth units of time, and segment No. 8 is only the resting segment.

When the arm *c* returns to its starting point, it is automatically disconnected, and comes to rest.

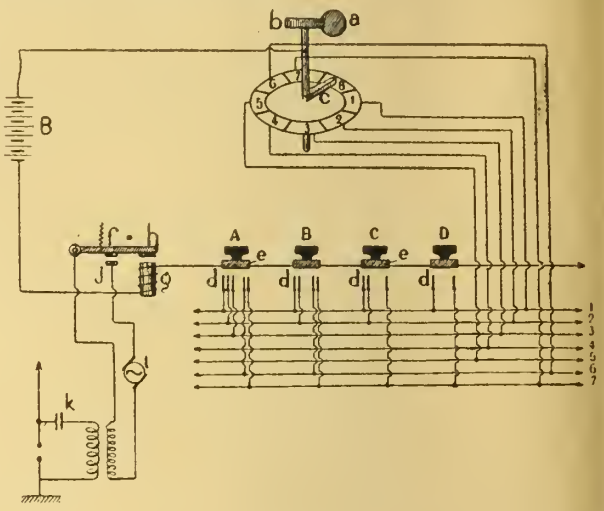


Fig. 4

Fig. 5 shows the receiving apparatus. The drum *c* consists of the aforesaid contact series, easily interchanged. By means of the contact rings *a* and *b* and springs, these contact series are connected with the electric battery B_1 and the magnet E_1.

The frame *h* carries six metal pieces, which are used for the purpose of forming the Morse signs.

The endless screw which moves the electromagnet *j* is driven by a small electromotor, and must be kept running continually and with uniform speed at all the stations which are working together. The speed can at any time be read from an indicator, which is seen on the top to the left in fig. 3. Under the screw are seen the wireless receiving apparatus with their coherers and relays.

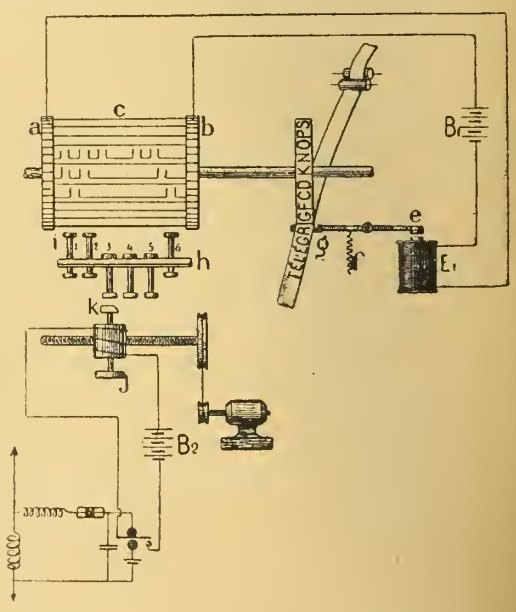


Fig. 5.

The impulses which are transmitted from the sending station act on the coherers and relays of the receiving station in such a way that the armature of the magnet is attracted, thereby causing the hammer *k* to push up the metal pieces *i*.

The electromagnet *j* remains in its position of rest at one end of the screw up to the moment when the first impulse arrives; but then it commences to move along the screw.

Arrived at the other end, the electromagnet is liberated and pushed back to the original position by means of a spring.

Experiments with this apparatus were carried out over a distance of about 12 miles between the two stations of Melsomvik and Tjömö, and although a considerable number of difficulties had to be overcome, the final results turned out very satisfactory. The

principle had been proved to be suitable for practical purposes in respect of line telegraphy, and the question now was to adapt the principle to radio-telegraphy, for which purpose two new apparatus were constructed. Essential featnres of these new apparatus were that they should be as plain and simple as possible, so as to facilitate the introduction of wireless on merchant ships and fishing vessels, &c.

The questions of ease of regulation of speed and synchronism were those which chiefly had to be considered, on account of the difficult problems in connection with them. It was imperative that two ships, for instance, should be connected at once, without first having to waste time with tuning and adjusting their apparatus.

This problem was solved by letting the contact-arm only make one revolution for each letter, simultaneously at both stations.

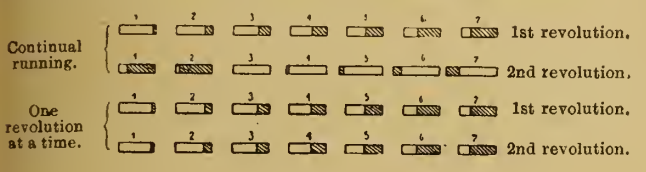


Fig. 6.

The two upper lines in fig. 6 represent the impulses of current of two apparatus, which are kept constantly moving with a certain fixed speed.

Assuming that the difference in speed amounts to 7 per cent., the one apparatns at the seventh impulse will be seven-tenths of an impulse behind the other. They have still three-tenths of an impulse in common, bnt in the second revolution the difference of 7 per cent. at the third impulse will prevent any further working.

The lower series in fig. 6 show the impulses for two apparatus, the contact-arms of which only make one revolution, while the difference in speed is 7 per ccnt.

After the first revolution the one apparatus will be seven-tenths of an impulse behind the other; but having passed the seventh impulse, the contact-arms stop, and the error is reduced to nil.

After each subsequent revolution the error is thus eliminated, and the apparatus may continue to work together in spite of the difference of 7 per cent. in speed; this latter method has therefore been adopted.

The difficnlties experienced in connection with the problem of synchronism have also been overcome, as well as that of facilitating the regulation of the apparatus.

The latest apparatus represent an improved construction of those described above, and the experiments already carried ont have

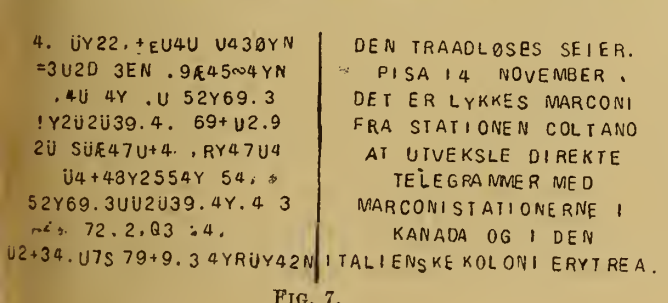


Fig. 7.

ustified all expectations in regard to safe working, as well as the possibility of preserving secrecy in the transmission of wireless messages.

The latter is dependent upon the cryptographic cipher in accordance with which the apparatus in question have been adjusted, and fig. 7 shows a *facsimile* of one and the same message, received by two stations with different cryptographic ciphers, of which the one is correct (in Norwegian) while the other is without any sense at all.

The number of different alphabets which can be used in connection with these apparatus is 720, and this can be increased to 5,040 by adding one impulse to the present number.

The distances at which the experiments with wireless telegraphy have been carried out are only small; but the system has very little to do with the question of distance, because it is applicable to all the existing systems, and may thus be worked in connection with one as well as with another.

Assuming that a system is capable of transmitting messages over a distance of, say, 1,000 miles, the message being received in Morse letters, the present system if used in connection with the former will enable the receiving station to obtain the messages in ordinary type.

The advantage of having a wireless system in the Navy, which is quite reliable in regard to the transmission of secret messages, need not be pointed out; and, as far as mercantile vessels are concerned, the introduction of this system may do away with the necessity of keeping a salaried expert on board for wireless telegraphy only, which means economy, and consequently will facilitate the introduction of wireless on ships in general.

During the experiments it has been proved that quite inexperienced persons have been able to forward perfectly correct messages, whioh would be impossible with the existing methods.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"A. U. L." writes: "I should esteem it a favour if you could give me your opinion of the following position of affairs that has arisen in this district. The Town Council are part owners in the electricity scheme; the gas undertaking belongs to a company.

"A competitive street lighting scheme has been carried out between the two rival illuminants, and by a small majority the Town Council has decided to adopt gas lighting.

"At least two members of the Town Council who voted are directors of the gas company, and several other members of the Town Council are interested as shareholders. Can they legally vote in favour of gas?"

*** It is not quite clear whether the Council in question is an Urban District Council, and so governed by the Public Health Act, 1875, or a Borough Council subject to the Municipal Corporations Act, 1882. Sec. 46 of the Public Health Act, 1875, provides that: "A person shall be disqualified for being elected or being a member or chairman of a Council of a parish or of a district *other than a borough*, or of a board of guardians if he . . . . (*c*) Is concerned in any bargain or contract entered into with the Council or board, or participates in the profit of any such bargain or contract, or of any work done under the authority of the Council or board. . . . . (2) Provided that a person shall not be disqualified for being elected or being a member or chairman of any such Council or board by reason of being interested. . . . . (*c*) In any contract with the Council or board as a shareholder in any joint stock company; but he shall not vote at any meeting of the Council or board on any question in which such company are interested, except that in the case of a water company or other company established for the carrying on of works of a like public nature, this prohibition may be dispensed with by the County Council." Assuming that the Council referred to by "A. U. L." is an Urban District Council—and assuming, further, that the supply of gas or electricity for street lighting is a public object (which it apparently is)—it appears that the votes in question were illegal unless the prohibition was dispensed with by the County Council. Sub-sec. (8) of the same section provides that if any person acts when disqualified, or votes when prohibited under this section, he shall for each offence be liable on summary conviction to a fine not exceeding £20. As interest in the contract continues so long as the contract itself exists, and as an injunction may be obtained against an offending member, it will be seen that a formidable weapon is in the hands of those interested in electric lighting. The terms of the Municipal Corporations Act, 1882, Sec. 12, are very similar to those above set out. Interest in contracts is a disqualification, save that to hold shares in "any company which contracts with the Council for lighting, or supplying with water or insuring against fire any part of the borough" is no disqualification. Nevertheless, by Sec. 22 (3) of the same Act, a member may not vote or take part in the discussion of any matter before the Council, or a committee, in which he has directly or indirectly, by himself or by his partner, any pecuniary interest. Enough has been said to show that, whatever the view of the Council (*i.e.*, whether "Urban District" or "Town"), there is probably a *prima facie* case against the councillors concerned; but it would be advisable to see a solicitor before taking any serious step.

Imports into Tunis.—The Central Bureau for the Preparation of Commercial Treaties, which is a German private undertaking which has assumed the responsibility for watching over changes in Customs and the effects of commercial treaties in so far as they affect, or may affect, Teutonic foreign trade, has just drawn attention to the question of foreign competition in French colonies, with special reference to the report of the German Consul in Tunis for 1910. It is pointed out that the preference given to French products in Tunis renders it difficult for foreign rivals to succeed, and that the authorities have their requirements of materials met from the same sources as the French authorities do in France, thus closing a large market to other nations. By way of illustration of the Tunisian import trade, it is mentioned that electrical machinery of the value of £7,080 was procured from France in 1910, as against £480 from Germany; French induction apparatus of the value of £6,000, as compared with £240 from Germany, and French machine tools for £4,800, as contrasted with £360 from Germany. Similar differences exist in regard to metal work, tools, railway materials and trucks, machinery, elevators, &c. These cases render it comprehensible, the Central Bureau remarks, that German manufacturers must raise emphatic objections to the "Tunisisation" of other countries—meaning Morocco—which have hitherto stood open to free competition.

A Patents Exhibition.—We are informed that London is to have a permanent Exhibition of Patents, which will be situated in a central position, and will be open to the public all the year round. It will form a centre where inventors can display their patents for the purpose of attracting the attention of possible purchasers. Further particulars are contained in the prospectus, which, we are informed, may be had on application to the Administration Office, 165, Fleet Street, E.C.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,194. "Electric lamp." Van Raden & Co., Ltd., and M. Metz. August 28th.

19,195. "Driving wheels of magneto machines used with internal-combustion engines." Abingdon Ecco., Ltd., and J. Gray. August 28th.

19,210. "Electrical appliance for transmitting messages, with provision for taking a record of each message and notifying the record to the sender of the message." D. S. Davies and C. H. Mason. August 28th.

19,228. "Electrically-operated sewing machine." G. Levy. August 28th.

19,230. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Addition to 19,187/11. Convention date, August 27th, 1910, Germany.) August 28th. (Complete.)

19,231. "Circuit arrangement for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, August 27th, 1910, Germany.) August 28th. (Complete.)

19,233. "Device for short-circuiting the current of magneto-electric ignition apparatus." Firm of Robert Bosch. (Convention date, May 15th, 1911, Germany.) August 28th. (Complete.)

19,242. "Anti-vibrators for electric light pendants." H. W. Hanwell. August 28th.

19,252. "Telephone station." C. G. Redfern. (Telephon-Automaten Ges. m.b.H., Austria.) August 28th. (Complete.)

19,260. "Systems of electrical distribution." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 28th.

19,266. "Electrical couplings." C. R. Belling. August 29th.

19,268. "Electric motors suitable for display advertising devices and the like." A. C. Harris. August 29th.

19,297. "Ignition apparatus." V. Danicek, K. Cernovsky and A. Hoffmann. August 29th.

19,305. "Electric furnaces." A. L. J. Queneau. August 29th. (Complete.)

19,312. "Arc lamps." G. E. Tate and F. O. Monkhouse. August 29th.

19,344. "Magnetic hairpin." F. de Latour. August 30th.

19,347. "Electric safety hand-lamps." Simplex Conduits, Ltd., and C. G. M. Bannett. August 30th. (Complete.)

19,352. "Making steam by electricity for all marine steam boilers and other boilers and the like." G. S. Holme. August 30th.

19,360. "Electrolytic coating of iron, steel, or other metals with zinc or zinc alloys." Q. Marino. August 30th.

19,362. "Speed regulation of electric motors." J. Wagner. August 30th.

19,363. "Electric measuring instruments." J. L. Orchard. August 30th.

19,365. "Electric controllers." Bray, Markham & Reiss, Ltd., E. N. Bray, F. R. Markham and F. E. Reiss. August 30th.

19,392. "Excess-current switches." Felten & Guilleaume Carlswerke Akt.-Ges. (Convention date, August 30th, 1910, Germany.) August 30th. (Complete.)

19,435. "Electric arc lamps." Ges. fur Maschinen-u. Metall-Industrie m.b.H. (Convention date, September 1st, 1910, Germany.) August 31st. (Complete.)

19,444. "Apparatus for perforating the signal-controlling tape to be used with automatic telegraph transmitters." W. Judd, A. Fraser and Eastern Telegraph Co., Ltd. August 31st.

19,456. "Circuit arrangement for automatic or semi-automatic telephone exchanges." Siemens & Halske Akt.-Ges. (Convention date, November 8th, 1910, Germany.) August 31st. (Complete.)

19,518. "Electrolytic treatment of nitric acid." Farbwerke vorm. Meister, Lucius & Bruning. (Convention date, December 24th, 1910, Germany.) September 1st. (Complete.)

19,525. "Electric arc lamps." Soc. Anon. Francaise Dite Banque du Radium. (Addition to 28,888/10. Convention date, May 26th, 1911, France.) September 1st. (Complete.)

19,526. "Arc lamps." Soc. Anon. Francaise dite Banque du Radium. (Addition to 28,888/10. (Convention date, January 2nd, 1911, France.) September 1st. (Complete.)

19,553. "Electrical connecting apparatus operated from a distance." G. A. Betulander. (Convention date, September 3rd, 1910, France.) September 2nd. (Complete.)

19,573. "Arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, October 12th, 1910, Germany.) September 2nd. (Complete.)

19,583. "Protective devices for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States). September 2nd.

19,584. "Electrical fuse devices." J. E. Spagnoletti and V. E. Joyce. September 2nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Wireless Signalling. R. H. Fessenden. 11,154. May 5th. (January 29th, 1910.)

Magneto-Electric Ignition Apparatus for Internal-Explosion Engines. R. F. Hall. 16,093. July 6th.

Electrical Apparatus. H. E. Reeve. 16,172. July 6th.

Electricity Meters. W. H. Johnson and A. M. Billington. 18,470. August 4th.

Apparatus for Treating Liquids by Means of Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen. 18,762. August 9th.

Socket for Fixing Electric Lamps. Etablissements Paz & Silva. 20,040. August 26th. (June 28th, 1910.)

Electrically Operated Playing Apparatus for Musical Instruments. C. M. Clark. (Telelectric Co.) 20,095. August 29th.

Apparatus for Varying the Mean Potential of Starting Machines (Distributing Dynamo Machines). Allgemeine Elektricitäts Ges. 20,769. September 6th. (September 6th, 1909.)

Detectors for use in Connection with Electromagnetic Waves. J. C. Smith and T. H. Lyon. 22,164. September 24th.

Method of Supporting and Insulating the Overhead Wires in Electric Tramways and Railways. C. Mittelhausen and A. R. Williams. 22,735. October 1st.

Means for Supporting Electric Lamps. H. T. Harrison. 22,775. October 1st.

Electrodes for Arc Lamps. F. M. Lewis. 22,803. October 1st.

Process for the Manufacture of Metallic Filaments for Electric Lamps. J. Schilling. 23,639. October 12th. (December 29th, 1909.)

Terminal for High and Low-Tension Electric Conductors. C. Meigh 23,891. October 15th.

Means for Driving Magneto-Electric Machines for Internal-Combustion Engines. J. C. Merryweather. 26,409. November 14th.

Conversations Counter for Telephones Without Crank-Handles. K. Born 27,857. November 30th.

Electrodes for Electric Furnaces. M. Ruthenburg. 28,526. December 8th

Commutators for Electrical Machines. Vickers, Ltd., A. D. Williamso and H. F. Brown. 29,161. December 15th.

Magneto Generator. F. W. Golby. (Draper-Latham Magneto Co.) 30,16 and 30,167. December 29th.

1911.

Apparatus for the Electrolysis of Fused Alkali Chlorides. Ges. Fü Chemische Industrie in Basel. 17,047. July 25th. (December 22nd, 190 Divided application on No. 18,300 of 1910, August 2nd.)

Controlling Apparatus for Electric Motors. Otis Elevator Co. (Ot Elevator Co.) 498. January 7th.

Dynamo-Electric Machines. O. F. Sire. 2,903. February 4th. (Februa 14th, 1910.)

Electric Contact Keys or the like. W. M. Crowe and British L. M. Ericsso Mfg. Co. 5,564. March 6th.

Method of Electrically Braking Polyphase Series Motors. Siemen Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 7,631. Marc 27th.

Incandescing Bodies for Electric Lamps and Methods of Manufacturi the same. K. Schwab. 8,004. March 20th. (April 9th, 1910.)

Transmitters and Receivers for Wireless Telegraphic and Telephon Apparatus. E. Bellini. 11,339. May 10th.

Electric Arc Lamps. Siemens Bros. Dynamo Works, Ltd. (Siemen Schuckertwerke.) 12,735. May 26th.

Thermo-Electric Batteries. Dr. P. H. Süchting and F. Oloff. 13,71 June 8th.

Electro-Deposition of Metals. A. Rodeck. 13,808. June 9th. (June 10t 1910.)

Electrical Progress in Sweden.—The Committee Electrical Inspectors has during the year 1910 expressed its view with regard to 137 questions dealing with electrical matters whi have come before the Government for approval. Among oth matters the inspectors point out the desirability of adopting mo practical and simple methods for dealing with applications f concessions for carrying out electrical works, recommending th such matters should be subjected to the decision of local authoriti instead of having to pass the Government as at present.

Up to the end of 1910 the Government had granted a total 910 applications for electrical concessions, of which 127 we granted during 1910. The long-distance transmission concessio represented a total of 253,300 H.P., the distance aggregating 2,4 miles; the corresponding figures for 1910 were 50,260 H.P. a 285 miles. Nearly all these concessions relate to the transmissi of energy from waterfalls. There is only one railway line wh is electrically operated, namely, the line from the iron ore depos at Kuruna to the Norwegian frontier. There are 16 tramw lines, almost all of which are municipal undertakings; the to length of single track amounts to 180 miles, and the total numb of passengers carried by these lines up to the end of 1910 amoun to 964 millions, and the receipts to about £500,000, more than h of which falls to the tramways of Stockholm, N.

It is of interest to note that an aluminium cable of 160 mm². h been employed between Bullarforsen and Domnarfvet, the sp occasionally running up to as much as 425 metres.

Electrical Labour in Australia.—The annual repo of the Australian Electrical Trades Union contained the followi remarks:—"The continued activity of the building industry, t extension of the tramway system, and the increasing demand f electric light and power—largely due to the enterprise of the Sydn Municipal Council, as well as a number of private supply compan in the various parts of the State, has been responsible for the pr perous condition of the electrical industry during 1910-11, whi gratifying state of affairs is likely to continue for some time. must, however, be remembered that, although occasionally there h been a shortage of labour, much of the work is of a casual natu and during the period under review, many excellent mechan have experienced a lot of broken time. Generally speaking, supp and demand are fairly evenly balanced at the present mome The union employment bureau has been of service to bo employers and employés; over 200 jobs in city and countr covering all branches of the trade (some of them permanent) ha been found for our members."

Picnic.—Last Saturday the staff of the Carnarvon a Bangor branches of the National Electric Construction Co. he their first picnic, which took the form of a drive through the V of Bettws Garmon to Beddgelert, where lunch was partaken of the Saracen's Head Hotel. A football match—Carnarvon *v.* Bang —was then played, resulting, after a strenuous game, full of exc ing moments, in a victory for Bangor. The party then proceed to the power station of the North Wales Power Co., in Cwm Dy which, through the good offices of Mr. D. O. Evans, they w allowed to inspect. Afterwards followed a stiff climb up to Pe pass, and a continuance of the drive to the Dolbadarn Ho Llanberis, where a sumptuous tea was provided, Mr. Evans playi the *rôle* of host. After tea, Mr. Evans conveyed the good wis of everyone to Mr. D. Tullis, who is leaving the company to t up a better appointment in one of the South African mines. R. Lloyd Roberts, on behalf of the Carnarvon staff, and Mr. Gordon Roberts, for the Bangor branch, thanked Mr. Evans his company and for the generous manner in which he had trea the staff on this their first outing. After further speeches the pa then drove back to Carnarvon.

THE
ELECTRICAL REVIEW.

VOL. LXIX. SEPTEMBER 22, 1911. No. 1,765.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1911 EDITION
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E C

THE INTERNATIONAL CONGRESS OF APPLIED ELECTRICITY.

THE Turin meeting of this Congress will be notable for very many years. At this, its second meeting, the Congress wisely and unanimously took steps to secure a true instead of a quasi-international basis for its future work, by voluntarily placing its destinies under the control of the International Electrotechnical Committee. That Committee will decide when and where the Congress shall hold its future meetings, and will entrust to the electrical institutions of the country selected the carrying out of the detail work. Everyone must see the wisdom of this step. The Congress has been saved from becoming a partially international electrical equivalent of the British Association, at whose meetings local delegates are always numerous. The Congress has already almost as many sections as the British Association, and has what the British Association has not, namely, linguistic difficulties. The official language of the Congress was French, in which all discussions were supposed to have been, but were not universally conducted. Papers were, however, printed, and occasionally read in German, Italian and English. The Congress fortunately was financially able to issue all papers in full, instead of in abstract as at the British Assocation. Of these we shall make a selection and print brief abstracts in our columns, for some are of considerable value. Membership of the Congress, in which the English element is at present distinctly weak, is commended to the consideration of our readers.

The future of the Congress has been secured; fostered by the International Electrotechnical Committee, its meetings will be of world-wide importance, and yet will in no way detract from the value of, say, our own I.E.E. meetings. No better means could have been conceived. In the I.E.C. we have the supreme administrative authority in regard to electrical matters throughout the world. The official representatives of various civilised countries lay down exact definitions of units, and can standardise nomenclature, symbols and the rating of plant. This administrative body is large enough for its duties. If it were larger, the expansion would be at the expense of its efficiency. Too large a body will talk too much and do too little, very much according to the old adage that councils of war never fight.

The Congress, as a subordinate body, meeting possibly at more frequent intervals than the Committee, will provide what our national engineering institutions — British, American or German, as the case may be—do not provide, and that is an international discussion on matters of engineering policy and detail.

But to secure this in the most effective manner, there should be some departure from the policy pursued in Turin. If papers of unequal merit are only issued immediately before the meeting, and if at one session several are down

for discussion, some must get slaughtered, and not always those of least value. Then, again, it is not always edifying when one goes to the marble portals on the Embankment to hear an author read his paper *in extenso*. It is still less so when that paper is read at high speed at an international gathering in a tongue inevitably alien to many delegates. The advance circulation of the paper in any one of, say, four languages, and the reading by the author of an official abstract of, say, 1,200 words in French, would evoke better discussions and improve both the efficiency and the attractiveness of such a congress.

We have written at this length, because the coming of the Congress to London becomes sooner or later a matter of certainty. We should like to suggest that there should be a splitting of the difference between, say, an annual and a quinquennial congress. Triennial assemblies would probably meet the case. If too frequent they will become of local rather than of international interest. While the college professor's long vacation permits of his attending annually, the professional man or the manufacturer will either ignore the Congress altogether, or at best will pay his subscription in order to receive the publications, but will not attend the Congress. The next Congress will meet at San Francisco in 1915.

We may, in conclusion, refer to the meetings of the Congress as revealing the potentialities of modern Italy. Strange, indeed, is the kaleidoscope of history. From republican and imperial Rome spread out a civilisation ranging from the Atlantic to the Euphrates, whose monuments remain in roads and towns, and whose spirit is enshrined in that Roman law which is the basis of so much in our legal systems. Then the tide of conquest rolled inwards, as told in Gibbon's dreary pages. Next came the artistic and literary renaissance, Italian in conception and development, which crowned the end of the middle ages. Turin revealed to those of us who were there last week yet another renaissance in Italy; a renaissance of scientific industrialism. The most recent mechanical manufactures have attained to great prominence: the automobile factory, the foundry, the shipyard, all indicate a high development. The use of electricity for lighting and traction, the employment of water power, the miles of overhead transmission (occasionally on poles and insulators that the Board of Trade would not pass), all portray a wonderful mental receptivity. We welcome it gladly because of our national associations with the political growth of modern Italy, with which British sympathies have been so intimate. But writing in a narrower technical sense as British electrical engineers, we regret that we cannot claim to have had anything to do with the direct inspiration of this electrical development. It is primarily to Switzerland, and in a lesser degree to France and Germany, that Italy is indebted for this inspiration. The British display at the International Exhibition at Turin, with which we shall deal next week, suggests the reason.

The Apathy of the Supply Authorities.

Where are the supply authorities? Why are they not buying tickets for Olympia? The Exhibition Committee, the management, exhibitors, and we of the Press may cut ourselves with knives and shout, but Baal either will not, or cannot, hear. Peradventure he sleepeth, or is on a journey into the sales department, or is still away on holiday—but from whatsoever cause, it is now becoming notorious that those who ought to be doing much to help are in danger of making a huge exhibition of apathy and inactivity. The Executive were criticised a few weeks ago for what it was thought they had not done, but the cap at the moment is exactly fitted to another pate. For the 1905 and 1908 Exhibitions, tens of thousands of tickets were purchased by the supply authorities and distributed to the manufacturers and householders in their various areas. On the present occasion very little interest indeed has been shown. Every supply authority stands to gain by widening the people's knowledge of electricity. Then why do they not shoulder their share of this responsibility? For £20 or £30 they can do a great deal of good among the wavering public in their areas by securing their attendance at the Exhibition. Manufacturers have been spending many hundreds, and, in some cases, thousands of pounds to secure an effective representation, but their efforts, as well as those of the Committee, will be rendered to some extent unfruitful unless there be more earnest co-operation or support on the part of those to whom this leaderette is particularly addressed. Wake up, borough electrical engineers! Wake up, Committeemen! Wake up, electric supply companies! Not only are you letting a grand chance slip through your fingers—a better chance altogether than your seven-day local show could ever be—but the responsibility for failure to secure the right people there will lie at your door. The daily Press is writing attractively about the event, the Committee is spending large sums upon advertising, the gas tiger is alert and athirst for the consumer's blood, and you—where are you?

Central Station Power Load.

It has been related that a small boy once bestowed his sympathetic attention on a navvy who was wielding a pick in a public thoroughfare (presumably exploring for a live electric cable) and noticed that upon every stroke the navvy emitted a grunt. Being moved by altruistic motives, and being desirous of assisting the navvy in his labours, the small boy suggested to the labourer that if the latter would confine his attention to the pick work, he (the small boy) would do the grunting for him. It was stated that he was very much pained at the way in which the suggestion was received.

Apart from the human interest of the story, it rather suggests the attitude which the central station engineer has in the past adopted towards the business-getting propaganda which has from time to time been suggested. He appeared to think that the mains staff or the chief engineer would have to do all the hard work, while the publicity man (under whatever fancy title he might appear) would simply do the grunting. Happily that attitude is being discounted by practical experience among the electricity undertakings which have adopted progressive business-getting methods, and to-day the consumers' department is a recognised factor in electricity supply. The Exhibition at Olympia ought to be utilised for the obtaining of new business almost, if not quite, as much by the business representatives of electricity supply undertakings as by the manufacturers who are exhibiting.

Finality has not, however, yet been reached by the majority of electricity supply authorities in the organisation of their business-getting departments as regards power business. This is admittedly a more difficult class of business to obtain than lighting, inasmuch as while there is no greater variation in the conditions under which electricity is to be applied in power work, as compared with lighting, a dozen or a hundred similar lighting installations can be found on a supply system for every two similar power jobs. In other words, there is more difficulty in standardising a power proposal than one for lighting. For this reason emphasis needs to be laid on the importance of systematic prospecting and bureau work in power business. By prospecting is meant the careful estimation, based on examination, of the power needs of every likely works in the sphere of supply of an undertaking,

with a view to suggesting a clean-cut proposal for the supply of electricity either at once or at a later date. Some manufacturers, of course, object to an outside engineer of any description examining their equipment in detail; but such types of short-sightedness are, fortunately, rare. The majority of manufacturers are prepared to give facilities to reputable persons to examine their plant, if they think that such persons will thereby be put into a position to make suggestions for reducing the operating costs, such suggestions costing the manufacturer nothing. It may be argued that such prospecting work on the part of electricity supply authorities involves the expense of a technical engineer without the absolute guarantee of business resulting from his work. The best reply to this is that those undertakings which have adopted the method have found it pay. It is analogous to the policy of German chemical manufacturers who keep staffs of highly-trained experts for the sole object of research work. If they are successful the firm benefits hugely; if they are not, the firm does not dock their salaries. Another objection which has been raised is that this policy cuts into the business of the consulting engineer. It is a pity that this is so, if it be so, but it must be remembered that consultants are, after all, but one means of facilitating good business, and if another method pays better, the wheels of progress must not be spragged.

Behind this position, however, lies another, which was also mentioned above. This is the establishment of an information file or bureau in every electricity supply authority's office which will contain actual working data regarding the relation of electric power supply to the industries which occur in the areas supplied. Such a file must not be composed solely of clippings from technical papers. Often these are very useful, and contain valuable data, but a man must be an omnivorous reader to be able to collate from general articles just the precise and intimate information which is necessary for the peculiar problems with which he is faced. The best data are those collected from previous practical installation experience, and for this reason, data of every motor on the supply, the nature of the work it does, together with particulars of its horse-power, type, speed, method of connection to the machine it drives, nature of overloads to which it is subjected, and general performance, should be collected as far as ever possible, and systematically filed. It sounds an appalling task, but it is the keynote to standardisation, and without this no electricity supply system can hope to present an absolutely definite case to the consumer. Failing this, the supply authority is compelled to delegate its technical work to the manufacturing companies which have built up such data systems, and this leads inevitably either to the preference being given, consciously or unconsciously, to one firm, or to the evils of multiple estimating and tendering, which is one of the biggest curses of the electrical industry in existence at the present day.

Pacific Cable Act.

The Parliamentary Paper (274) recently issued from the Treasury Chambers brings this subject again before us.

It has been generally thought that the Pacific Cable is not a paying concern, and this we have from time to time suggested is probably due to the placing to reserve of more than would be placed by a private undertaking. In the accounts before us for the period ended March 31st, the revenue is shown to be increasing, and the general conditions of working have been greatly improved.

When power has been obtained to enable the Board to have a direct cable between Australia and New Zealand, another £14,000 of expected additional revenue will have to be taken into account, and this figure may, no doubt, be regarded as a very conservative estimate.

The position of the undertaking to-day shows that eight annuities of £77,544 have been set aside, equalling £620,352. There has also been placed to the credit of renewal, repair and general reserve a sum of £264,395.

There is evidently a misprint in Statement VI, and securities purchased as *per contra* should read £50,380 instead of £5,038). The Government subsidies have, as we forecasted, gradually decreased from £87,751 in 1903-4, to £48,210 in 1910-11, and so the proportions due from the participants are becoming of a light nature, considering the great advantages to the Empire of a national cable system and the great saving in telegraphic charges to all concerned. A Bill to extend the Pacific Cable Act of 1901 provides that the sums standing to the credit of the reserve fund shall not at any time be less than £100,000; it is proposed to lay a cable from Australia to New Zealand, and the cost will have to be added to the already large capital outlay of £2,000,000, redeemable now in 42 years. Any sums expended for the new cable must be repaid to the "Cable Repair, Reserve and General Renewal Fund" within 35 years at 3½ per cent. interest.

This seems at first sight to be an arrangement which does not possess much elasticity. If the amount be paid out of profit for extending lines, all that is necessary is again to build up the fund from which it has been taken; but why lay down a hard and fast rule as to the period in which the money is to be repaid, and why pay oneself interest?

Then, again, the repaying of capital (large or small) would always depend upon the work an enterprise found before it. That is to say, it would be paid off out of profit and interest saved year by year. It seems cumbersome and expensive to build up a fund to meet the whole of the capital, and pay interest on it for 50 years. Also the extension and duplication of the cables should be provided for, so that the earning power can be kept continuous.

It seems impossible to earmark and hypothecate earnings if full progress is looked for. The Pacific cable will not have the fullest chance, if legitimate extensions in or out of the Pacific are not made, and if duplications are not undertaken before the first line becomes weak and requires all the money set aside to keep it in working order.

The subject of deferred telegrams has been discussed in telegraph circles for many years. It has been left to the Postmaster-General to bring it into greater prominence, and we now learn from this Parliamentary paper that within the next few months there is every prospect of its fulfilment.

Scientific Development.

One of the most interesting and hopeful features of modern industrial practice is the growing tendency to adopt scientific methods of investigation, to hasten the development of new processes or the perfecting of new devices. Conspicuous examples of successful results from the application of scientific method are not far to seek; the tantalum and tungsten lamps, high-speed steel, loaded telephone cables and many other instances might readily be cited, and manufacturers—particularly our German cousins—have learnt that progress may be accomplished in the course of a few months, under the direction of scientific experts supplied with adequate facilities, financial and otherwise, for the purpose in hand, that would require years for evolution by the old-fashioned methods of trial and error.

This being admitted, how is it that we do not see the system more generally put in force? One of the most crying needs of the moment is improvement in the design and construction of electrical cooking apparatus, but, so far as we know, no broad investigation into the principles involved, and the best means of applying them, has yet been undertaken. The Institution of Mechanical Engineers has set a good example by appointing Committees to carry out researches in connection with internal combustion engines, alloys, &c.; our own Institution has set on foot investigations connected with insulating materials, the heating of wires, and so on. Is it beneath the dignity of the I.E.E. to appoint a Committee of research on cooking apparatus?

We commend the matter, with all seriousness, to the attention of the authorities concerned; and in the meantime, for our part, we print in this issue an article on the application of electricity to cooking ovens, which we hope will prove useful to those engaged in the design of such apparatus.

THE APPLICATION OF ELECTRICITY TO COOKING OVENS.

[CONTRIBUTED.]

Now that electricity for cooking purposes appears as if it were, before many years have passed, to be used on a scale comparable with gas, it may be of interest to consider some of the factors in the problem presented to ironfounder and electrical engineer. The subject has already received consideration from a number of firms equipped for the work, and a variety of electrical cooking appliances is on the market at the present time. Costs of operating the various apparatus are also available in many instances, details having been published in back numbers of the Electrical Review. It is not the intention of the writer of this article, however, to give specific figures relating to present design or performance; but rather the desire is to direct attention to the general principles underlying the design. Further, only one of the many possible applications of electricity to cooking is here considered; and it must be understood that none of the remarks need necessarily apply to modes of heating or cooking other than that with which we are immediately concerned —viz., the application of electricity to ovens.

It may be as well to state right away an assumption made all through the article—one, possibly, which will be readily enough admitted—viz., that in general oven-cooking the ideal condition is one in which the object to be cooked is subjected to a sensibly equal temperature at all points. It may be that for particular operations, special distribution of temperature is required; but particular cases may be approached with more confidence when the general case is understood.

The present design of electric oven has followed that of the gas oven in many essential points, except that in the latter the bottom of the oven is usually open, while in the former the oven is completely closed. Both types usually consist of an oven proper in an outside casing, the space between the two shells being filled with some bad conductor of heat. The transition from gas practice has not been altogether satisfactory to the electric oven, which still labours under several disadvantages because of an insufficient appreciation of certain fundamental differences in the two problems.

The first step in the design of an oven is obviously the complete consideration of the characteristics of the heat-producing medium, whether it be coal, coal-gas or electricity. A comparison of the costs of obtaining heat from these sources is both instructive and interesting, and shows very clearly the initial difficulty that electricity must face. If coal of a lower calorific value of 10,500 B.Th.U. per lb. can be obtained at 17s. per ton; if gas of a lower calorific value of 550 B.Th.U. per cb. foot can be obtained at 2s. 6d. per 1,000 cb. ft.; and if electricity can be obtained at 1d. per B.T.U.; it can easily be calculated that for 1d. the numbers of units of crude heat to be obtained from coal, gas and electricity are approximately 115,300; 18,300; and 3,410 respectively. From this it appears that it costs $5\frac{1}{3}$ times as much to get any given amount of heat from gas as from coal; and 34 times as much to get the same amount of heat from electricity as from coal. Heat from coal is, therefore, so cheap comparatively that few precautions are taken to utilise the total available thermal units to the best advantage. Improvements in the design of coal-fired ovens are, however, being introduced from time to time, and there is reason to believe that, as the price of coal increases, greater attention will be paid to this matter in order to reduce the cost of operation. Similar remarks apply to the case of gas: for, though various precautions are certainly taken in gas ovens of repute to minimise waste of gas, the limit of efficiency is not yet reached. It will be evident, of course, that while it may not be easy greatly to improve coal-fired ovens in respect of heat utilisation, it is not so difficult to accomplish this with the gas oven; and the actual efficiency of the average gas oven is considerably above that of the average coal-fired oven. With electricity, on the other hand, the problem of how to save heat is very much simpler than in the other two cases; and efficiencies very much higher than those of the best gas ovens are readily obtained. Indeed, it because of these higher heating efficiencies that it is possit for the cost of electric cooking to approach the cost cooking by gas or by coal.

In an electric oven of present design, the heat energy absorbed in five principal ways, being required :—

1. To raise and maintain the temperature of the heati element.

2. To raise and maintain the temperature of the a enclosed in the oven.

3. To raise and maintain the temperature of the inter metal work of the oven.

4. To make good the heat lost by radiation and co vection, &c.

5. To cook the food.

Headings 1 to 4 represent losses, of which 1, 2 and 3 a quite unavoidable, being inherent in the system of tra mitting heat from the electric current to the food to cooked.

Under heading 4, losses which are to some extent avo able are included, but it is to be understood that part these losses also are unavoidable.

1. The percentage of the total amount of heat used the cooking process that is required to raise the temperature the element itself is in general quite negligible, and m safely be ignored so far as any of the present-day eleme are concerned. The actual amount of heat necessary m be calculated with fair accuracy when the physical propert of the element are known; as a rule the amount is by the smallest of the losses represented by headings 1, 2, 3 and There seems to be a tendency to cut down the weight of t element—and also its size—to a minimum; it size may or m not be of much importance, but certainly its weight is little or no importance within fairly wide limits; and th is little need to endeavour to save an ounce or two in weight of the element at the expense of its reliability a useful life.

2. The proportion of heat required to raise and maint the temperature of the air inside the oven would not be v considerable but for the facts that (*a*) the food abso the heat it requires mainly from the air, and (*b*) there always leakages of air from the oven. With regard to latter, heat is lost when the oven door is opened for a purpose, and perhaps the usual ventilator and leaky joi add considerably to the total loss under this head. T remedy in this case is to have the oven joints as tight practicable, and to open the oven door no oftener thar essential.

3. With regard to the heat required to raise the tempe ture of the internal metal work of the oven, this proba ranks next to 1, in ascending order of magnitude, in ordinary daily use, since the oven is likely to be in serv some hours at a time; the total amount of heat accoun for under this heading will in usual cases be about 6 o per cent. of the whole. The weight of the metal of oven and of the shelves, &c., inside the oven, and th specific heat determine the actual amount; therefore it obvious that it is advisable to cut down the weight of th parts as far as possible consistent with their having suffici strength. It is to be understood that this remark ref only to the interior oven or oven proper; the thickness the outside casing and its weight have no direct connect with the amount of heat required to raise the temperature the interior oven.

The heat required under heads 1, 2 and 3 may regarded as heat stored in the oven which will be given again when the oven cools down; and if it were practica to work on such lines, the heat losses might be decreas In the ordinary case, such a procedure would be ridiculo and though some use can certainly be made of the h stored in the oven, it is much safer to assume that it is tot lost.

4. The heat lost by radiation, convection, &c., forms largest percentage of the total heat lost, and here it possible to effect fairly considerable economies. For c venience' sake, this loss will be referred to as a radiat loss, the term being quite sufficiently accurate for our p sent purpose. The general features of the problem radiation are well known, and, as they affect the case electric ovens, may be shortly stated thus :—

(*a*) The rate of heat loss increases rapidly with rise of temperature.

(*b*) The rate of heat loss decreases with greater efficiency of heat insulation.

(*c*) The heat loss varies with the area of the surface exposed.

The surface of the oven is fixed by consideration of utility and size, and will be taken as unalterable; the ratio of oven surface to oven volume increases, of course, with decrease in the size of oven. With regard to (*a*), however, the lower the temperature of the oven, the less the radiation losses; therefore, no higher an oven temperature should be used than is sufficient for cooking purposes. According to modern cookery practice, the highest oven temperature generally required is 380° F. to 400° F. The heating elements themselves are naturally at a higher temperature than this, and the radiation losses in their vicinity are considerably greater than in positions further remote from them. Care should be taken to see that the lagging of the oven near the elements is quite satisfactory, as well as to see that the elements are run at as low a temperature as possible.

Various opinions have been expressed from time to time regarding the heat insulation of an electric oven, see (*b*). For very small ovens to be used for short times only, quite a good arrangement is to have the oven of thin material very brightly polished outside and inside. The effect of the bright inside surfaces is to reflect some of the heat back into the oven and of the outside surfaces to hinder the radiation of heat from the oven. Such a design is open to the criticism that no precaution is taken to prevent currents of air carrying off large amounts of heat by convection; but, as already indicated, for very small ovens in use for short periods, it has the advantage of initial cheapness, and its efficiency is not abnormally low under ordinary conditions.

For ovens of larger size some other means of preventing large radiation losses must be adopted, as experiment clearly shows the above simple design to be very inferior from this point of view; and up to the present nothing better has been devised, for commercial purposes, than to suspend or fix the oven proper inside a stout outer casing, and to fill the space between them with asbestos, slag-wool or other bad conductor of heat. The thickness of this insulation should be as great as possible—considerations of first cost will place a limit on the thickness adopted rather than considerations of maximum economy—the minimum being about 2 in. Whatever the thickness employed, the lagging should be packed fairly tightly between the oven and its casing, to prevent access of currents of air which would carry off heat by convection. Care must also be taken to provide the minimum of metallic connection between the oven and the casing (not more than is made by a few screws, as the oven may rest on blocks of heat-insulating material). This is a point which is too often overlooked, and it is really surprising to find ovens in which a considerable amount of lagging is used with metallic contacts, which quickly render the lagging of little effect, to the detriment of the oven's efficiency.

5. It is hardly necessary to deal with the heat utilised under this heading, as the subject has nothing to do with the manufacturer. It has been pointed out that we assume that the food to be cooked obtains the necessary heat from the surrounding air, which should be at nearly uniform temperature throughout the oven. If the food is exposed to "radiant heat" from the elements, it will be found very difficult to obtain a uniform temperature in the oven; and as "radiant heat" has no place in successful coal-fire and gas ovens, there is no apparent reason why it should be recommended in an electric oven, while there is a good reason, above stated, why it is a drawback. For grilling, toasting, &c., radiant heat is of immense value, but to apply it to oven heating in general would seem a mistake.

Turning now to the heating element, it will be admitted that its nature is of no moment so far as the conversion of electrical energy into heat is concerned. A given number of Board of Trade units will generate the same amount of heat whether the medium be wire, of high or low resistance, or any special form of element. The actual relation is approximately—

1 B.T.U. = 3,410 British Thermal Units.

There are, however, conditions other than the above which greatly reduce the number of possible and practicable types of elements, or resistance; and some of these conditions will now be considered briefly.

First of all, the element must not melt at the highest temperature it can attain in the oven under full power. The resistance may stand the current quite successfully in the open air, but the hot oven obviously makes a vast difference. Nor should the element in general be very near its melting point, as a certain amount of mechanical strength is usually required, and this can scarcely be sufficiently obtained if the material is near its fusing point. It is advisable that it should have a low temperature coefficient in order to prevent the passage of unduly heavy currents when the power is switched on with the resistance cold. It is also very important that the action of the air on the element, as a whole, is negligible, *i.e.*, the element must not oxidise rapidly, if it oxidises at all, even at the highest temperature to which it can be exposed in the ordinary use of the oven.

Trouble may be experienced with the expansion and contraction of certain classes of elements, and this must be guarded against. The design of the necessary fixings should permit of the movement taking place without throwing on the element stresses above those which it can safely bear.

Consideration ought to be given in some measure to the question of ease of repair; and such an arrangement should be adopted as will not necessitate shutting down the whole oven because of the failure of a section of the element; the more so, since repairs will usually be done by ordinary workmen, not specially skilled in this particular branch.

The element must be able to resist the effects of the hot juices and vapours met with in the oven, and should not be damaged if liquids are spilled on it.

It is extremely difficult to comply with all the above conditions in the commercial electric oven and, as in many engineering problems, a compromise may be adopted. In the meantime, it would appear that wire elements, as a class, most nearly fulfil all the conditions, their one real drawback being their liability to oxidation at high temperature. It may be anticipated, however, that this disadvantage will be largely overcome in due time; possibly by the discovery of a new material, possibly by the better use of the material to hand at the moment. In certain cases, however, it would seem that this problem of oxidation—closely allied to that of the melting point in some ways—is not being tackled in a rational fashion. Since oxidation takes place most rapidly at the highest temperatures, the aim should be to keep down the temperature of the wire to the lowest necessary to give the required oven temperature in a reasonable time. The heat may be transferred from the element (*a*) by a small area of high temperature; (*b*) by a larger area of lower temperature, and obviously in this connection the larger area is to be desired. From the point of view of radiation also, the larger area of heating surface is an advantage, always provided that its temperature is kept correspondingly low. In order that such an element may not require too much space in the oven, its volume must be kept down by making it as thin as practicable.

Trouble is experienced in large ovens in keeping the inside temperature sensibly uniform, but this may be largely got over by the insertion of thin sheet metal baffle plates so fixed as to give a definite direction to the currents of air. The larger the heating surface, of course, the less the need for such a device.

The choice of position of the elements comes up here. So far as actual heating efficiency is concerned, there is probably not a great deal to be said against any of the usual positions, provided the element is contained wholly in the interior oven. It may be, however, that positions at the sides of the oven are conducive to a better circulation of air than are top and bottom arrangements. As the elements must also be protected from meat juices, the side position offers some advantage, as sufficient cover is obtained by a louvred thin sheet metal plate having its openings downwards. In the case of bottom elements a cover, which will allow of free passage of the air and yet prevent grease, &c., getting into the element is not quite so simple, though a similar arrangement can be devised.

The placing of an element of large heating surface at

the side of the oven will generally require a design of inside racks different to that usually adopted; but there is no difficulty in providing quite a suitable arrangement. There should be an air space between the back of the element and the side of the oven if the best results are to be obtained, and the element should be inside the oven entirely, and not relegated to a special compartment. Such a design destroys the primary idea of a good circulation of hot air.

The element should be so constructed as to enable its removal from the oven to be accomplished with comparative ease, connections being simply yet securely made. The electrical insulation of wires from the metal work of the oven, and of one section of the element from another, requires a little care, and must not be overlooked.

The power consumption for which any oven is designed will depend primarily on the use to which the oven is to be put. But it will also depend on the efficiency of the lagging and, to a lesser extent, on the cost of energy. Nothing need be said on the first two points; but the third is not evident at first sight. The fact is that, if the cost of energy is low, a liberal allowance will be advantageous in some respects; if it is high, a smaller current will probably prove the more economical in the long run. The explanation is that with the systems of control in general use, it is more difficult to strike the exact temperature required with the heavier current than with the smaller current, and in many cases there is a temptation to keep on the full power longer than is necessary. This tends to heavier running costs with the large currents, which, if energy is cheap, may be neglected altogether; but there is the undoubted advantage of being able to reach any desired temperature of oven in a shorter time with the heavier current.

Generally, full power should be sufficient to raise the temperature of the oven from that of the surrounding air to about 400° F. in, say, 30 minutes. Higher consumption of power will decrease the time required to attain the same temperature, and *vice versa*; but as the time taken decreases in a greater ratio than the power increases, it is obviously more economical, so far as heating up the oven is concerned, to use the larger power. For instance, in a certain oven, full power heated the oven to a temperature of 400° F. in 18 minutes, whereas half power took 50 minutes to do the same—a comparison very evidently in favour of the faster heating. The reason for this is that the quicker an oven is heated up, the less time there is for radiation losses and the greater the efficiency of the apparatus as a whole.

This, however, is only one point in the problem, and the disadvantages of high powers, already explained, more than counterbalance this advantage. An oven of average size will have ample power—provided the lagging and the position of the element are attended to properly—if its allowance is from 0·5 to 0·6 KW. per cb. ft. of oven capacity. In specially designed small ovens, less than this allowance is met with, and in large ovens as much as 1·2 KW. per cb. ft. is recorded.

With regard to the control of the oven, that most satisfactory from the technical point of view is one which will permit of any desired temperature being attained and maintained without variation. Such a perfect arrangement would probably be useless in ordinary circumstances, and a simpler method must be adopted. A consideration of the conditions leads to the conclusion that, at the very most, four different "heats" are advisable, and, at the very least, two different heats are essential; the greatest power is used only to heat up the oven, and the lower powers for the various cooking operations. If four heats are favoured they can be easily arranged for, by having the elements in four sections, in parallel; or in two sections in parallel, each section consisting of two parts in series, each part being controlled by a separate switch. Such a method of control lends itself nicely to obtaining a symmetrical arrangement of half power heating, which, as a rule, is sufficient for roasting purposes during the greater part of the process.

If two heats are regarded as sufficient, a satisfactory arrangement is to have the elements in four parts also, and to control one part of the element on one side in series with a second part on the other side, by one switch. This method also gives a symmetrical distribution of heat.

The simplest method of two-heat control is, of course, to have two switches, each controlling its own element.

There is need to add that the necessary switches ought to be designed with some regard to the currents in the circuits. Manufacturers are too apt to supply a very flimsy article, which may be positively dangerous, when the conditions call for something considerably more substantial; in this, however, the makers are probably no worse than are others in different trades.

There is no doubt that a reliable thermometer registering with reasonable accuracy the temperature of the oven is of great assistance in the economical working of electric ovens. But if sufficient information regarding the various heats, and the purposes for which each heat is most useful, is supplied with each oven, the thermometer may be omitted from the outfit without serious loss.

Not much has been said above on the subject of opening the oven door: this is generally supposed to be a very great source of waste indeed. No doubt a considerable amount of heat may be lost in this way; but as authorities are agreed that, for example, "basting" of joints is essential at regular and frequent intervals, there seems nothing for it but to open the oven door as often as may be necessary. Perhaps if someone invented a satisfactory mechanical apparatus for basting, this source of loss might also be eliminated to a great extent.

NOTES ON TENDER FACTS AND POLICIES.

By L. CROUCH.

From time to time the writer has prepared various analyses of the amounts of published tenders for electrical contracts, and he now commends to the attention of his readers the following notes based on these investigations:—

There is naturally considerable variation between the highest and lowest tenders for any particular contract, which variation is usually proportionately greater on small than on large contracts. The truth of the latter statement is evidenced by Table I, in which the percentage excess of the highest over the lowest tender in contracts of various average amounts is shown as a mean function of the latter. These figures also show the highest tender to average a value 20 per cent.—50 per cent. (or even 70 per cent.; grand average from Table I = 50 per cent.) above the lowest tender received.

It goes without saying that the lowest *bonâ fide* tender received is usually the one accepted, but the indiscriminate issue of contracts to the lowest tenderer is extremely unwise. A reasonable margin between the lowest and accepted tenders should be permitted when such will enable the tender of an experienced firm of high repute to be accepted, in preference to the lower estimate of a less reliable contractor. Much engineering material and machinery cannot be thoroughly judged till it has been in use for some time, so that a purchaser is forced to rely, to a certain extent, on the honesty and experience of the contractor, and it is quite reasonable to allocate a certain capital value to these attributes. Firms seeking new lines of development will frequently send in very low tenders for the sake of gaining experience in the work concerned: the

TABLE I.—Excess of Highest over Lowest Tender in 160 Electrical Contracts (Years 1909-11).

Average value of contract.	No. cases considered.	Percentage excess highest over lowest.		
		Maximum.	Minimum.	Average.
£0—100	24	233	2	68·4
£100—250	38	144	2	44·5
£250—1,000	38	150	1	55·5
£1,000—5,000	32	194	2	48·8
£5,000—10,000	11	182	3	47·2
£10,000—30,000	7	40	2	21·0
£30,000—50,000	5	90	18	37·4
over £50,000	5	52	5	19·6

purchaser may apparently save considerably by accepting this unusually low offer, but it is more than likely that he will ultimately pay dearly for the contractor's inexperience. (This remark applies rather to small contractors than to large firms seeking fresh developments and having a valuable reputation at stake.)

When a firm guarantees to employ British labour at predetermined minimum wages, this fact should be placed to its credit in comparing its tender with those of firms prepared to take all or some of the work out of the country in order to secure cheap foreign labour.

It is interesting to examine, in some detail, how often the lowest tender is actually accepted in this country. Basing the present analyses on the notes on "Tenders Accepted," appearing in the columns of the Electrical Review during 1909-1911, and considering only those contracts concerning electrical materials and apparatus (including complete generating sets), it is found that only the accepted tender is published in a number of cases. In practically every such instance the accepted tender was the lowest received, and it may be noted that the average value of these contracts was only 20-30 per cent. that of the average accepted tender in cases where full particulars were given of all tenders received (see Table II).*

TABLE II.—Contracts for which only Accepted Tender was Published (1909-11).

Year.	No. of contracts.	Total amount of accepted tenders.	Average value of accepted tender.	Value (%) of accepted tender, as compared with corresponding figure in Table III.
1909	131	£190,938	£1,457	27 per cent.
1910	254	332,314	1,308	22 ,,
½-1911	106	87,585	826	75 ,,

Table III summarises the leading particulars of the latter class of tender for the years 1909, 1910, and first six months of 1911. It will be seen that, in from 90-100 per cent. of the total number of cases considered, the lowest tender was accepted. The gross excesses of the accepted, highest and mean tenders respectively over the lowest tenders were :—

Year.	Accepted.	Highest.	Mean.
1909	£410	£83,609	£36,467
1910	602	116,102	40,952
½—1911	nil	11,705	8,073

—the average values per contract of the various groups being as shown in Table III. The average accepted tender was only 0—⅛ per cent. higher than the average lowest tender, the excess of the average mean tender being 10—20 per cent. There is thus little actual necessity in practice to decline the lowest tender for any of the above reasons, *if* the tenders here considered were all allocated in the best manner possible—a point which is at least open to question. The importance of the above considerations cannot be disputed, and the fallacy of hastily accepting the lowest tender is gaining ever wider recognition.

TABLE III.—Contracts for which full List of Tenders Received was Available. (1909-1911.)

Year.	No. of cases.		Average amount (£) of tender.				*Average number of firms tendering.
	Total.	Lowest tender accepted.	Accepted.	Lowest.	Highest	Mean.	
1909	70	63	5,347	5,341	6,535	5,861	7·8
1910	69	65	5,928	5,920	7,600	6,513	7·0
½-1911	34	34	1,107	1,107	1,451	1,344	6·2

* See text.

The total money paid out on the contracts analysed in Table III (= Σ tenders accepted) = £374,282 in 1909; £409,062 in 1910; and £37,628 during the first six months of 1911. The relatively low total in the latter case is due to the absence of tramway extension contracts, in London and elsewhere, which contributed so greatly to the 1909-10 figures.

It is interesting to note that the average number of firms tendering, in the contracts dealt with by Table III, fell from 7·8 in 1909, to 7·0 in 1910, and 6·2 in 1911 (to June 30th). The cases concerning which incomplete data are available (Table II) would, of course, affect these figures to a limited extent, especially in view of the fact that, among the contracts dealt with in Table II, for which 10 or more firms submitted tenders, the majority relate to small business :—

In year	No. of cases in which average amount of tenders was—						
	Less than £100.	£100—£500.	£500—£1,000.	£1,000—£2,000.	£2,500—£5,000.	£5,000—£7,500.	Other cases.
1909	2	7	2	4	2	2	10 firms for a £33,465 contract
1910	2	4	1	3	1	1	28 for £19,572
½-1911	1	2	1	—	1	—	26 for £14,063

In other words 55 per cent. of these cases concerned contracts for less than £1,000 each, and 75 per cent. involved less than £2,000 each, *i.e.*, it is for contracts of small amount that the greatest number of firms tender, so that omissions in data concerning relatively unimportant contracts may easily affect the apparent average number of firms tendering. It is quite possible, however, that the decrease in the latter figure during 1909-1911, as shown by Table III, may have a definite industrial significance.

It has been pointed out that a firm may tender at an unprofitable figure for the sake of gaining experience in a new class of work. A somewhat similar case, but one which leads to quite different results so far as the purchaser is cerned, is that of a contractor submitting an unprofitable tender for the sake of securing special advertisement from the gaining of the contract. Several notable instances of this policy have lately arisen in connection with street lighting. Gas companies have undoubtedly offered to light the main streets of certain large cities at unremunerative rates (even below cost price), for the sake of advertisement and to gain prestige in the eyes of prospective gas consumers. It is only fair to remark that certain electric supply authorities have been accused of the same policy—though with much less justification.

In such a case, the lessor of the contract will probably secure the best products and services of the contractor at a more or less exceptionally low figure, and he should generally accept the tender, providing this does not involve unfair hardship to any other party, and providing he does not thereby commit himself to unavoidable further dealings with the same contractor who, at a later date, may take advantage of his position to recoup his previous losses! The contractor regards such an "unprofitable" tender strictly as a commercial proposition; by it he gains the advertisement and prestige he seeks, and, in many cases, he recoups the whole cost thereof from other clients, a number of whom he probably secures as the direct result of the original tender and its favourable terms.

In every class of contract there are a number of cases decided entirely by private interest or patronage, and it is needless to say that, in such instances, the successful tender is accepted by no means obvious or logical to the statistical student! Apart from such irregular transactions (which, though involving a vast annual expenditure, are mainly confined to miscellaneous routine contracts, such as can be passed unobtrusively by the persons concerned, and to minor "special" contracts), a study of published information relating to tender acceptances requires little labour, affords much valuable knowledge, and should certainly be more common among engineers than is at present the case.

* In 1911 (up to June 30th), the absence of very large contracts (see Table III), makes this percentage so high as 75 per cent.; a considerably lower figure will doubtless be attained for the complete year.

Graetzin Lamps in Euphos Glass.—We understand that Messrs. Krupka & Jacoby, of 11, Queen Victoria Street, E.C., who have met with a large demand for the Graetzin metallic-filament lamp, are supplying it with bulbs made of Euphos glass, which is specially prepared so as to intercept all ultra-violet rays, and thus protect the eyesight from injury.

HIGH-VOLTAGE TESTING.

By DANIEL H. OGLEY, B.Eng. Royal Technical, Salford.

A well designed high-voltage testing department should be an essential part of the equipment of all test houses, as almost every machine specification calls for stringent insulation tests. This being so, the ohmmeter test—while affording a certain indication of the insulating qualities of a machine—cannot be taken as final, but requires to be supplemented by a power test.

Besides machine insulation tests, all insulation should be subjected to pressure tests before assembling, the pressure required for this purpose varying from, say, 20,000 volts in the case of mica tubes, to as low as 1,000 volts for thin presspahn and the like.

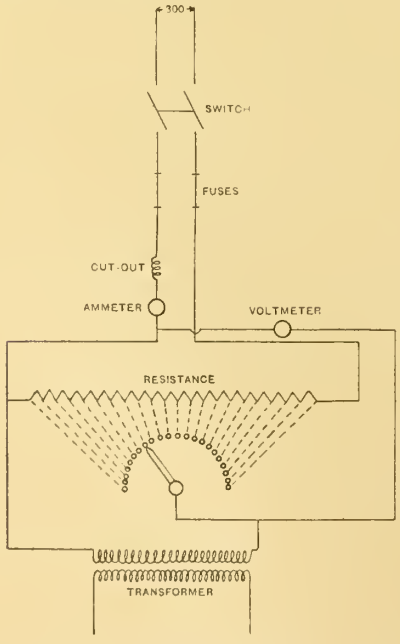
A testing voltage varying between wide limits is thus called for, and may readily be obtained by the installation of the simple apparatus shown in the sketch below.

The instruments, cut-out, &c., could be mounted on a small board fixed above, and at the back of the resistance, which latter would be best wound on porcelain and covered with a perforated frame to assist in ventilation.

A supply voltage of 300 or so in conjunction with an 80 : 1 transformer would give all the variation required, and the voltmeter could be calibrated to read the high-tension volts directly.

The transformer should be fixed in a test bay, which is understood to be devoted entirely to high-pressure tests; and further to remind workers in other parts of the building of the fact, it may be surrounded with a red barrier. The switchboard is fixed at the other end of the bay remote from the transformer, and as all variation of pressure is conducted from the switchboard, danger to assistants is obviated.

Some manufacturers prefer to test the machines where they have been assembled. This is a dangerous practice, since the transformer must either be moved to a position close



Connections of H.V. Testing Apparatus.

to the machine, in which case it is difficult to screen the apparatus being tested from the workmen, or long high-pressure leads must be taken from the test bay to the machine. All workmen must be moved from under the leads, and accidents are very likely to occur. In both cases, the assistant varying the pressure is often out of sight of the apparatus being tested, and has to rely for guidance on shouts from some other assistant on the spot.

It is much better practice to test all apparatus in the high-pressure testing bay, where it is in sight of the tester and is not dangerous to anyone.

Machine Tests.—Machine tests are more or less standard, stators being tested with from 2 to 2½ times the working pressure, and the duration of test being one minute. The usual rotor test for voltages between 250 and 500 is 2,000 volts, and 1,000 volts for those below 250 volts, with the exception of squirrel-cage rotors, the testing voltage in this latter case being 250-1,000 volts.

Some recent tests stipulated in specifications are as follows :—

1. Three-phase induction motor, mesh-connected, 6,000 volts alternating supply. Test 12,000 volts for five minutes before and after nine hours' run.

2. 500-volt three-phase star-wound stator. Test 2,000 volts for one minute between winding and earth.

3. 6,600-volt induction motor. Test 17,000 volts for one minute between winding and earth. Rotor (squirrel cage) 1,000 volts for one minute.

4. 2,000-2,500-volt single-phase generator. Test 5,000 volts for five minutes winding to earth.

Insulation Testing.—In testing insulation great care should be taken to avoid the forming of corona streamers, as, owing to their intensely localised heating effect, no correct breakdown test can be made when they are permitted to form.

The streamers form with great difficulty when each electrode is surrounded with a dielectric. Thin sheets of presspahn, &c., may be properly tested by making the sheets up in tubes and slipping them over thin metal rods mounted at right angles. Glass tubes may be tested properly in this manner.

Mica tubes may be tested by using an electrode in the form of a flexible wire brush. This is drawn inside the tube and makes contact with the whole inside surface. The outer electrode is a sheet of metal wrapped tightly round the mica tube.

To avoid the formation of corona when testing lead-covered cable, asbestos wool may be applied in a bunch over the ends. The corona is displaced by the slight current which the asbestos carries.

ELECTRICITY SUPPLY AT OLYMPIA.

The whole of the electricity supply at the forthcoming Electrical Exhibition at Olympia is taken from the Hammersmith Borough generating station, with the exception of such energy as may be used on consumers' own stands, being generated by self-contained exhibition plant. The bulk of the supply is single-phase, 50 cycles A.C., supplied to three permanent sub-stations in the Exhibition buildings through 2,200-volt cables from Hammersmith. These sub-stations are entirely independent (maximum security of supply being thus obtained), and contain 2,200/220-volt static transformers. The possible single-phase supply is approximately 1,260 KW. Three-phase current is obtained, from a high-pressure two-phase supply from Hammersmith, by the Scott T-transformer system (180 KW. available at 220 volts three-phase). Direct-current supply is from three sources :—(*a*) From a temporary 300-KW. sub-station fed with 2,200-volt two-phase current from Hammersmith through cables of 400 KW. capacity. The two-phase supply is transformed to six-phase current, which is fed to a rotary converter delivering at 220 volts D.C. (*b*) From two motor-generators, each of 150 KW. capacity, permanently installed on opposite sides of the Exhibition building. These machines are supplied with 2,200-volt two-phase A.C., and deliver 220-volt D.C.

From the permanent and temporary sub-stations supply is taken to the various stands *via* cables and service-boxes laid in the floor of the Main Hall or attached to girders under the galleries. The greater part of the distributing network is permanently laid in the building, but it has been necessary to employ a considerable length of temporary cable, some of which is of 0·6 sq. in. copper section (480 amperes capacity). All distributing conductors are rated at 800 amperes per sq. in., and an insulation resistance of at least 1,000 megohms per mile is specified. Leads from the service boxes to the consumers' switchboards must be enclosed in screwed iron barrel or wood casing; the use of flexible wiring is dis-

raged, and all wires within reach of the public are to be losed in wood casing or other approved covering. encased conductors must not be in contact with bunting other inflammable material. In the application forms for tricity supply issued by the management to exhibitors, re is a most useful summary of the safety precautions essary in wiring and illuminating stands.

All the meters, D.P. switches and fuses required up to the d delivery terminals are provided by Messrs. Ferranti, ... on behalf of the management, but exhibitors must ply all their own lamps, motors and wiring, &c. High-

ment is about 1½d. per unit. No attempt has been made to secure more than a safe profit from the sale of energy; the lighting tariff is very favourable, but, owing to the limited supply available, no special concession can be granted to power consumers. A large and steady lighting demand has been encouraged, and, at the discretion of the consulting engineers (Messrs. Russell & Snell), motors taking an excessive starting current may be subjected to limitations as regards time of starting and distribution and duration of running periods. All lighting is confined to the main single-phase supply, except where direct current is essential, as in



Electrical Illuminations at Olympia.

ssure cylindrical fuses with tin wires chosen to blow at per cent. overload are specified; metallic-filament lamp nits must not contain more than 15 lamps, and each lamp rein must not exceed 50 C.P.; motors exceeding ¼ H.P. st be of the enclosed or enclosed-ventilated type.

Four scales of tariffs have been adopted, viz.:—

1. A.C., one-phase, 220 volts, 50 cycles, for illuminating poses or equivalent small demands—inclusive tariffs vering terminal and connecting charges, &c.):—

0·28 KW. maximum demand	£2 2 0
0·56 „ „ „	3 15 0
0·84 „ „ „	5 5 0

2. A.C. one-phase 220-volt 50 cycles, by meter:—2½d. per it plus terminal charge.

3. D.C. 220-volt by meter:—3½d. per unit plus terminal rge.

4. A.C. three-phase 220-volt 50 cycles, by meter:—2½d. unit plus terminal charge, and a charge for hire of tributors from the temporary sub-station.

The terminal charges for tariffs (2), (3) and (4) are:—

. demand.	Terminal charge.	KW. demand.	Terminal charge.
2	£3 3 0	8	£9 9 0
3	4 4 0	9	10 10 0
4	5 5 0	10	11 0 0
5	6 6 0	15	15 0 0
6	7 7 0	20 or over ...	20 0 0
7	8 8 0		

About 250 exhibitors will take electricity supply; approxi-tely 140 will consume ¼ to 1 KW. under tariff (1), but of ese a number also require power supply under (2), (3) (4).

Though the charge for D.C. supply is only 1d. per unit gher than that for A.C., the additional cost to the manage-

the case of some arc lamps. The single-phase supply is cheapest and available in greatest bulk, and the security of supply and constancy of voltage are greater than can be guaranteed in the D.C. and three-phase circuits; hence its preference for the lighting supply.

The peak demand will probably occur at about 7 p.m. and remain fairly constant till near closing time. So far as is at present known, the total demand will be roughly as follows:—

	KW. demand.	Available supply.
Single-phase A.C.—lighting (tariff (1))	95 KW.	1,260 KW.
—power (tariff (2)) ...	754 KW.	
Direct current—(tariff (3))	532 KW.	600 KW.
Three-phase A.C.—(tariff (4))	236 KW.	180 KW.*
Total	1,617 KW.	2,040 KW.

* Supplemented by temporary sub-station.

The maximum demands yet received are for 341 amperes, single-phase; 182 amperes, D.C.; and 150 amperes, three-phase (220 volts throughout); these currents are the limiting capacities of the maximum-demand meters, and are somewhat above the probable demand, to reduce the risk of damaging the instruments. Among the demands for supply under tariffs (2), (3) and (4), 78½ per cent. are for 40 amperes or under, and 38 per cent. for 10 amperes or under.

Though application forms for electricity supply should have been received by the management not later than March 31st, some cases are still outstanding. Many forms have contained incorrect estimates of requirements, and non-electrical firms have frequently shown the greatest care in determining their probable demand!

The decorations of the building are incomplete at the time of writing, but show signs of being exceptionally

charming. The interior illumination of the hall will be extraordinarily brilliant; in addition to the large number of flame arcs permanently installed, arrangements are being made for the exhibition of numerous high-c.p. metallic-filament lamps, and the stalls themselves will, of course, be profusely illuminated. Already 10 32 ft. × 3 ft. 6 in. illuminated panel signs are promised round the gallery railings.

Our thanks are due to Mr. F. B. O. Hawes, secretary to the Exhibition, for his courteous assistance in the preparation of the above notes.

* * *

The external illumination of Olympia is in the hands of the Imperial Lighting Co., Ltd., and despite a recent fire at the company's works, there is every prospect of the following equipment being in full working order by to-morrow night.

The name of the exhibition, its opening and closing dates, and the words "Lighting, Heating, Cooking, Power," will be shown across the main entrance in letters 2 ft. high, lighted at night by about 400 16-c.p. metallic-filament lamps. Immediately over the main entrance there is to be a Union Jack traced out by correctly coloured lamps, and given the appearance of waving in the wind, by a motor-driven drum switch. To right and left of the flag will be two playing fountains, 16 ft. 6 in. in extreme height, and composed of five double sprays switched on successively by a drum type flasher so as to produce a realistic impression of motion. Under each fountain there will be arranged a zig-zag flashing device imitating lightning; at the conclusion of each flash, the words to right and left of the device will light up. At the right and left terminations of the dome contour will be powerful searchlights throwing inwardly inclined beams across the word "Olympia," and thence on to the sky. Finally, the main outline of the building will be marked by festoons of coloured lamps.

The flashing lamps will be of the carbon-filament type, 30-watt, 8-c.p., 220-volt units being employed. The remaining incandescent lamps will have metallic filaments—nine 25-volt, 16-c.p. lamps being placed in series across 220-volt distributing cables. In all, about 1,500 incandescent lamps will be employed, and roughly one quarter of these will be on "living" circuits. Specially designed drum flashers, driven by $\frac{1}{20}$-h.p. motors will control the fountains (five-ways), lightning flashes and wording. The total demand for the incandescent lamp circuits will be 135 amperes, and each of the large projectors will require 100 amperes. The projectors are specially neat and portable, and have been designed for this class of work by the Imperial Lighting Co.

The Exhibition management originally made strenuous efforts to secure co-operation between electric sign manufacturers in the provision of a really elaborate illuminating scheme, but unfortunately this could not be arranged. As a result the outlay had to be much more limited than would have been the case under the hoped-for co-operative plan, and under the actual circumstances, the Imperial Lighting Co. have provided a very satisfactory equipment.

Electricity Supply from Sweden to Denmark.—For some time a proposal has been under consideration to supply the city of Copenhagen with electrical energy from the waterfalls at Trollhättan, near Gothenburg, and the superintendent of the Board of State Waterfalls, Colonel Hansen, has now, after investigation, declared that the difficultics in connection therewith will not be very great. The Board of Waterfalls, however, will take no initiative themselves, but will leave it to the Government, who probably will lay the matter before the Rigsdag. Prof. W. Rung, one of the best Danish authorities on electrotechnical matters, seems to be somewhat sceptical over the scheme, and declares that he is not quite sure whether the electricity will be very much cheaper when supplied from Trollhättan, and that he himself would hesitate to advise it. He estimates the costs to be about £350-£450 per km. Another question is whether duty must be paid on electrical energy imported from a foreign country. On a former occasion an electricity works established at the free harbour of Copenhagen had to supply energy to one of the railway stations, and duty calculated according to the coal consumption was paid.

A Berlin Chimney Falls.—According to a London newspaper, a large chimney at the Berlin works of the Allgemeine Elektrizitäts Gesellschaft collapsed last Saturday, apparently owing to an explosion. Three persons were killed and seven injured by falling masonry.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Quartz in Electrical Heaters.

The undersigned was probably the first to employ manufactured quartz for electrical purposes, see Patent No. 14 of 1902, in which quartz capillary tubes are employed containers for electric fuses; and Patent No. 3,25 1902, in which quartz is employed in connection mercury vapour lamps.

E. B. Schattn

London, S.W., *September 16th*, 1911.

In reply to Mr. M. Taylor's inquiry in your current i I think Mr. Bastian can unblushingly claim to have the first to successfully apply quartz in his very prac and popular "Quartzalite" apparatus.

Exactly who was the first to apply it unsuccessfully w probably be a difficult fact to ascertain.

I think there was a company in Bristol which, some y ago, made a heating element consisting of a quartz stuffed full of some special resistance powder, but this d was apparently not satisfactory.

Andrews, of the American General Electric Co., was an early experimenter, and has obtained patents in United States only. He winds a wire on a tube and enc that within a second outer tube, an unnecessarily cl arrangement, as it seems to me.

Alfred A. Newma

London, S.E., *September 18th*, 1911.

The Premium Pupil System.

In the current issue of the Review your correspond "University Lecturer," somewhat light-heartedly criti the Council of our senior Institution in connection with recent Education Conference. He states that the w business was futile, and expresses the opinion that no sion can be arrived at in a discussion between professors naturally swear by college and consultants who represent premium system.

Now, there can be very little doubt that many of t who have followed the proceedings will agree with your tributor as to the futility of the Conference, and I person fully believe that the professors and the premiumites do at present seem likely to "agree on some common cours action." When, however, "University Lecturer" goes to say that the premiumites, who belong to a lost cause, formed a "no surrender" party, and are "dying in the ditch," &c., I feel called upon to take up my pen in endeavour to prevent the perpetration of an injustice.

As to whether the premium system is dead or dying, your correspondent refer to the opening remarks of chairman of Sec. III of the Civil Engineers' Conference. would appear that as a result of the Council's inquiry, it found that "in 75 per cent. of the cases considered t were regular arrangements for pupilage, and in only 25 cent. was no provision made for such regular pract training. . . . Of the 25 per cent., more than half the c occurred in the engineering departments of munic authorities."

In spite of the Council's figures, however, there will many who will hold with your correspondent that the p system is really dead, and in this there is real danger, fo such a notion should become prevalent there is no doubt t the profession, as a whole, will suffer in the end. Experie of both sides has shown me that, so far as concerns electr engineering at any rate, the possibilities of the premi system are very great, and it is astonishing how little t are realised.

Your correspondent says "it is beginning to be recogni that there is an art in teaching," *i.e.*, in imparting kn ledge to the student. Quite so, to be able to teach well is accomplishment possessed by few, but there is no monop held by university or college lecturers. I believe that th

ntlemen are developing their art in the wrong direction. ar better were it that they should cultivate less a capacity r imparting technical knowledge and instead endeavour to ach their students the art of learning. What fraction of ie total acquired knowledge can the college trained youth pply directly to his work? Ask him six months after he is taken up his first job. Twelve months later he will ave thoroughly forgotten most of that which he has not en actually using. He will, however, continue to learn r many years.

Alas, much of the time at college is wasted, and once a oungster has mastered elementary principles and acquired ie art of learning, he will do well to seek out some firm who ke their pupil system seriously.

It should be known, therefore, that it is possible in this ay to develop theory and practice side by side under con- itions which will make it easy for the pupil of average pplication and ability to rapidly out-distance his brother at ollege in all matters that are of importance to the normal ngineer.

University Graduate.

September 17th, 1911.

Charging Ignition Batteries.

Apropos the article in the REVIEW of September 8th on harging small accumulators: to avoid the waste of energy n charging through a lamp or bank of lamps, I find there a great saving by charging off the regulating cells of the ghting battery through a resistance (an old motor starter an be used, or a length of, say, 14 S.W.G. iron wire can be gged up on a frame, and can be tapped at a point to give ie required amperes). Most works have ammeters more r less on the scrap heap, these can be rewound, if necessary, r possibly there are some old type disused voltmeters that nly require rewinding and recalibrating. With regard to ie two wires to be taken from the lighting battery end cells, ne can be soldered to the lead bar of the last cell of all. he other, sufficiently long, is sweated to a connector that an be clamped to the lead bar of whatever cell is required o give the necessary voltage to charge a cell or a number n series.

P.

Lift Control.

Reading of the regrettable fatal passenger lift accident ecently, I thought that this risk could be greatly inimised by the *stop* push being allowed to project, say, $\frac{1}{2}$ in. r $\frac{3}{4}$ in., and be of a distinctive colour. As the general ress buttons are black, the stop push should be ivory or one. By this arrangement the lift could be much more eadily stopped, and one would avoid the groping about ith one finger to find the stop push as at present.

Fred. J. Lorimer.

London, N.W., *September 13th*, 1911.

BUSINESS NOTES.

Russia.—POLAND.—The following information is from he report by H.M. Consul at Warsaw (Mr. C. Clive Bayley) on the rade of Poland and Grodno in 1910, which will shortly be issued.

A report from a reliable source in the Lodz district states that there is a good opening for steam turbines and electrical instal- ations generally. Very important orders for this class of nachinery are constantly being placed in Germany. By far the reater number of steam, gas and oil engines continue to be mported from Germany and Austria. It is very seldom that an English-made steam engine is heard of as being sent into this district, and it is not by any means a question of price."

Electric light is practically always installed, either alone or in onjunction with gas. Birmingham electroliers and electric light ccessories are both cheaper and better than those procured from ermany, but British manufacturers of these goods are very little epresented in Poland.—*Board of Trade Journal.*

Trade Announcements.—THE WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., advise us that their agency greement with Messrs. Galsworthy, Ltd., is now terminated by effluxion of time. The W.E.M. Co. have, therefore, made arrange- ments to open a depôt at 165, Wardour Street, W. Their new premises comprise commodious stores, and a large stock of all their manufactures will be carried. They have appointed their South of England representative, Mr. H. Bailey, as manager of the London depôt, with Mr. A. E. Blower as chief assistant. At their stand at Olympia (No. 244A) they show, besides the ordinary range of switches, main switches, main boards, &c., a complete selection of switches fitted with their patent earthing attachment to comply with the Board of Trade Regulations.

The business of the W. & L. Electrical Engineering Co., of Granville Street, Swinton, near Manchester, has been taken over by MESSRS. WM. & JACOB TURNER WALMSLEY.

MESSRS. E. BROOK, LTD., of Huddersfield, announce that Mr. Chas. H. Jessop is acting as their representative for London and the South from September 11th. He was until recently in the employment of the Langdon-Davies Motor Co., Ltd., and his present address is 163, King Street, Hammersmith, London, W.

MESSRS. G. M. BODDY & CO. have removed from 15, Gray's Inn Road to 8, Leadenhall Street, E.C. (telephone No. 10503 Central), where they will supply the new "Mazda" drawn-wire tungsten lamps, which they have adopted since the recent patent litigation. Their 18 years' experience in the sale of electric lamps has enabled them to keep closely in touch with the successive improvements in manufacture, and their special feature at the Electrical Exhibition will be these "Mazda" lamps, which will be shown by them at stand No. 297. They have just issued a circular to the trade explaining the high qualities of the drawn-wire filaments.

THE EASTERN ELECTRIC AND TRADING CO., of Sukkur Sind, India, are jobbers of everything electrical, and commission agents, and they desire to get into touch with British manufacturers.

The International Institute of Technical Bibliography has removed to 68, Hampstead Way, London, N.W.

Book Notices.—"The *Journal* of the Institution of Municipal Engineers." Vol. III, No. 2. August, 1911. London: The Institution. Price 1s.

"*Journal* of the Franklin Institute." Vol. CLXXII, No. 3. September, 1911. Pennsylvania: The Institute. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 9. September, 1911. New York: The Institute. Price $1.00.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXIII, No. 9. September, 1911. Baltimore, Ind.: The Society. Price $1.00.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXVIII., No. 8. August, 1911. Santiago de Chile: The Society.

"*Boletin* de Ingenieros." Vol. I, No. 12. August, 1911. Mexico: Secretaria de Guerray y Marina.

The *Journal* of the Tramways and Light Railways Association for September contains the recently published Board of Trade Regulations with respect to the use of electrical power on tramways, also a reprint of a paper on "Tramcar Meters, &c.," read by Mr. A. Sharman Giles, M.Inst.C.E., before the Institution of Civil Engineers.

The Faraday House Journal for September has been issued, and contains articles on "The Electrification of the Randfontein Central," "Finding the Neutral Point in C.C. Machines," &c., and the results of the Easter and Summer Examinations. The British Westinghouse Co., Brown-Boveri & Co., and the electricity works of Hornsey, Rawtenstall and York have joined the affiliation scheme of the Institution, whose new term begins on Monday, September 25th.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVII, Part 9. August, 1911. London: Andrew Reid & Co., Ltd.

"Original Papers on Commercial Dynamo Design." By William L. Waters. 1911. London: Chapman & Hall. Price 8s. 6d. net.

"A Handbook on the Gas Engine." By Herman Haeder and W. M. Huskisson. 1911. London: Crosby Lockwood & Son. Price 18s. net.

Electric Time Service.—THE SYNCHRONOME CO., of 32 and 34, Clerkenwell Road, E.C., inform us that among other important contracts for electric time services which they have in hand at present are the following:—London and North-Western Railway Stations at Harrow, Pinner and Bushey, and new offices at Euston; Webb Orphanage, Crewe; Royal Military College, Sandhurst; Vickers, Ltd., Westminster; Exchange Telegraph Co.; Lever Bros.' new offices, Royal Liver Buildings, Liverpool; Temple Press, Rosebery Avenue; Manchester Municipal Girls' Secondary School; Sheffield Training College; Farringtons Girls' School, Ltd., Chislehurst; County School for Boys, Bromley, Kent; St. Felix School, Southwold; Crawford Municipal Technical Institute, Cork; Coronation Clock Tower, Wednesbury; new Putney Hospital; Liebig's Extract of Meat Co.'s new offices, Queen Street Place; ss. *Laconia*, for the Cunard Steamship Co.; the Royal Naval Barracks, Shotley.

Fire Precautions at Olympia.—THE RADIUM FIRE EXTINGUISHER, LTD., of 67, Chancery Lane, W.C., has made arrangements to loan radium extinguishers to exhibitors for use on their stands during the period of the Exhibition at a nominal charge. We are informed that this extinguisher has proved its ability to deal successfully with fires caused by high tension electric currents, arcs of 2,000 volts having easily been extinguished under test conditions in London electric lighting works. It is also used on the City and South London and other electric railways.

E.C.C. Staff Benefactions.—The sum of £150 has been subscribed by the employés of the E.C.C., for the Wolverhampton Hospital Saturday Fund.

Bankruptcy Proceedings.—W. H. Illingworth, electrical engineer and dealer, Halifax and Leeds.—First and final dividend of 3s. 9¾d. in the £, payable September 26th, at Official Receiver's chambers, 12, Duke Street, Bradford.

Cuthbert Fenton Lindop, electrician, 16, Moss Lane, Aintree, late 62, Dale Street, Liverpool.—The adjourned public examination of the above debtor was held on Monday last at the Court House, Government Buildings, Victoria Street, Liverpool, before Mr. Registrar Cooper. The Deputy Official Receiver stated that on July 29th the debtor was ordered to prepare certain accounts, and he had only handed them to the Official Receiver on Saturday afternoon. There had been no time to examine them, even assuming them to be satisfactory, and it would be necessary to have a further adjournment. The examination was further adjourned.

France.—La Société Internationale des Accumulateurs Vedeka is the name of a new company which has just been formed in Paris, with a capital of £6,000.

La Société Francaise d'Industrie Electrique is the name of a new company which has lately been formed in Paris with a capital of £180,000. The new concern, which has taken over works at Colombes, will act as agents in France for Messrs. Ganz & Co., of Budapest, and Messrs. Dick, Kerr & Co., Ltd., of London and Preston.

Dissolutions and Liquidations.—J. G. Childs & Co., Ltd., electrical engineers, Hawthorn Works, Hawthorn Road, Willesden Green.—Under the compulsory winding-up order made last May on a creditor's petition, Mr. H. E. Burgess, Official Receiver, has now issued his report to the creditors and shareholders. The statement of affairs, as at March 31st, 1911, the date of the appointment of the Receiver for the debenture-holders, shows unsecured debts, £20,641; fully secured creditors, £3,714; other liabilities, £100 (not expected to rank); preferential claims, £296; and loans on debenture bonds, £5,452; making a total indebtedness of £30,202. The assets, which are entirely absorbed by the debenture and preferential claims, are valued at £3,410, and consist of cash, £1 15s.; stock-in-trade and work in progress, £1,000 (estimated cost, £4,040); machinery, £1,000; trade fixtures, fittings, &c., £200; office furniture, £20; drawings, plans, patterns, &c., £300; and book debts, estimated to produce £888. The account with the contributories discloses a deficiency of £41,061, which is explained as follows:—Excess of capital and liabilities over assets on September 30th, 1910, as per company's balance-sheet, £14,939; estimated gross loss on trading as per account to March 31st, 1911, £7,947; expenses of carrying on business from September 30th, 1910, to date of winding-up order, £3,070; losses and depreciation not written off in company's books, now written off by directors:—Stock-in-trade and work in progress, £3,040; plant and machinery, £1,491; wind-turbine development, £2,070; patents, £528; bad debts and discounts, £366; drawings, experimental work, plans and patterns, £1,421; goodwill, £5,979; other losses, £2.257 — £17,153; making £43,109; less increase in valuation of buildings, £2,048; leaving the deficiency as per statement of affairs, £41,061.

According to the report of Mr. Burgess, the company was incorporated on December 27th, 1901, with a nominal capital of £20,000, and was formed to acquire and carry on the business of electrical engineer belonging to J. G. Childs. The capital was by special resolution on February 20th, 1902, divided into 10,000 6 per cent. cumulative preference and 10,000 ordinary shares of £1 each. The nominal capital was increased on April 4th, 1907, by the creation of 3,575 second preference shares of £1 each. The first directors of the company were J. G. Childs and H. Turnbull, who were appointed under the articles of association. Other directors appointed were T. S. Hill, on January 29th, 1902, and R. and A. E. Phipps, on February 3rd, 1910. H. Turnbull resigned on December 31st, 1906, and R. Phipps died in the early part of 1911. The other directors remained on the board until the date of the winding-up order. The business acquired by the company had been carried on by J. G. Childs for two years, and according to his books a profit of £543 had been made during the year preceding the sale to the company. Further working capital becoming necessary, Messrs. Hill and Turnbull agreed to invest £2,000 each in the business. By an agreement dated January 3rd, 1902, the company purchased from J. G. Childs the goodwill and assets as at June 30th, 1901, for the sum of £5,300, payable in fully paid shares of the company, and the company undertook to discharge certain liabilities of the business, which amounted to £1,950. The assets taken over appear in the books as follows:—Sundry debtors, £1,237; plant, machinery, stock, &c., £1,012; goodwill account, £5,001 = £7,250. No prospectus was issued, the share capital issued for cash being taken up by the directors and their relatives. The amount issued for cash was as follows:—Ordinary shares, £3,007; first preference shares, £6,200; second preference, £3,575. In the autumn of 1902 the company was in need of financial assistance, and commenced borrowing money from two of the directors, viz., Messrs. T. S. Hill and H. Turnbull. Mr. Turnbull continued advancing money until February, 1906, and in April, 1907, the amount of his loans, aggregating with interest £3,575, was satisfied by the issue of 3,575 fully paid second preference shares, and a release from certain guarantees of the company's debts given by him. At the date of the last issued balance-sheet T. S. Hill's loans to the company amounted to £14,832; against this amount debentures for £4,600 were issued to him, reducing his claim on loan account to £10,232. Additional advances since have increased the company's debt to him by upwards of £2,000. In June, 1903, the company took more convenient and suitable premises at Hawthorn Road, Willesden Green, on a lease for 99 years at a rental of £135 per annum. The lease was granted free of cost to the company, but contained a proviso that £800 should be spent upon the buildings. According to the company's books the buil account was debited at various times with sums which total £1 On March 3rd, 1904, the lease was mortgaged to Mr. S. Hill in sideration of a loan of £3,000. This loan is still outstanding, appears in the last balance-sheet with interest at £3,629. directors acting at this date guaranteed the repayment of the with interest, but Turnbull was subsequently released from liability under this head. The company's trading, which consi chiefly of the manufacture and sale of electrically-controlled l was carried on throughout at a loss. Profit and loss accounts balance-sheets were prepared and audited for the years 190 1910. The loss on the respective years is stated as follows:—

25 months to July 31st,			1903	£3,004
12	,,	,,	1904	2,525
12	,,	,,	1905	1,928
12	,,	,,	1906	1,561
12	,,	,,	1907	576
12	,,	,,	1908	1,341
12	,,	,,	1909	1,183
14	,,	Sept. 30th,	1910	2,821
		Total loss		£14,939

On February 21st, 1908, an issue of £5,000 6 per cent. mortgage debentures was authorised in general meeting. T debentures, with the exception of £400, are entered in the c pany's books as having been issued to T. S. Hill, and his l account is debited accordingly with £4,600; but in fact debentures were handed by Hill to various other creditors of company, excepting £1,000 which Hill has lodged with bankers as part security for an overdraft of about £13,50(respect of money obtained at various times and lent to the c pany. Hill has personally guaranteed the repayment of the o draft. In October, 1908, the directors resolved to take up manufacture of wind-turbines, incorporating certain invention J. G. Childs relating thereto. Considerable expense was incur in developing and advertising the wind-turbines, and a sn number was sold, about five in this country and four abroad Canary Islands, Argentine, Granada and Australia. In Decem of 1909, with a view to relieve the financial pressure, attem were made to float an independent company to take over t branch of the business, but the negotiations to this end through. The sum of £1,569 stands to the debit of the wi turbine development account, this amount having been arrived after deducting sales aggregating £1,121. The company's inte in this invention and in all patents vested in Childs Hill, the fees on which were paid by the compa consists of three-fifths of the foreign patents and assignable licence to manufacture the inventions in Engla The directors decided in March, 1910, to move to new premises South Fambridge, in Essex. Messrs. Childs and Hill had th acquired the equity of redemption of 2 acres of land and buildin thereon for about £100. Mr. R. Phipps subsequently provided money required to pay off the existing mortgage on the proper and refunded to Childs and Hill the money paid for the equity. T company was only a tenant at will, and was not interested in freehold. The premises were equipped with the necessary plant, a the manufacture of wind turbines and lifts was commenced the The amount expended on plant and buildings is stated to have b about £1,600, in addition to which the expenses of removal amoun to £257. The directors state that this removal was for econo the intention being to carry on the mechanical part of the busin there, while the construction of woodwork for the lifts was c tinued at Willesden. Under the instructions of the company Chi went to the United States in October, 1910, to effect a sale of t American patent rights relating to wind turbines in that count and the board granted a power of attorney giving him authori to dispose of such rights in any manner he might think be Certain negotiations took place, but no sale has been effect and the power of attorney given by the company has expir On March 31st, 1911, Mr. H. W. Freshwater, of 7-8, Railw Approach, London Bridge, was appointed Receiver on behalf of t debenture-holders under powers contained in the debentures, a since that date he has been in possession of, and is realising, t company's assets, and completing a number of unfinished co tracts. His estimate of the value of these contracts is as follows Amount estimated to be payable under the contracts £2,577, le amount already expended by the Receiver, and approximate amou required to complete, £1,400; estimate of amount to be realise subject to Receiver's charges, £1,177. The Receiver has express the opinion that the assets will not realise sufficient to satisfy t claims of the debenture-holders. The failure and insolvency of t company are attributable chiefly to contracts having been unde taken at prices which were not remunerative, and to excessiv expenditure in carrying on the business. The liquidation has bee left in the hands of the Official Receiver.

Midgley's Electro-Therapeutical Co., Ltd.—A meeting called for October 17th, at Manchester, to hear an account of th winding up from the liquidator (Mr. F. Murgatroyd.)

W. & L. Electrical Engineering Co., general electrical eng neers and contractors, Granville Street, Swinton, near Manchester.— Messrs. J. T. and W. Walmsley and E. W. Lucas have dissolve partnership. Debts, &c., will be attended to by Messrs. Walmsley who will continue the business under the same style.

Small Lighting Plants.—We have received a inquiry, emanating from a foreign source, for "a good and reliabl make of gasoline engine and dynamo for 20 up to 50 lights, com plete with switchboard, &c., easy to install and to keep going. If there are any made for less that 20 lights, particulars of these ar asked for. So many makers have taken up this line that we hav no doubt that there will be numerous replies—which may b addressed to this office.

Catalogues and Lists. — The London Electric [illegible]M, George Street, Croydon. — We have received an advance [illegible] of the firm's new catalogue (No. 190), in which, in the course [illegible] 112 pages, are given very fully illustrated particulars of their [illegible]ne working part" arc and metal-filament lamp lowering gear [illegible] self-sustaining winches. The firm have, as our readers are [illegible]are, specialised for a very long time in this department, and [illegible]tral station engineers, contractors and others will find it useful [illegible] have at hand this complete and up-to-date record of the [illegible]ferent types and prices. There are diagrams and photographs [illegible]actual installations of all special types of gear, namely, central [illegible]rier, two-stage, span wire and inverted gear, &c., as well as [illegible]inary swan neck and rectangular pillar street lighting. Exam[illegible]s of converted centrally hung lamps at Eastbourne, Grimsby, [illegible]diff, Ealing, Oxford Street, London, Westminster, Ilford, &c., are [illegible]wn. The firm undertake complete change-over jobs anywhere, [illegible]ieving borough and other engineers of trouble and responsibility, [illegible] 50 pages of illustrations show specimens of what they have [illegible]ne under such arrangements. For the convenience of contractors [illegible] others a number of catalogues have been printed without the [illegible]n's name. The firm keep a large stock of their manufactures. [illegible] current interest in the list there is an illustration of Olympia [illegible]icating that their gear is fitted to large lamps inside the [illegible]lding.

Messrs. Lacy-Hulbert & Co., Ltd., 91, Victoria Street, West[illegible]ister, London, S.W.—A number of leaflets containing illustrated [illegible]criptions, with drawings and dimensions, prices and other par[illegible]ulars of "Boreas" rotary pumps, electric air compressors, vertical [illegible]t-driven air compressors, and small "Class V" compressors.

The Selas Lighting Co., Ltd., 5, Newcastle Street, Hulme, [illegible]nchester.—32-page catalogue (art paper) giving descriptions of [illegible] "Selas" flame arc lamps, enclosed arc lamps (direct) for D.C. [illegible] A.C., true colour matching lamps, semi-direct and indirect [illegible]dowless illuminating enclosed lamps, and particulars of various [illegible]res, line resistances, raising and lowering gears, and pulley [illegible]cks, winches, arc lamp brackets and carbons. The catalogue is [illegible] illustrated, showing interiors and exteriors of the different [illegible]es of lamps, and prices and general particulars are tabulated. [illegible]able of "Selas" auto-transformers (40 to 100 cycles), their sizes [illegible] prices, appears at the end. Copies of the catalogue can be [illegible]ained by the trade.

The Radium Electric Co., 82, Hatton Garden, London, E.C.— [illegible]strated price list of "Radec" metal-filament lamps, with pear [illegible]pe, round, and candle shape bulbs.

The India-Rubber, Gutta-Percha and Telegraph Works [illegible], Ltd., Silvertown, London, E.—24-page list (No. 40A), giving a [illegible]ge number of tables of particulars, pattern numbers and prices [illegible] twin. concentric and high-tension cables, flexible conductors and [illegible]ds.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon [illegible]ad, London, E.C.—Several leaflets for the 1911-12 season, setting [illegible]th particulars and prices of their "Efesca" metal-filament lamps [illegible] domestic and general use, and for street and other outside [illegible]hting; one of the sheets shows and particularises, with prices, [illegible]ir auto-transformers.

Messrs. Schoen Bros., 29-30, Cock Lane, Snow Hill, London, [illegible].—16-page illustrated and priced catalogue of electrical novelties, [illegible]niature lighting, accessories, pocket lamp cases, small motors, [illegible]nction and medical coils, &c.

Messrs. Julius Sax & Co., Ltd., 24A, High Street, New Oxford [illegible]eet, London, W.C.—Several illustrated and priced leaflets showing [illegible]pholders, vitreous china wall plugs, and "Goliath" electric bell [illegible]e.

The British Aluminium Co., Ltd., 109, Queen Victoria [illegible]eet, London, E.C.—Leaflet giving thicknesses, weights, diameters, [illegible], of aluminium tubes.

The Auto-Lift and Runway Co., 44, Miller Street, Man[illegible]ster.—Sixteen-page pamphlet containing illustrated descriptions [illegible] prices of hand and electric pulley blocks, crabs, jib cranes, [illegible]ctric friction hoists, electric transporters, &c.

Messrs. E. Bennis & Co., Ltd., Little Hulton, Bolton.—New [illegible]aphlet of 20 pages, containing descriptive notes regarding the [illegible]nis new-link chain-grate stoker and its evolution. Some in[illegible]nces of individual installations are illustrated, these including [illegible]nsington and Notting Hill joint electric lighting station, Central [illegible]ctric Co.'s station, Leeds and Coventry electricity works. The [illegible]lts of boiler tests made at some of these and other stations are [illegible]nlated.

The British Thomson-Houston Co., Ltd., 83, Cannon Street, [illegible].—Price list No. 310 of the B.T.-H. "Gem" lamp. This is now [illegible]de at Rugby, and represents the highest development of the [illegible]bon-filament lamp, the filament being raised to an extremely [illegible]h temperature in the electric furnace in the course of manufac[illegible]e, with a resulting gain in efficiency of 25 per cent. compared [illegible]h the ordinary carbon lamp, with an equal life and very slight [illegible]rease in price. It is made of 16 C.P. at 100-130 volts, consuming [illegible] watts, with a life of 1,500 hours, but can be supplied of 20 C.P., [illegible]ing 50 watts, with a life of 800 hours. The resistance of the [illegible]ment varies with temperature, like that of metals, so that it is [illegible]s affected by variations of voltage than the carbon lamp. It is [illegible]ted that eight million "Gem" lamps are in use in the United [illegible]tes.

The Westinghouse Cooper Hewitt Co., Ltd., 151-2, Great [illegible]fron Hill, E.C.—We have received an excellent little brochure [illegible]itled, "Better than Daylight" (Form No. 94), in which the [illegible]vantages of the Cooper Hewitt lamp for the textile trades are [illegible]nvincingly set forth. There is no doubt that workpeople like [illegible]s light when they have become accustomed to it. A list of [illegible]ctories in which the lamp has been adopted, would, we think, be [illegible] useful addition to the booklet.

Messrs. Simplex Conduits, Ltd., Birmingham.—Weekly mailing card giving prices and illustration of their electric boot polisher. These machines are made from ⅛ to ¼ H.P. for D.C. with shunt-wound motor, and for single or three-phase A.C., with induction motor.

Messrs. Tyler & Freeman, of 20, New Bridge Street, E.C., have sent us a pamphlet briefly describing the more important works which they carried out in 1910; it is well illustrated, most of the views showing large country houses in which complete installations were erected by the firm; many large works were also equipped by them, including those of Messrs. Aveling & Porter, which are now entirely driven by electricity, with motors of over 500 H.P. Repton Schools, and the new engineering workshops of the Central Technical College, are amongst the many buildings in which installations were carried out.

Exhibition Awards.—Messrs. R. Wolf have been awarded the Grand Prix for their "Wolf" superheated steam locomobiles shown at the Exhibition of the North of France at Roubaix, also the Gold Medal of the Imperial Russian Ministry of Industry at Odessa. These honours complete a series of highest awards obtained by these locomobiles this year at the exhibitions at Omsk, Siberia (two Gold Medals), Crefeld (Germany), Allahabad, India (Gold Medals). Last year distinctions were gained at Brussels and Buenos Ayres.

LIGHTING and POWER NOTES.

Bacup.—The T.C. has decided to apply to the L.G.B. for a loan of £1,250 for electricity purposes.

Bath.—On Friday last an inquiry was held relative to the application of the T.C. for a loan of £7,900 for E.L. purposes, viz., the installation of a Diesel gas engine and a booster. The Inspector added to the amount £100 for contingencies. There was no opposition.

Bitton.—The Coronation memorial at the village of Bitton has taken the form of public lighting by electricity, and the current was switched on September 14th.

Brighton.—In a recent report to the Town Council, Mr. Christie recommends certain simplifications of tariffs and the abolition of meter rents; these concessions will involve a loss to the central station, which will be compensated within a few years at most by the increased demand resulting. The present tariffs (6d.-2d. on maximum demand system; 3d. flat to hotels, &c.; 4d. to flat to shops and private consumers), are to be *gradually* replaced by a common 3d. flat rate free from meter rent. The adoption of this proposal would involve £600 reduction on the current year's revenue. The complete abolition of meter rents would result in a loss of revenue of £1,200 per annum, but in a few years this amount would be recouped by the extended demand. The cutting off of supply between 5.30 p.m. and 8 p.m. during December and January would have to be abolished. Last year 173,576 units were sold at 1½d.; the estimated loss by the concession (£361) would be neutralised by the increased demand among breweries, laundries, &c. A flat power rate of 1½d. was proposed.

The T.C. has been recommended by the Lighting Committee to install an air-pump (motor-driven) at the electricity works at a cost of £635, and an electrically driven circulating pump, at a cost of £229, with an expenditure of £656 for alterations to cables, &c.

Burnley.—The Corporation has applied to the B. of T. for a prov. order to supply electricity within the residential district of Reedley Hallows, which is just beyond the borough boundary.

Burnham (Som.).—The U.D.C. has decided to apply for a prov. order to light the sea front and a number of the streets of the town by electricity. The population is 3,000, with an increase of nearly double in the summer months.

Carlisle.—Out of the profits of the electricity undertaking for the past year, £1,000 is being transferred to the city fund, the remainder being carried forward as a working balance.

On the engineer's recommendation and to comply with B. of T. requirements, the Electricity Committee has agreed to the provision of new feeder and battery switchgear, to make certain alterations, and to erect a new steel staircase at the electricity station, at a cost of £600.

Cavan.—At the last meeting of the Council a proposal to light the town by electricity at a cost of some £7,500, resulted in a committee being appointed to confer with the gas company with a view to the purchase of the concern, a report to be furnished to the next meeting.

Colombia.—The *Diario Oficial* of August 2nd notifies that a contract has been entered into between the municipal authorities of Riosucio and George Gartner, empowering the latter to construct an electric generating station for the purpose of supplying electric light to the inhabitants of Riosucio.—*Board of Trade Journal.*

Continental Notes.—France.—The *Standard* states that the Ministerial proposal for four new series of taxation includes a general tax on gas, electric, and other lighting. Lighting for public or industrial purposes is to pass free, and so are the lights on vehicles, but there is to be a tax of one-twentieth of a penny per hectowatt-hour for electricity and one-tenth of a penny per cubic metre of gas. Calcium carbide sold for lighting purposes is to pay one and eightpence per hundredweight. Electric lamps are to pay from a halfpenny (10 watts) to threepence halfpenny (300 watts), with a double tax on metallic-filament lamps. There is to be a special tax of half-a-crown a yard on the tubes of mercury vapour lamps and three halfpence on each incandescent gas burner. Arc lamp carbons are to be taxed a penny a pound, and incandescent mantles are to pay a halfpenny each.

Sweden.—Two turbines of 10,000 h.p. each are now being installed at Trollhättan, which will increase the capacity of the works to 60,000 h.p. At the present time contracts have been entered into for the supply of 25,000 h.p., and negotiations are being carried on for the supply of another 5,000 h.p. It is anticipated that a great portion of the additional power available will be transmitted along the line Uddevalla-Lysekil, and in particular to some new stone quarries which are going to be opened on the west coast. A new transmission line is also being built to the town of Falkjöping. The question of supplying electrical energy to Copenhagen from the Trollhättan Works has been raised again in earnest, as it has now been proved that the inland demand is not so great as was anticipated, and is not likely to grow so rapidly within the near future as to be capable of absorbing the whole amount of power available.

Croydon.—On Monday the B.C., on the recommendation of the Lighting and Electricity Committee, decided to expend £1,700 in laying a new feeder from the electricity works to the Drummond Road sub-station. The borough electrical engineer (Mr. A. C. Cramb) described this as a necessary alternative route, to give a reasonable chance of the supply being restored without delay, in case of failure on one feeder. Councillor Houlder, on behalf of certain objecting householders, drew attention to a circular offering electricity at 1d. per unit where it was used for heating, cooking and lighting, the agreement being that if the householder failed to use electricity alone for lighting purposes, the charge should be 1½d. Alderman Miller (chairman of the Committee) said the Council had authorised the charge. Councillor Houlder replied that that might be, but there was general dissatisfaction among users of electricity, and he would bring up the matter again later.

Douglas.—The T.C. is considering the advisability of providing an electric light undertaking and of electrifying the tramway system, and has retained Messrs. Handcock and Dykes to report.

Egham.—The erection of the new power station of the Staines and Egham Electric Lighting Co., of which it is expected the Lord Mayor of London will lay the foundation stone on 30th inst., is proceeding on the Causeway at a convenient situation between the two towns to be supplied with electricity.

Great Harwood.—A plan has been submitted to the Council giving details of the electric lighting scheme drawn up by Mr. J. W. Speight.

Gellygaer.—The U.D.C. has decided to obtain an estimate for lighting by electricity the whole of the Fochriw and Deri wards of the town.

Glasgow.—By the casting vote of the chairman, the T.C. Electricity Committee has decided to recommend that the Corporation be not represented by deputation at the Electrical Exhibition, Olympia, London.

Hastings.—The T.C. has received the sanction of the L.G.B. to a loan of £581 for extension of electric light mains in several roads, the authorised period being 25 years. Final arrangements have now been made between the Hastings Corporation and the Guardians for the extension of the electric light mains to enable the scheme for the electric lighting of the workhouse to be carried out. The Guardians are inviting tenders up to October 18th for an installation. Specification from the Clerk to the Guardians, Wellington Square, Hastings. There are 400 inmates, and it will be the biggest group of buildings in the town to be installed with the electric light.

Hayward's Heath.—An effort is being made to have the E.L. introduced into the district.

Itchen.—The U.D.C. has, by nine votes to four, declined to rescind the recent resolution in favour of the Council applying for a prov. order for electric lamps.

Kirkburton.—The U.D.C. has consented to the Yorkshire Electrical Distribution Co., Ltd., giving a demonstration of public lighting with electricity.

Kilsyth.—A London company has intimated its intention to apply for a prov. order, but the Council is divided on the question, and the matter stands delayed for a month.

Lancashire.—A correspondent states that electricity on a fairly extensive scale will be used in connection with the new collieries for which the Clifton and Kearsley Coal Co. are now sinking shafts at Astley, in South Lancashire.

Lepton (near Huddersfield).—The U.D.C. has gi permission to the Yorkshire Electric Power Co. to make addit to the overhead lines at Rawley, subject to the footpath b suitably protected.

London.—Shoreditch.—As the result of increases the prices of fuel, additional extensions and renewals in the ge ating station, and the conversion of 1,055 gas lamps to electric the annual estimates to March 31st, 1912, were increased by £1, to £51,511. The net reduction in anticipated revenue, du reduced tariffs, is £2,512 (allowing for probable extensions). amended estimates provide for the spending of £26,379 during six months ending March 31st, 1912, the estimated surplus at latter date being then £4,772, instead of £7,025, as origin estimated. Following the completion of the conversion of street lamps south of Old Street from gas to incandes electric lighting, it is now proposed to replace gas lamps n of Old Street by metallic-filament lamps. A number of streets in which it is proposed to lay cables offer an immed demand for general lighting and power supply, and many oth offer prospects of developments in the near future. There ar present 1,055 gas lamps in the district in question, and in 160 str it is proposed to lay about 14 miles of cables at an inclusive cos approximately £8,385. In the ordinary side streets it is propo to lay cables capable of supplying 25 h.p., and in the sma streets a cable capacity of 6 h.p. is suggested. The cost of verting the lamps is estimated at £665 5s., and the whole ou will be distributed over several years. Important revisions h been adopted in the present charges for power and factory ligh supply, especially as regards an alternative to the maximum-dem system, which many consumers fail to understand. The new ta are so framed as to benefit both large and small consumers, special discounts are to be granted for early settlement of accou The tariff modifications are :—

A flat rate of 1·25d. per unit for power supply of not less t 1,250 units per quarter, with a load factor of at least 10 per c and a sliding scale of discounts ranging from 5 to 20 per cent., acc ing to demand (5 per cent. for 2,500 and under 3,750 units per quar 10 per cent. for 3,750 and under 5,000 units ; 15 per cent. for 5,000 under 6,250 units ; 20 per cent. for 6,250 units and over). Wh factory lighting consumption equals 5 per cent. of the po consumption, a further 2½ per cent. discount is to be allowed the power rate. The maximum power tariffs are to be 1·5d. supplies of at least 10 per cent. load factor, and 2d. where the factor is less than 10 per cent.

For factory lighting a flat rate varying from 3·25d. for less t 3,750 units per quarter down to 2·5d. for 6,250 units and ove adopted ; if electric power is not used, all factory ligh demand is to be charged at 3·25d. per unit.

To encourage contractors and others to make an effective dis of electrical fittings and accessories, electricity shall be supplie electrical showrooms at 2·5d. per unit.

In March, 1910, the public street arc-lighting tariff was red from 2·25d. to 1·9d. per unit (equivalent to £1,100 per annum), it is now further reduced to 1·5d. per unit (£1,292 per annum on year's figures). Public offices in all departments of the Council to be supplied at 3·5d. per unit for lighting purposes (estim annual saving to rates = £70). The revised charges are to effect after the September meter readings, and are to be alterna to the existing tariffs. The discounts quoted will only allowed on quarterly accounts paid within one month after quarter, on monthly accounts paid within 15 days, or on we accounts paid within seven days.

St. Pancras.—The Finance Committee has decided in fa of utilising £6,977 of the £13,203 profit on the electricity un taking for the year ended March 31st, 1911, for the relief the rates. The Electric and Public Lighting Committee decided to continue the central arc lighting in the wide portion of Euston Road, and to re-arrange the existing arc lar Mains are to be extended in three streets at an estimated of £65.

Bermondsey.—Agreements are to be entered into with following firms for the supply of energy at special tariffs: C wright Bros., Union Road ; Grant & Co., Riley Street ; Bar Bros., Ltd., The Grange ; Bevington & Sons, Abbey Street. Electricity Committee reports the loss of about 75,000 units ow to many of the consumers shutting down their works in co quence of the late strike. The effects will also be felt in present month, which means a serious loss of revenue to undertaking.

Marylebone.—A meeting of electrical contractors in the boro was held recently, when a resolution was passed protesting aga the continued existence of the sales department of the B.C. as b unnecessary and unfair, and objecting to the methods adopte the department in making use of the information obtained by i the electricity authority to enter into unfair competition. hoped that the resolutions when brought before the Maryle B.C. on October 5th will open a way for the contractors to stat person their complaints against the conduct of the munic electrical undertaking.

Hammersmith.—The Electricity Committee reports that November 13th, 1907, the Council agreed to supply Me Gwynnes, Ltd., with one 50-h.p., four 30-h.p., one 18-h.p., three 10-h.p. motors, in addition to one spare motor, and a mo generator upon hire, subject to the company entering int agreement to take from the Council a supply of energy fo minimum period of five years, paying not less than £1,000 annum for energy supplied at the standard rates of 1d. per for power, and 3d. per unit for lighting, this price to include charge for the hire of the motors. Messrs. Gwynnes have a

roached the Electricity Committee with a view to the Council plying on loan three additional motors, which the company e would be required in connection with large additions which about to be put down to their electrical plant. The Committee e that the estimated cost of the additional motors would be 0, and that under their agreement the company had taken h more than the minimum supply stipulated. The company e that they would be willing to enter into a fresh agreement he lines of the present one for a further period of five years. ordingly the Committee has decided to purchase the motors ired, and lend same to the company in consideration of them eing, in a form to be approved by the Council, to take a supply urrent for a further period of five years on the terms of their ent agreement.

Mansfield.—The L.G.B. has sanctioned the borrowing £3,500 in connection with the proposed extensions to the electy undertaking.

Mansfield Woodhouse.—Steps are to be taken to give pply of electricity to Mansfield Woodhouse in accordance with terms of the order. The details are to be considered at a future ting.

Middlesbrough.—It is stated that important improveits at Middlesbrough Dock are contemplated by the North-Eastern way Co. The improvements include the substitution of electric es of greater radius for the present hydraulic cranes on . 3 and 4 quays, and the provision of an electrically driven steelcoal conveyor.

Newbury (Berks.).—The electric light has been installed t. Nicholas' Church, and it was used for the first time on Sunday. installation has been carried out by Messrs. Cash, of Westster, under the scheme of Mr. Pooley, Westminster.

Penistone.—The Council has given its formal sanction the Yorkshire Electric Power Co. to lay underground cables to various works in the Penistone area.

Poole. — The Bournemouth and Poole Electricity ply Co. having applied for an extension of time for a year for rying out the Wimbourne and District E.L. order, 1905, the C. has decided to raise no objection.

Radcliffe.—The L.G.B. has informed the U.D.C. that ay commence main extensions and the installation of water ening plant, for which a loan of £1,800 has been obtained, hout waiting formal sanction, on the understanding that if the rd finds itself unable to sanction a loan the sums expended st be met out of current revenue.

Sheffield.—The electricity accounts for the 12 months ing March 25th, 1911, show a surplus of £3,417, as against a cit of £2,035 for the previous year. The total generating costs e fallen from 0·555d. to 0·472d. per unit. Practically the whole the increase in the total sales is in the power supply, but for first time since March, 1908, the units for lighting show an rease on the previous year. The effect of metallic lamps on the tion and consumers respectively and the rapid development ulting from the cheapening of electricity supply are shown the following figures :—

	Lighting units.	Lighting revenue.	Additional consumers.
1908	3,973,256	£59,410	—
1909	3,821,340	£53,117	217
1910	3,541,572	£46,264	299
1911	3,673,444	£45,873	399

The Electricity Committee recommends the transference of a ther £5,000 from the accumulated surplus to the renewals fund. e extensions at Neepsend will be available for the coming winter, l further extensions will be executed next year. The total sales l the total revenue (£86,000) both constitute records ; the power s show an increase of 3,804,486 units (56 per cent.). The rease in total revenue is £10,890 ; in costs £4,370 ; in interest l sinking fund, £1,067. The capital expenditure to March last als £993,525 ; the amount paid into sinking fund, with accumuons for debt redemption is £194,140 (to March, 1911).

Swinton (Lancashire).—The British Advertising Co. e applied to the local D.C. for a supply of current for the lighting a picture hall in Elm Street. The Earl of Ellesmere has granted Council permission to erect four poles for an overhead service, a rental of 2s. 6d. per pole per annum, for electricity supply to tle Wardley Farm. His lordship states that he is not prepared grant permission for the three further poles required to serve ssrs. Holland's mineral waterworks. The Council last week olved that the proposed supply be not considered.

Swinton and Pendlebury.—The U.D.C. has appointed committee to consider what action shall be taken in connection h the electricity undertaking on the expiration of the existing eement with the Lancashire Electric Power Co.

Torquay.—The T.C. has received sanction from the L.G.B. to a loan of £5,250 for additional plant at the electricity rks.

Worsley.—The Swinton and Pendlebury D.C. has ferred dealing with the proposed supply of electricity to the oad Oak Park district of Worsley until the question of dealing th the general supply of the district is considered.

Whitby.—The U.D.C., on Saturday, opened, in the uncil Chamber, a week's exhibition of cooking and heating by ectricity.

TRAMWAY and RAILWAY NOTES.

Australia.—The *Australian Mining and Engineering Review* states that the Prahran-Malvern Tramways (V.) for the year ending June 30th earned a revenue of £25,822, the car-mileage run for the year being 475,353. No fewer than 3,706,180 passengers were carried during the period under review. An addition to the rolling-stock is to be made by the construction of four closed bogie cars, which have been ordered for delivery by November next. The total cost of each car will be approximately £1,500. The track has been extended along High Street, Prahran, to Punt Road, with satisfactory results ; but the trust is anxious to carry the extension to St. Kilda Road, as a connection would then be established with the city cable lines. The duplication of the High Street line and its extension to Glen Iris station is being reported upon by Mr. Dix, the trust's engineer. It is also proposed to link the Caulfield and St. Kilda lines with the trust's system. The requisite material for the Dandenong Road line is now arriving. Contracts have been let as follows :—

Rails, fishplates, &c.—Messrs. Noyes Bros. Pty., Ltd., £6,624.

Special work, points, and crossings.—Messrs. Edgar Allen & Co., Sheffield, £1,926.

Overhead construction.—British Insulated and Helsby Cables, Ltd., £4,550.

Centre and side poles.—Noyes Bros. Pty., Ltd., £657.

Permanent way.—Younger & Howitt, schedule rates.

The *Daily Chronicle* correspondent at Melbourne says that on 13th inst., the Royal Commission on the Metropolitan Traffic of Melbourne reported favouring the electrification of suburban railways and trams, vesting the latter in a Greater Melbourne Council. Pending the creation of the latter body the trams should be controlled by a special State-cum-Municipal trust of 12 paid members. The scheme involves the buying of the existing cable tram company and the erection of an enormous State power house to supply the trams and trains. The capital expenditure will exceed five millions.

Reuter's agent at Sydney states that the Government has submitted to Parliament proposals for the construction of new branch railways and other public works at an estimated cost of £8,000,000.

Bath.—The Bath Electric Tramways, Ltd., have applied to the B. of T. for a further extension of time for two years for the construction of the light railways in the rural district and Keynsham.

Canada.—The B. of T. have received a copy of an Act, passed on March 31st last by the General Assembly of the Province of Nova Scotia, authorising the granting of aid under certain conditions to companies proposing to construct electric railways in the province. The aid may take the form of (*a*) a subsidy not exceeding $2,000 (about £410) per mile ; (*b*) a loan not exceeding $8,000 (about £1,640) for each mile of electric railway built and worked ; (*c*) a guarantee of the bonds or debentures issued by the company.—*Board of Trade Journal.*

Cardiff.—The annual report of the electric lighting and tramway department to March 31st last, shows very satisfactory results. The 1910 record tramway results have been considerably bettered, and the readjusted fares and stages have been fully justified. The surplus tramway balance is £12,034, an increase of £1,002 over 1910. Actual working expenses increased £2,063 (from £74,378), but the income rose from £130,565 to £135,394 (£4,829 increase). The whole of the generating plant has been brought up to date. The motor-generator plant transferring the Canton Station day-load and part of the evening load to Roath power station has resulted in a gain to the lighting department of £2,787. The depreciation fund has risen from £36,627 to £44,515. The total car-miles was reduced from 2,514,648 to 2,475,542, but the number of passengers carried (25,662,830), showed an increase of 214,596. The percentage of tramway working expenses to receipts fell from 57·1 to 56·1 per cent. The workmen's cars show a loss of 4·25d. per mile (£1,566 per annum). No fewer than 2,540,112 transfer tickets were sold during the year ending March 31st (value, £10,583 16s. ; increase in number 351,938). There is a tendency to interfere with the transfer system by lengthening stages. Further concessions are, as yet, impracticable, particularly in view of the increase in the maximum pay of employés (½d. per hour). The lighting department has begun to reap the benefits accruing from metallic lamps ; electric lighting appreciates the value of property in the city. The lighting income increased £2,259 (from £43,196), and the expenditure decreased £471 (from £28,109) ; the net surplus after meeting all charges was £909. During the year, 247 fresh consumers were connected, the total on March 31st, 1911, being 2,106. The department's business is stated to have been greatly restricted by the absence of powers to carry out installations on the hire-purchase system ; further agitation is to be made for the granting of such powers.

Croydon.—The B.C. Tramways Committee on Monday proposed an increase of ½d. per hour in the maximum rates of pay of motormen, conductors, painters, and shed labourers, and ¾d. for car cleaners, the change dating from August 3rd last. The total cost was estimated at £1,633 per annum. Councillor Pelton, in moving the report, said the Committee were on the best of terms with the whole staff, and in the negotiations no threat was used to in any way hamper their judgment. Several other speakers bore testimony to the good feeling existing, one remarking that they met as man to man and friend to friend. The

proposal was unanimously carried Answering a question, Councillor Pelton said that, judged by the results of the tramways as a whole, the position of the recently re-opened Whitehorse Road route was not satisfactory.

Doncaster—Bentley.—The B. of T. has confirmed the Light Railway Commissioners' Order authorising the Doncaster T.C. to construct tramways to Bentley at a cost of not over £6,400. The estimated outlay is £7,600, this including £2,550 for cars and £1,400 for the electrical installation.

Edinburgh.—A deputation of members of the Edinburgh Tramways Committee recently visited Bradford for the purpose of inspecting the railless trolley system in operation between Laisterdyke and Dudley Hill. The visitors were accompanied by Mr. C. J. Spencer, the Bradford tramways manager.

Glasgow.—The T.C. on Thursday last week discussed the proposed extensions of the tramway system into suburban districts mainly, besides a memorandum as to the cost and extent of the respective new routes. This memorandum showed that the cost of the extension from Gairbraid Street to Great Western Road was, for line and equipment, £16,000; road widening, &c., £20,000; and new bridge, £10,000. South Portland Street to St. Enoch Square—Track and equipment, £22,864; new bridge, £60,000; removal of St. Enoch's Church, £15,000. University Avenue route, £7,818; Killermont to Canniesburn Toll, £7,718; to Milngavie, £45,382; Cathcart to Clarkston, £30,976; Baillieston to Coatbridge, £38,145. In some general observations on the proposals, Mr. Dalrymple said that the question as to whether lines outside the city paid, had been frequently raised, and he had found it exceedingly difficult to convince even members of his Committee that it was scarcely possible to run a service of cars on any main route from the centre of Glasgow outwards that would not pay. Experience went to prove that, speaking generally, routes which were entirely within the city limit did not yield as much per car-mile as those routes which had their termini at, say, Paisley, Cathcart, Uddingston, Bishopbriggs, &c. It really did not matter what they referred to—week-day, Saturday, Sunday or holiday—all showed the same result, that routes which were called outside routes had always the highest earnings per car-mile. From the expenditure point of view, it was not to be overlooked that the cost of operating a car outside the city was probably less than half the cost of operating the same car in the central area; in fact, it was only necessary to carry very few passengers to meet the expense of running an outside service. He had great faith in the future of outside extensions. A Glasgow tramway system entirely confined within city limits was unthinkable.

There was over four hours' discussion at the Corporation meeting, at which it was declared that no proper time had been given members to consider the scheme. It was, however, subsequently decided by majorities to proceed with the promotion of a provisional order for powers for the following extensions: Gairbraid Street to Great Western Road, and Killermont to Canniesburn Toll. The Committee is to reconsider and report on the South Portland Street to St. Enoch Square route, and it was decided not to proceed with the other projected lines.

Ilford.—At the last meeting of the U.D.C., Councillor Stroud, reporting on the tramway undertaking for the past year, stated that although a considerable amount had been spent in equipment, a balance out of revenue of £679 was being carried forward, which, with interest £778, made a total balance to the credit of the undertaking of £6,919. A cross-over is to be put in at the Loxford Bridge terminus, at a cost of £130.

Leith.—The total revenue of the Corporation tramways for the past year amounted to £31,432, as compared with £31,649 in 1910. The traffic receipts amounted to £30,570, while revenue from passengers' luggage totalled £201. The working expenses amounted to £17,789, compared with £19,150 for 1910, which leaves a credit balance of £13,642—£1,143 more than last year. The receipts per car-mile show an increase of ·07d. and expenses a decrease of ·22d. Renewal of parts of the track and overhead line will soon be necessary.

London.—Last week, while a steam train was being shunted at the Crystal Palace Station of the L.B. & S.C. Railway, a fireman who mounted on the cab of the engine touched a live overhead wire with his shoulder, and was thrown down to the ground, receiving bad burns and cuts on the head. The injuries, however, were not of a serious nature.

HAMMERSMITH.—The B.C. has consented to the adoption of the overhead trolley system for the Brook Green Road, Hammersmith Broadway and Queen Street.

Manchuria.—It is reported from Harbin that a company is in course of formation to construct and work a system of electric tramways in the town of Dairen.

New Zealand.—The Christchurch (N.Z.) Electric Tramways, for the year ending March 31st, earned a profit of £2,219. According to the *Australian Mining and Engineering Review*, the gross revenue for the 12 months totalled £112,499, and operating expenses £68,037, leaving the sum of £44,460 as net earnings. Of this sum, interest and sinking fund absorbed £21,669, whilst for depreciation, fire, accident reserves and renewals, £20,572 has been set aside. The previous 12 months' profit amounted to £10,146, but during the year under review depreciation had been increased from 3 to 4 per cent.

Oldham.—At a meeting of the Surveyor's and Tr ways Committee, the introduction of a railless trolley system 'the Coppice and Moorside was discussed. The Committee is t the system in operation.

Tasmania.—LAUNCESTON.—The municipal electric tr way system was officially opened on August 16th by the Mayo Six cars are running on two routes, a third route being course of construction.

Walsall.—An extensively-signed memorial has l presented to the Tramways Committee asking for an extensio the tramways on the Walsall Wood section. The Committee the present declines to do anything in the matter, but it informed the memorialists that the members are closely watch the experiment of railless trolley cars, and, should the re be satisfactory, the Committee will again consider the ques of extension.

The Tramways Committee has called the attention of Electricity Committee to certain failures of supply which l occurred from time to time, causing a loss of traffic to the tram undertaking. It is stated that since July 18th the current failed on 12 occasions, for only two of which it was clear that electricity department were not responsible.

West Hartlepool.—A Special Committee of the C poration, which is dealing with the question of the tramways chase, is holding frequent meetings to discuss the problems wh face it. The Park and Foggy Furze routes have been subjec arbitration and litigation regarding the purchase price, and wil handed over shortly to the Corporation. The question which to be decided is whether the Corporation shall run the tram on these routes, or lease the running powers if this can be don reasonable terms. There is also the question of the advisabilit purchasing the section of the tramways between the Hartlepo which lies within the West Hartlepool borough boundaries, lease of which will fall in shortly. There is also the Seaton Ca route to be considered. There is every probability of the Corp tion having to spend a large sum of money additional to £12,000 or £13,000 which, in accordance with the arbitrat award, and the subsequent judgments, it was paying for Park and Foggy Furze tramways as they stood.

TELEGRAPH and TELEPHONE NOTE

Argentina.—A concession has been granted to Anto Grego for the installation and working of a telephone syste Macachin, in the Pampa Central district, for a term of 30 years.

Italy.—The high-power radiotelegraphic station Coltano is to be inaugurated at the end of October, the King Italy being present on the occasion.—*Rassegna di Lavori Pubblic*

Norway.—The erection of the large wireless station Spitzbergen recently decided upon by the Norwegian Storthing being carried out with the greatest activity, so that wireless comm tion with Spitzbergen may be an accomplished fact before the cl of the year. The installation will be on the "Telefunken" syste and the apparatus and accessories will be supplied by the Allgeme Elektricitäts Gesellschaft, of Berlin. The two masts erected Spitzbergen and Hammerfest respectively will be 60 m. high; t ironwork tower at the great station at Nauern, near Berlin, 100 m. high. The new stations, as do all in Norway, belong the State. A steamer, with building material, engineers and wor men, has already left Christiania for Spitzbergen. In view of t comparatively short time in which constructive operations a possible on Spitzbergen, the Norwegian Telegraph Department, well as the various manufacturers, is working at high pressu The Spitzbergen station is situated at Green Harbour, at t entrance to the Eisfjord, where a whale-fishing station is located. *Zeitschrift für Seewesen.*

Postal Servants.—On Friday last week a meeting officials of all the postal federations and associations of the Unit Kingdom was held at Glasgow, and passed resolutions calling upo the P.M.G. to appoint a Select Committee of the House of Commo to inquire into the alleged grievances of the postal servants.

Wireless Telegraphy.—Extensive wireless telegrap installations are to be erected in the Belgian Congo, covering distance of 1,800 miles, along the course of the Congo up t Katanga.—*African Engineering.*

The G.P.O. engineers are erecting a wireless station on the roo of the telegraph department, for the purpose of experiments i wireless communication with the Continent.

Germany.—HAMBURG.—The new Central Telephon Exchange has a capacity of about 80,000 subscribers, and i one of the largest in the world. The operating room is 132 m × 20 m. × 9 m. high. In the exchange 112,700 relays, con trolling 70,000 incandescent lamps are in use; 55,000 jac strips (1,100,000 single jacks) have been installed, 1,000,000 m of flexible wire and a total length of 35,000,000 m. of leadin wire were used, and 15,000,000 joints were made. The curren for the microphones of the subscribers, for the signalling arrangements and the relays, is supplied from two accumulato batteries each having a capacity of 7,800 ampere-hours, this being sufficient for 24 hours' working of the station. The total numbe of telephone operators (females) is 1,500.—*Elektrotekn. Tidsskrift.*





H. W. Butler,
Chairman of Executive Committee.



F. B. O. Hawes, A.M.I.C.E., A.I.E.E.
Secretary to the Exhibition.

THE PRESIDENT



Sir W. H. PREECE, K.C.B., F.R.S., M.I.E.E., &c.
President of the Exhibition.



H. L. Benjamin,
Organizing Manager.



T. E. Gatehouse,
F.R.S.E., A.M.I.C.E., M.I.E.E.

AND COMMITTEE.



F. J. Walker.



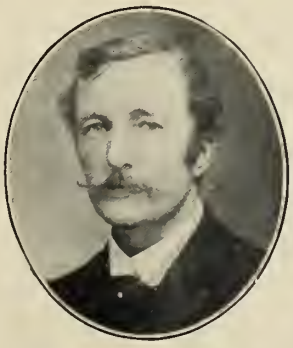
A. C. Cramb,
M.I.E.E., M.I.Mech.E.

Photographs.

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H. L. Benjamin	,,	*Lambert Weston.*
F. J. Walker	,,	*Elliott & Fry.*



A. T. Snell, M.Inst.C.E., M.I.E.E.,
Consulting Engineer.



S. G. C. Russell, M.I.E.E.,
Consulting Engineer.

Photographs.

A. C. Cramb	by	*Bender & Lewis.*
A. T. Snell	,,	*Arthur Weston.*
S. G. C. Russell	,,	*Elliott & Fry.*
T. E. Gatehouse	,,	*Turner & Drinkwater.*

EXHIBITION NOTES AND COMMENTS.

The Objects of the Exhibition.

To-morrow at 2 o'clock, after a formal ceremony performed by Sir Wm. Preece, the Electrical Exhibition doors will be thrown open to the public. To-night, in celebration of this auspicious occasion, the committee, exhibitors, and some others interested in the progress of electricity are holding an inaugural banquet at the Trocadero Restaurant, under the chairmanship of Sir W. H. Preece, K.C.B., F.R.S., the president of the Exhibition. While some principals and managers or heads of departments are thus fraternising at the "Troc." engendering the right spirit of friendliness and co-operation which, while not eliminating legitimate rivalry, will perhaps help to keep competitive rage within more reasonable bounds, their representatives will be quite equally profitably engaged in the hall and gallery of Olympia, putting finishing touches to the 240 exhibits, so as to make a strong and lasting impression upon the public mind. Here we have named two great ends that this Exhibition is intended to serve—a greater intimacy between those directly interested in electrical industry, and a better understanding of electricity and the variety and usefulness of its applications by the public, that great body of individuals who through public departments, contractors, or "on their own," are the purchasers of many of the lines of manufacture shown. We hope that both of these objects will be furthered in the course of these four weeks of exhibition activity. But there is a danger that we may regard this event too much from the point of view of those who desire to give a "boost" to electricity among the populace. From the list of exhibitors published on a following page, as well as from our knowledge of the character of the exhibits, we are convinced that the Exhibition will be one of great interest to electric light and power station engineers—designers as well as operators—in all parts of the kingdom, and to engineers of all classes who are interested in the hundreds of steam and electrical appliances that are offered to assist them in their striving after efficiency, economy, and general satisfaction. It is not to the public and the electrical engineer alone that this Exhibition is of use. The engineer, as an engineer, cannot fail to find awaiting him education and instruction, which at other times he could only obtain by the expenditure of much time and money. Here many manufacturers and their representatives are present expressly for the purpose of imparting information to such men, and we hope that they will be besieged with questions. Maybe they will develop such a talking ability that the closing functions of October 21st will bear evidence of their progress in a direction where some people think that the English race is a trifle deficient.

The "E.R." and the Exhibition.

As for the Electrical Review and its part in this matter, we have taken our stand (No. 227) opposite the main gangway at the further end of the Hall, where we shall be pleased to see our friends. But beyond this, it is our intention, as a journal, to follow fairly closely the lines adopted by us on the occasion of the Manchester Electrical Exhibition. What we did then led to so general a chorus of approval, that we prefer to do very much the same again rather than to indulge in sensational departures which may not in the end be altogether satisfactory.

We are, with the aid of exhibitors, preparing descriptions of all the exhibits that we regard as meriting attention. A first instalment of these appears in the following pages, and notices of the remainder will be spread over the next four issues. Electrical journalism in London, unfortunately, is still not altogether free from the *quid pro quo* "understanding" in connection with editorial descriptions and advertising. It is a reprehensible practice, as we have said before, and only serves to bolster up papers which, without it, might not be able to exist. It would be a good thing if the trade as a body would set its face against the practice right at the very beginning of this Exhibition, so that the reputation of the electrical press may not be again sullied by a repetition of those miserable acts which were the subject of conversation on many sides at Manchester. A Press which has to go whining after manufacturers is not a good thing for any branch of industry. The electrical manufacturers' interests will be best protected when their trade organs are able to speak fairly, independently, and without fear, and are at liberty to describe any new manufacture or development that is likely to interest the reader.

The Foreign Reader and the Exhibits.

Interest in an Exhibition of this character is not confined to this country. The reader in the Colonies, and electrical men stationed in some of the most out-of-the-way quarters of the globe, will peruse our pages with additional interest during the next few weeks in search of knowledge regarding the latest productions of British manufacturers. Appreciating what this means, we have supplemented our usual arrangements whereunder the Review is already available at many a Consular station or Commercial Attaché's department, and our description of the exhibits of 1911 will reach the hands of an army of electrical engineers and electrical buyers who cannot come from 100 to 12,000 miles across the seas to see the manufactures themselves but are prospective purchasers whom the British manufacturer is anxious to reach. We trust that this will redound to the benefit of the whole industry, for a collection of descriptions of leading manufactures of a hundred or two firms is of no little value and will not be lightly cast aside.

Timely Counsel from Authorities.

In addition to our photographs of the Executive Committee and officers, which under the auspices of the National Electrical Manufacturers' Association has been responsible for the work of organising this Exhibition, we publish to-day messages which are of timely interest from three well-known gentlemen. Mr. H. W. Butler, the chairman of the Executive, strikes the right note in urging us all to put our shoulders to the Exhibition wheel. Mr. Frank Bailey, one of London's greatest and oldest-known authorities on electricity supply, expresses many feelings which will be uppermost in the supply engineers' minds at such a moment, and Mr. G. Harland Bowden, the at once aggressive and diplomatic second-year chairman of the Electrical Contractors' Association, reminds us all of some things that are wrong, and offers sentiments which every section will do well to consider and talk about during the coming week, when they are rubbing shoulders at Olympia.

Learning from Experience.

When the first Electrical Exhibition at Olympia was held in 1905, the electrical industry had not any large accumulation of experience of the organisation of exhibitions to guide it. Though, as some will remember, things in the main passed off with excellent success, there were some features which led to a little dissatisfaction, and not a little friction. But we know better now. Manchester, though a remarkable success in 1908, also had features which did not give universal satisfaction. Again, we know better now. And though it may still be that everything will not run to the perfect pleasing of everybody—we wonder whether there ever was an exhibition in this world in which it did?—our knowledge of past mistakes should assist to secure for the present Exhibition a larger measure of approval for what has been done for exhibitors' convenience than at either of its predecessors. If any reader chooses to compare the *personnel* of 1911 with that of 1908, he will find that at least eight of the committeemen are the same. The secretary is not the same, but Mr. F. B. O. Hawes was "in the thick" of the fight at Olympia in 1905, and he has for many years been in the inner counsels of the Electrical Manufacturers' Association. As this year's secretary he has been labouring unceasingly to secure a success. Everybody will agree that he is a gentleman of unfailing courtesy. The organising managers are the same as came to the assistance of the electrical industry at an important stage at Manchester in 1908, and what Mr. H. L. Benjamin and his staff do not know about exhibition arrangements—well, it is hardly worth the knowing. So far as we can see, barring accidents, everything augurs well for a good time for everybody, provided the right classes of the industrial and general community are by generous ticket distribution, and by attractive and timely

lvertisement, induced to turn their steps or motors in ie direction of Olympia.

Stand Attendants! A Word with You.

We have visited scores of engineering, electrical and industrial exhibitions, and *the* thing which, above all others, has left a very definite impress upon our minds the important part which the stand attendant has to fill n such occasions. It may be that the reader of these notes the master of his own business, and he is putting his right oot forward and representing himself in order to build up future connection; he may be a manager of a large and ell-known electrical organisation, who will have with him at his Exhibition a score of faithful assistants doing his will; may be a commissionaire, a young lady attendant or a lad ho at times is left in charge. Each of these in his or her own way can do much to make or mar the Exhibition. We might write pages of counsel on what to do and what not to do so as to secure the best results, but we will refrain. We have written much of this kind of thing on other occasions. A business-like Exhibition which is to do good business, demands of everybody his best. Courteous and intelligent talk, the assiduous attention and the amiable manner, the knowledge when to smoke and drink and when not to do so, these ought by this time to be understood as essentials in the efficient attendant. There is a proper time for everything, as said that old-time sage who carried the burden and privilege of a thousand wives. Let us all, then, give one, long, continuous, determined pull all together for the next month and so confer a lasting good upon all departments of the electrical industry.



H. H. Berry, M.I.E.E.



H. Bevis, M.I.E.E.



T. J. Grainger, A.I.E.E.



D. N. Dunlop.



W. M. Mordey, M.Inst.C.E., P.P.Inst.E.E.



B. Longbottom, M.I.E.E.



P. A. Lundberg.



F. H. Nalder, M.I.E.E.



H. Oppenheimer, A.I.E.E.



S. D. White.



H. C. Siddeley, A.I.E.E.



W. R. Rawlings, A.M.I.E.E.

Photographs.—H. H. Berry, by *Rodway Gardner*; H. Bevis, *Lafayette*; T. J. Grainger, *Lafayette*; W. M. Mordey, *O. & K. Edis*; P. A. Lundberg, *Miles and Kay*; F. H. Nalder, *Wayland*; H. Oppenheimer, *Stereoscopic Co.*; S. D. White, *Arthur Weston*; W. R. Rawlings, *Webster & Son*; H. C. Siddeley, *Lomnitz*.

ON MAKING THE EXHIBITION A SUCCESS.

By H. W. BUTLER

(Chairman of the Executive Committee).

In a few hours the Electrical Exhibition of 1911 will have opened its doors and become an accomplished fact. All the labours of organisation and detail which have occupied the Committee and management for over a year are now finished; everything possible in the way of ensuring the comfort, convenience, and welfare of both exhibitors and public, has been thought out and carried into effect—in short, all that is possible has been done by the organisers with the material at their disposal to ensure the success of the Exhibition. It now only remains for the exhibitors to take full advantage of all that has been prepared for them, and thus to put the finishing touch towards making the event that huge success which it not only promises but deserves to be. Let the right spirit actuate everyone concerned, from the principal to the stall attendant, let there be only one quality of exhibit so that there can be none better, and let every step be taken to get the right public to visit the show, and I have no hesitation in saying that the impetus given to all branches of the trade will be felt not only in the immediate future, but for months and years after the Exhibition has closed its doors.

Let exhibitors see to it that their exhibit is never left unattended, but is always in charge of some competent individual who, by his clear and persuasive explanations, will be able to sow the seeds of future business even if he is not able to effect a "deal" on the spot.

As regards the public, the magic charm of electricity is such that the interest it creates will be sufficient to fill the show, but still it is very important that steps be taken to get the right people, and this is where not only the exhibitors, but the electric supply authorities and the contractors, can render great assistance; an assistance which, while helping towards the success of the Exhibition, will even in a greater degree benefit themselves. Let exhibitors and contractors ensure that every likely customer is pressed to make at least one visit: let the supply authorities and companies supplying London and its immediate neighbourhood send all their consumers, or would-be consumers, to see the special displays in electric cooking, heating, lighting and motive power; and let the engineer of every supply authority and company in the United Kingdom so contrive that his committees or directors and their most important customers, at least, are enabled and persuaded to see all the latest developments.

Only when every one has followed out these suggestions will it be possible to say that the labours of the Committee and management have been made use of to the fullest extent, or in a manner that we are entitled to expect.

In conclusion, if I may say a few words to the exhibitors in general, it would be to suggest that they utilise any spare time they may have during the show to become better acquainted and more friendly with their competitors. I have been in the trade now over 30 years, and the longer I am in it the more I feel that the great thing wanted is for its members to know each other better, and to foster greater co-operation amongst themselves.

Remember, too, that the Exhibition was conceived, organised and carried through by the N.E.M.A.—or, as it is now called, the British Electrical and Allied Manufacturers' Association—an association which enables you to become better acquainted with your competitors, and which is already doing good work. If properly supported, there is no limit to the sphere of usefulness of such an association to the trade as a whole; and, if you are not already a member, ask yourself whether it is good policy, or even good business, to remain outside, when by doing so you are certainly weakening its power for good.

THE EXHIBITION AND ELECTRICAL SUPPLY.

By FRANK BAILEY, M.Inst.C.E.

(Joint Managing Director of the City of London Electric Lighting Co., Ltd.; Director of the Metropolitan Electric Supply Co., Ltd.).

The utility and commercial success of exhibitions have been frequently discussed, and, perhaps, too frequently it has been necessary to supplement the efforts of exhibitors by including side-shows of weird and ingenious contrivances capable of producing every motion which can cause bodily inconvenience to the daring visitor. The Electrical Exhibition, which will be opened to-morrow, will require neither joy-wheels nor wiggle-woggles to attract paying guests during the four weeks it will occupy the large space at Olympia. The promoters have secured the support of all manufacturers and suppliers of electrical appliances, and a friendly rivalry in excellence should interest, not only those who wish to procure the best fittings and appliances, but also those who wish to see what can be done with an electrical supply.

The growth of the electrical industry since the last Exhibition in 1905, in all matters relating to supply of energy, provides convincing evidence that a progressive demand will continue to call for all the goods which will be displayed. The connections to the mains of the various supply authorities in London and the provinces have increased from about 1,000,000 KW. in 1905, to 1,500,000 KW. at the end of 1910, this growth being all the more remarkable when it is remembered that the lighting value of a kilowatt in glow lamps has increased from 250 C.P. to 1,000 C.P.

Domestic electrical illumination is now so cheap that the natural desire for more light is easily gratified. The Exhibition will doubtless provide all the necessary illustrations to assist those who wish to obtain the best results at the least cost, enable the present user to obtain improved results, and convince the doubtful light-seeker that the modern glow lamp can bring artistic brightness into every home.

Electrical fittings have not hitherto been universally accepted as works of art, but with the past experience of 25 years to guide and attract the attention of artistic designers, we may reasonably expect that the merits of the lamp, and freedom from limitations caused by consideration of weight and fumes, will tempt a departure from the Spartan severity of the gas bracket.

Many of the supply authorities in London and the provinces have realised the commercial benefit of maintaining showrooms equipped with illustrations of electrical apparatus of interest to their consumers, and the assembly of the best examples of all fittings at this Exhibition will enable them to take this opportunity of improving the display at their local showrooms.

All users of electric light are now anxious to secure relief from the glare of the metal-filament lamp; and as considerable progress has been made in the various forms of globes and shades to secure diffusion and even distribution of illumination, the Exhibition will be of great value in showing the public that a soft and subdued light can now be obtained.

While all consumers are interested in lamps and fittings, there are still many people who are anxious to ascertain what appliances they can obtain for domestic use in order to reduce the difficulties of the present-day servant problem. We are now accustomed to be told that in America they have overcome all necessity for employing Mary Ann, and electrical supply works the vacuum cleaner, cooks the meals, irons the linen, cleans the knives, and blacks—or browns—the boots. At Olympia we shall see all these appliances in successful operation.

The vacuum cleaner, originally patented in 1883, has had a long period of development, and although in its modern form it has not departed much from the original, it is considerably improved in detail; there is now no necessity to provide a large apparatus in the basement, or to run piping all over the house, with the consequent possibility of blocking the pipe with matches or other material. Many forms of apparatus will be on view at the Exhibition, which will convince the most sceptical that they are not only portable but also practically noiseless in operation.

As regards cooking, it is perhaps easier to show the apparatus at work than to give convincing proof that it will stand the test of time. The importance of this domestic application will appeal to all users; and as the cooking range does not now consist of only the one much-abused vessel which was formerly offered as a satisfactory means of performing all culinary operations, and could boil, fry, roast, or act as a cigar-lighter by simply turning the switch, it has a fair chance of becoming indispensable to every modern house, and will doubtless be offered for sale with a guarantee for reliability and long life.

The electric iron, and other laundry fittings, will tempt many householders to have their lighter laundry work done at home.

With this brief survey of matters which may interest most of the visitors to the Exhibition, we must now realise that it is not easy for the ordinary visitor to see everything without trouble, or to witness an actual demonstration of every appliance. The supply companies of London have, therefore, arranged to assist both exhibitors and visitors. For this purpose a large space has been allotted to them, and the Conference of Chief Officials of the London Electric Supply Companies are once more indebted to their Honorary Secretary, Mr. F. J. Walker, the Manager and Secretary of the St. James' and Pall Mall Electric Light Co., Ltd., for arranging for a special pavilion where all information relating to public electrical supply can be obtained; and in addition, a suitable space has been prepared for the purpose of giving public demonstrations of the use of vacuum

eaners, cooking appliances, ironing, &c. In this good work l the London Electric Supply Companies are joining, and Ir. C. Stanley Peach, F.R.I.B.A., has kindly prepared the ans for this unique part of the Exhibition.

All supply authorities have been much indebted to manu-ctnrers of appliances, and to the trade generally, for their ssistance in furthering the interests of the industry, and by ffering facilities for public displays, it is hoped that the ıpply companies will not only benefit themselves but also ssist those who have any apparatus to sell. By issuing ıvitations to their customers the supply companies will be ble to secure a large attendance and to arrange for the dis-lay of the domestic appliances of most interest to their con-ımers. Representatives selected from the supply companies ill be in constant attendance, and will be able to satisfy any ıquiry as to supply ; they will also be ready to take visitors ound the Exhibition, and do everything except pay for the oods which we are confident the visitor will wish to obtain.

THE EXHIBITION AND THE INDUSTRY.

By G. HARLAND BOWDEN, M.I.M.E.

(President of the Electrical Contractors' Association.)

ALL interested in the consumption of electrical energy are rateful to the promoters of this Exhibition for their un-iring and strenuous efforts in organising the Exhibition, nd for the opportunity thus afforded to all concerned to nspect the various manufactures associated with the supply nd consumption of electrical energy, gathered together nder one roof.

The Exhibition is, perhaps, more interesting to the general ublic than to any of the commercial interests associated vith the enterprise. The use of electricity for domestic urposes is becoming a matter of everyday necessity. Too ften we allow to pass unchallenged the statement that elec-ricity in the home is a luxury. I once heard a reverend gentleman in an out-of-the-way parish in the West of England state that he would sooner live in a small cottage ighted by electricity than live in a mansion illuminated by ny other means ; and this is a general experience. Any ndividual who has once experienced the convenience and leanliness of electric lighting, and who may change his place f residence, is always prepared, at considerable sacrifice, to btain electric light again, if, unfortunately, his new locality e in a district where current is not readily available. The ame remarks apply to the numerous details in which elec-ricity now plays an important part in our home life, and in ur industrial life. Therefore, the public are chiefly nterested in this Exhibition, and time will be well spent in examining the various exhibits, and in scheming how the levices shown can best be applied for greater convenience and economy at home. I can imagine a member of the British ublic visiting this Exhibition. He looks round and sees roof of enterprise, and naturally arrives at the conclusion, s will a great number of his fellows, that the paths of those ommercially interested in the increased consumption of lectrical energy, are happily laid, and that the Exhibition, proving, as it does, an education to the public in the general utility of current consuming devices, will develop and increase the demand for electricity and electrical apparatus.

Here are assembled for the benefit of the public, in tempting form, every detail that the consumer may require. The visitor referred to is interested ; he is ready to listen and to receive instruction, and he says, or thinks, "This Exhibition shows me exactly what I require. How can I arrange about my installation ?"

It seems quite simple. In the first place there are :—(A) Supply authorities, ready to supply current day and night ; (B) Manufacturers whose whole energy and enterprise have for years been devoted to perfecting the numerous devices which we can use in our homes for lighting, cooking, heating, &c. ; (C) In every town throughout Great Britain, skilled contractors ready to wire premises, and to install at reasonable terms all those details, and to carry out the work to the satisfaction of the supply authorities, and in strict accordance with Fire Office Rules, and other regulations and by-laws.

The public are, therefore, justified in imagining that at Olympia the various interests of the manufacturer, the contractor, and the supply authorities are collected in harmony, showing a combined and friendly coalition for the welfare of the trade generally, so that without any hitch or delay the consumer can be promptly given all the necessary attention by skilled representatives of the various interests thus organised. Such a combination should look forward with confidence to success, the aim and object being to increase the use and consumption of electrical energy. As business men A, B and C realise that such increase can only be brought about by the consumer feeling that he is receiving the very best advice and attention. The consumer is satisfied when he finds A, B and C each attending to their own departments, and combining to give prompt and careful attention to his requirements. I repeat that any member of the public is justified in looking round this Exhibition and assuming that these various interests of A, B and C are working together for the common good and for the public benefit towards the desired end.

There is, however, a skeleton in the cupboard. The manufacturer, by whose enterprise the Exhibition is made possible, sees his turnover sadly affected by the opposing interests and the absurd position created between the supply authorities and the contractor. The municipal supply authorities, instead of encouraging the manufacturer and the contractor, are desirous of taking over the whole of the installation work for their consumers from the manufacturer and contractor. Hence, the contractor, who is admittedly the best canvasser for the supply authorities, not knowing at which point he is going to be assailed, fears to risk further capital in developing what may become another's business. The position throughout the country is not such as one would imagine after a visit to this Exhibition. The manufacturers, with very few exceptions, endeavour to carry out their obligations to their friends and the contractors, and try honestly to protect the trade interests by maintaining the usual trade terms and discounts. The number of contractors is slowly diminishing because of the unfair competition of the municipal engineer. Hence the manufacturers' sales are not what they should be. On the other hand, should the municipal electrical engineers have their way, the manufacturers will be at the mercy of an individual or individuals who will be at once current supply authorities, consulting engineers, contractors and merchants, with power to carry out the work and pass it afterwards, or refuse to pass the various fittings as their autocratic will may be pleased to decide, or in the event of a flaw in the installation over which the manufacturer has no control. Under such threatened conditions, can the manufacturer feel that his wares will be given a fair chance, or that the public will receive fair encouragement to make their own selection of cooking or heating apparatus or fittings, decorative or otherwise ? I do not think that the experience which the general public has had with officials of municipalities will lead them to believe that they will receive the ordinary treatment of a customer who desires, at least, to have some say as to how his money shall be spent. From the point of view of increasing the demand for electricity, the supply authorities cannot hope that, even with all their energies devoted to the task, the results would compare with what could be accomplished by the whole trade unhampered by strife and aggressive action on the part of one towards the other.

The Exhibition fairly demonstrates immense possibilities for good, but under the surface lies this evil which is doing incalculable harm to all interested in the supply and in the manufacture and installation of electricity and current consuming devices connected therewith. It is necessary that the eyes of all concerned, including those of the consumers, should be opened to the position of affairs, and the ideal conditions which one might imagine existed at an Exhibition such as this should be the aim and object of all interested parties, in order that the increased trade hoped for by those who have been enterprising enough to bring about this Exhibition may be successfully attained, and in order that the great commercial interests and the firms involved shall not be reduced to mere ciphers in the insane competition with local gas companies, which, regardless of the welfare of the electrical trade generally, appears to be the main object of the municipal electrical authorities.

LIST OF EXHIBITORS AND STAND NUMBERS.

Name of Exhibitor.	Stand Nos.
Abbey Electric Co.	5
Acme Patent Ladder Co. ...	301
Adams Manufacturing Co., Ltd.	107, 108
Aerators, Ltd.	77
Allen & Simmonds, Ltd. ...	229
Alexander, Geo. H.	295
Armitage, C. W.	261
Armorduct Manufacturing Co., Ltd.	120, 121, 138, 139
Aster Engineering Co., Ltd. ...	243
Auto Recorder Co.	228
Barker, John, & Co., Ltd. (Kennedy Bending Machine)	280
Bastian Electric Heating Syndicate, Ltd.	173, 190
Bastian Meter Co., Ltd. ...	173, 190
Bat Meter Co., Ltd.	83
Bell, Heslop	276
Benjamin Electric, Ltd. ...	151
Bennis, E., & Co., Ltd.	200, 215
Berry Construction Co., Ltd. ...	30, 31, 312
Berry, Skinner & Co.	129, 130
Bi-Metals, Ltd.	324
Bonnella & Son, Ltd.	198, 217
Boosey, W. E., & Co. (The Trident Co.)	281
Braun & Co.	259
Bristol (The) Co.	3
British Aluminium Co., Ltd. ...	266
British American Novelty Co.	
British American Stamp Co. ...	275
British Electric Transformer Co, Ltd.	30, 31, 241
British Metal Engraving Co., Ltd.	267
British Prometheus Co., Ltd. ...	197, 218
British Thomson-Houston Co., Ltd.	124, 135
British Vacuum Cleaner Co., Ltd.	174, 189
Brook, E., Ltd.	245
Brook, Hirst & Co., Ltd. ...	153
Bruce, Peebles & Co., Ltd. ...	119, 140
Brunner, Mond & Co., Ltd. ...	260
Brush Electrical Engineering Co., Ltd.	84, 89
Buckton, Joshua, & Co., Ltd. ...	122, 137
Bullers, Ltd.	118, 141
Burton, C. W., Griffiths & Co. ...	205, 210
Calleuder's Cable and Construction Co., Ltd.	196, 219
Cassier, Louis, & Co., Ltd. ...	282
Causton, Sir J., & Sons, Ltd. ...	300
Chamberlain & Hookham, Ltd.	156, 157
Chicago Raw Hide Co., Ltd. ...	272
Churchill, Chas., & Co., Ltd. ...	85, 88
Concordia Electric Wire Co., Ltd.	270
Consolidated Pneumatic Tool Co., Ltd.	50, 73
Corona Lamp Works Co. ...	244
Coventry Chain Co. (1907), Ltd.	251
Credenda Conduit Co.	156, 157
Credenda Signs Co.	156, 157
Crypto Electrical Co.	57
Dennis, W. F., & Co.	293
Dorman & Smith	59, 64
Dowsing Radiant Heat Co., Ltd.	161
Drake & Gorham, Ltd.... ...	61, 62
Dugdill, J., & Co.	238
Dussek Bitumen Co.	242
Earth Driven Clock Co. ...	307
Eastman & Son (Dyers and Cleaners), Ltd.	236
Eastman & Warne	236
Ebonestos Manufacturing Co, Ltd.	226
Edison & Swan United Electric Light Co., Ltd.	98, 117
Edison Manufacturing Co. ...	253, 254
Efandem Co.	4
Electrical Apparatus, Ltd. ...	24, 37
Electrical Contractors' Association	265
Electrical Engineer, Ltd. ...	277
Electrical Engineering... ...	152
Electrical Press, Ltd.	1
ELECTRICAL REVIEW ...	**227**
Electrical Times, Ltd.	26, 35
Electrician	180
Electricity	13, 48
Electric Ordnance and Accessories Co., Ltd.	80, 92
Electromotors, Ltd.	126, 133
Elliott Bros.	54, 69
Emanuel, A., & Sons, Ltd. ...	195, 220
Engineer, Ltd.	284
Engineering and Arc Lamps Ltd.	327
Engineering Instruments, Ltd.	49, 74
Escarè & Denelle, Ltd.... ...	145, 166
Everett, Edgcumbe & Co., Ltd.	66
Evershed & Vignoles, Ltd. ...	168
Excelsior Trading Co.	305
Eyre Smelting Co., Ltd. ...	263
Falk, Stadelmann & Co., Ltd....	79, 93
Famous Diamond Steel Co. ...	258
Felt & Tarrant Manufacturing Co.	299
Ferranti, Ltd.	102, 113
Foster Engineering Co., Ltd. ...	194, 221
Galsworthy, Ltd.	244
Gambrell Bros.	290
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General Electric Co., Ltd. ...	103, 112, 125, 134
Gent & Co., Ltd.	169
Globe Electric Co., Ltd. ...	120, 121, 138, 139
Goodchild, G. W.	237A
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Harrison, H. T....	309
Hart Manufacturing Co. ...	76
Hawkes, O. C., Ltd.	19, 42
Heatly-Gresham Engineering Co.	175
Henley's, W. T., Telegraph Works Co., Ltd.	178, 185
Hervé, L.	278
Hill, Siffken & Co.	264
Hoffmann Manufacturing Co., Ltd.	149, 162
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Hopkinson, J., & Co., Ltd. ...	170, 193
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Imperial Electric Co.	164
Imperial Lamp Works (Brimsdown), Ltd.	100, 115
Imperial Lighting Co.	233
Iron and Coal Trades Review...	52, 71
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Isenthal & Co.	20, 41
Jacobs, W. & R....	296
Jandus Arc Lamp and Electric Co., Ltd.	105, 110
Johnson & Phillips, Ltd. ...	123, 136
Kingolite Co.	262
Krausse & Auerbach	323
Kroney, E., & Co.	285
Ladbroke Bureau	319
Laing, Wharton & Co., Ltd. ...	56, 67
Lancashire Dynamo and Motor Co., Ltd.	122, 137
Lanston Monotype Corporation, Ltd.	264
Lea Recorder Co.	27, 34
Le Carbone	95
Leskole Co., Ltd.	222
Linolite Co.	143
Lister, R. A., & Co., Ltd. ...	11, 12
Litholite, Ltd.	201, 214
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SOME OF THE EXHIBITS AT OLYMPIA.—I.

(The figures in parentheses are the numbers of the stands.)

Crypto Electrical Co. (57),

Bermondsey Street, S.E.

The machines shown by this firm include a petrol-driven namo set designed for lighting country houses, which they are w supplying, with outputs from 250 watts up to large sizes; d a line of alternating to continuous-current transformers suitle for lighting cinematograph arc lamps, charging accumulators, actuating the switchgear, &c., on an alternating-current lift, and on. We illustrate the 350-watt size. Another feature on the rypto stand is a D.C. to D.C. rotary transformer, which has been

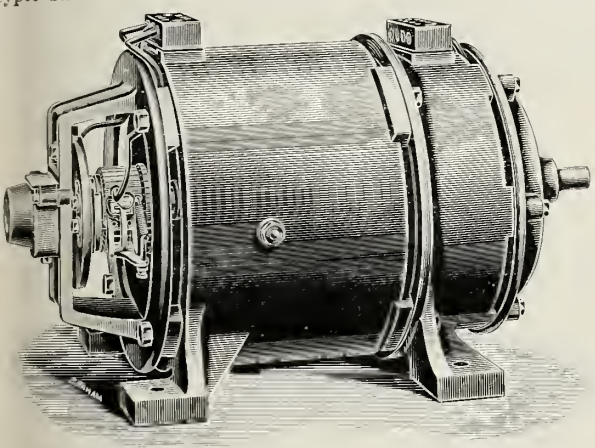


Fig. 1.—Crypto A.C.—D-C. Transformer.

esigned to reduce from high-voltage mains to low voltage for inematograph arc lamps. It is of the double wound type, fitted vith a commutator at each end. The machines which are made at he Bermondsey factory can be wound on the motor side for any oltage up to 530 volts.

Finally, mention may be made of a line of standard pattern lternating-current motors, both slip-ring and squirrel-cage rotor ype, and a line of continuous-current motors and dynamos.

Messrs. E. Brook, Ltd. (245),

Colne Road, Huddersfield.

A number of single, two and three-phase motors wound for oltages ranging from 50 to 500, and frequencies from 25 to 100 re exhibited by this firm, who, as our readers know, specialise in his class of work. Slip-ring motors, motors fitted with back gear, porthole fans, motors and dynamos combined for charging accunulators are in evidence. Particular attention may be drawn to heir back-geared motors, which consist of the ordinary motor

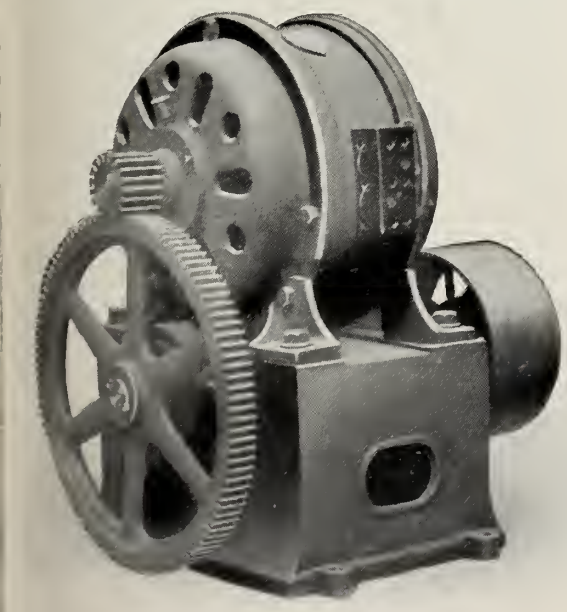


Fig. 2.—Brook Back-geared Motor.

mounted on a special box type casting fitted with a reduction gear ratio, 6 to 1 (fig 2). These castings are fitted with ball-bearings throughout, and by making them up in large quantities the firm can take any stock motor and fit it on to these gears within two hours, so that delivery can be effected the same day as ordered. Another speciality is Messrs. Brook's small motors of ½ H.P. for driving looms. These are made for single and three-phase, are totally enclosed and fitted with ball-bearings, and have a special cradle to allow for the belt always being kept at the correct tension.

J. Rhodes & Sons, Ltd. (14, 47),

Grove Ironworks, Wakefield.

This exhibit consists of two of the power presses in which the firm has specialised. In fig. 3 we illustrate their latest model inclinable press (No. 19) in upright position, with electric motor fitted for driving it. Their No. 21 power press, which is not shown running, has been specially designed for stamping the tops and bottoms of petroleum cans. The efficiency of the Rhodes presses is due to the fact that the centre of the crank, the centre of the slide, and the centre of the hole in the slide, are all in one straight line. The ejector is in front of the slide and is adjusted by a single screw. The coupling is of steel, with gun-metal bearing. The machines are fitted with all the latest improvements, such as Messrs. Rhodes's new patent safety clutch motion, patent ejector in the ram, and other features which enabled the presses to take the Grand Prix at the Brussels Exhibition of 1910. The press illustrated is fitted with automatic double roll feed adjustable for operating dies varying in thickness. The rollers can be instantly swivelled out of the way of the operative for setting.

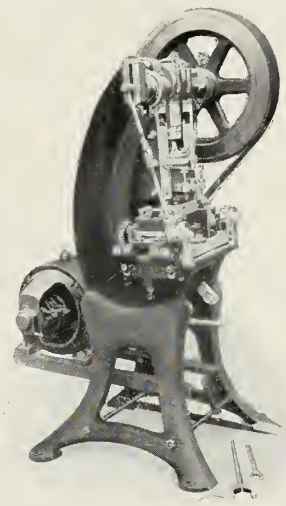


Fig. 3.—Rhodes Inclinable Press

The Aster Engineering Co., Ltd. (243),

Wembley, Middlesex.

Quite an imposing collection of generating sets is exhibited by this firm, including no fewer than eight high-speed vertical engines running on either petrol or paraffin, and, in most cases, directly coupled to dynamos. These range from 2 to 30 H.P. in output, and one of them, a 14-H.P. twin-cylinder set running on paraffin, is used for lighting the stand. We have selected for illustration a four-cylinder 18-H.P. set running on petrol; the cylinders are 95 mm. bore, 140 mm. stroke, with mechanically operated valves, and Bosch high-tension magneto ignition, driven by enclosed oil-fed gears. An enclosed centrifugal governor controls the throttle. The bearings are of bronze, lined with white metal, and lubricated

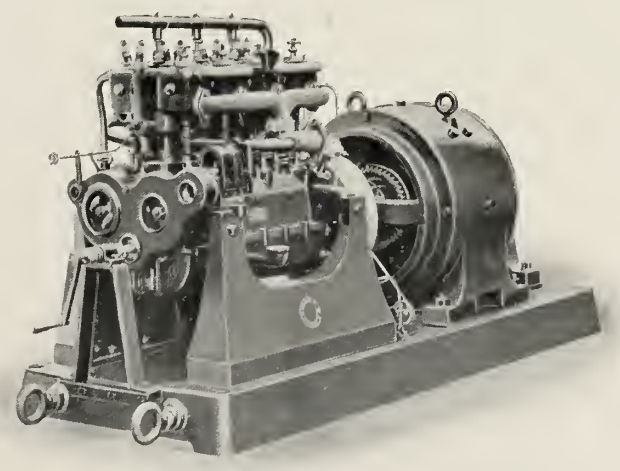


Fig. 4.—Aster 18-H.P. Generating Set.

under pressure with oil supplied by a gear pump drawing from the base of the engine; the big ends of the connecting rods are similarly lubricated through the drilled crankshaft. The engine is mounted on a substantial cast-iron bedplate, and is coupled by means of the Aster flexible coupling to the generator, which was made by Messrs. Siemens Bros., and has an output of 12 KW. at 1,000 R.P.M. The engine can be adapted for paraffin by fitting it with a different carburetter and slightly modifying the piping.

We understand that the Aster Engineering Co. claim to be the largest high-speed vertical engine builders in Europe, there being over 17,000 of their engines at present in use.

Reavell & Co., Ltd. (232),

Ranelagh Works, Ipswich.

At the farther end of the hall (right hand corner) Messrs. Reavell and Co. have an interesting collection of their manufactures con-

taining examples of their air compressors, oil engines and steam engines. Their patent quadruplex compressor is represented by one of the smaller-sized machines of 45 c.f. capacity, belt driven. As most of our readers are aware, the principal feature of this compressor is the fact that it has four single-acting cylinders in which the air is compressed, these cylinders being arranged radially in an annular casing, which forms a water jacket, through which all the cylinders pass. The effect of this is to ensure very efficient cooling of the air during compression, and a consequently low power consumption. All the connecting rods work on a single crankpin, and air is admitted to the cylinders through ports in the connecting rod gudgeons, which are hollow, and similar ports in the pistons which are opened and closed by the axial motion of the gudgeons. This entirely eliminates suction valves and ensures a gain in volumetric efficiency of at least 5 per cent. as compared with compressors having spring-loaded suction valves. The four cylinders result in a very even turning moment, and make the machine very suitable for electric driving. The arrangement also renders the machine very easy to dismantle, it being possible to take out all the cylinders, pistons, &c., in the space of a few seconds by simply removing a single tap-bolt fixed in the crankpin.

The firm are also showing a compressor of the new type which they have designed, and which they have named their "Axial"

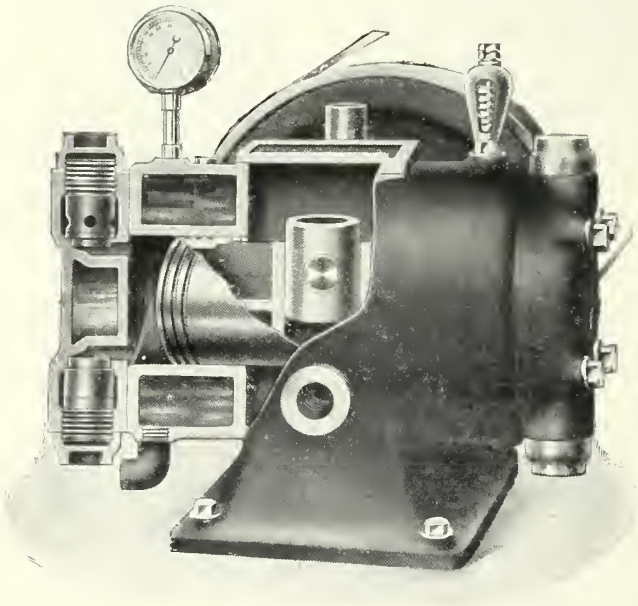


Fig. 5.—Reavell "Axial" Compressor.

compressor. The construction of this machine will be clear from the illustration given in fig. 5, which shows the compressor partly in section. There are only three working parts—the piston, the crosshead, and the crankshaft. The crankshaft has a crankpin formed upon it, which projects into the crosshead, and a hole is bored in the piston to take the latter, which slides up and down as the crankshaft rotates, moving the pistons backwards and forwards. This compressor is very compact and simple, and the price in consequence is moderate.

Messrs. Reavell's portable "sub-station compressor" is shown, which is so arranged that it can easily be carried by two men, and one of the firm's vertical high-speed oil engines is exhibited, directly coupled to a dynamo. A very large number of these oil engines have been sold for electric light and power generating sets for country houses, and they are also very suitable for driving centrifugal pumps and other machinery. They can be very easily arranged for belt driving by fitting a pulley. Lubrication is on the "splash" principle, and is, therefore, automatic, enabling the engines to be left running for long periods without attention. One of the firm's small high-speed steam engines, directly coupled to a dynamo, is also shown. This engine is of the vertical enclosed type. Lubrication here is also on the "splash" principle.

Aerators, Ltd. (77),

Craig's Court House, Charing Cross, S.W.

This firm exhibits a line of fire extinctours charged with carbon dioxide in liquid form, sealed up in steel cylinders, which discharge from 2 to 2½ gallons of water at a practically constant pressure, and a smaller type to take the place of hand-grenades. The "Prana" non-rusting plaited metallic hose-covering is another interesting feature, being extremely flexible and yet very strong. The wire used is not only galvanised, but also double-tinned to prevent rusting, and the closeness of the plaiting confers great strength upon a hose protected with this covering. It might be applied with advantage to the armouring of flexible cables. Fig. 6 shows the double-plait type of covering.

The company are also manufacturers of die-finished castings, of which one is illustrated in fig. 7, showing slots and grooves cast in; screw-threads above $\frac{3}{16}$ in. Whitworth can be cast, and the saving of machining greatly reduces the cost of the parts. The system is particularly useful in the manufacture of many types of electrical

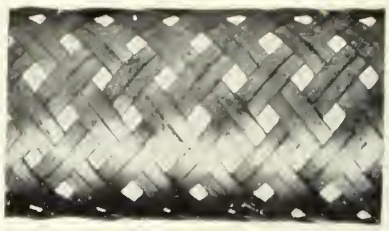


Fig. 6.—"Duplatt" Hose Covering.

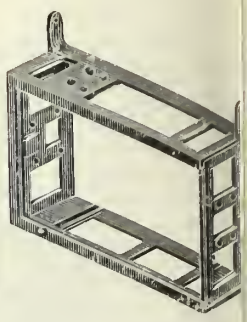


Fig. 7.—"Prana" Die-Finished Casting.

apparatus requiring great accuracy of fitting. A special "Prana" alloy is used, in various grades, which incidentally is an excellen metal for bearings.

"Auto" Recorder Co. (228),

Kent Street Works, Leicester.

This company is exhibiting a "Midland" patent controlled draught furnace, a complete apparatus being shown ready to lay in a boiler flue. It is also fully showing its "Auto" CO_2 recorder for the automatic and continuous analysis of boiler flue gases which we illustrate in fig. 8. Two of these instruments will be in operation, and a third will also be at work, but with its outer case removed and with a glass central water vessel so that the working can be plainly seen. Yet another of these instruments will be present, but entirely taken to pieces, so that the visitor may fully understand the details of the inner construction. This instrumen is being used in a large number of works; for instance, one Lan cashire combine has 28, a Colonial firm has purchased 40, and a Continental firm has taken 19. In the Auto Co.'s own works it ha paid to give the stokers a bonus according to the excellence of th chart, and in many up-to-date works this practice is followed Every few minutes the instrument analyses a sample of the gase passing to the chimney from the furnace, and records on the char the percentage of CO_2 contained therein. The recorder is fixed nea to the boiler, a ½-in. pipe running from the flue to the instrument and the "Auto" patent filter supplied is placed in the pipe near the boiler flue to remove the dust and keep the pipe from choking Only a small water supply to work the recorder is required

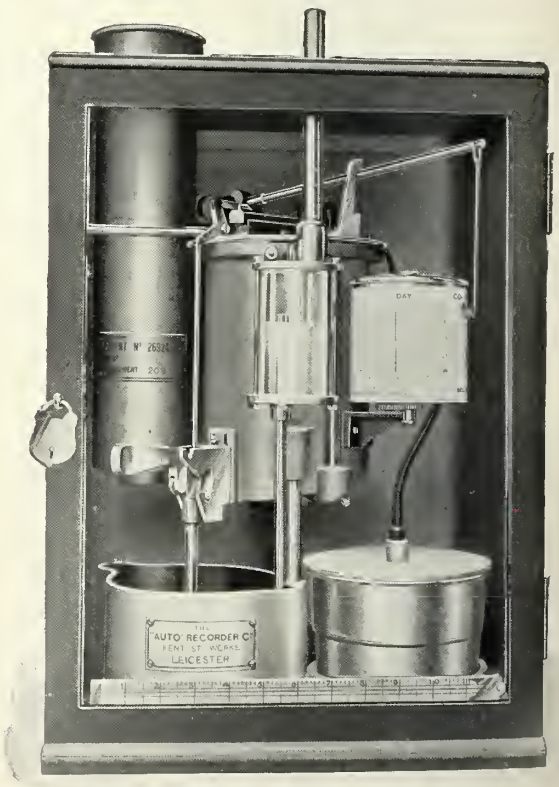


Fig. 8.—The "Auto" CO_2 Recorder.

capable of delivering a few gallons an hour, also a drain from the recorder. The latter is started by a simple operation, and thereafter its action is automatic. Two or three minutes daily to change the chart, cleansing of the filter, taking two minutes, about twice a week, and a changing of the caustic solution about every two to four weeks—these represent all the attention that is required. The size of the "A" model is 15 in. × 12½ in. × 21 in., and its weight in an all-metal case is 120 lb.

Electromotors, Ltd. (126, 133),

Openshaw, Manchester.

This firm's name has become one of the household words of the electrical industry, especially in recent years. It has secured for itself at home an excellent reputation and abroad a fine connection, which is another way of saying the same thing, for its dynamo and

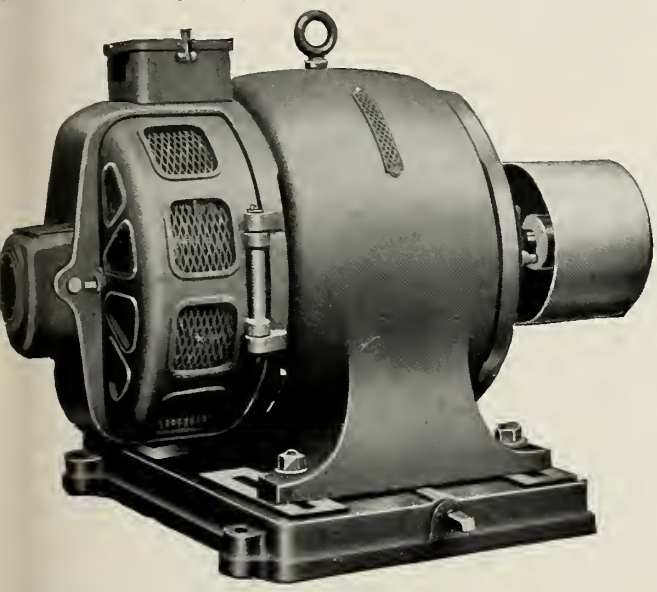


Fig. 9.—Standard Enclosed Ventilated Type Motor.

motor specialities, and its work in connection with factory and works electrification. Its stand is in a prominent position in the central gangway, not many steps from the main entrance to the

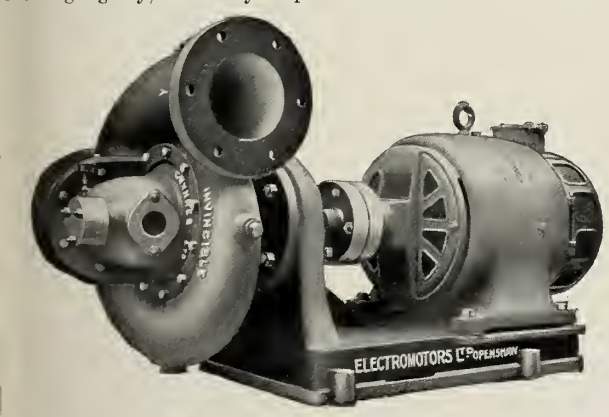


Fig. 10.—Motor-Driven Centrifugal Pump.

Hall. The exhibit includes a few representative sizes of a specialised range of continuous-current motors, and demonstrates their application to the driving of various types of machinery.

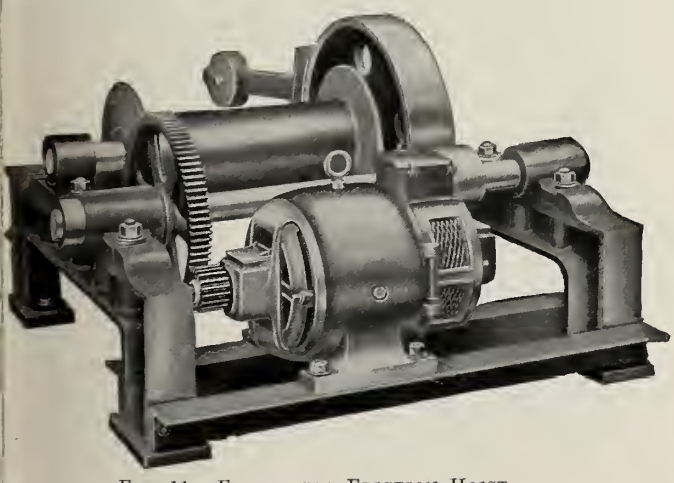


Fig. 11.—Electrical Friction Hoist.

Enclosed ventilated type motors of 1, 5, 10, 20 and 30-H.P. sizes are to be seen, and there is also a 20-H.P. 850-R.P.M. pipe-ventilated motor with weather-proof cowl, mounted on a standard box-bed type spur reduction gear, having machine-cut double helical wheels and self-lubricating bearings for the second-motion shaft. A small steam dynamo suitable for ship lighting, capable of giving an output of 4 KW. at 550 R.P.M., is exhibited (see fig. 12). The engine is of the single-cylinder vertical double-acting open-fronted type with shaft governor. Another feature is a small single ram pump suitable for country houses and small installations generally, capable of dealing with 250 gallons of water per hour, against a total head from all causes of 100 ft. In conjunction with this apparatus is an automatic float equipment, starting and stopping the pump according to the amount of water in the tank, and a special tank to show this in operation is provided.

A 17½-in. electrically-driven fan is shown, the motor being of the shunt-wound totally enclosed pattern, easily capable of driving the

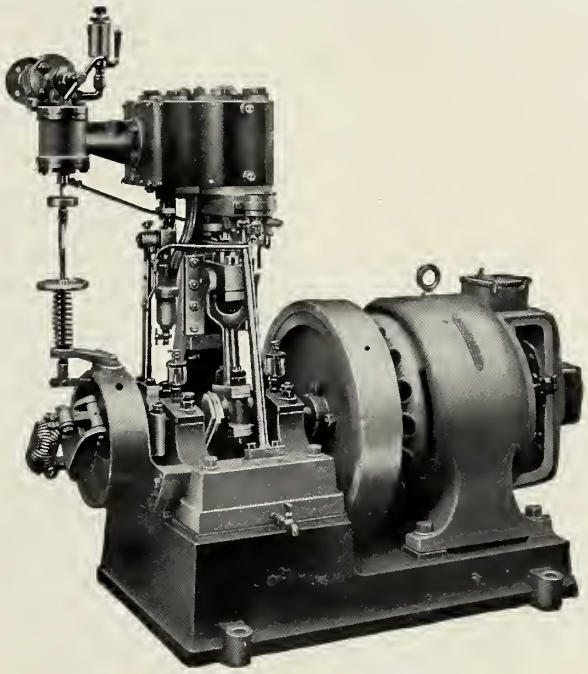


Fig. 12.—Steam Dynamo for Ship Lighting.

fan on open intake and discharge. The fan is suitable for dealing with 9,000 cb. ft. of air per minute under these conditions. There will also be observed (fig. 10) a 3-H.P. enclosed ventilated motor direct-coupled on a combined bed to a 3-in. centrifugal pump, capable of dealing with 180 gallons per minute, against 15 to 20 ft. total head. A large motor and worm gear, as supplied to lift makers, is exhibited, consisting of an 8-H.P. compound-wound reversing motor direct-coupled on combined cast-iron bedplate to a worm gear capable of reducing from 700 to 16 R.P.M. An electrically-operated brake is provided between the motor and the worm gear.

An electrically-driven friction hoist (fig. 11) capable of lifting a load of 5 cwt. at 100 ft. per minute, suitable for handling goods outside warehouses, &c., and specially adapted for lifting sacks, bales, cases, &c., can be seen.

Finally, we may mention a 30-in. low-speed propeller fan, which is capable of handling 6,900 cb. ft. of air per minute at 450 R.P.M. when absorbing approximately 360 watts.

British Vacuum Cleaner Co., Ltd. (174, 189),

Parson's Green Lane, London, S.W.

An interesting assortment of vacuum cleaning machines is shown by this firm. These include their "Excelsior" "W." and "R.C.D." hand-power cleaners, their "Excelsior" ideal electric sweeper and the "B.B." electric cleaner. The model "L." electric vacuum cleaner is supplied with a ⅓-H.P. motor, and it weighs approximately 90 lb. The working vacuum is

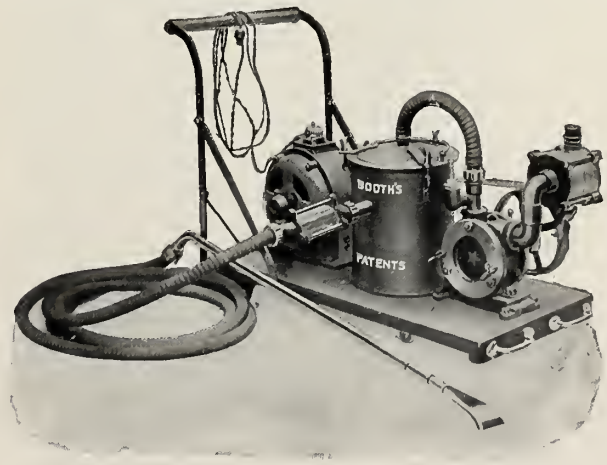


Fig. 13.—Electric Vacuum Cleaner, Model T.

12 in. to 15 in. of water, and the pump revolutions per minute are 600 to 700. It is supplied for either A.C. or D.C. Models "R." and "T." (see fig. 13), which are also exhibited, are each driven by a ½-H.P. motor, and they weigh 120 and 140 lb. respectively. The former is for 15 in. to 18 in. working vacuum, and the latter for 20 in. to 24 in. There is also shown the "C.C." two-cleaner plant of the fixed rotary type, driven by a 2-H.P. D.C. motor (revolutions per minute, pump 650, motor 1,300). It weighs 2¾ cwt. Prices and illustrated particulars of all the foregoing and some other types are set out in the literature issued by the company.

The Brush Electrical Engineering Co., Ltd. (84, 89), 1, *Kingsway, London, W.C.*

The Brush Co.'s principal exhibit is a complete turbo-dynamo, which we illustrate herewith. The turbine is of the "Brush-Parsons" combined action and reaction mixed-pressure type; it is capable of an output of 400 KW. when working with high-pressure steam, or a mixture of high-pressure and low-pressure steam, and of 300 KW. when supplied with low-pressure steam at a pressure of 16 lb. per sq. in. absolute. It is designed to work with a vacuum of 28 in. of mercury, and at a speed of 2,500 R.P.M. The high-pressure portion of the turbine consists of a set of nozzles working in conjunction with an impulse wheel, having two rows of action blades; the steam is expanded in the nozzles from an initial pressure of about 160 lb. per sq. in. down to about atmospheric pressure. The low-pressure section of the turbine is of the pure "Parsons" type, in which the steam is further expanded down to an absolute pressure of about 1 lb. per sq. in. Under all conditions of working the steam distribution is under the control of the main governor, and the changes from high pressure to low pressure or to mixed pressure are performed automatically.

The dynamo is of the compensated type, and is fitted with auxiliary poles; the compensating winding counteracts the armature reaction, while the auxiliary poles produce a commutating field in a neutral zone. The armature is of the slotted drum type, and ventilating ducts are provided at frequent intervals to ensure efficient cooling of the core and winding. The commutator is mounted on a spider shaft through which the air is drawn to cool the inside of the armature, thereby ensuring a low temperature rise. Rings of special steel are shrunk on to the commutator at short intervals, and are insulated therefrom by mica rings.

A steam dynamo is also exhibited, with an output of 22·5 KW. at 250 volts when running at 625-650 R.P.M., and supplied with steam at a pressure of 200 lb per sq. in., exhausting freely to atmosphere. It consists of an enclosed vertical double-acting compound engine, fitted with a governor of the automatic expansion shaft type, and provided with forced lubrication, direct coupled to a D.C. generator of the slotted drum armature ironclad type. The dynamo is provided with a ball bearing of substantial construction, lubricated with grease, by the use of which several advantages are gained, wear being practically eliminated, while the attention required is reduced, the machine is shortened, and its efficiency is improved.

Amongst other Brush exhibits are a variable-speed three-phase A.C. motor of the squirrel-cage type, with four running speeds (480 to 1,450 R.P.M.), obtained by changing the number of poles of the stator; a D.C. motor with ball bearings, and a 150-H.P. induction motor; various electrical travelling pulley blocks and hoists; the Brush portable electric grinder, specially designed for trimming the commutators of turbo-dynamos, but suitable for any other grinding operation; and the collector portion of the trolley gear for the Bremen system of railless trolley vehicles, which was fully described in our issue of June 9th last. The distinguishing features of the system are the arrangement of the two overhead wires, one above the other, and the ingenious type of collector which, as shown in the accompanying illustration, combines the characteristics of the wheel and bow types of collector.

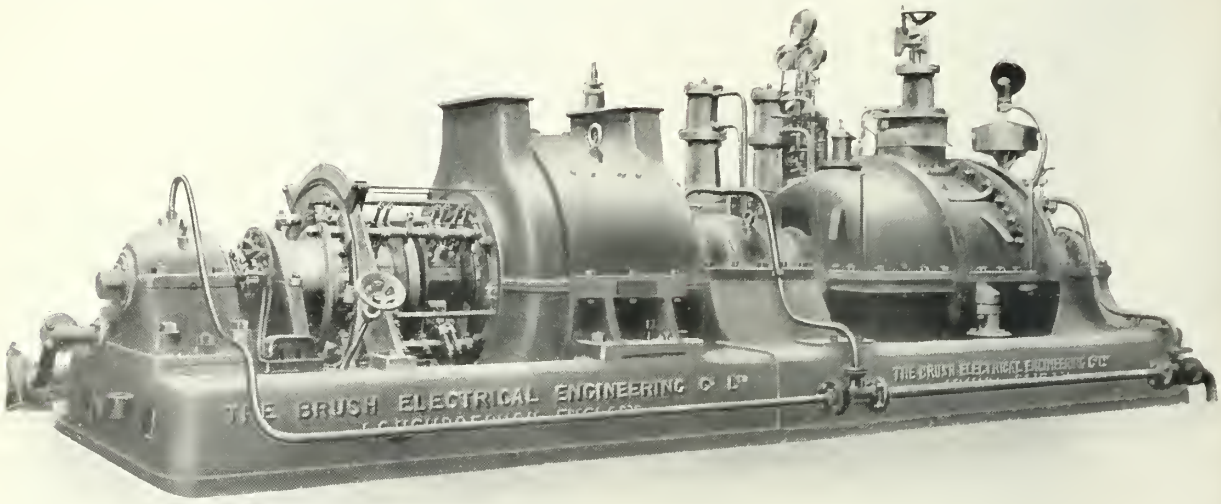


Fig. 14.—Brush-Parsons 400-kw. Mixed-Pressure Turbo-Dynamo.

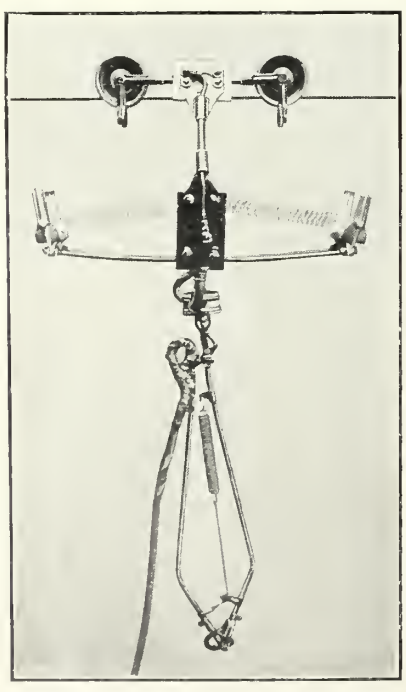


Fig. 15.—Collector of Bremen Railless Trolley System.



Fig. 16.—Quartzlite Lamps at Millwall.

The Brush Quartzlite lamp is shown in use for lighting the stand, and we reproduce a view of a steamship in Millwall dry dock, showing how effective this lamp is for illumination where work has to be carried on at night. There are four of these lamps on each side of the docks, each giving 2,500 to 3,000 C.P.; they have had to be screened on the river side, as they dazzled bargees in midstream. They have proved very satisfactory in penetrating fog.

Mention should also be made of the Brush "Metallum" high C.P. metallic-filament lamps, which are included in the exhibit.

Messrs. Charles Churchill & Co., Ltd. (85, 88),
9-15, Leonard Street, E.C.

Messrs. Churchill are showing a number of their grinding machines, of one of which we reproduce a photograph (fig. 17). This is a 10 in. × 24 in. Universal grinder, suitable for finishing shafts, spindles, cutters, reamers, &c., and can be used for external and internal and for face grinding, parallel or taper, to a very high degree of accuracy. Special attention has been given in the design to afford every convenience and great precision in setting angles, fixing the work heads, and arranging independently the speeds of work and wheel to the best advantage. The sliding surfaces are accurately scraped true, and lubrication is amply provided for. The



Fig. 17.—Churchill Universal Grinding Machine.

automatic wheel feed sizes the work to within 0·00025 in. The machine is available for a large and varied range of work. Amongst other machines of this kind shown by Messrs. Churchill (who specialise in this line) are a 10 in. × 60 in. plain grinding machine for shafts, &c., and a vertical surface-grinding machine taking work of 10 in. × 36 in. surface and 13 in. high.

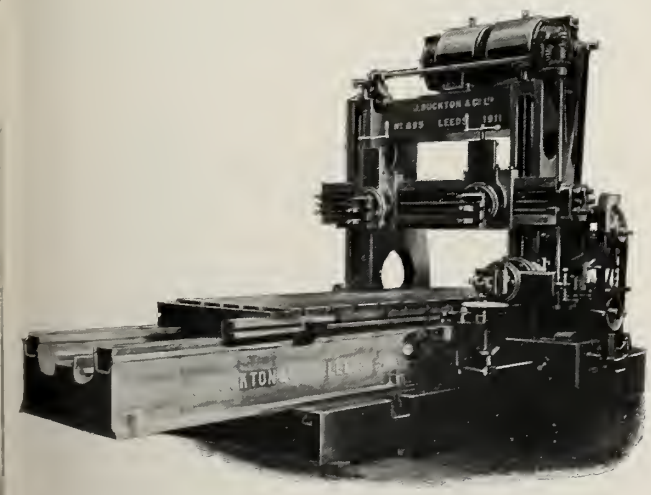


Fig. 19.—Buckton Electrically-Driven Planer.

Another exhibit which we illustrate (fig. 18) is a horizontal drilling, boring, milling and tapping machine, which is admirably adapted for dealing with engine and machine tool parts with rapidity and accuracy, the various adjustments being provided with graduated dials to show the exact distance moved. Such appliances as jigs and other special devices can be quickly dealt with on this machine. A gear box giving 16 speeds is provided, with a reverse for tapping. The work table measures 24 in. × 32 in., and a maximum travel of 51 in. can be obtained. The various indexes are graduated in thousandths of an inch, and the machine is built to limits of error of ·001 in. in 12 in. These, and the other exhibits on this stand, serve to show the extremely high standard of design and workmanship which characterises the machine tools made by Messrs. Churchill at their Pendleton Works.

Joshua Buckton & Co., Ltd. (122, 137),
Well House Foundry, Leeds.

This exhibit consists of one of the firm's improved table planing machines, to plane up to 10 ft. long, and to admit up to 4 ft. wide and 4 ft. high, with cutting speeds of from 25 ft. to 75 ft. per minute, and a return speed of from 25 ft. to 200 ft. per minute. The cross slide carries two tool boxes, and the machine is fitted with a side tool box on the near side arm. The cross slide tool boxes have self-acting feed motions for horizontal, vertical and angular cuts The side tool box has self-acting vertical feed motion and horizontal

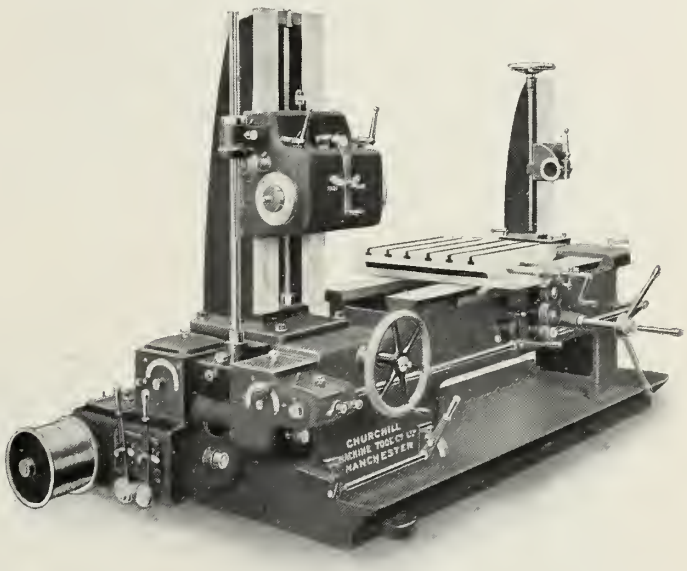


Fig. 18.—Churchill Horizontal Drilling, Boring, Milling and Tapping Machine.

and angular traverse by hand. The table is driven by a machine-cut spiral pinion gearing into a machine-cut rack on the underside of the table. On the outer end of this spiral pinion shaft is a spur-wheel driven by a similar steel spiral pinion, coupled up to the shaft of the reversing motor of the Lancashire Dynamo Co.'s "Lancashire-drive."

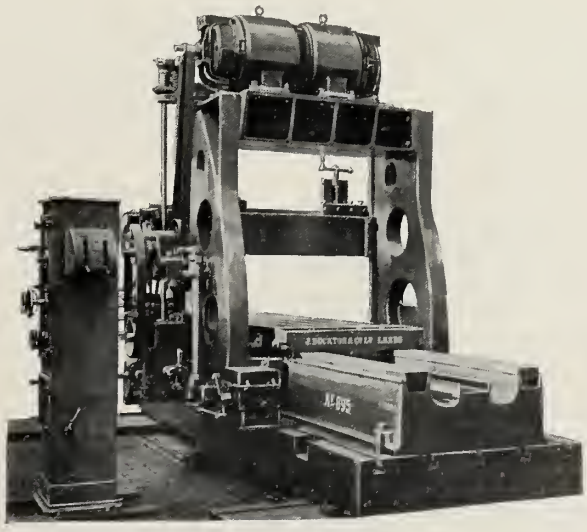


Fig. 20.—Back View of Buckton Planer, showing also Control Pillar.

With this spiral gear there are always a number of teeth, usually not less than four, in mesh simultaneously with the rack, and the motion of the table is effected noiselessly, with extreme smoothness, and without any jar or chatter, while the frictional resistance is reduced to a minimum.

A distinguishing feature, and one which tends greatly to increase the output of the machine, is Messrs. Buckton's patent power feed and traverse motion. By means of this gear the feed of any tool box, in any of its automatic motions, can be varied over the whole range from a fine feed to a broad finishing cut with suitable intermediate rates. The feed on all the motions can be stopped, reversed or varied instantly without stopping the machine. The cross slide can be rapidly traversed up and down by power, and all or any of the tool boxes can be rapidly traversed by power in any

of their automatic motions. All these various motions are actuated by the patent power drive, and all the regulating handles are conveniently arranged to be operated from one side of the machine, and from approximately one position. The facilities afforded by this gear for rapid adjustment and setting of the machine, and change of feed, enable great economy and increase of output to be attained.

It is claimed that by virtue of the all-spiral drive and the isolation of the feed gear from the reversing motion, the table can be reversed without shock or jar at the highest economic speeds. The bed is deep and of heavy section, with oil pockets formed in the sliding ways, and fitted with automatic lubricating rollers. The tool boxes are of improved construction, with double swivel motion, so that the tool can always be presented at a suitable angle to the work.

Messrs. Ferranti, Ltd. (102, 113),

Hollinwood, Lancs.

Messrs. Ferranti's exhibit is arranged on novel lines, and comprises a great variety of material connected with switchgear, meters of various kinds, relays, motor starters and regulators, time switches, circuit-breakers, &c., as well as cooking and heating apparatus, and, of course, electricity supply meters of various patterns. Their D.C. motor starter (fig. 21) represents quite a new departure, being quite

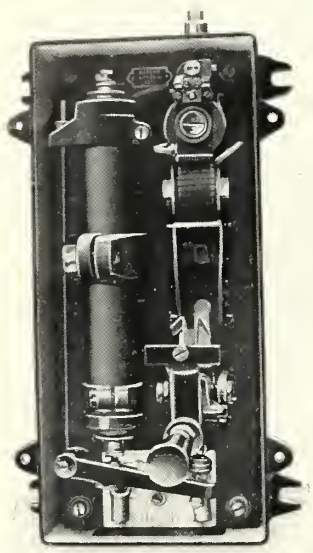


FIG. 21.—FERRANTI COMPRESSION-TYPE MOTOR STARTER.



FIG. 22.—TOTALLY ENCLOSED COMPRESSION TYPE STARTER.

unlike the customary types; it has no face-plate, and contains only two contacts—those of the circuit-breaker, which naturally are indispensable. The "compression-type" starter contains neither metal resistances nor asbestos, and in most of the patterns shown, mica is the only insulating material used. A non-metallic motor-starter was designed and introduced by the firm some five years ago, and the device under notice is a development of this type. The improvements consist of:—

1. The use of a non-metallic totally-enclosed ironclad resistance unit which is practically imperishable.
2. A reduction of the resistance gradually and continuously instead of by more or less considerable steps.
3. The elimination of the contact face-plate, contacts, and tappings to the variable resistance.
4. The use of only two contacts, one in the main circuit and one for short-circuiting the variable resistance.
5. The absence of slate or marble in all but the smaller sizes, and the use of moulded mica to the total exclusion of asbestos throughout the complete range.

The resistance unit consists of graphite disks contained in a steel tube, which is lined with a special refractory insulating material having exactly the same coefficient of expansion as the tube itself; the whole is raised to a temperature far in excess of any that can occur in practice even under the heaviest overloads. The variation of the resistance is obtained by applying pressure to the column of disks. The tubes are carried on and insulated from substantial metal clamps, and they can be affixed or removed in a few minutes. In the full "on" position the resistance is short-circuited by a switch constructed on the same lines as a circuit breaker, provided with rubbing contacts, which are laminated in the larger sizes, and fitted with sparking contacts, and magnetic blow-out. The main circuit is closed through a similar breaker mounted on the same arm as the short-circuiting switch, and both sets of contacts are readily accessible. This arm is operated by a simple system of link gear directly connected to the handle.

These starters are made in semi-enclosed, totally enclosed, and totally-enclosed ratchet motion patterns. A no-volt coil is an integral portion of the starter, and it permits of the addition of an overload attachment. The overload setting may be varied from 100 per cent. overload to 300 per cent. overload.

All the starters are enclosed in stout cast-iron cases: the semi-enclosed pattern has a slot in the cover for the handle, while the enclosed pattern has a hole through which a spindle passes, carrying either a hand-wheel or a lever (fig. 22). Slow motion is obtained by the addition of a ratchet gear to the enclosed pattern. The case of the totally enclosed pattern is weatherproof, and can be made watertight if required.

Each starter is provided with a push-button, by which it may be tripped. The starter may also be tripped from a distance if suitable provision is made.

Other notable features on this stand are the protected and ironclad type fuses. The former are designed to prevent the possibility of personal contact with live metal. All current-carrying parts are completely surrounded by insulating material when the fuse-handle is in position. The contacts are placed in non-conducting fireproof boxes, open in front and provided with internal projections which guide the tongues into the contacts. The fuse wire is contained in a handle composed of a fibre tube enclosing one of hard asbestos. Metal clips secure the tongues to the asbestos, and the fibre tube is extended sufficiently to enclose the clips and cover the boxes containing the contacts. Two wide insulating flanges are mounted on the fibre tube, serving as hand-guards and as guides between the boxes and the fuse handle. Thus these fuses are safely and easily manipulated even in the dark, as the handle is guided between the boxes by the flanges, and the tongues are directed between the contacts by the internal projections.

The ironclad fuse consists of the front terminal pattern protected type fuses, totally enclosed in a substantial weather-tight cast-iron



FIG. 23.—IRONCLAD FUSEBOX WITH PROTECTED FUSES.

case, designed to facilitate the replacement of the fuses. The construction of the case follows closely that of the firm's well-known ironclad switch, and allows for the attachment of special adapters permitting almost any form of cable connection.

The ironclad fuses and the Ferranti ironclad switch can be

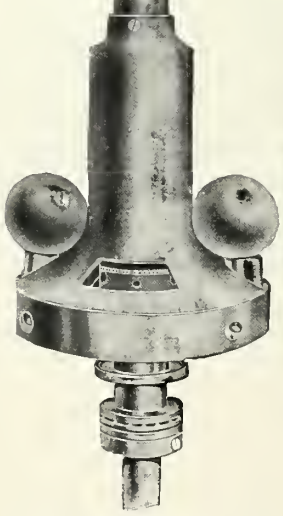


FIG. 24.—HARTNELL "P" TYPE GOVERNOR (see page 469).



FIG. 25—HARTNELL ENCLOSED GOVERNOR.

assembled to form a unit, the fuse cover being interlocked with the switch handle, so that it cannot be opened unless the switch is in the "off" position.

These are samples only of the interesting display of apparatus which is well worthy of a visit.

Messrs. Wilson Hartnell & Co., Ltd. (266),

Volt Works, Leeds.

The governors with which the name of this firm has been associated from our earliest recollection are well represented at this stand. A complete set of the original Hartnell vertical governors is shown, these being as popular and efficient as ever. The largest of these has an outside spring, to regulate the speed whilst the governor is running, and is so powerful that the work required to open the balls, lifting the sleeve 5 in. against the pressure of the spring, is no less than 600 ft.-lb. A somewhat similar governor is provided with an outside spring, closed dashpot, and double-acting dashpot spring. A governor on a horizontal shaft is also shown, this position being chosen in order to eliminate the disturbing effect of gravity, so that a very small variation of speed can be achieved. The "P" type governor is illustrated in fig. 24, p. 468. This is designed for small engines and turbines, and the balls work on roller bearings, the sleeve rests on rollers at the ends of the governor arms, and the main spring is supported on a ball-bearing plate. The result is that the governor responds extremely quickly to changes of speed. A type of almost identical appearance is made to have two distinct rises, the first commencing at 250 R.P.M., and being completed at 270 R.P.M.; the governor sleeve then remains stationary until a speed of 390 R.P.M. is attained, when it again begins to rise, completing the full rise at 404 R.P.M. This type is useful for acting through large variations of speed, for example, to prevent an excessive speed being attained by a hoist, while remaining unaffected over a wide range of speed below the predetermined limit.

Our other illustration shows one of the most recent designs of the Hartnell governor—an enclosed type, of which three examples are exhibited. Fig. 25 represents a pattern with long covers to accommodate the springs, which rest upon ball plates. These governors act with a high degree of accuracy—two or three per cent. variation of speed—and are much used for water and steam turbines, and small engines. One of those shown has two rises, one at 200 R.P.M., and the other at 2,000 R.P.M. Nine of the 11 governors are shown in motion, driven by a 4-H.P. 220-volt Hartnell motor.

The Hart Manufacturing Co. (76),

77, *Rochester Row, Westminster, S.W.*

This exhibit consists of a complete collection of the entire line of "Diamond H" switches and accessories, many of which have been illustrated in our pages. These switches, as is well known, are

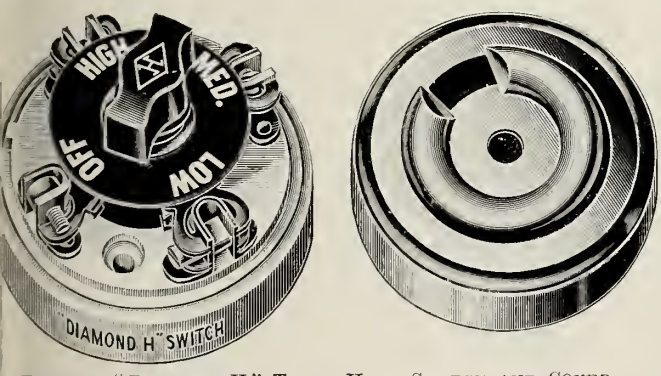


Fig. 26.—"Diamond H" Three-Heat Switch and Cover.

made of the highest-grade materials and of approved construction, all working parts being made of case-hardened and tempered steel, contacts of spring phosphor-bronze, and insulation of India sheet mica. The break is exceptionally long and rapid on all the various lines, and the switches are made for practically every purpose. Among the company's more recent products are their remote-control

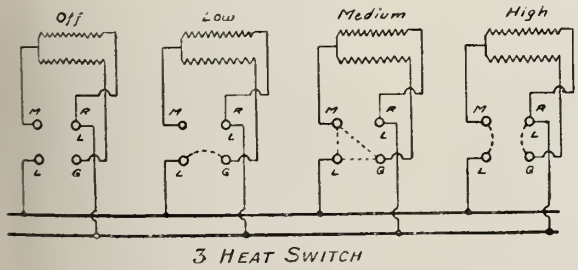


Fig. 27.—Connections of Switch.

switches, which they propose to place upon the British market very shortly. They have also just brought out a series-parallel switch for heater work. Of this switch we give illustrations in fig. 26, the connections of the same appearing in fig. 27.

The Imperial Electric Co. (164),

85, *Fleet Street, E.C.*

A portable vacuum cleaner operating from the electric lighting circuit is the leading exhibit of this firm The illustration (fig. 28) shows motor, fan, chamber, and dust bag attached to exhaust, the entire apparatus weighing only 9 lb. The motor in this cleaner makes 10,000 R.P.M., and enables the device to do very effective and rapid cleaning work. A feature of this apparatus is that the motor is suited to both alternating and direct currents of 90 to 250 volts pressure, and any periodicity from 25 to 90.

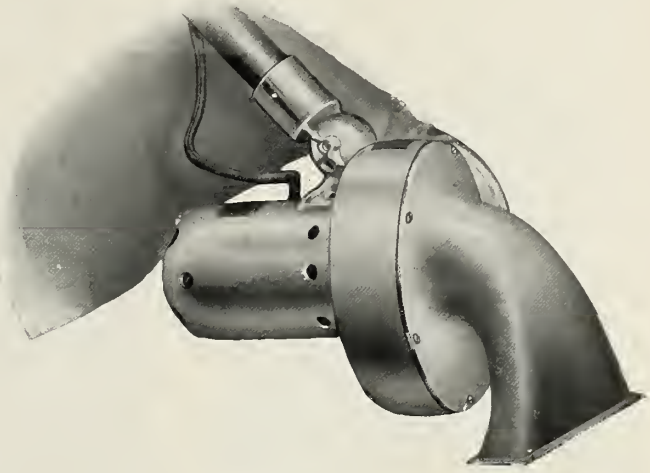


Fig. 28.—Imperial Electric Co.'s Portable Vacuum Cleaner.

A portable massage vibrator that gives 60 variations of massage stroke is also shown. It is in demand amongst physicians, masseurs, and hairdressers, and for private use.



Fig. 29.—Portable Massage Vibrator.

The illustration (fig. 29) shows the machine complete in case, with applicators for various purposes. The motor operates with both direct and alternating currents from 90 to 250 volts, and on various periodicities. Machines are also shown which are driven by dry-cells (self-contained).

Four different types of medical coils generating interrupted galvanic and Faradic currents are supplied by this firm for domestic



Fig. 30.—Imperial Electric Co.'s Medical Coil.

use; they make a speciality of these four lines. The machines are designed for treating different ailments in the home. Various electrodes can be supplied, all of which can be used on any of the four types of machine, one of which is shown in fig 30.

The Sterling Telephone and Electric Co., Ltd. (127, 132), 200, *Upper Thames Street, E.C.*

The Sterling Co.'s exhibit is one of bewildering diversity, their stands being fitted up with a prodigal display of telephones, bells, indicators, blasting machines, &c. The "Parlyphone" and more highly developed telephones for connection to domestic bell circuits are too well known to call for detailed reference, nor need we specify the numerous types of wall and table telephones for short and long-distance working; the "Primax" automatic interphone, however, which is of recent introduction, merits special mention, and we illustrate herewith one of the patterns in which it is made. The annoyance caused by induced overhearing and cross-talk on ordinary intercommunication systems is only too familiar a trouble,

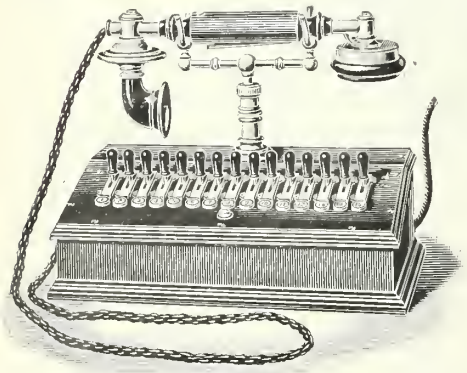


Fig. 31.—Sterling "Primax" Automatic Interphone, Table Pattern.

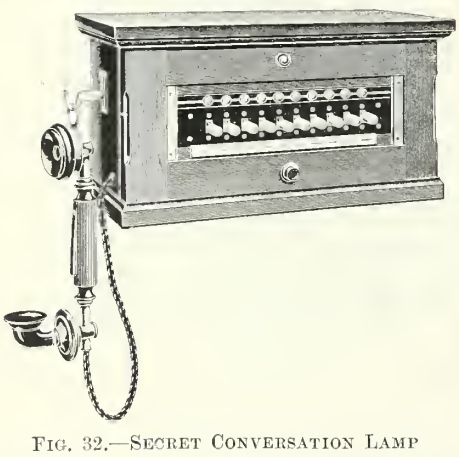


Fig. 32.—Secret Conversation Lamp Signalling Interphone, Wall Pattern.

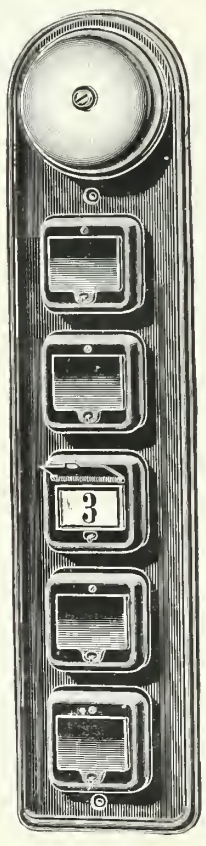


Fig. 33.—"Unitype" Indicator, Elevator or Ship Pattern.

but in the "Primax" system it is so far eliminated as to be negligible. Local batteries, also a fruitful source of inefficiency, are dispensed with, a single central battery sufficing to operate the whole system, up to as many as 30 stations. Yet only two additional common wires are required in the cable, and the instruments cost no more than their forerunners. Calls may be received and answered irrespective of the position of the line selector, and the act of replacing the receiver or hand combination restores the lever in the type illustrated to the normal position.

In the "Era" automatic interphones for double lines, which are also well represented, cross-talk is, of course, entirely eliminated; but the limit is reached in the lamp-signalling secret conversation interphone shown in fig. 32, which combines the advantages of the foregoing designs with an absolutely secret, non-tappable service. The use of lamps for signalling minimises the number of moving parts, so that these instruments are not likely to get out of order, and the visual lamp signal facilitates quick operation, besides affording to the caller himself a definite indication whether the person called is engaged or not.

One of the most prominent features of the exhibit is a handsome combination table lamp-signalling switchboard, in the form of an office bureau. This can be equipped for 100 stations, and enables the operator to carry on ordinary clerical work, beside attending when required to the telephone calls.

Passing over a variety of military and mining telephones, fir alarms, &c., we note as special features a gas and watertight electri trembling bell, in which the hammer is screwed to a flexibl diaphragm, permitting the motion to be transmitted from th internal mechanism while the case is hermetically sealed; also th new "Thruster" bell, which has the whole movement enclosed i a waterproof cast-iron case, from which it can, however, be with drawn complete on removing four screws, without disconnecting an wires. This is shown complete and dismounted in fig. 34.

Electric blasting machines capable of firing from two to 80 shot are shown, but we have space only in conclusion to illustrate th new "Unitype" bell indicator, fig. 33. This is made up of unit each complete in itself, so that contractors can build up indicator to any requirements without having to carry a large stock.

We understand that with few exceptions, all the apparatu shown was made at the company's works at Dagenham, in Essex.

Messrs. R. Waygood & Co., Ltd. (75, 97), *Falmouth Road, London, S.E.*

Messrs. Waygood have on exhibition a full-sized electric passenge lift for conveying visitors to the gallery. It is operated by car switch with self-centring detachable handle in the cage, th gates being fitted with electrical and mechanical locks to prevent th lift being worked while any gate is opened, and to prevent the gat being opened unless the cage is opposite the floor. They are als showing an electric service lift at work, capable of raising ½ cw at about 100 ft. a minute through a travel of about 15 ft. Th lift will be controlled by three pushes, "up, down and stop," an will represent the latest design of this type of lift. Another ite is a model of one of their improved hand-power lifts for private res dences, operated by handle and controlled by foot-brake, the cag being guided by round steel runners. A model of an electric pus button passenger lift, dispensing with the necessity of an attendan and therefore specially adapted for the use of private houses, also on view, together with a number of the firm's accessories.

Messrs. Adams Manufacturing Co., Ltd. (107, 108), 106, *New Bond Street, W.*

Motor controlling apparatus "of infinite variety" is the keyno of the "Igranic" exhibit. To select the leading features of th display for special notice is a difficult task—there is nothin that does not merit notice, but not *all* the items can be dealt wit in the space at our disposal. Fortunately, we have in previo issues illustrated some of them, and we may, therefore, be conte with only mentioning the Igranic ironclad motor panels of th pillar type (standardised in 13 different combinations), which a well represented; in these starters all the main contact-makin and breaking is removed from the contacts of the starter to th automatic circuit-breaker, and the whole of the operating is don with one handle. The multiple switch starting rheostat, and th patent inching starter for printing machines, &c. (with circui breaker interlocked with starter handle), have also figured in o pages. The company show the latest type of automatic soleno self-acting starter, combined with a clapper type ma switch, with carbon break and magnetic blow-out; this is suitab

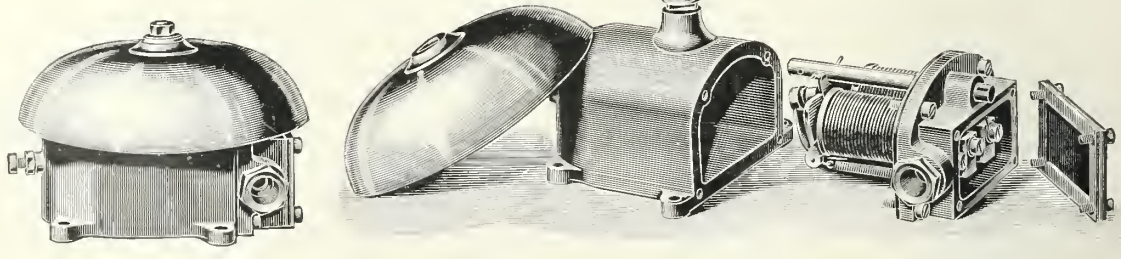


Fig. 34.—"Thruster" Bell, complete and dismounted.

for the automatic control of pumps, air compressors, &c., or the remot control of any kind of machine. Fig. 35, p. 471, illustrates a com bined "double arm" starter and speed regulator for use with shun or compound-wound motors, fitted with no-volt and overload releases and renewable contacts. This first starts and then regulates th motor, and is so interlocked that the motor must be fully excite before the armature circuit is closed. Fig. 36 shows a neat littl treadle-operated starter and regulator (with cover removed), fo sewing machines and similar small treadle-operated machines In this ingenious device, which is easily fixed under the table of th machine, the main circuit is closed by a disk bridging the tw lower posts; the latter are magnetised, and hold the disk unti the spring forces it off, when at the same time a quick break and magnetic blow-out are produced. For a quick stop the disk i forced up to engage with the upper pair of posts, short-circuiting the armature and giving a dynamic brake.

Another phase of automatic control is shown in fig. 37—a paten controller for electrical organ-blowing with a bellows; as wil be seen, a chain or rope from the bellows actuates the regulatin resistance, giving any variation from full speed to rest.

Several types of lift controllers are exhibited in operation including a full automatic push-button controller. The Adam

granic remote control switches are also shown, as well as "type L" oil-immersed starting switch, for use with auto-transformers, or for star-delta connection; this is of the throw-over type, and possesses some exceptionally good features. The switch must be closed on the starting side, before it can be turned to the running position, and the handle cannot be left in the starting position. Overload coils can be connected in two of the phases

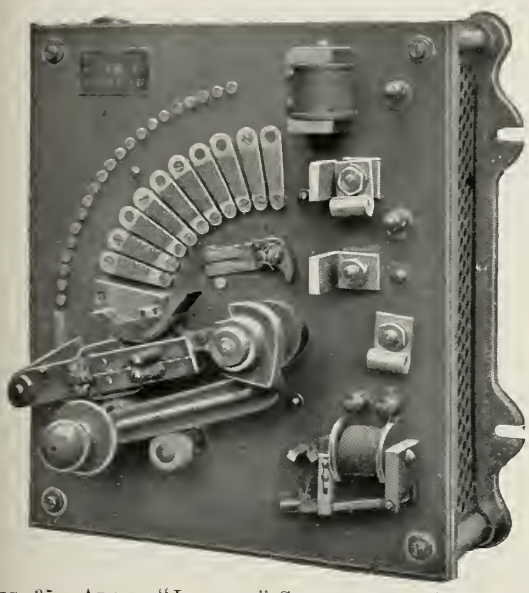


Fig. 35.—Adams "Igranic" Starting and Regulating Rheostat.

on the running side, with only a portion of the windings in circuit on the starting side, so that the switch will not trip with the starting current, unless overload conditions exist.

We must not omit to mention the Adams Igranic theatre dimmers of the metallic type, as used at "The Little Theatre" (Electrical Review, October 21st, 1910), and many other theatres, which are being used to control some of the lighting on the stand.

As above-mentioned, many of the firm's devices will be shown at work, and we have no doubt that visitors will find it well worth their while to see them.

Allen West & Co., Ltd. (202, 213),

Lewes Road, Brighton.

The leading feature of this exhibit is controlling gear. Reversing drum type controllers for both A.C. and D.C. circuits, fitted with various forms of operating gear for crane and general

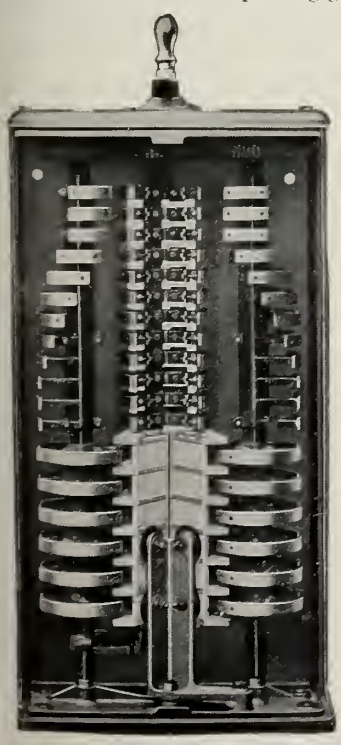


Fig. 38.—Allen West & Co.'s 350-h.p. A.C. Double-Drum Controller.

industrial work; drum type machine-tool controllers to give a large range of speed control on shunt motors; heavy duty controllers for steel works; oil-immersed controllers for general use in fiery mines; liquid haulage controllers, also for use in fiery mines; improved unit type resistances and unbreakable stamped resistance grids, and drum type collector columns for use on cranes, are included, and several of the special features referred to below are covered by patents.

A noticeable feature of the apparatus exhibited is the massive construction of all parts; the fingers used on the drum controllers

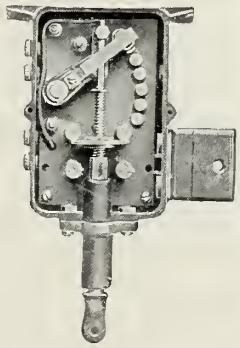


Fig. 36.—Sewing Machine Regulator, with Front of Housing Removed.



Fig. 37.—"Igranic" Controller for Organ Blowing.

are of the mechanical hinged type, and obtain their pressure from spiral springs instead of the usual flat type. Each finger is securely attached to a machined terminal base, rigidly clamped on to a mica-insulated steel bar, and is thus mechanically held in the right position. All the fingers are fitted with heavy renewable contact tips of hard-drawn copper, and the current is carried from the finger to the terminal base by a heavy shunt of laminated copper. The finger tip has a stud permanently screwed into it which passes through a hole in the hinged finger back, and is held thereto by a nut and lock-washer; the trouble of replacing tips attached by separate screws which weld to the worn copper is thus obviated. The drum rings and finger tips are of more massive section than is usual, this provision having a considerable cooling effect on the arc, which greatly prolongs the life of the wearing parts. Of the many types of controller shown, we have selected for illustration an A.C. drum-type controller for 350 H.P. at 440 volts (fig. 38). This contains two drums working in parallel through gearing, and actuated by a single handle. It also illustrates the special provision which is made to facilitate the connections with external wiring.

Machine tool controllers for shunt-wound motors, designed to provide a large range of speed regulation by means of resistance in the shunt field circuit, are exhibited, of drum type throughout: a single handle controls the motor speed throughout its whole range, and it is impossible to reach the high-speed notches without first passing through those provided for starting.

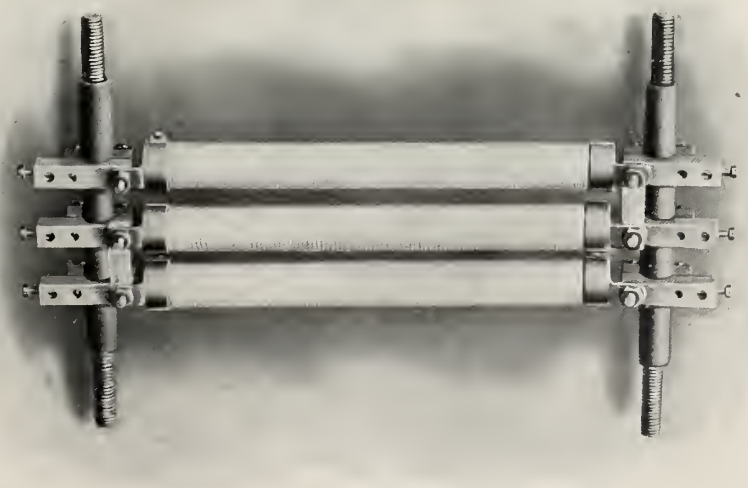


Fig. 39.—Resistance Unit on Mica-Insulated Rods.

Steel works controllers are shown of the face-plate pattern, but constructed on the latest lines, with particularly massive contacts and mica insulation. They are provided with protecting covers,

which are easily detachable for inspection, but effectively prevent the entry of the dust and dirt which are usually prevalent in the situations where they are employed. A very large number of notches are provided in both the forward and reverse directions, so that easy starting is ensured, and a powerful magnetic blow-out acts on each notch.

Examples of the firm's resistance specialities are shown in the improved unit construction and patent unbreakable stamped grids. In both cases the resistances are carried on mica-insulated steel

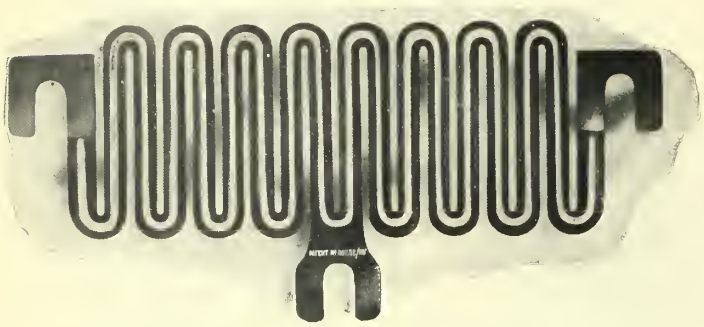


Fig. 40.—Unbreakable Stamped Resistance Grid.

bars, so that a fireproof construction results. The units are of the wire type, wound on steel tubes. They are thinly coated with a special cement, and provided at the ends with heavy clamped terminals, which entirely obviate the troubles which occur when resistance elements of this type are only provided with thin strip or wire terminals. The great feature of the stamped grids is, of course, their mechanical strength, which makes a breakage from any cause almost impossible. They are particularly suitable for use in situations where there is considerable vibration, and will also appeal to shippers for export purposes. In both the grids and units the resistance material used is of negligible temperature coefficient, and there is no danger of deterioration due to rusting. We illustrate both these items, as well as a crane collector column made on the drum principle, in which standard controller fingers are employed. Mica insulation is used throughout, and bearings are provided so that the fingers and rings are always in perfect alignment and there is no danger of improper contact being made, which is often the case when the fingers are supported from some part of the moving or fixed portion of the crane without any means being provided to preserve their exact alignment with the rings.

Oil-immersed controllers of two sizes are exhibited, one being of the drum type throughout, which is used for the smaller horse-powers, and one for the larger sizes, having separate oil-immersed reversing switches. In these controllers the drum portion is of the

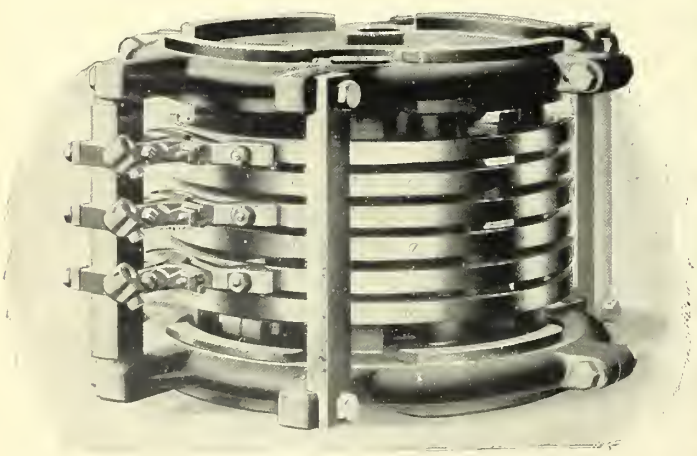


Fig. 41.—Allen West Crane Collector Column.

horizontal type with drum rings of even more massive section than those used in the non-oil-immersed lines. Provision for inspection is made, so that it only takes a few seconds to have the contacts exposed for inspection or renewal.

The firm claim that their liquid controllers are the first to be put on the market in which a scientific circulation of the resistance liquid is employed. In these controllers a single hand-wheel or lever performs all the functions necessary for starting, stopping, reversing and speed regulation. The movement of this operating gear from its "off" position first closes the oil-immersed stator or line switches, and further movement reduces the liquid resistances in the rotor or slip-ring circuit until the "full on" position is reached. All the various parts are mechanically interlocked, so that it is impossible for them to operate in any but the correct order.

Gent & Co., Ltd. (169),

Faraday Works, Leicester.

Clocks, telephones, alarms and bells—these are the lines that the visitor always expects to find, and to find effectively displayed, at an exhibit arranged by Messrs. Gent & Co. On the present occasion once more this expectation is realised. The exhibit accord

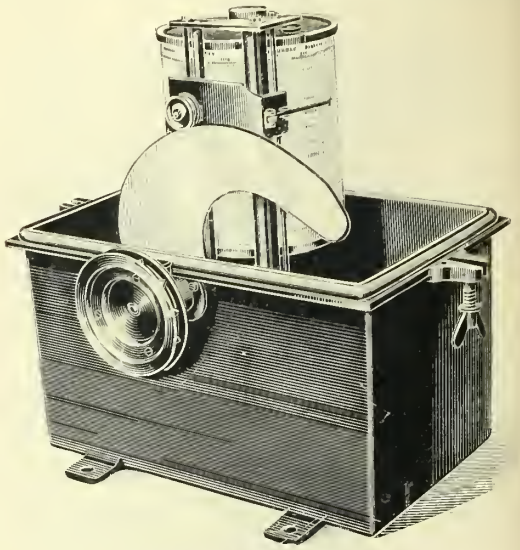


Fig. 42.—Gent's Water Level Recorder.

ingly includes first of all their electrical impulse clocks for turret house, or factory use, by which accurate and uniform time can be maintained throughout an establishment, including any number of clocks, all working together without any periodical winding. The only attention needed is that required by the battery (which is of the ordinary Leclanché type) say once in 12 months, of which timely warning is given by their "weak battery warning" bell. The Parsons-Sloper secret and other telephones, as made for the General Post Office and leading railways, are able to secure for the secret conversation between any two points in connection throughout a system of intercommunication telephones connected

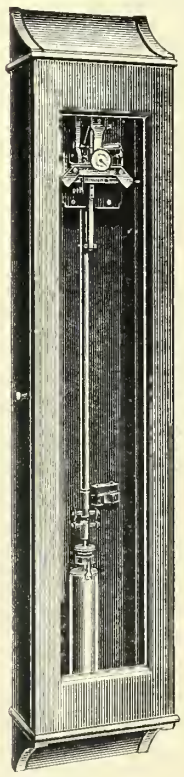


Fig. 43.—B.P. Patent Impulse Transmitter.

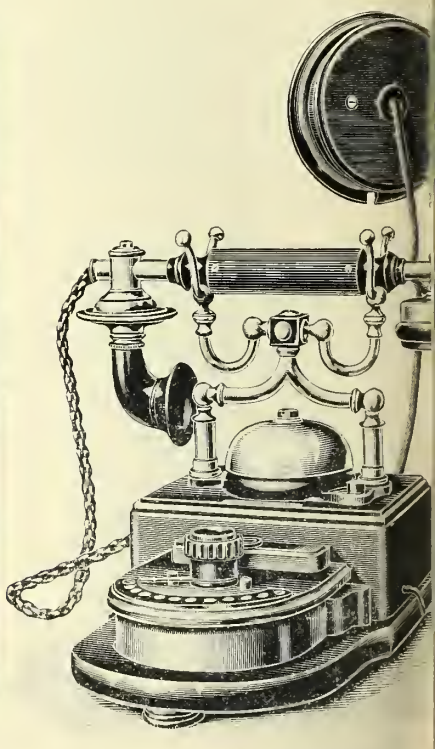


Fig. 44.—Parsons-Sloper Secret Interphone.

on ordinary single-line intercommunication wiring. In commercial houses as well as in some other places, secrecy of conversation is essential, and an important advantage also is that such conversation cannot be interrupted by a third party. Water-level indicators and recorders (fig. 42) are shown for recording at any distance the rise or fall in the water-level at a reservoir or tank, "inch by inch" as the variation takes place; water-level alarms are also exhibited, and electric dry ink marking tell-tale clocks, for checking asylum attendants, night watchmen and others. A system which has been adopted for many years past for asylums, workhouses

hospitals and large works, is also to be seen here, as well as electrical bell indicators, with special designs of pendulums, drop or mechanical replacement indicators, ships' indicators, semaphores, and a variety of water-tight and other bells.

Messrs. E. Bennis & Co., Ltd. (200, 215),

Little Hulton, Bolton.

This firm has an interesting boiler-house exhibit, showing two types of mechanical stokers, fed by means of bucket elevators, distributing shoots and band conveyors. There are five separate parts to the exhibit, constituting a complete coal and ash-handling plant. Different methods of supplying coal to two types of mechanical stokers are demonstrated—the "Bennis" high-temperature coking stoker fitted to an internally flued boiler, and the "Bennis" new-link chain grate stoker fitted to a water-tube boiler. A "Bennis" elevator, fitted with rotary feed and special chain and buckets for boiler-house use, is shown elevating the coal to bunkers composed of riveted plates and supported on massive stanchions. Part of the bunker is provided with a hopper bottom, and fuel is fed direct from the bunker into the coking stoker. A shoot leading from the bunker feeds the chain-grate stoker. The fuel thus fed into the stokers travels along the bars, and after passing through the furnace falls on to band conveyors. These illustrate the latest type of "Bennis" band conveyor with built-up idlers and adjustable self-oiling bearings. The conveyors feed into the boot of the elevator mentioned above. The entire process is continuous, and the plant is driven by an A.E.G. motor. Winn mountings are fitted to the boiler fronts.

The "Bennis" high-temperature smokeless and gritless coking stoker shown is of the latest type, with patent air-cooled doors, and cooling plates round the stoker front. This stoker and self-cleaning compressed-air furnace will burn, according to the draught, from 10 to 60 lb. of fuel per sq. ft. of grate per hour without smoke or grits. By its design, large evaporative boiler capacity, economy and flexibility are ensured.

The "Bennis" patent new-link chain grate stoker embodies many improvements. The links are halved together and rounded at their ends, and the drive is adapted to give six variations of speed to suit various classes of coal and varying loads. The grate can also be used with forced draught. The provision of the patent air-seals, which prevent the entry of an excess of air at the sides, the machine-cut six-speed gear running in oil, and ball-thrust bearings are among the improvements that render this smokeless chain-grate stoker admirably adapted for all types of water-tube boilers. It has been adopted by the Admiralty, and excellent results are being obtained in the boiler-houses of many electrical undertakings in the United Kingdom and on the Continent. A "Bennis" automatic CO_2 recorder and calorimeter are also exhibited.

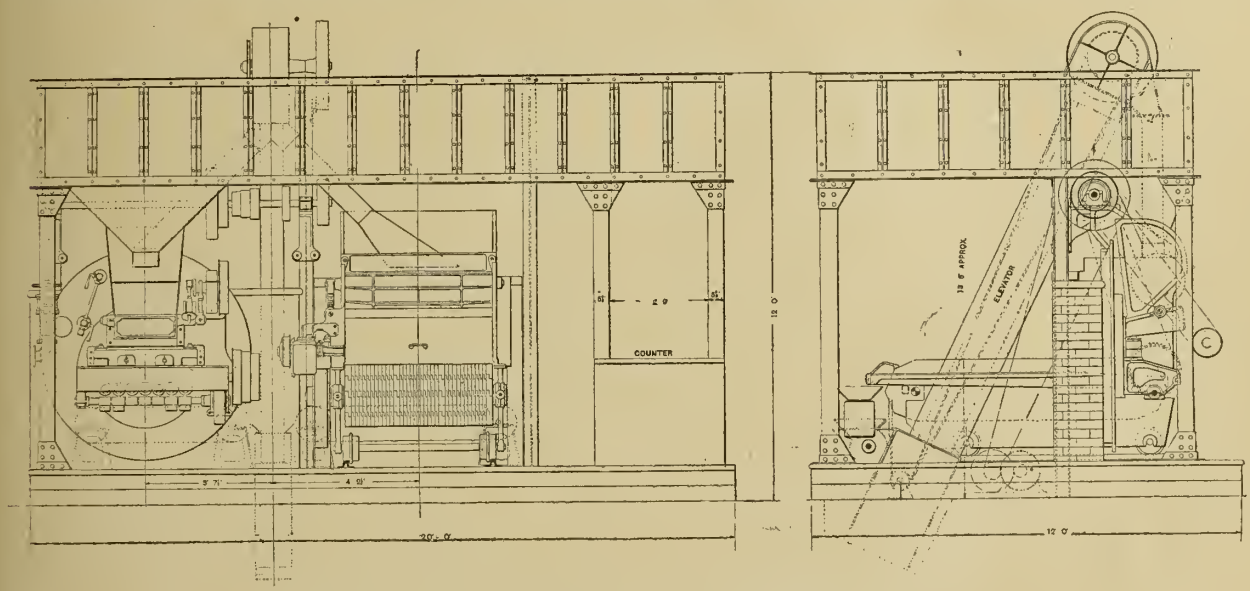


Fig. 45.—Arrangement of Bennis Boiler-House Exhibit.

Messrs. Major & Co., Ltd. (142),

Sculcoates, Hull.

This firm, who are manufacturers of insulating varnish, compounds and other allied specialities, are exhibiting a full range of their manufactures as used in the electrical trade. They will also have in operation a high-tension testing set and other apparatus on which demonstrations will be given. A special Exhibition sample offer is being made in order that users may have an opportunity of carrying out a proper works test in bulk. We are asked to state that at the stand literature will be available describing the manufacture of insulating varnish. All their products are tested before going to the customer, and the firm's chemical and electrical laboratories are fitted with all the necessary plant for carrying out these tests.

Litholite, Ltd. (201-214),

55, *Hackney Grove, N.E.*

Here the following articles are being shown:—Litholite non-hygroscopic insulators, moulded into the form of handles for use on switchboards, starters, &c., bushes, washers, caps for covering projecting bolts and nuts, bobbins, winding supports, terminal blocks for use on motors and dynamos, insulated spindles and washers for brush-gear, tube-end bushes for conduit wiring, electrolier nipples, telegraph insulators, &c. We are informed that a test made by Faraday House on August 4th, 1911, on a litholite disk 21·4 cm. diameter by 0·651 cm. thick, showed a resistivity of 108,000,000 megohms with a testing pressure of 500 volts, the temperature of the room being 78° F. XX grade (fire-resisting) shields for covering lampholders to meet Home Office requirements are also exhibited.

British Metal Engraving Co., Ltd. (267),

Kingston-on-Thames.

On this stand, which will be found in the gallery, there is a very varied assortment of nameplates, dials, scales, &c., all of which are made at the firm's works in Kingston-on-Thames, in different finishes, engraved brass as well as aluminium. Nameplates for motors, dynamos, installations, &c., from the usual raised brass lettering on sunk black ground to complicated coloured artistic plates are displayed, as well as circular and shaped counter disks, with the numbers in a circle, and meter plates in every different style. In addition, there are large quantities of plates with blank spaces for stamping on the numbers of watts, revs., ohms, H.P., as well as the speeds, type, number, &c., all with engraved lettering to show up permanently on the apparatus to which they are affixed. Dial plates for meters, with the divisions imprinted on aluminium, and holes through which a pointer protrudes, are also shown. Celluloid and bone labels for switchboards, &c., form a popular side line. Almost every sample plate in evidence advertises some familiar firm of electrical and engineering manufacturers or representatives.

The Brimsdown Lamp Works (100, 115),

Kingsway House, London, W.C.

This company has a good show of the Brimsdown metallic-filament lamps, manufactured under the colloid-tungsten and later patents, which, the exhibitors claim, confer upon them the sole rights of manufacture of lamps under this process in Great Britain. The advantages claimed for the colloid-tungsten lamps are that the filament is more homogeneous and has a longer average life than other types, and possesses the highest possible efficiency; and its good qualities have been recognised by many British and Colonial Government departments, electricity supply authorities and other important concerns. The facia of the stand is outlined with an entirely new reflector illuminating strip, and other devices combine with this to render the stand well worthy of a visit. The lamps are, of course, entirely British made, and are manufactured in all the usual patterns.

Messrs. J. Hopkinson & Co., Ltd. (170, 193),

Britannia Works, Huddersfield.

This exhibit comprises a full-size model Lancashire boiler equipped with Hopkinson's patent safety boiler mountings and valves, and an archway of valves for various purposes. There is also a small archway showing the Hopkinson-Ferranti patent stop valve as compared with the ordinary mushroom and the parallel slide type.

Inquiries.—A correspondent wishes to get into touch with makers of machinery for manufacturing electric conduits and fittings. Particulars of oil fuel systems suitable for application to Lancashire or dryback marine-type boilers, and the name of makers of the Weber luxometer, are asked for.

CONTRACTS OPEN and CLOSED.

OPEN.

Aston Manor.—September 29th. 20,000 tons of coal for the electricity works of the T.C. R. Foster, borough electrical engineer.

Australia.—Victoria.—October 3rd. 42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" August 25th.

November 21st.—One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

South Australia.—October 25th. Cable and paper sleeves for the P.M.G. See "Official Notices" September 1st.

Sydney, October 30th.—Five turbo-alternators of 5,000 KW. each, for the New South Wales Government Railways. Full particulars from Electrical Engineer's office, 61, Hunter Street, Sydney. This contract was advertised in the *Sydney Telegraph* of July 29th and the matter is referred to fully in our "Tramway Notes" of last week.

South australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" to-day.

Bristol.—October 2nd. One 10-ton and eight 2-ton high pedestal travelling jib cranes, electrically driven, Royal Edward Dock, Avonmouth, for the Docks Committee of the T.C. W. W. Squire, Engineer, Cumberland Road (returnable deposit of £5).

Cape Colony.—Wynberg.—September 25th. Tenders are invited for street lighting, for a public supply of electrical energy to the Council, and to private consumers. Particulars from the Town Clerk.

France.—The Chemins de Fer de l'Etat propose to acquire 450 electric motors for the electrification of the suburban tramways. Particulars from Le Service Electrique, 43, Rue de Rome, Paris.

Halifax.—September 26th. Electrical fittings for six months, for the B.G ; A. T. Longbotham, clerk, Carlton Street.

Hastings.—October 18th, Electric lighting of the workhouse. Ore, for the B.G. See "Official Notices" September 15th.

Hungary.—October 2nd. Tenders are invited for the establishment of an electric public and private lighting service at Paszto, in the province of Heves, Hungary.

Keighley. — September 25th. Coal-handling plant, storage reservoir for 200,000 gallons of water, and two circulating pumps, for the Corporation Electricity Works. See "Official Notices" September 8th.

Liverpool.—September 26th. Electric supplies for a year, for the West Derby B. of G. ; H. P. Cleaver, clerk, Brougham Terrace, West Derby Road.

September 30th. Electric lifts and electric light fittings for the Select Vestry, at the Workhouse, Brownlow Hill. G. W. Coster, vestry clerk, Brownlow Hill.

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

October 12th. 100,000 pairs of white open type type arc lamp carbons, for the B.C. See "Official Notices" to-day.

September 27th. Extension of the telephone systems at the Guardians' buildings at Homerton. See "Official Notices" September 15th.

Manchester.—September 25th. The Corporation is inviting tenders for electrical machinery, plant, and wiring for Elm Street Cold Storage Warehouse. Specifications and forms of tender from the Superintendent, Markets Department, Town Hall.

October 4th.—One 4,000-4,500 KW. low-pressure exhaust type turbo-alternator, for the Corporation. See "Official Notices" September 15th.

October 3rd.—For (*a*) permanent way special track work ; (*b*) permanent way points, tongues, and hardened steel centres ; (*c*) granite setts. Specifications and forms of tender obtainable from Mr. McElroy, general manager. Deposit £2 2s. (returnable).

Radcliffe.—Proposed new fire-alarm system, about £400.

Sheffield.—A large water-tube boiler capable of evaporating 21,000 lb. of water per hour to replace a small marine type of boiler at the tramways power station, Kelham Island.

South Africa.—Port Elizabeth.—October 19th. The T.C. requires tenders for the supply of (*a*) electric motors, and (*b*) electric motor starter panels. Specifications from the Municipal Electrical Engineer Tenders to Town Clerk.

Spain.—The municipal authorities of Segorbe (province of Castelloa) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

Taunton.—September 25th. Steam coal for a year (about 2,500 tons), for the electricity works. A. J. Howard, borough electrical engineer.

York.—September 23rd. Supplies for a year, for the City Electricity Department. See "Official Notices" September 15th.

CLOSED.

Australia.—Melbourne.—The City Council has placed an order with Messrs. Siemens Bros. Dynamo Works, Ltd., for a Tudor battery (4,000 amperes for one hour), which is to be put at the centre of the area of densest demand.

Mr. C. W. Webster, of Bradford, who is representing the Compania Fabril de Carbones Electricos, of Barcelona, has received instructions from Messrs. McIlwraith, McEacharn & Co., Ltd., of London, to supply the Melbourne City Council with a very large quantity of flame carbons (approx. 700,000 ft.). The firm are makers of beacon flame carbons, and Mr. Webster has lately received contracts and orders to supply these to Sheffield, Leeds, Halifax, Wallasey, Coventry, Sunderland, and other corporations.

Blackburn.—The Guardians have accepted the tender of Messrs. J. W. Garsden & Co., at £192, for an electric hooter, in place of the compressed-air hooter previously recommended for acceptance.

Bolton.—The Electricity Committee has accepted the tender of Mr. J. B. Scholes for 25,000 tons of coal.

Brighton.—The T.C. has been recommended to have the No. 5 turbine at the electricity works reconstructed by the British Westinghouse Electric and Manufacturing Co., Ltd., at a cost of £4,980.

Government Contracts.—The following tenders have been accepted by the Government department named, during the past month :—

War Office.

Cable, electric, &c.—Britisb Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegrapb Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; London Electric Wire Co., & Smiths, Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
Generating set.—Siemens Bros. Dynamo Works, Ltd.

India Office, Store Department.

Armatures and electrical fittings.—J. Stone & Co.
Cells.—Siemens Bros. & Co.

Crown Agents for the Colonies.

Telephones, &c.—Western Electric Co., Ltd.
Wireless installation.—Marconi's Wireless Telegrapb Co., Ltd.

Office of Works.

Cables for Imperial College of Science.—Siemens Bros. & Co., Ltd.

G.P.O., Stores Department.

Telephonic apparatus, bell sets.—British Insulated and Helsby Cables, Ltd,
Flexible cords.—British Insulated and Helsby Cables, Ltd.; London Electric Wire Co., & Smiths, Ltd.
Plugs.—British L.M. Ericsson Manufacturing Co., Ltd.
Paper core cable.—Western Electric Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Desiccators.—Lacy-Hulbert & Co., Ltd.
Detectors.—General Electric Co., Ltd.
Lightning protectors.—Britisb L.M. Ericsson Manufacturing Co., Ltd.

G.P.O., Engineering Department.

Electric lifts, District Office, London, W.C.—Medway's Safety Lift Co.
Telephone extension, Mayfair Exchange.—Western Electric Co., Ltd.

London.—Poplar.—The Electricity Committee received the following tenders for plant in connection with the extensions to be carried out at the generating station :—

Two water-tube boilers, fitted with underfeed stokers, and hot-air economisers.

Stirling Boiler Co., £7,673 (three motors) (not according to specification); first alternative, £7,802 (four motors) (do.); second alternative, £7,983 (two motors).
Babcock & Wilcox, £8,190 (two motors).
Howden Boiler Co., £8,200 (three motors) (not according to specification) first alternative, £8,408 (four motors) (do.); second alternative, £8,60 (two motors).
Clarke, Chapman & Co., £8,571.
Fraser & Chalmers, £10,498.

In the opinion of the electrical engineer the tender of Messrs. Babcock & Wilcox, at £8,190, should be accepted, and instead of both boilers being fitted with underfeed stokers and hot air economisers, he recommends that one only be fitted in this manner, and the other with close-link travelling grate, with water economiser and induced draught. The cost would be the same in either case. The advantages of the Babcock & Wilcox boilers, the engineer states, are :—(1) Short, straight tubes, greatly facilitating inspection and cleaning, and thus obviating difficulties experienced with bent tubes. (2) Exceedingly high evaporation results have recently been obtained on the Continent, which go to prove that the evaporative capacity of this class of boiler has been hitherto much underrated in this country. (3) The grate area of the boiler put forward is greater than that of any of the other types. This, in his opinion, is a particular feature in obtaining the best evaporation in any boiler. (4) By the proposed special arrangement of induced fan draught, the fan is not influenced in any way by the hot gases, and, in combination with the considerably increased length of

grate, the capacity can be raised by at least 15 per cent. to 20 per cent. After considering these facts, the Committee have come to the conclusion that although the tender of Messrs. Babcock and Wilcox was £207 in excess of the lowest tender, the extra cost would be more than counterbalanced by the superiority of this type of boiler, and they accordingly recommend that the tender of Babcock & Wilcox to supply and erect on foundations provided by the Council two water-tube boilers, and fitted with underfeed stokers and hot air economisers, and the other with close-linked travelling grate, with water economiser and induced draught, at £8,190, be accepted.

For the supply and the erection of a 30-ton electric overhead travelling crane the following offers were received :—

Chatteris Engineering Co., £845.
Jas. Carrick & Sons, £912.
A. Jack & Co., £930.
Royce, Ltd., £960.
S. H. Heywood & Co., £961.
Alternative, £1,060.
Cowans, Sheldon & Co., £995.
J. Booth & Bros., £995.
C. & A. Musker, £998.
Marshall, Fleming & Co., £1,010.
Babcock & Wilcox, £1,025.
Stothert & Pitt, £1,040.
Sir Wm. Arrol & Co., £1,046.
Herbert Morris & Bastert, £1,052.
Howden Boiler Co., £1,045.
First alternative, £1,104.
Second alternative, £1,134.
Third alternative, £1,290.
Ransom & Rapier, £1,155.
Carrick & Ritchie, £1,189.
Alex. Chaplin & Co., £1,220.
J. Carter & Sons, £1,295.
Craven Bros., £1,310.
Jas. Spencer & Co., £1,320.
J. Smith, £1,325.
J. Henderson & Co., £1,605.
Alternative, £1,620.

Reporting on these tenders the Engineer states that he had carefully examined the details of each tender, and was convinced that Messrs. Royce's crane had certain distinct advantages over other makes. The most prominent were (1) hoisting gear, and all rims of driving wheels, &c., are made of wrought steel, and teeth cut out of the solid. (2) Roller bearings throughout, reducing friction to a minimum. (3) The whole of the crane and motors are made complete by one firm. (4) Special patent arrangement, known as slipper drive, whereby it is rendered impossible to overload the motor. (5) The general arrangement of running the cables from motors to the operating cradle is one which allows very great facility in testing and general examination. The engineer further states that two cranes made by this firm were now in use at the destructor works and were working satisfactorily, and that, in his opinion, the tender of Messrs. Royce, Ltd., at £960, should be accepted. The Committee have recommended accordingly.

The following tenders have been received for one overhead bunker, one combined coal elevator and conveyor, and extension to existing coal conveyor :—

Tickle Bros.—(*a*) Bunker, £1,076; (*b*) new conveyor, £490; (*c*) extension of existing conveyor, £420.
New Conveyor Co.—(*a*) £1,188; (*b*) £609 10s.; (*c*) £444 10s.
Bennis & Co.—(*a*) £1,270; (*b*) £610; (*c*) £530.
Spencer.—(*a*) £1,212; (*b*) £865; (*c*) £451.
Edgar Allen & Co.—(*a*) £1,730; (*b*) £818; (*c*) £522.
Barry, Hendry & Co.—(*a*) £2,050; (*b*) £575; (*c*) £490.
Babcock & Wiloox.—(*a*) £2 100; (*b*) £760; (*c*) £373.
Dempster & Sons.—(*a*) £1,654; (*b*) £1,015; (*c*) £787.

The Committee have decided to accept the tender of Babcock and Wilcox for extending the existing conveyor, at £373, and to defer the consideration of (*a*) and (*b*) for further examination. At the meeting of the Council, on September 14th, the recommendations of the Electricity Committee were carried.

SOUTHWARK.—The B.C. has accepted the following tenders :—

Siemens Bros.—40-kw. motor-generator and switchgear for supply of alternating current to premises in Chapter Road, £122.
British Insulated and Helsby Cables, Ltd.—440 yds. of 1 L.T.T.C. cable, £97.
Reavell & Co.—An air Compressor, £54.

The tender of the Corona Lampworks, Ltd., of St. Pancras, has been accepted for the whole of the metal-filament lamps for the Queen's Theatre, Shaftesbury Avenue.

Mansfield.—The Education Committee has accepted the tender of the Mansfield Engineering Co., at £40, for installing the electric light at Carter Lane Schools.

North Ormesby.—The U.D.C. has accepted the tender of Messrs. Baker Bros., of Stockton-on-Tees, for the installation of fire alarms, at £68.

Sheffield.—The City Council has accepted the tender of the British Thomson-Houston Co., Ltd., for 50 R.G.E. traction motors, at £100 each, for the Tramways Department.

Sherburn.—The P.C. has accepted the tender of Messrs. Haydn Harrison for 36 250-volt 50-C.P. Osram lamps.

Sunderland.—The T.C. on 13th inst. accepted the following tenders :—

Sunderland Forge and Engineering Co.—Re-insulating commutator of one 350-kw. rotary converter.
Ralph Nesbit & Co., Newcastle.—Treating with preservative compound four cooling towers at Hylton Road electricity works.
Isler & Co.—Spare parts for air-compressor machine at Hylton Road electricity works.
British Insulated and Helsby Cables, Ltd.—Cables for Roker Baths Road extension and stock.

Warrington.—The Education Committee has accepted the tender of Mr. H. Bibby, at £344, for electrical installation at the new Evelyn Street Council school.

Waterloo.—The U.D.C. has accepted the tender of Messrs. Harold Leake & Co., of St. Annes-on-Sea, at £421, for the electric light installation at the secondary school.

FORTHCOMING EVENTS.

Electrical Exhibition—Olympia.—Friday, September 22nd. At the Trocadero. At 7.30 p.m. Inaugural banquet.
Saturday, September 23rd.—At 2 p.m. Opening ceremony at Olympia.

Junior Institution of Engineers.—Tuesday, September 26th, at 6.30 p.m. Visit to the Electrical Exhibition at Olympia, under the guidance of members of the Committee.

NOTES.

Educational Notes.—NORTHERN POLYTECHNIC INSTITUTE.—The Prospectus for the session 1911-12 has been issued; the new engineering session started on September 20th, under Mr. H. Ade Clark, Wh. Sc.

SOUTH-WESTERN POLYTECHNIC INSTITUTE.—The Calendar of this Institute has been issued, and gives full particulars of the day and evening courses offered in Electrical Engineering, of which department Mr. A. J. Makower is the head. Students may prepare for the degree in Engineering of the University of London at this Institute, which also possesses a great variety of electrical plant and apparatus for practical work. The new term begins on Monday, October 2nd (day classes) and September 25th (evening classes), and a wide range of electrotechnology is dealt with in the various courses scheduled.

NORTHAMPTON POLYTECHNIC INSTITUTE.—The book of "Announcements" for the session 1911-12, which has just been issued, gives information regarding the day and evening courses in Engineering (Mechanical and Electrical), Electrochemistry, Technical Optics, &c.; courses are provided in Automobile work, Aeronautics and Radiotelegraphy. The day courses commence on Monday, October 2nd, the evening courses on September 25th. The new electrical generating station, which we described in our issue of October 21st, 1910, is now in operation. In the Technical Chemistry and Horological Departments morning classes have been instituted for apprentices, who spend the afternoons in their employers' workshops; this is a novel experiment, the results of which will be awaited with interest. Dr. R. M. Walmsley is the principal and head of the Electrical Engineering Department, associated with him in the latter function being Mr. F. M. Denton. Special lecturers are Mr. E. K. Scott, Dr. J. Erskine-Murray, Mr. J. H. Stephens and other experts in various lines.

UNIVERSITY COLLEGE, LONDON.—The prospectus of the Faculty of Engineering for 1911-12 has been published, and gives full particulars of the curricula drawn up for the different branches of engineering, including the diploma and degree courses. Special courses can also be arranged for. Prof. J. A. Fleming is Dean of the Faculty, and Prof. J. D. Cormack Vice-Dean. Information is included with regard to the social advantages available at the College, and to the numerous Scholarships open to candidates. Prof. Fleming is the head of the electrical engineering department, with Assistant-Prof. W. C. Clinton, and Mr. E. K. Scott is the lecturer on electrical design.

KING'S COLLEGE, LONDON.—The new session opens next month; courses of study are provided in Civil, Mechanical and Electrical Engineering, the last-named being under the direction of Prof. Ernest Wilson, and facilities are given for preparation for the engineering degrees of the University of London, as well as the Diploma and Certificate of the College. Special advanced lectures and courses have been arranged for, of which some particulars are given in our advertisement pages to-day.

Hackney Electricity Staff Outing.—The first annual outing of the staff and employés of the Hackney Electricity Works took place on Saturday last, the day being spent at Brighton. The party numbered 52. The weather was ideal. Dinner was served at "Mutton's" Hotel, the borough electrical engineer, Mr. L. L. Robinson, being in the chair, supported by the Mayor of Hackney, whose presence showed his keen interest in anything affecting the social well-being of the employés of the Council. The toast of "Our Guest, the Mayor," proposed by the chairman, was received with musical honours. "No speeches" was the order of the day, but in a few words the Mayor remarked that such an occasion must tend to the smooth working of the electricity undertaking. After tea the party returned to London, everybody feeling indebted to Messrs. Chas. Lill and F. Heathman for their efforts in making the outing so successful.

Some Effects of the Strike.—So much has been said and written on strikes during the last month, that we are almost constrained to apologise to our readers for referring to the subject again; but as actual examples of the untoward effect of blind obedience to the call of the paid agitator are not often brought into the light of day, we think it right to refer to a case which is reported in the *Times* of September 18th. Two boys were charged with begging at the City Juvenile Court. The father of one of them had been earning £3 a week as a printer. He was now being paid 18s. a week by the Union for picket duty. "The home," said the London County Council official, who gave evidence, "was in a terrible state of poverty. Five children, boys and girls, slept in one bed, with no covering. Nearly all the furniture had been disposed of." The father, giving evidence, said that belonging to

the Union he was forced to come out against his better judgment. He had no desire to strike. The home of the other lad, which was once comfortable and happy, containing amongst other luxuries a piano, now had nothing in it but the beds. Comment on these facts is needless. To use the words of the Alderman, "the persons most to blame for such suffering were not the weak-minded individuals who threw away their employment, but the leaders who induced them so to act." Truly the plight of the workman is pitiable when beset by his Union. If he remains faithful to his employer he is probably prevented from getting to work by the pickets. If he does what the Union requires, he forfeits his job, receives less than a third of his usual pay, and has no fixity of tenure in the contemptible occupation of a picket.

Electrical Fatality.—An inquest was held on the 15th inst. at Benton Square, near Newcastle-on-Tyne, on the body of Hugh McKechnie, aged 38, who lived at Byker, Newcastle: he was killed while working at an electric cable line near Scaffold Hill, Benton Square, on Wednesday. It was stated that the deceased was employed by the British Insulated and Helsby Cable Co., and was working at the top of a pole which carried a line of cable, when apparently his foot came into contact with a live cable and he fell to the ground, a distance of more than 40 ft. Dr. Saunders, of Backworth, expressed the opinion that McKechnie had been killed by electric shock, and was dead when he fell. The jury found that deceased had been accidentally killed whilst following his employment.

Institution and Lecture Notes.—The Polytechnic, Regent Street, W.—A special course of 12 lectures on "Illuminating Engineering" is to be delivered under the supervision of Mr. Leon Gaster. Six are arranged for Tuesday evenings between October 31st and Christmas, and the others for Thursday evenings after Christmas, as follows:—

October 31st and November 7th (Tuesdays).—"Electric Lighting," by Prof. J. T. Morris, M.I.E.E.
November 14th and 21st.—"Gas Lighting," by Mr. J. G. Clark.
November 28th.—"Oil, Petrol-air Gas, Acetylene, &c.," by Mr. E. Scott Snell.
December 5th.—"Illumination and the Eye," by Dr. W. J. Ettles, F.R.C.S.E.
January 11th, 18th and 25th, February 1st, 8th and 15th (Thursdays) by Mr. J. S. Dow, B.Sc., A.C.G.S., on the following in the order stated:—"The Measurement of Light"; "Illumination and its Measurement"; "Shades and Reflectors"; "Daylight and Artificial Lighting Compared"; "Colour of Artificial Illuminants"; "Practical Lighting Problems."

The fee for the full course is 12s. 6d., or 2s. for a single lecture. All of the lectures will commence at 7.30 p.m.

South African Institute of Electrical Engineers.—At a meeting held on August 17th, at the S.A. School of Mines, Johannesburg, Mr. J. H. Rider presided, and extended a welcome to Prof. Buchanan, the newly-appointed Professor of Electrotechnics at the School of Mines. Mr. G. V. Adendorff read a paper on "Atmospheric Phenomena and their Relation to the Production of Over-voltages in Electric Transmission Lines." Dealing with the overhead grounded wire, Mr. Adendorff said it was found that good protection was in most cases secured by placing a grounded wire above each phase of the line, provided the wires were of good conductivity and were grounded at as many places as possible. To make the protection as complete as possible the wire should be grounded at every pole, and no expense should be spared in order to obtain a thorough and satisfactory ground. If the system of installing a grounded wire on either side of the line were adopted, the extra expense would be justified by the better protective results obtained. The whole question of atmospheric phenomena in that country was of such vast importance to the electrical engineer that a complete study of the whole subject should receive his careful consideration.

The Society of Engineers.—On Monday, October 2nd, at the Institution of Electrical Engineers, Victoria Embankment, W.C., a paper will be read on "The Necessity for Safer, Quicker and Cheaper Railways, with Some Proposals Therefor," by C. Reginald Enock, F.R.G.S.

Junior Institution of Engineers.—Commendatoré G. Marconi, D.Sc., LL.D., has been elected President of the Junior Institution of Engineers, in succession to Sir J. J. Thomson, F.R.S.

Institution of Municipal Engineers.—The third annual general meeting will be held at Windsor on Saturday, October 21st.

Pickup v. Barton.—At the Blackburn County Court on Monday, John Pickup, of Burnley, claimed from Thos. Barton, electrician, Blackburn, the return of two sets of Weston 3-ton chain pulley blocks, one set of Weston 2-ton pulley blocks, three steel joists, six hangers, two travelling carriages for blocks, or £10, their value, and £2 damages for wrongful detention. Defendant, it was explained, had a sale of machinery and plant effects, and the plant in question was re-sold to plaintiff. In the ordinary course, the plant should have been removed within a week, but an arrangement was arrived at whereby the plaintiff left it for a fortnight or a month, in order that it might be used for lifting purposes. Many efforts had been made to secure the plant, but without success. Defendant said he had never actually refused to hand over the plant. He wanted rent for storage. His Honour said it was not disputed that the goods belonged to plaintiff, and the question was merely one of costs on plaintiff's claim. A verdict was given for plaintiff for the return of the goods in seven days, or their value, £5 17s. 6d., together with £1 1s. damages and costs.

Electrical Trades Union.—On Saturday last the Western branch held a dinner and concert at its place of meeting, the Bush Hotel, Shepherd's Bush Green, W., in order to promote good fellowship in the trade and to celebrate the great progress of the union and the branch in particular during the past 12 months. After dinner the evening was devoted to music and song. Between the two halves of the programme, speeches were delivered by Mr. T. Philpot, London district secretary, and Mr. J. Kinniburgh, organiser, emphasising the necessity of combination of London's electrical workers, and asking all present not to rest till London possessed the strongest organisation in the world. Mr. W. J. Webb, secretary of the Western branch, was the recipient of many good wishes, but stated that what he had done was little compared with what he might do if electrical workers would communicate with him at 98, Coomer Road, Fulham. Two members had travelled from Bristol and Taunton respectively in order to be present. That was the spirit that would make London the centre of the electrical world.

American Practice.—As a comment on our "Hints to Manufacturers" in our issue of August 18th, we have received from the Crouse-Hinds Co., of Syracuse, New York, a catalogue bearing the unfamiliar title of "Panels and Cabinets." In this country we speak more of "switchboards" and "fuseboards," although for many years *board* has not formed the material on which the apparatus has been mounted. The manner in which cramped back-space is avoided in the examples illustrated is by the exclusive use of front connections—a method now largely used here also. The panels vary considerably from recognised British practice. In the first place, a single slab of slate carries both poles, and not only so, but the D.P. connections for each circuit are brought side by side, instead of being separated by the width of the board. Further the bus-bars are vertical and the circuit fuse horizontal in all cases the former being raised off the panel with bars to each circuit passing under them, an arrangement requiring considerable quantities of copper strip. Evidence of lower voltages of supply would appear from the prominence of the 125-volt boards and the absence of anything over 250 volts, even for three-wire work. Sweating sockets apparently are only provided for the mains. The list is a weighty one of 80 large pages printed in colour on glazed paper, but the illustrations of sundry fittings might be improved by showing one of the knife-switches in the "off" position, and by illustrating the interior of the "snap" switch instead of only its cover.

Electric Time Service.—A correspondent inquires whether, preparatory to undertaking the supply and control of a number of electric clocks from a central point on the basis of yearly rentals, it is necessary to obtain a licence from the Postmaster-General. It appears that the transmission of electrical clock impulses over wires has been held not to constitute an infringement of the Postmaster-General's telegraphic monopoly a licence is therefore not required. If, however, the distribution is likely to be over a wide area—especially in London—it would be advisable for the distributor to notify the Post Office of his intention, in order to avoid future trouble. In some cases the Postmaster-General would no doubt be willing to lease wires on annual mileage terms for such purposes.

Exhibition Functions.—Among the events to be held in connection with the Olympia Electrical Exhibition are the following:—

Electrical Contractors' Association, meeting on October 2nd at Olympia.
British Electrical and Allied Manufacturers' Association, dinner at the Hotel Cecil, on October 12th.
Institution of Electrical Engineers, meeting at Olympia, probably on one of the Thursdays during the run of the Exhibition.

New Bridge Opened at Paisley.—The new bridge over the river Cart, at Carlile Quay, was formally opened on Friday last by Provost Muir Mackean. The bridge, which has a span of 93 ft., and is 10 ft. wide, is erected on the Scherzer rolling lift principle, and is raised entirely from one side by electric power. It is stated that this is the largest single-span lift bridge in Britain, and the only one of its kind in Scotland. Sir William Arrol & Co. were the contractors, and the cost was £2,240.

International Congress of Applied Chemistry.—In September next year the eighth International Congress will be held at Washington and New York, U.S.A.; the final rules to be observed by contributors of papers will be issued in December next. Particulars can be obtained from the Secretary of the Congress at 25, Broad Street, New York, U.S.A.

Explosion.—An electrician named Munro, employed by the Clyde Valley Electric Supply Co., was injured by a gas explosion at Uddingston, near Glasgow. Several electricians, it seems, were examining manholes, and the gas in one of them came in contact with an acetylene lamp two yards away. The flames rose to a height of 16 ft., and a number of bystanders had narrow escapes.

Fatalities.—Mr. Philip Arthur Edmundson, aged 28, electrical engineer in the service of the Cornwall Electrical Power Co., was drowned while bathing at Lelant in a heavy sea. At an inquest on Monday the jury returned a verdict of "Accidental Death." The deceased had been in the employ of the company about a year.

The Contractors' Association and Marylebone.—The *Standard* states that the Central Board of the Electrical Contractors' Association has instructed the Law and Parliamentary Committee to proceed with an action against the Marylebone Borough Council on the question of competitive trading. It is added that the case will be proceeded with when a somewhat similar case at Dulwich has been concluded.

B.A. Report on Electrical Standards.—Mr. A. P. Trotter informs us that his name has been attached to the report of the British Association Committee on Practical Standards for Electrical Measurements, without his authority, and doubtless as the result of a mistake. But it compels him to state that he withdrew from the Committee in July, 1910, because he strongly disagreed with some of their resolutions, and with the mode in which their business was carried on.

The list of names of members of the Committee was, of course, printed as it came to us from the Association.

Our Royalty and Electricity.—The *Times* says that King George's new six-cylinder Standard landaulette for the Indian Durbar will be equipped with a generating plant for electric lighting.

The American *Electrical Review* says that the General Electric Co. (U.S.A.) has just finished an electric fan for Queen Mary. "It will be used to dry her hair after a shampoo. The fan is mounted in gold and has an ebony switch. It was specially designed to be in keeping with the Royal toilet articles."

A Curious Breakdown.—The designers and erectors of electric power plant machinery sometimes come across unexpected difficulties which entirely upset their calculations and for a time are quite baffling. This is the reason for that cryptic item which is often (and should always be) found in even the most finely cut estimate, labelled "contingencies." Even in the most standardised schemes it is nearly always the case that something will go wrong and will have to be put right by the contractors before the plant is taken over by the purchaser. An interesting case which illustrates this point may be narrated. A small alternating-current power house had been erected, the alternators being direct coupled to horizontal medium speed steam engines; the coupling was at one end of the crankshaft, and a small fly-wheel at the other. It was expected that the fly-wheel plus the weight of the rotating part of the alternator (the field) would be sufficient to reduce the cyclic variation of the sets sufficiently to give smooth parallel running. The arrangement adopted had been used before, and the makers both of the engines and the alternators were good firms. Curiously enough, however, after the station had been put into parallel running, there was not a great lapse of time before one of the crankshafts broke right across, and the indications of the fracture were those of severe torsional stresses. A new shaft was put in, but failed some little time afterwards, and a third shaft broke in exactly the same way. The matter was then very carefully looked into, and it was found that the engine builder, who had originally standardised his engines with wrought-iron crankshafts, had afterwards followed modern practice by using mild steel. This was, of course, quite in order, but the point had been overlooked that mild steel is far more subject to "fatigue" than wrought-iron. The continual torsional effects produced by the parallel running of the alternators and the consequent variations of effort in the crankshaft between the fly-wheel end and the coupling end had produced a certain amount of crystallisation in the material, finally resulting in a fracture. The point is very apt to be overlooked that wrought-iron, although very largely superseded by mild steel, still has its uses. We have often pointed out that the fly-wheel should invariably be placed between the engine and the generator, and the object lesson conveyed by this example may serve as a warning to those engine builders who persist in following the practice which we have condemned.

Appointments Vacant.—Lecturer in electrical costs and quantities, one evening per week, for the Battersea Polytechnic. Switchboard attendant, for the Erith Council Electricity Department (10s. to 15s.). See our advertisement pages in this issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Walsall Electricity Committee has placed on record its satisfaction at the ability and energy displayed by Mr. Ashton Bremner during the period of six months in which he has been acting electrical engineer of the electricity undertaking of the Corporation, and the manner in which he has discharged, under trying circumstances, the numerous duties devolving upon him during the absence (owing to illness) of the borough electrical engineer.

The Dewsbury T.C. has appointed Mr. F. H. Souden, of Castleford, as mains assistant.

Mr. R. J. Rosser, assistant city electrical engineer of Cape Town, was to leave Cape Town for England on September 4th (by ss. *Buluwayo*) for a six months' holiday. After visiting the Electrical Exhibition at Olympia he will proceed to the Continent and to America to have a look round.

Mr. H. R. Harper, city electrical engineer of Melbourne, Australia, left this country for New York and Melbourne on Saturday last

Tramway Officials.—Mr. Harry Pilling, superintendent of the mechanical and electrical department of the Accrington Corporation, has been appointed manager of the electrical tramways, at a salary of £200 per year. The retiring manager is Mr. James Wilson. Mr. Wilson had expressed a wish to retire, and in consideration of his services during the transfer of the undertaking from the old company, he was granted one year's salary in lieu of notice and payment of £50 a year for the next four years as a consultative fee for his advice. It was stated that other changes would be carried out under the advice of the new manager, and it is expected that the rearrangements will effect an economy of about £500 a year.

General.—Mr. Philip Kemp, M.Sc.Tech., has been appointed lecturer in electrical engineering at the East London College (University of London), in succession to Mr. L. Murphy, who has resigned to take up the position of managing engineer to the Perry Barr Fan Works, Birmingham. Mr. Kemp, after a distinguished career at the Manchester Municipal School of Technology, spent two years at Messrs. Mather & Platt's works in the testing department, designing room and drawing office. Since then he has had two years of teaching experience in electrical design and laboratory classes, under Prof. Schwartz. He was awarded in 1910 the "Joule" Medal for a paper on "Some Thermo-Dynamic Properties of Rubber," and is a joint author of a paper printed in the *Journal* of the I.E.E. on "The High-Tension Spark Discharge in Air."

The staff of Messrs. Siemens Bros., Stafford, have presented a silver afternoon tea service to Dr. Kloss, who is leaving to take up a University Professorship in Germany.

Mr. J. H. Butters, B.Sc., A.M.I.E.E., has been appointed to the position of chief engineer to the new Hydro-Electric Power and Metallurgical Co., Ltd., of Tasmania, and manager of their hydro-electric supply. Mr. Butters served as apprentice with Messrs. Thorneycroft & Co., Ltd., leaving them to join Messrs. Siemens Bros. Dynamo Works, where he held the position of designing engineer, and was in charge of the estimating design department at their Stafford Works, being later transferred to the head office as central station and power engineer. Two years ago he was appointed to the position of engineer to the firm's Australasian branch, which position he has now resigned to take up his new appointment. Mr. J. H. Gillies, the managing director of the new company, is now in London. Mr. Butters is proceeding immediately to Tasmania to lay out the work and to prepare specifications for the large machinery which will be necessary to carry on the new company's work.

Mr. T. A. Edison is in Europe at present, and while motoring near Nuremberg on Sunday evening he had the misfortune to run over and kill a 12-year old boy.

Mr. James Strachan has resigned the position of works manager, which he has held for the last three years with Messrs. Tetley & Co., Salford, and is now manager of the works of the Salford Electrical Instruments, Ltd., North George Street, Salford.

Mr. H. R. Abbott, of the Electric Maintenance Department at the Neasden Works of the Metropolitan Railway, is leaving the company to take up an appointment as workshop and car-shed superintendent with the Ceylon Tramway and Lighting Co.

Obituary.—The death has occurred at his residence at Wadhurst, Sussex, of Mr. Rayner, a director of Maple & Co., Ltd., electrical contractors, &c., of Tottenham Court Road, London. Deceased was a native of Ashford, Kent, and had been with the firm almost all his life.

According to the *Evening Standard* Herr Adolf Schwieger, a director of the Siemens-Schuckert and Siemens & Halske Works, and a pioneer of electric railways, has died at Wiesbaden, aged 66.

The electrical trade friends in the West of England and South Wales of Mr. Harry Nance, of Cardiff, will learn with regret of the death of his wife at the early age of 24 years.

CITY NOTES.

National Electric Construction Co., Ltd.

The annual meeting of this company was held at the offices, 3, Laurence Pountney Hill, E.C., on Wednesday, September 13th, Mr. L. B. Schlesinger presiding.

The report submitted for adoption was as follows :—

"The gross profit for the year to December 31st, 1910, is £11,456, and deducting therefrom expenses of administration, debenture

interest, &c., there remains a balance of £1.028, plus £6,322 brought forward, making a total of £7,350. This amount is to be dealt with as follows: Transfer to debenture redemption fund £1,550, depreciation on free wired installations £361, rolling stock, &c., Dewsbury and Ossett Tramways, £208, furniture, fixtures, plant and tools £75; carry forward £5,156.

"Attempts to finance new electrical undertakings in this country meet with little response, and tramway construction work, excepting extensions, has practically come to an end. The negotiations for an important contract abroad, to which reference was made in the last report, are approaching completion, and it is expected that an agreement will be concluded in the near future. Other foreign contracts of considerable magnitude are in course of negotiation. Since the close of the year the overdraft at bank has been reduced from £38,386 to £5,480, and special loans from £22,500 to £10,000. The undertakings in which the company is interested continue to show progress."

Rhondda Tramways Syndicate.—The profit earned for the year was satisfactory, a divident of 6 per cent. on the capital of the syndicate being paid after placing a substantial amount to reserve. Since the close of the year the syndicate has sold its holding of £200,000 5 per cent. debentures in the Rhondda Tramways Co., Ltd., on satisfactory terms. The syndicate is now in liquidation, and a cash distrihution of 55 per cent. has already been made to its shareholders.

The Rhondda Tramways Co., Ltd., is ahout to carry out extensions, and arrangements for the finance are in course of completion. The contract, amounting to ahout £34,000, will be placed with your company.

Mexborough and Swinton Tramways.—The profit earned hy this undertaking for 1910 showed a suhstantial increase over the profit for the previous year, and it is satisfactory to note that the receipts for the current year show a marked increase over those for the corresponding period of last year.

Musselburgh and District Electric Light and Traction Co., Ltd.—The Port Seton extension was in operation for a complete year. A substantial increase in the profits was obtained, allowing a dividend of 6 per cent. on the preference share capital to be paid.

Torquay Tramways.—The overhead system has heen installed, and has been working since March 17th, 1911. The change from the surface-contact system has resulted in a large saving in hoth current and maintenance. The extension to Paignton was opened on July 17th, 1911, and the receipts from that date on the whole system have heen in accordance with the estimates.

Oxford Electric Tramways.—Owing to the financial conditions prevailing, it has been impossihle to carry out the electrification of this system, but the horse tramways are working at a profit which allows of a dividend on the syndicate's capital.

Dewshury and Ossett Tramways.—After providing for sinking fund and interest payments to the local authorities, who provided the capital, this system shows a profit of £261 for 1910, which compares with a loss of £829 14s. on the previous year's working. There is a suhstantial increase hoth in receipts and profits from January 1st to date.

Town Lighting Installations.—These undertakings continue to make progress.

At Bo'ness an important contract has been settled for the supply of electric power, which has heen taken from June, 1911. The 8-c.p. lamps connected at Bo'ness now numher 21,894, as compared with 21,810 last year; and at Carnarvon 15,459, as compared with 13,651.

The Chairman, in moving the adoption of the above report, said an explanation was due for holding the meeting so late. It was intended to hold the meeting in June, but about the same time the negotiations for an important contract appeared to be nearing completion, and the directors thought it advisable to postpone the meeting for a few weeks in the hope that they would be able to report at the meeting that the contract had been concluded. The contract was for the construction of an electric railway on the Continent, the capital for which was being guaranteed by some 30 authorities. They disposed of all their competitors a long time ago and knew that, if the scheme went through, the contract would go to the company. The delay had been entirely due to the difficulty these authorities had had in settling among themselves their various interests, but he was happy to inform the shareholders that they were now all in agreement and had signed the petition to the Government to authorise a Joint Board or some such authority to be formed. According to a cable they had received recently, the Government had advised a deputation that the powers would be granted without delay. Their engineer had already met the consulting engineer and the Committee and agreed upon the prices for the construction work, but he would hardly like to make any definite statement as to the date when the business would be concluded. The contract was not so large as contemplated, the scheme having been cut down. It would be for about £50,000, but it was probable, before it was finished, extensions would be taken in hand, so that the final scheme might reach the figure they first discussed. In addition to this contract, they were interested in several tramway propositions abroad. In one case, a group had paid a substantial deposit, and they had an arrangement with this group that, if the finance was arranged, the contract would be carried out by the company. The contract would run into £450,000. Their engineer had been abroad investigating tramway propositions at the expense of the group, the condition being that if any schemes were taken up they were to have the contracts. They had just completed an extension of the Torquay tramway to Paignton. This was opened in July last. The chairman then proceeded to quote from the report as to the progress made by the Rhondda Tramways Syndicate, Mexborough and Swinton Tramways, Musselburgh and District Electric Light and Traction Co., Ltd., Torquay Tramways, Oxford Electric Tramway and Dewsbury and Ossett Tramways, in all of which the company is interested. Coming to the profit and loss account, he said the expenditure was £5,991, as compared with £5,814 for last year; the debenture interest was the same as last year. The directors' fees amounted to £300, the balance being waived. Auditors £76, as against £105 last year. Expenditure on contracts which had fallen through amounted to £130, as compared with £86 last year. The gross profit for the year was £11,456, and deducting therefrom expenses of administration, debenture interest, &c., there remained a balance of £1,028. To this had to be added £6,322, the balance carried forward at December 31st, 1909, making a total of £7,350. The directors recommended that this amount be dealt with as follows:—Transfer to the debenture redemption fund, £1,550; depreciation on free wired installations, £361; rolling stock, &c.; Dewsbury and Ossett Tramways, £208; furniture fixtures, plant and tools, £75; and to carry forward £5,156. As a result of the disposal of Musselburgh securities and the return of a substantial part of their capital in the Rhondda Syndicate, the revenue from this source would be down this year. On the other hand, with the Torquay tramway undertaking now in working order, they should get some return on that. The expenditure on tramways and lighting concessions stood at £54,573, compared with £51,549, the increase being due to the Parliamentary expense incurred in connection with the Folkestone and Oxford Tramways. The directors were satisfied that their organisation for construction work was thoroughly efficient in every way. In conclusion, he said that they had a tramway proposition in this country which did not require a great deal of capital, and which they would shortly ask their shareholders to support financially. He was satisfied that it was an undertaking which would do well, and it meant a contract for the company. He referred to the Aldershot Light Railway, the total capital required being about £84,000. They were now forming a syndicate with a capital of £84,000.

Mr. Carr Saunders seconded the motion, and the report was adopted.

Dick, Kerr & Co., Ltd.—The report of the directors for the 12 months ended June 30th last, states, according to the *Financial News*, that the profits earned amount to £37,994. Out of this have had to be paid debenture interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £12,060, leaving a balance of £25,933, to which must be added the profits brought forward from last year, viz. £42,258, making a total of £68,191 available for appropriation as follows: To pay a dividend of 6 per cent. per annum on the preference share capital (the proportion of this dividend to December 31st, 1910, has already been paid), absorbing £18,300; to pay a dividend of 5 per cent. on the ordinary share capital of £260,000 (to be paid less income-tax). £13,000; and to carry forward the balance of £36,891. Notwithstanding the continued competition in all branches of the business during the past year, the directors state that they are pleased to submit accounts which show considerable improvement in comparison with the two preceding years.

Continental.—France.—La Société de Constructions Electriques, of Nancy, is declaring a dividend of 5 per cent. for the last financial year, the same as for the preceding 12 months. It is proposed to increase the capital of the concern from £40,000 to £80,000.

Shawinigan Water and Power Co. — A quarterly dividend of 1¼ per cent. is announced.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Hastings and District Electric Tramways Co., Ltd.—268,235 ordinary shares of 10s. each fully paid, Nos. 130,001 to 398,235; and 80,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 80,000, partly in lieu of the preference shares of £5 each now quoted.

Melbourne Electric Supply Co., Ltd.—20,000 7 per cent. first cumulative preference shares of £5 each fully paid, Nos. 30,001 to 50,000.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £400.000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B23,501 to B27,500.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 8 per cent. per annum for the six months ended June 30th last, payable October 16th next.

Gateshead and District Tramways Co.—The directors have resolved to pay the usual half-yearly interim dividends on the 5 per cent. and 6 per cent. preference shares on September 30th, and on the same date to pay an interim dividend on the ordinary shares for the half-year ended June 30th, 1911, at the rate of 5 per cent. per annum.

Metropolitan Electric Tramways, Ltd.—The directors have declared an interim dividend on account of the year 1911 at the rate of 6d. per share (less income-tax) on the ordinary share capital, payable on October 16th.

Yorkshire Electric Power Co.—The report of the directors (as summarised in the *Times*) states that the gross profit for the half-year ended June 30th, was £6,633, as against £4,950. The net profit, after deduction of mortgage interest, amounted to £4,137, as against £2,622. There has been a general increase in the sale of energy to all classes of consumers. The balance available at June 30th last was £13,613, and the directors recommend a dividend, less tax, for the half-year, of 6 per cent. per annum on the amount paid up on the cumulative preference shares, carrying forward £12,477. Applications for 6 per cent. cumulative preference shares continue to be received, and at the date of the report, July 18th, over £83,000 has been applied for out of the £100,000 authorised.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended July 28th, 1911, were 912,348, compared with 794,120 in the corresponding four weeks of 1910. The units delivered during the four weeks ended August 25th, 1911, were 968.863, compared with 824,917 units in the corresponding four weeks of 1910.

Bank Rate.—The Bank Rate was yesterday raised from 3 to 4 per cent.

Anglo-American Telegraph Co., Ltd.

In calling an extraordinary general meeting for September 29th, the directors state that the conditional agreement between this company and the Western Union Telegraph Co. for the purchase by this company of the Western Union Co.'s new trans-Atlantic cable and its equipment at a cost of about £700,000, and for the lease of the whole of this company's cables, properties and business to the Western Union Co., has been exchanged.

"If the stockholders of both companies confirm the agreement by the prescribed majorities, and the Court sanctions the necessary extension of the Anglo Co.'s memorandum of association, the result will be that, by means and subject to the conditions of the lease, the Anglo Co. will for 99 years be guaranteed a rent equal to dividend at the following rates on its total capital of £7,000,000:—On the preferred stock, 6 per cent. per annum; on the ordinary stock, 3¾ per cent. per annum; on the deferred, 1½ per cent. per annum. The agreement for lease has been reached after much negotiation and consideration of the legal difficulties and under the advice of eminent English and American counsel. In view of the more stringent enforcement recently in America of the Sherman Anti-Trust Act, the Western Union Co. became concerned as to its position under the pooling and working agreements of 1882, and at length notified the Anglo Co. that on and after March 1st, 1911, it would not accept the penal and personal consequences of the Anti-Trust Act, and must treat these agreements as illegal and withdraw from the pool. The company's American counsel has advised that, whilst it is impossible in the present state of the decisions to pronounce with certainty upon the validity of the agreement now entered into, he is of opinion that the proposed lease is good under the American common law, and would not be held to be in violation of the Anti-Trust Law. The reports of the Western Union Co. show that its profits, after paying its own working expenses and fixed charges, amount, on an average over the last 10 years, to upwards of £1,000,000 per annum. After the lease is executed, fewer directors will be needed. Several members of the present board will then retire, and the stockholders will be asked to vote £4,000 by way of compensation to those who do so, to be divided between them as they think fit. At least three will remain to look after the shareholders' interests under the lease. Cables cost less now and rates are lower than when your predecessors became the pioneers of Atlantic telegraphy. Moreover, a considerable part of the Anglo Co.'s large capitalisation of £7,000,000 must be regarded as 'dead,' since it represents money sunk in early attempts to bridge the Atlantic. Notwithstanding, the rent under the proposed lease is 3¾ per cent. per annum upon the whole capitalisation. Your directors recommend you to approve the agreement, and to cover by means of a lease at a fixed rental the various risks inseparable from cable property."

The resolutions to come before the meeting are:—

1. That the conditional agreement dated August 22nd, 1911, and made between this company of the one part and the Western Union Telegraph Co. of the other part, which has been laid before this meeting, be and the same is hereby sanctioned and approved, and that the directors be and they are hereby authorised to carry such agreement into effect in due course subject to such modification (if any) as they may from time to time approve.

2. That the provisions of the memorandum of association of the company with respect to the objects of the company be altered by the addition at the end of Clause 3 of the said memorandum of the following words, that is to say:—

"And in addition to the above, to enter into and carry into effect, enforce, modify or determine agreements for the purchase of trans-Atlantic telegraph cables and every other kind of property, whether real or personal, and leases of and agreements for leasing at such rent and upon such terms and conditions as may be deemed expedient the whole or any part of the property, goodwill and assets of the company, and in particular

"(*a*) To enter into and carry into effect (with or without modification) an agreement dated August 22nd, 1911, between this company and the Western Union Telegraph Co. for the purchase by this company of one of the trans-Atlantic telegraph cables of the Western Union Telegraph Co. and its equipment, and for the grant by this company to the Western Union Telegraph Co. of a lease (at the rent and on the terms and conditions in such agreement appearing) of the whole of the property, goodwill and assets of this company in so far as the same are capable of being leased (except as in such agreement mentioned) and relating to the other matters in the said agreement mentioned.

"(*b*) To effect the purchases, make the payments, grant (with or without modification) the lease and execute and do all acts and things whatsoever which by the said agreement (with such modifications thereof, if any, as may hereafter be agreed upon) are, or ought, to be effected, made, granted, executed and done by this company.

"(*c*) To enforce and determine the said agreement, and the lease to be granted in pursuance thereof, or either of them, with such modifications (if any) thereof respectively, as may, for the time being, subsist; and

"(*d*) generally to do all acts and things whatsoever which may be considered necessary, conducive or incidental to carrying into effect, with such modifications (if any) thereof respectively as may hereafter be agreed upon, the aforesaid agreement and lease, or either of them, or to enforcing or determining such agreement and lease, or either of them, with such modifications (if any) thereof respectively as may for the time being subsist."

3. That upon the said conditional agreement, dated August 22nd, 1911, becoming operative (with or without modification), and any present directors of the company retiring within three calendar months after the same becomes operative, there be paid out of the funds of the company to the said directors who so retire the sum of £4,000, such sum to be divided amongst such retiring directors in such proportions as they may agree.

Direct United States Cable Co., Ltd.

The directors' report for the half-year ended June 30th, states that the revenue, after deducting out-payments, amounted to £46,230, as compared with £58,556 for the corresponding period of 1910, a decrease of £12,326. This falling off in receipts is due to the Western Union Telegraph Co. having departed from the arrangement that has been in force since 1882, by withholding traffic collected by that company in America which has hitherto been transmitted over the cables of the Anglo-American Telegraph Co., Ltd., and of this company. The working and other expenses during the six months, including income-tax, amounted to £27,749, as compared with £25,277 in the corresponding six months in 1910, an increase of £2,472, which is accounted for by expenses at the Harbour Grace Station, established in the latter part of last year, and which appear now for the first time in the accounts. The reserve fund account, after being debited with the cost of maintenance of cables, balance of expenditure on fire extinguishing plant at Ballinskelligs Station, expenditure in connection with the diversion of the cable to Newfoundland, and the transfer to revenue account of a sum of £7,168 (to provide for the dividend and bonus paid on July 31st, 1911), and being credited with interest on the investments and profit on sale of securities, stands in the accounts at a sum of £512,323, as compared with £533,024 at June 30th, 1910, showing a decrease of £20,701. If, however, the expenditure of a capital nature upon the company's properties, and in connection with the diversion of the cable, amounting to £31,204, which has been charged to the reserve fund account during the year, be taken into consideration, it will be seen that a sum of £10,503 has been added to the reserve fund account during the year, after charging against it the cost of maintaining and renewing the cables. As the result of negotiations extending over many months, an agreement, of which particulars accompany this report, has been provisionally entered into by the directors with the Western Union Telegraph Co. This agreement is to be submitted to the shareholders at an extraordinary general meeting to be held at the conclusion of the sixty-eighth ordinary general meeting on Friday, September 29th. The negotiations were in progress in July, when the final accounts have hitherto been issued, but in the circumstances the directors considered that it was not in the interests of the shareholders then to issue them. They, therefore, deferred the publication of the accounts, paying a dividend and bonus for the quarter to June 30th last at the same rate as for the corresponding quarter in 1910. Thus, a dividend of 4 per cent., with a bonus of 1 per cent., making 5 per cent. in all, was paid to the shareholders during the past financial year.

In a circular which accompanies the above report, the directors state shortly the effect of the more salient provisions of the agreement, a copy of which will be produced at the office of the company to any shareholder who desires to see it. The agreement provides that this company shall lease to the Western Union Co. for a term of 99 years, dating as from April 1st last, its cables, telegraph lines, offices, landing places, plant, stores, &c., at an annual rental of £58,568. For the convenience of the Western Union Co., the term of the lease commences as from April 1st last. The rent from that date up to June 30th last has been agreed in account at the sum of £10,803, this sum being regarded as compensation to this company for the loss occasioned to it by the withholding of traffic by the Western Union Co., to which this company was entitled under the agreement of 1882 As from June 30th last the full rent of £58,568 becomes payable In addition to the above rental the Western Union Co. agrees to provide the cost of the administration of this company's business. including rent of offices, &c., and also to pay all rates, taxes, charges, assessments and outgoings payable in respect of the leased properties. Further, the Western Union Co. agrees to make a contribution to the remuneration of the directors, and to maintain the value of this company's pension fund, so that it may be adequate to meet all subsisting and future liabilities. On the other hand, this company will retain its reserve fund, which now amounts to £512,323, and will remain responsible for the repair and renewal of the leased properties as hitherto, all other liabilities of this company being taken over by the Western Union Co. The agreement contains a provision that this company shall not be at liberty to pay a dividend of over 5 per cent. per annum without the consent of the Western Union Co. The agreement further provides that the proposed lease shall be construed and take effect as a lease made in England and in accordance with the laws of England. It will be appreciated, however, that the lessee, being an American corporation, will be subject to the laws of the United States of America, and if any question were raised as to the validity of the lease under the Sherman (Anti-Trust) Law it would have to be decided by the American Courts. The possibility of an unfavourable decision has been provided for by the insertion in the lease of a clause to the effect that if for any reason the lease should fail or cease to be binding upon the Western Union Co. that company shall nevertheless be bound at all times to give this company the same or as good connections, through service and facilities, as those which this company enjoyed in the year 1910 over the Western Union Co.'s landlines in the United States of America.

STOCKS AND SHARES.

Tuesday Evening.

Under the influence of the rather more exhilarating Continental news in regard to Morocco, the Stock Exchange markets have cheered up in some small measure. True it is that the probability of a rise in the Bank Rate has forced Consols down to another record low level for the 2½ per cent. stock; but, apart from the orthodox gilt-edged departments, investment securities are firmer, and there is certainly a little more disposition on the part of the investor and speculator to pay greater heed to the Stock Exchange.

At the same time, prices on balance are none too good, particularly in the Home Railway market; there the liquidation has been especially severe. People bought far more stock than they could carry conveniently, either in the market or with their bankers, and it has been forced out in blocks at a time. The progress of the Railway Commission has afforded the market no assistance. From the evidence which has been given on both sides, it is considered that the companies will have to pay substantially more to their

employés in the near future. Nor have the echoes of the great strike entirely died away; they are still audible in Ireland, and in the present state of nervousness the fear exists that the epidemic may break out afresh.

Metropolitan Consolidated shows a further big loss of 1¾ on the week, and Districts are also ¾ down. In both cases the prices stand at nearly the lowest of the year, and although Metropolitans come into spasmodic favour, buyers at present seem unable to afford any stability to their market. An unpleasant feature is the way in which the company's prior-charge stocks are falling. East London receded to 4¼. Central Londons of all three classes have kept steady, for which it is suggested that the project to "ozonise" the air in the Tube at all the other stations in addition to the Bank, is to a great extent responsible. Incidentally, it may be observed that some travellers who were not aware of the new system have failed to notice much difference in the atmosphere at the Bank station. City and South Londons are steady at 29½. The suggestion of nationalisation of railways, which has been called into practical being by the strike events of last month, is not regarded as a bull point by the market; but although the proposition has certainly come nearer to the range of practical politics, its carrying-out is probably so many years away that it can scarcely be said to deserve painstaking consideration yet.

Sharp falls occurred in Rio Trams and Mexico Tramways in connection with financial trouble that developed in Brussels somewhat acutely at the end of last week. The price of Rio Trams was forced down to 112½, from which it has since recovered to 115, leaving the price only slightly down on balance. Mexico trams were lowered at one time to 114, rebounding to 116, which shows a point loss on the week. Sao Paulo Tramway shares also gave way, though they have subsequently improved to 174½, which is *ex* the 2½ per cent. dividend deducted last Thursday. The trouble in Brussels led to the bonds as well as the shares being marked down. Besides the Continental difficulties, there was some apprehension of failures occurring in Glasgow and Edinburgh, in both of which centres the securities are popular for investment. Within the last day or two, however, these troubles are understood to have been arranged, and no open defaults have been reported, with the result that, as stated before, a good part of the fall has been recovered. Manaos Tramway Debenture is a point to the good. London United Tramways Preference have gone back ¼, and Dublins are ½ lower on the railway strike in Ireland.

The principal feature of the week, so far as concerns the stocks and shares with which we deal, is the publication of the agreement between the Anglo-American Telegraph Company and the Western Union Telegraph Company, which is to come before the shareholders of the former undertaking for confirmation on the 29th inst. The agreement provides for the same terms as have been announced before; that is to say, the Western Union guarantees a dividend of 3¾ per cent. on the Anglo-American Ordinary stock, which allows the Preferred 6 per cent. and the Deferred 1½ per cent. dividends. Of course, the knowledge that these terms would in all probability be finally accepted has led to the prices of the Anglo Company's issues discounting the actual event; and the only result of the agreement's publication has been to advance the prices of the Preferred and Deferred to a slight extent, while the Ordinary stock is ½ lower at 68, business having been marked on Monday 67.

Even now the desirable consummation cannot be called absolutely secure. It may be well supposed that the proprietors of the Anglo-American Company will accept the terms; but the doubt arises as to whether, under the Anti-Trust Laws of the United States, the fusion will be regarded as permissible. President Taft is this week on a stump tour, pledged to do all he can in the way of upholding Anti-Trust doctrines, and it would appear to be a dangerous policy for the Anglo-American Telegraph Company to agree to the proposals unless, when carried, they can be regarded as watertight. Direct United States shares, which are also interested in the agreement, are unchanged at 7⅞. Commercial Cable 4 per cent. Debenture stock at 88½ shows no change; it is understood that the company is on the warpath with opposition against the Anglo-American Western Telegraph fusion. Eastern Extension shares have not recovered from their slight drop of last week, and Eastern Telegraph Ordinary at 138½ can be bought to return a trifle over the round 5 per cent. on the money; there is a quarterly dividend pending on both next month. Westerns fell ¼, but West India and Panama are being bought again, and the price is ⅛ harder. Globe Ordinary show ⅛ decline.

Marconi shares, after being strong at 47s. 6d., went back a little to 45s. 9d., and National Telephone issues are easier. The Deferred fell 2, and both classes of senior Preference shares ⅛ each. Reuter's shares are a good market, again showing a rise of ⅛. American Telephone and Telegraph capital stock gained a point, and the 6 per cent. certificates of the Submarine Cables Trust are higher to the same extent. Mackay Companies stocks of both classes are *ex* dividend.

The list of English Electricity Supply and Power shares is devoid of change so far as the London issues are concerned, with the solitary exception of Chelseas, where ⅛ fall is brought about by the dividend deducted last week. Oxfords are an equal amount lower for a similar reason. Miscellaneous shares are also very quiet. Edison & Swan fully-paid fell ⅛, but there has been rather more inquiry for British Westinghouse Preference, although the price shows no quotable change. Castner-Kellner's are again harder. Electric Constructions have come on offer, the price falling to 12s. 6d. middle. India-rubber shares put on 10s., there being very little floating supply of stock. The rubber share market is firm in consequence of the strength of the raw material; in fact, it is one of the few good markets round the Stock Exchange at the present moment.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 13	3,220	+ 252	15	24,900	+ 1,600	..	..
Ayr	,, 16	641	— 393	18	7,545	— 365	8	..
Bath	,, 16	1,988	— 7	37	31,870	+ 1,146	..	..
Birkenhead	,, 17	2,293	+ 78	24	28,432	+ 1,088	13·7	..
Birmingham Corp.	,, 9	17,987	+4,7.9	23	186,508	+30,148	56·4	..
Blackburn	..	..	..	..	..	..	..	..
Blackpool Corp.	,, 14	6,772	+1,862	..	46,421	+ 6,137	..	..
Blackpool-Fleetw'd	,, 18	3,627	+ 388	11	19,847	+ 1,639	..	..
Bolton	,, 17	5,392	+ 213	25	63,825	+ 4,562	26	..
Bournemouth	,, 13	4,774	+ 394	24	47,505	— 1,328	22	..
Bradford	..	..	..	..	..	..	56	1·8
Brighton	,, 17	2,611	+ 236	24	28,798	+ 2,045	9·5	..
Bristol	,, 15	14,215	+1,535	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 8	457	— 18	36	7,837	+ 49	3·65	..
Barnsley	,, 8	370	+ 36	,,	6,642	+ 440	..	..
Barrow	,, 8	803	+ 181	,,	11,077	+ 1,258	5·37	..
Devonport	,, 8	1,155	+ 202	,,	17,967	+ 2,699	8·85	..
Gateshead	,, 8	2,130	+ 107	,,	37,459	+ 2,123	11·25	..
Gravesend	,, 8	485	+ 36	,,	7,746	+ 242	6·5	..
Greenock	,, 8	1,699	+ 259	,,	25,284	+ 3,405	7·25	..
Hartlepool	,, 8	677	+ 64	,,	9,937	+ 848	6·72	..
Kidderminster	,, 8	296	+ 28	,,	4,410	+ 307	..	..
‡Leamington	,, 8	511	+ 154	,,	6,561	+ 483	..	..
Merthyr	,, 8	436	— 11	,,	7,576	+ 123	2·9	..
Metropolitan	,, 8	19,863	+3,403	,,	318,526	+50,185	22	..
Middleton	,, 8	729	+ 81	,,	12,608	+ 1,127	8·5	..
Mid.Joint Com'tee	,, 8	9,681	—2,741	,,	199,910	— 7,177	..	..
Oldham—Ashton	,, 8	1,226	+ 44	,,	20,758	+ 777	9·13	..
Peterborough	,, 8	321	+ 67	,,	4,676	+ 497	5·31	..
Potteries	,, 8	3,911	+ 300	,,	69,163	+ 6,680	29	..
Rothesay	,, 8	754	+ 92	,,	8,790	+ 77	2·75	..
Southport	,, 8	758	+ 68	,,	11,380	+ 512	8·17	..
S. Metropolitan	,, 8	2,029	+ 313	,,	31,909	+ 1,999	..	..
Swansea	,, 8	2,453	+ 105	,,	41,505	+ 2,518	12·5	..
Tynemouth	,, 8	782	+ 100	,,	10,312	+ 455	3·75	..
Weston-s-Mare	,, 8	906	+ 584	,,	6,982	+ 887	3	..
‡Worcester	,, 8	743	+ 83	,,	10,837	+ 551	5·75	..
Wrexham	,, 8	218	+ 15	,,	3,660	+ 175	..	..
Yorks. Wool. Dist.	,, 8	2,235	+ 223	,,	38,111	+ 2,799	17	..
Miscellaneous	,, 8	533	+ 46	,,	8,365	+ 480	..	..
Burnley	,, 16	3,065	+ 224	..	..	..	11·7	1
†Burton-on-Trent	,, 10	292	+ 17	23	7,037	+ 641	10	..
Bury	,, 17	2,611	+ 104	24	32,583	+ 3,210	22·5	..
Cardiff	,, 9	5,121	+ 162	23	59,692	+ 5,303	..	..
Chatham and Dist.	,, 14	2,003	+ 157	37	32,041	+ 467	15	..
Cork	,, 14	1,223	+ 96	37	18,846	+ 601	9·9	..
Croydon	,, 8	3,764	+ 444	22	43,955	+ 3,869	..	..
†Darlington	,, 9	232	+ 20	24	5,368	+ 554	..	..
Darwen	,, 15	599	+ 40	24	6,672	+ 583	4·36	..
Dover	,, 9	693	+ 133	23	6,691	+ 1,036	4·75	..
Dublin	,, 15	12,406	+ 871	..	77,806	+10,410	54	..
Dundee	,, 13	2,579	+ 111	17	21,095	— 286	15	..
East Ham	,, 16	3,008	+ 208	24	26,888	+ 1,455	7·9	..
†Exeter	,, 15	381	+ 29	24	9,003	+ 772	5·5	..
Glasgow	,, 16	40,726	+2,928	..	292,001	+19,340	98	·75
Hastings	,, 14	3,123	+ 363	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	,, 16	5,692	+ 491	24	69,162	+ 3,451	14·5	..
Ilkeston	,, 14	279	+ 11	24	3,278	+ 120	..	..
Ipswich	,, 16	1,076	+ 140	24	11,970	+ 829	10·5	..
Kilmarnock	,, 16	312	— 1	18	3,169	+ 311	4·25	..
Lancashire United	,, 13	3,023	+ 50	37	50,374	+ 1,755	39	..
Leeds	,, 16	15,405	+1,176	24	185,733	+13,311	108	..
Leicester	..	..	..	..	..	..	..	..
†Leith	,, 16	664	+ 55	17⅝	12,691	+ 1,098	8·7	..
Liverpool	,, 9	23,062	+ 553	36	411,473	+11,506	116	2·5
‡L.C.C.	,, 6	86,511	+4,600	..	1,021,978	+64,302	141·6	8·5
London United	,, 16	14,183	+ 697	..	248,532	+10,844	..	..
Lowestoft	..	..	..	..	..	..	8·5	..
Manchester	,, 16	32,728	+1,119	24	397,142	+23,118	188	..
Newcastle	,, 16	8,263	+ 807	..	104,289	+ 7,568	14·5	..
†Newport	,, 9	722	+ 23	23	17,138	+ 913	14·5	..
Oldham	,, 17	3,004	+ 236	25	49,165	+ 1,974	23·75	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	,, 13	1,677	+ 107	24	19,440	+ 1,490	..	..
Salford	,, 11	9,850	+ 153	23	116,715	+ 6,177	..	..
Sheffield	,, 19	12,676	+ 753	..	161,498	+10,889	40	..
Southampton	,, 13	2,857	+ 459	24	31,398	+ 4,178	22	..
Southend-on-Sea	,, 13	2,145	+ 530	24	19,743	+ 3,063	..	..
South Shields	,, 16	1,262	+ 115	24	16,004	+ 1,938	..	..
†Swindon	,, 6	184	+ 20	23	3,778	+ 463	..	..
Tyneside	,, 13	1,021	+ 157	11	6,267	+ 802	..	..
Wallasey	,, 16	2,377	+ 322	24	28,648	+ 4,471	..	..
Walthamstow	,, 16	1,540	+ 94	24	19,836	+ 1,726	9	..
†West Ham	,, 17	2,814	+ 309	23	64,902	+ 6,491	15·25	..
Wolverhampton	,, 13	2,006	+ 160	24	24,845	+ 1,639	25	..
Cen. London Rly.	,, 16	8,633	—2,122	11	47,318	—10,287	6·32	..
City & S. Lon. Rly.	,, 17	6,260	— 12	11	33,428	— 468	7·26	..
Dublin-Lucan Rly.	,, 15	349	+ 11	11	1,927	— 89	7	..
G.N. and City Rly.	,, 16	2,714	— 8	11	14,824	+ 243	3·5	..
L'pool Overh'd Rly.	,, 17	3 267	+ 374	..	17,047	+ 723	6·8	4·3
Llandudno-Col. Bay	,, 15	1,232	— 85	41½	18,131	+ 432	..	..
London Elec. Ry. Co.	,, 16	23,290	— 60	11	127,495	+ 1,415	21·25	..
Mersey Railway	,, 16	8,778	— 158	11	19,738	— 1,760	4·5	..
Metropolitan Rly.	,, 17	31,950	—1,201	11	176,527	— 4,451	24·5	..
Met. District Rly.	,, 16	21,045	+ 589	11	115,258	+ 4,817	24	..
Anglo-Argentine	,, 16	100,840	+11,462	..	1,803,398	+170.278	..	..
§Auckland	August	16,268	+ 855	2	32,467	+11,794	23·3	·6
Bombay (B.E.T.)	Aug. 18	5,648	+ 430	33	17,967	+ 2,699	..	..
§Brisbane	August	24,650	+2,700	8	168,520	+18,725	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 16	8,046	+ 670	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	August	3,253	..	8	27,687	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	1,621	+ 150	..	25,203	+ 2,180	..	..
§Montevideo	August	24,015	+1.759	..	350,272	+14,653	..	..
Perth (W.A.)	Sept. 15	3,189	—1,068	..	59,347	+13,570	22	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
rnemouth & Poole, Ord.	*					
). 4½ % Pref.	10	5½	5½	7⅜ — 8⅜	..	6 5 9
). Second 6 % Pref.	10	4½	4½	8¾ — 9¾	..	5 14 3
). 4½ % Deb. Stock	10	6	6	10 — 10½	..	4 12 4
npton & Kensington, Ord.	Stock	4½	4½	101 —103	..	4 7 5
). 7 % Cum. Pref.	5	10	10	7⅝ — 8⅛	..	6 3 1
ral Electric Supply, 4 % Guar. Deb.	5	7	7	7⅜ — 7⅝	..	4 7 6
ring Cross, West End & City	100	4	4	99 —102	..	3 18 5
). 4½ % Cum. Pref.	5	5	5	3¾ — 4¼	..	5 19 2
). "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅛ — 5	..	4 10 0
). Do. 4 % Deb.	100	4½	4½	37⅜ — 4¼	..	5 5 11
sea, Ord.	5	4	4	94 — 98	..	4 1 8
). 4½ % Deb.	Stock	4½	5	3⅞ — 4⅜ xd	..	5 14 3
of London, Ord.	10	7	4½	98 —100	..	4 10 0
). 6 % Cum. Pref.	10	6	7	12 — 12½	..	5 12 0
). 5 % Deb.	Stock	5	6	11¾ — 12¾	..	4 14 1
). 4½ % Second Deb.	100	4½	5	119 —123	..	4 1 4
ity of Durham, 5 % First Mort. Deb.	Stock	5	4½	100 —103	..	4 7 5
ity of London, Ord.	10	5	5	89½ — 91½	..	5 9 3
). 6 % Pref.	10	6	5	7⅜ — 7⅞	..	6 7 0
). 4½ % Deb.	Stock	4½	6	10¾ — 11¼	..	5 6 8
) 4½ % Second Deb.	Stock	4½	4½	108 —110	..	4 1 10
undson's, Ord.	5	Nil	4½	100½—103½	..	4 7 0
). 6 % Cum. Pref.	5	Nil	Nil	⅜ — ⅝	..	Nil
). 4½ % First Mort. Deb.	100	4½	Nil	2 — 2½	..	Nil
estone	5	5½	4½	83 — 86	..	5 4 8
). 5 % Cum. Pref.	5	6	6	4⅛ — 5	..	6 0 0
). 4½ % First Deb.	100	4½	4½	4¾ — 5¼	..	4 15 3
e	5	8½	9	95 — 98	..	4 11 10
				6⅝ — 7⅜	..	6 2 0

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾ — 4¼	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	.. — ..	..	..
Oxford	5	7	7½	6 — 6½ xd	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅞ — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87⅞ — 89½	..	5 0 7
Westminster, Ord,	5	10	10	7½ — 8	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

laide, 6 % Pref.	5	6	6	5⅛ — 5⅝	..	5 6 8
ntta, Ord.	5	8	8½	6⅝ — 7⅜	..	5 19 4
). 5 % Pref.	5	5	5	4⅜ — 5¼	..	4 15 3
gary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
adian Gen. El. Com.	$100	7	7	105 —110	..	6 7 3
). 7 % Pref.	$100	7	7	121 —125	..	5 12 0
loba Lt., Power and T., Ord.	1	2	3	⅜ — ⅞	..	3 8 4
). 5 % Deb.	100	5	5	94 — 97	..	5 3 1
. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
). Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
). Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85 — 87	..	5 14 11
goorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 1/8	..	Nil
o. 6 % Pref.	1	6	6	1/16 — 3/32	..	8 6 8
inistiquia Power, 5 % G. Bs.	$500	5	5	101½—103½	..	4 16 7
ras, Ord.	5	Nil	..	2¾ — 3¼	..	..
bourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
ican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	—1	5 13 0
ican Lt. & Power, Common	$100	4	4	85 — 87	—1	4 12 0
). 7 % Cum. Pref.	$100	7	7	106 —108	— ½	6 9 8
). 5 % 1st Mort. Gold Bds.	..	5	5	93 — 95	—1	5 5 3
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power	$100	6	7	165 —170	..	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 41	..	12 3 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Eleo. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	114 —116	..	3 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1⅝ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105 —107	..	5 12 2

TELEGRAPH AND TELEPHONE COMPANIES.

azon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
o. 5 % Deb. Red.	Stock	5	5	98½—100½	..	4 19 6
erican Telep. & Teleg., Cap.	$100	8	8	138 —140	+1	5 14 4
o. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
glo-American Telegraph	Stock	3⅝	3¾	67 — 69	— ⅛	5 8 8
o. 6 % Pref.	Do.	6	6	112 —113	+ ⅛	5 6 2
o. Def.	Do.	25/-	30/-	24⅞ — 25⅛	+ ⅛	5 19 5
glo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
li Telephone	5	8	7	6⅛ — 7⅜	..	4 18 3
nmercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
ba Telegraph	10	6	6	10¼ — 11	..	5 9 1
o. 10 % Pref.	10	10	10	17¾ — 18½	..	5 9 7
ect Spanish Telegrapb, Ord.	5	4	4	3¾ — 4	..	5 0 0
o. 10 % Cum. Pref.	5	10	10	8¾ — 8⅞	..	5 14 3
o. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
ect United States Cable	10	4½	4½	7⅞ — 8⅛	..	5 7 5
ect W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
stern Telegrapb, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
o. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
o. 4 % Mort. Deb.	Do.	4	4	102 —104	..	3 16 11
stern Extension	10	7	7	13½ — 14	..	5 0 0
o. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
st and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
be Telegraph and Trust	10	5⅞	5⅞	10½ — 11	— ⅛	5 6 10
o. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
eat Northern Telegraph	10	18	18	30½ — 31½	..	5 14 3
lo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
ckay Companies Common	$100	4	5	83 — 85 xd	..	5 17 8
o. 4 % Cum. Pref.	$100	4	4	74 — 76 xd	..	5 5 3
rconi's Wireless Telegrapb	1	Nil	Nil	2 7/32 — 2 11/32	— 1/32	..
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	114 —117	—2	5 2 7
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅝	— ⅛	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅝	— ⅛	5 12 11
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 7/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	98½—100½	..	3 9 8
Do. 4 % Deb.	Do	4	4	98½—100½	..	3 19 7
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1⅛ — 1⅜	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reutcr's	8	5	5	8⅞ — 9⅜	+ ⅛	4 5 0
Submarine Cables Trust	Cert.	6	6	133 —136	+1	4 8 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16 — 7 7/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2 3/16 — 2 3/16	+ 1/16	2 13 4
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¼ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾	— ¼	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	1/10 — 1/4	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	3/4 — 1½	.	Nil
Do. 6 % Pref.	10	1½	1½	3¾ — 3¾	..	3 17 5
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	66 — 68	..	4 8 3
Do. Pref.	100	4	4	85 — 87	..	4 12 0
Do. Def.	100	2	2	49 — 51	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	29 —30	..	5 0 0
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	— ½	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3 — 3⅛	— ½	Nil
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3
Metropolitan Railway Consol.	100	1	1⅜	41¼ — 41¾	..	— 1/4
Do. Surplus Lands	100	2¾	2¾	64 — 66	..	..
Do. 3½ % Deb.	100	3½	3½	90 — 92	..	—2
Do. 3½ % Pref.	100	3½	3½	87 — 89	..	—1
Do. 3½ % Con. Pref.	100	3½	3½	86 — 88	..	1
Metropolitan District Ord.	100	Nil	Nil	23¼ — 23⅞	..	— ¾
Do. 6 % Deb.	100	6	6	145 —147	..	..
Do. 4 % Deb.	100	4	4	96 — 98	..	..
Do. 4 % Prior Lien	100	4	4	100 —102	..	..
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	..	..
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	..
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32 — 1 1/32	..	..
Do. Def.	1	Nil	Nil	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	7/8 — 1	..	..
Do. 4½ % Deb.	100	4½	4½	99 —101	..	..
Do. 5 % Deb.	100	5	5	102 —104	..	..
Potteries, Ord.	1	2	2	7/32 — 11/32	..	..
Do. 5 % Pref.	1	5	5	21/32 — 23/32	..	..
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	..
Soutb Metro. Trams, 6 % Pref.	1	3	6	13/32 — 19/32	..	1
Do. 4 % Deb.	100	4	4	73 — 78	..	..
Underground Elec. Railways	..	..	..	..	..	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	..
Do. 6 % Income	100	Nil	1	59 — 61	..	..
Do. Power House Debs.	100	..	4	101 —103	..	..
Yorksbire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/4	..	..
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	..
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	..

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16 — 5 5/16	..	5 3 6
Do. 2nd Pref.	5	5	5	4⅜ — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	— ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6⅝ — 7⅛	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	138 —142	+1	5 12 8
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101¼—103½ xd	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5¾ — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16 — 9/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 5/16	..	4 12 6
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf.	1	6	6	15/16 — 1 1/16	..	..
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	..
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	..
Do. 5 % Deb.	100	5	5	97 —101	..	..
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	..
Manaos Trams & Lt., 1st Deb.	100	..	5	89 — 92	..	+1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	..
Mexico Trams Com.	$100	7	7	115 —117	..	—2
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	..	..
Do. 6 % Bonds	100	6	6	97¼ — 99¼	..	—1¼
Para Elec. Rlys. & Lt., Ord.	5	..	10	6⅜ — 7⅛	..	— ⅛
Do. 6 % Pref.	5	6	6	5¼ — 5⅜	..	+ ⅛
Do. 5 % 1st Deb.	100	5	5	99½ —101½	..	..
Pertb (W.A.) Elec. Tr., Ord.	1	2½	2½	1⅜ — 1 1/16	..	..
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	..
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	..
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	..
Rio de Janeiro Trams	$100	1	4½	114½ —115½	..	— ¾
Do. 1st Mort. 5 % Bonds	..	5	5	101½ —102½	..	..
Do. 5 % Mort. Bonds	100	5	5	97½ — 98½	..	..
Sao Paulo Tram, Lt. and P.	$100	10	10	173 —176 xd	..	+1½
Do. 5 % 1st Deb.	$500	5	5	102½ —104½	..	..
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	..
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	..
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	..
Do. 6 % Pref.	5	6	6	5 — 5½	..	..
Do. 5 % 1st Deb.	100	5	5	102 —105	..	..
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105 —107 xd	..	..

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	23/32 — 25/32	..	Nil
Do. 6 % Pref.	1	12	9	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜ — 5⅝	..	4 12 6
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7¼ xd	..	6 17 11
Do. Pref.	5	6	6	5⅝ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	3/8 — 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 17 11
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 9/16 — 3 11/16	+ 1/16	4 14 11
Do. Deb.	100	4½	4½	103 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2
Dick, Kerr	1	6	5	13/16 — 15/16	..	..
Do. Pref.	1	6	6	1 3/32 — 1 5/32	..	..
Do. Deb.	100	4½	4½	95 — 98	..	..
Edison & Swan, A, £3 paid	5	Nil	Nil	9/16 — 11/16	..	..
Do. fully paid	5	Nil	Nil	1¾ — 2¼	— ⅛	..
Do. 4 % Deb.	100	4	4	67 — 71	..	..
Do. 5 % Second Deb.	100	5	5	78 — 81	..	..
Electric Construction	2	Nil	2½	1/2 — 3/4	— 3/32	..
Do. Pref.	2	7	7	1 1/32 — 1 5/32	..	..
Greenwood & Batley, Pref.	10	7	7	7¾ — 8¼	..	..
Do. Deb.	100	5	5	94 — 96	..	..
General Electric, Pref.	10	5	5	8½ — 9	..	..
Do. Deb.	100	4	4	88 — 93	..	..
Henley's, Ord.	5	15	15	12 — 12¾	..	..
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	..
Do. Deb.	100	4½	4½	106½ —108½	..	..
India-Rubber, G. & T.	10	10	10	13½ — 15½	+ ½	..
Do. Pref.	10	5	5	9⅞ — 10⅜	..	..
Telegraph Construction	12	17½	20	34½ — 36½	..	..
Do. Deb.	100	4	4	100 —102	..	..
Willans & Robinson	1	Nil	Nil	1/32 — 5/32	..	..
Do. Pref.	5	1½	Nil	1/2 — 1	..	..
Do. Deb.	100	4	4	55 — 65	..	..

* Unless otherwise stated, all sbares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

THE BRITISH ASSOCIATION.—III.

Electric Drives for Screw Propellers.

By H. A. Mavor.

Section G. (Abstract.)

T may be said in general terms that high efficiency is associated ith low rate of revolution of the propeller, while in the steam rbine high rates of revolution are essential to the most economical se of the steam. Internal-combustion engines have speeds more early approximating those of reciprocating steam engines, but ere also there is a tendency to speeds higher than are convenient r economical from the propeller standpoint.

In addition to those fundamental incompatibilities arising from auses out of the reach of direct accommodation, there are other onditions which limit the direct application of engine to propeller.

At the present moment the economy of power production in the est practice on land is considerably in advance of what has been one at sea. The principal reason for the better economy of the nd work is the higher rate of revolution of the power generator hen untrammelled by propeller conditions.

Various methods of making the required adaptation of generator o propeller are at present under trial. For this, mechanical gear- ng by toothed wheels or hydraulic transmission may be considered erious competitors with electric transmission, but for large powers ; seems reasonable to expect that electric transmission, which is iready developed for this very purpose on land, is likely to find an qually useful field where the conditions are such as to require an ntermediate device at sea. The cost, weight and efficiency of electric ransmission compare favourably in the examples which have been xamined with either of the two competing methods.

There are other important qualifications of electric transmission n which it stands altogether unrivalled. The most important of hese qualifications are :—

It provides a ready means of reversing the direction of rotation f the propeller without changing the direction of rotation of the ower generator.

The electric transmission also provides means for changing the peed ratio between generator and propeller, so as to permit of the ower of the generator being developed under the most favourable onditions at all speeds of the ship.

Lastly, it provides means for applying the power of one or more ngines to one or more propellers, so that the power generating nits may be so disposed as to give the highest efficiency, and when hey are not required they can be stopped. These properties of the lectric transmission supply exactly what is required to render team turbines, and also internal-combustion engines, completely daptable to the purpose required.

Power generators give their best efficiency when full speed of otation is maintained, even when running below full power. It s, therefore, advantageous to keep the engine revolutions within he range of governor control while the required speed change is ccomplished by electric combinations.

The properties of the electric motor lend themselves well to the equirements of manœuvring. The rate of reversal is under erfect control. The possibilities of rapid and certain action are nore than are attainable in a reciprocating steam engine connected irect to the propeller, and the electric motor is applicable to powers or which there is no possibility of using anything in the nature of eversing gears or clutches.

The property of combining the power of more than one engine or application to one or more propellers is the special feature f the author's inventions as distinguished from the ordinary nethods of electrical engineering. Engines of different types, izes and rates of revolution can have their powers combined with- ut interconnection of their electric circuits, and without risk of nistake or error. An oil engine at 100 r.p.m. may be running the essel at low speed, and a steam turbine running at 20 times the

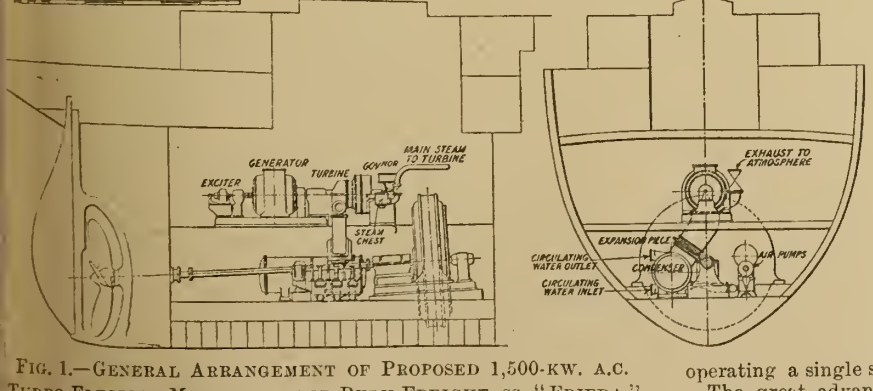


Fig. 1.—General Arrangement of Proposed 1,500-kw. a.c. Turbo-Electric Machinery for Bulk Freight, ss. "Frieda."

speed may be jointly applied to the propellers without any com- plication of the electric equipment. Each unit does its own work independently.

The advantage of such an equipment in vessels which are required to operate under varying load conditions is evident. Without sub- division of the power units, the whole of the main machinery must be in motion while the ship is in motion.

At speeds reduced below its normal rate of revolution, the turbine is even less economical than the steam engine. Sub-division into high-pressure, low-pressure and intermediate elements has been carried out in certain steam equipments, but this results in a some- what complicated and inconvenient system of piping, because the steam has to be led from one part of the system to the other across the vessel. In the electric system each unit can be self-contained, and disposed in the manner best suited to a convenient arrangement of the engine room. The sizes of the individual units can be adjusted to suit the powers required at the different working speeds, or they may be duplicate and interchangeable.

A few examples of application of the system are here presented, together with a description of a small vessel built to demonstrate and illustrate the principles of operation and to provide experience in the use of the plant. In all cases alternating three-phase cur- rents are used and interlocking devices connect mechanically the main reversing switches with the exciting switches so that no

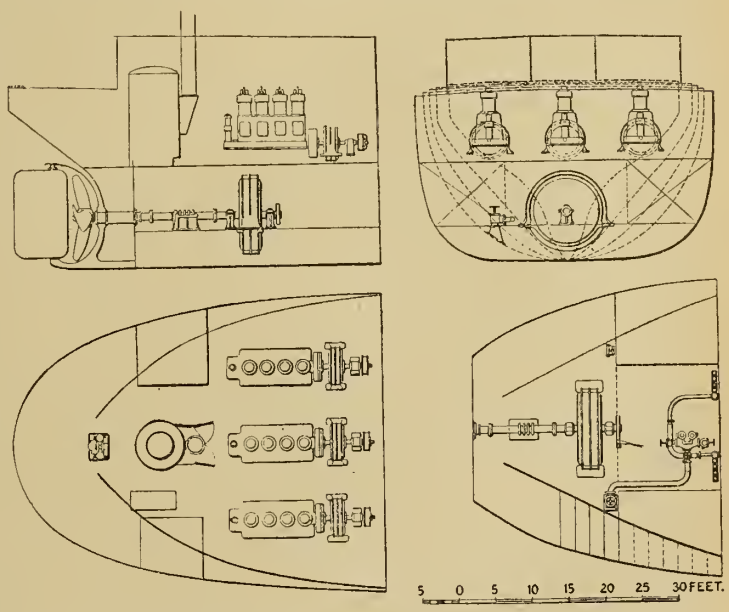


Fig. 2.—Proposed Arrangement of Oil-Electric Propulsion for Lake Steamer, 250 ft. by 42 ft. 6 in. by 19 ft.

change can take place in the connections while they are passing currents.

The turbo-electric steamship *Frieda* has been specially designed for the transport of bulk freights between the Gulf of Mexico and New York City. The vessel is to be 300 ft. long and will carry a dead weight of, approximately, 5,000 tons at a mean loaded speed of 12 knots at sea.

The propelling machinery (fig. 1) is aft, and consists of a turbo- electric outfit for three-phase 50 cycles when running at 3,000 revs. per min. The turbine is supplied with steam at a pressure of 200 lb. per square inch at the stop valve.

This electric generating plant is arranged on foundations on a platform deck in the engine room, and the condensing plant in the engine-room hold. The condenser is fitted with a vacuum aug- mentor, and is suitable for dealing with the full load quantity of steam from the turbine. The vacuum obtained will be 28½ in., with cooling water about 85° F. The condensing plant consists of a vacuum condenser, three-throw air-pumps and centrifugal pumps with electric motor drives.

The current is led to a three-phase motor, which is keyed direct to the main propeller shaft, and is capable of developing 1,900 b.h.p. at a speed of about 84 r.p.m. The steam is generated in two Scotch boilers, with Howden's forced draught and liquid fuel burners.

This installation costs and weighs less than the normal equipment. The coal saving is over 10 tons per day.

The illustrations in fig. 2 show the application of the system to the propulsion of a 245-ft. Canadian canal type tank barge.

The equipment consists of three separate units of Diesel non-reversible oil engines, each capable of developing 200 sbaft h.p., and directly connected to an alternating- current generator. The currents from one or all of the units are respectively led to the separate windings of a three-phase motor keyed to the main propelling shaft and operating a single slow-turning screw.

The great advantage and economy of this system consists in being able to run at full power or at one-third power, using one or three engines at full-load economy, at will, thus providing for an economical operation impossible with any other propulsive system. The fact that non-reversible oil engines are used, running under governor control, greatly simplifies the maintenance and operation.

The control is operated by a low-tension interlocking switch, operated by an ordinary engine-room telegraph stand located in the

pilot house, so that the manœuvring of the vessel is at all times in the hands of the navigating officer. This equipment increases the cost of the ship about 10 per cent. above the normal, but the carrying capacity is very largely increased.

The installation illustrated in fig. 3 shows a marine turbo-electric installation submitted to the U.S. Navy Department for adoption in one of the four large colliers recently given out to contract.

It consists of a steam turbo-alternator of 5,000-kw. capacity with condensing plant; the current is led to two motors, one being keyed

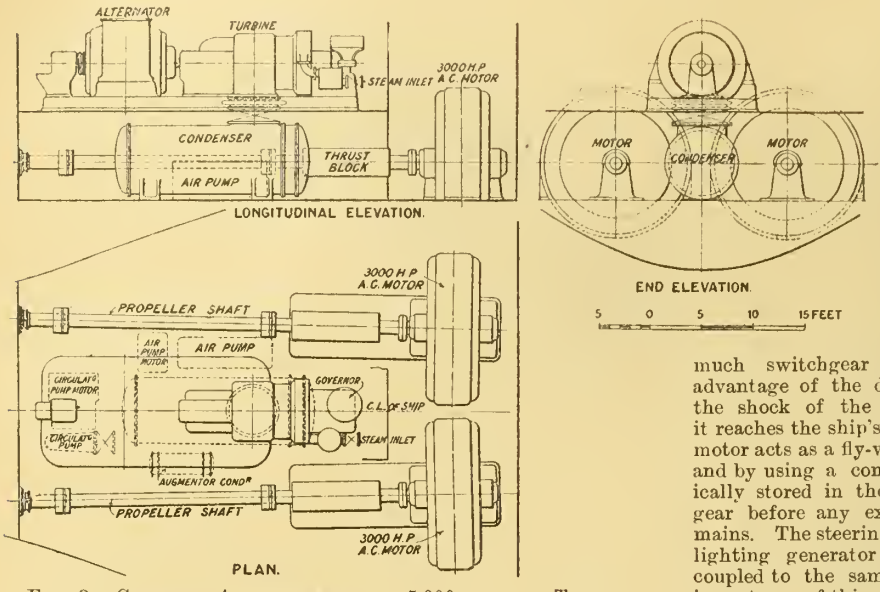


Fig. 3.—General Arrangement of 5,000-kw. a.c. Turbo-Electric Machinery, proposed for U.S. Naval Colliers.

to each propeller shaft. The machinery is right aft in the vessel; the steam is generated by Scotch boilers.

The vessels in which it is proposed to install this machinery are 525 ft. long, and will carry a dead weight of 12,500 tons of coal, at a speed of 14 knots at sea. Here again the cost, weight and economy are better than can be shown with the normal reciprocating-engine equipment.

Electrical Steering.

By B. P. Haigh, B.Sc., Assoc.M.Inst.C.E., Jas. Watt Engineering Laboratories, University of Glasgow.

Section G. (Abstract.)

Electrical power may be applied in steering in connection with two separate problems. In the first place, electrical apparatus may be used in place of the customary control shafting or hydraulic telemotor to transmit the motion of the hand wheel aft to the steering engine. Several such electrical "telemotors" are now available, and these have the advantages of being very easily worked even in the longest ships, and of convenience in installation. The second problem is that of supplying and controlling electrical power for moving the rudder itself, and it is here that electrical steering offers the greater advantage over gears now in general use requiring a supply of steam. The main difficulties experienced in electrical steering have been those of limiting the amount of power required to the capacity of the ship's dynamos, and of controlling the heavy power in a reliable manner. The electric motor must not only be arranged to move the rudder promptly and accurately within the small angles of 5° or less that are required for keeping a course, but must also be capable, without any adjustment of the control gear, of rapidly putting the helm hard over 35° to either side, against heavy water resistance.

In order to economise power, the gearing between the electric motor and rudder post should be designed for a high efficiency, and consequently it will not be "self-sustaining." Means must therefore be provided to hold the rudder in its hard-over position. A magnetic brake similar to those used on cranes is suitable for this purpose, and will also serve to stop the gearing promptly when the required position has been reached.

Experience has led to the design of steam engines of special proportions for steering, and in the same way electrical motors need not be designed to carry their full load continuously. Motors of smaller dimensions for "half-hour rating" and fitted with commutating poles are preferable, and as the heating limit is not here in question the motor may be totally enclosed even in large sizes, without any considerable increase in its dimensions.

Besides possessing adequate power, a steering gear must be satisfactory as regards sensitiveness—that is, it must be capable of moving the rudder to an angle that accurately corresponds to the position of the steering wheel. This is especially necessary within the range of small angles that are used for keeping the vessel on its course. In the highest class work the steering gear should respond to a motion of the hand wheel corresponding to one degree of helm (less than one-eighth turn of the wheel). A certain small amount of idle travel is desirable to prevent the gear being used too frequently. Sensitiveness does not only depend on the idle travel of the wheel but also on the "time lag"—*i.e.*, the interval between the movement of the wheel and the corresponding movement of the rudder. In this respect it appears that electrical steering may possess considerable advantage over ordinary steam gears, for as can be arranged that the rudder responds more quickly, a close course may be kept with watchful steering. As regards idle travel there is little to choose between steam and electric gears.

In the following table a number of different types of electric steering gear are classified according to the method of control:—

A. Steering gears in which the motor is started and stopped for every motion of the rudder:—(1) The motor being supplied with current at variable voltage from a special generator; (2) the motor being controlled by reversing switch and resistances.

B. Steering gears in which the motor is kept running continuously; mechanical control being introduced in one of the following forms:—(1) Friction clutches with gearing; (2) hydraulic transmission with rotary or reciprocating pumps; (3) magnetic friction clutches on motor shaft.

The second line of development, including the gears grouped together under heading B, appears to offer more promising results than method A, to which one great objection is the wear and tear unavoidable where much switchgear for heavy currents is used. A further advantage of the different types classed together under B is that the shock of the sea on the rudder is greatly reduced before it reaches the ship's electrical installation. The armature of the motor acts as a fly-wheel, or extra fly-wheel weight may be added, and by using a compound motor a large part of the energy kinetically stored in the revolving masses is given up to the steering gear before any excessive current is demanded from the ship mains. The steering gear can therefore be supplied from the ship lighting generator without any noticeable flicker in the lamps coupled to the same mains. It is difficult to over-estimate the importance of this feature, both as regards simplicity, and consequently reliability, and as regards economy of power.

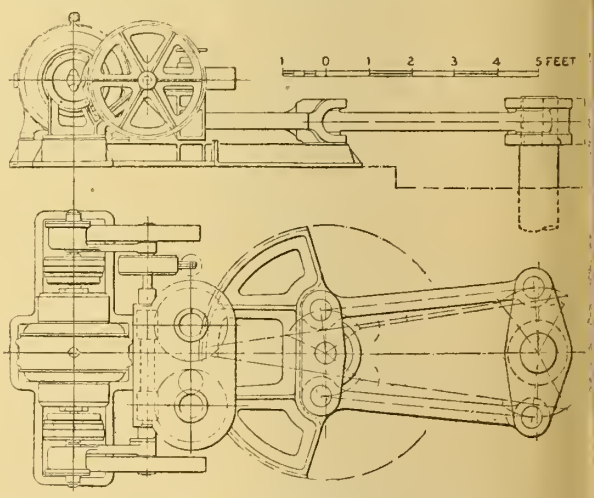


Fig. 1.—Arrangement of Electrical Steering Gear for 11½-in. Rudder Post.

To indicate the amount of power required under these conditions we may take the case of the proposed gear described later, and shown in figs. 1 and 2; this is designed for an 11½-in. rudder post, suitable for a vessel, say, 450 ft. in length,, of 16 knots speed. In this case a motor of 30 b.h.p. is provided, capable of developing a torque of 175 ft.-tons in the rudder post and of moving the rudder through 70° in 20 seconds. These figures are based on special features in the design of the gear and on an efficiency of 64 per cent. in the gearing. The motor would be a d.c. machine, with compound winding, and would run at a speed of 500 r.p.m. under full load and at varying speeds up to 1,000 r.p.m. on lighter loads. The current required at full load would be 270 amperes at 100 volts. A vessel of this size, engaged in passenger service, would probably be provided with generating plant for lighting and forced-draught purposes, of about 200 kw., and if this is divided among four dynamos, each of 500 amperes capacity at 100 volts, it should be possible for any one of these running alone to put the helm hard over in emergency.

In the steering gear designed by the writer in conjunction with Messrs. Brown Bros. & Co., of Rosebank, Edinburgh, the control is by means of magnetic friction clutches, which have several advantages due to the absence of external thrust and the ease of the control. A number of tests have been made on an experimental gear of fair size. Figs. 1 and 2 show details of a proposed gear suitable for an 11½-in. rudder post, to which reference has already been made in connection with the amount of power provided. Although the motor in this gear runs continuously, no gearing is kept in motion as the motor shaft is extended at either end to carry the two magnetic clutches, which are normally out of gear, leaving the rudder stationary. The driven portions of these clutches are carried on bearings and are geared to the countershaft carrying the worm

ar in such a way that the rudder is moved to port or starboard by inging one or other of the clutches into action. The two parts of e clutch are drawn together by magnetic attraction, and a light ring is provided for withdrawing the clutch after the motion quired is completed. The friction drive is transmitted by red re blocks bearing on the conical edge of the light steel disk that ts as the keeper of the magnet, and no thrust remains to be taken by collars. Either ball bearings, as shown in fig. 2, or ring oiling urnals may be used, provided the motor has not excessive end ay. Provision is made for taking up wear on the fibre blocks by justing the inner ring on the clutch body to feed the blocks rough holes in the outer ring. In the gear suitable for an 11½-in. dder post, the clutch coils are fed with a current of ½ ampere, pplied through slip-rings enclosed within the motor. No electrical rts are therefore exposed to the action of damp, for as the motor always running it keeps itself dry. Should it be desired to move the armature, the clutches are removed at the same time, ter sliding the fibre friction blocks back by turning both screwed ngs on the clutch body. Impregnated fibre friction blocks have e advantage of engaging silently, whereas wood, although in me cases having a higher coefficient of friction, appears liable to ueak painfully. The mechanical arrangement of the gear shown fig. 1 has certain novel features, notably the use of two pinions gaging with the toothed sector. As these carry equal loads, the ear is distributed, and a lighter sector may be used, with teeth of educed pitch as compared with those necessary if only one pinion ere provided. Further, a lower ratio of worm gear is required and higher efficiency obtained. The loads on the two pinions are kept qual by using right and left-hand worm-gear, with an intermediate inion to keep the directions of rotation right. The two worms re cut on a sleeve sliding freely on the shaft without thrust locks, and as a certain amount of end play is provided between the earings, the teeth of the sector can be allowed a considerable mount of wear without disturbing the equal distribution of the oad. The quick pitch of the worms and the absence of frictional oss at thrust blocks ensure a very high efficiency being obtained.

The power required is further reduced by the use of variable everage linkwork, in which the rudder crosshead and the dummy rosshead carrying the toothed sector are connected together at ifferent radii, so that the connecting rods do not form a parallel notion. The leverage, which in the midships position is 1·5 to 1, ncreases gradually to 2·2 at the hard-over position of 35°, so that the maximum torque is obtained with less current when the rudder is hard-over; and, further, the gear responds more quickly in the ordinary working range amidships. As this linkwork is not a so-called "geometrical" motion, the positions of the crosshead pins must be carefully chosen; when this is properly done, no difficulty is found in working over to 38° of helm. In this way a saving of 30 per cent. can be made in the motive power, and taking account of the extra efficiency of the double worm-gear, the maximum torque of 175 ft.-tons is obtained with a current of 270 amperes at 100 volts, instead of 450 amperes as would be required with gearing of the ordinary type.

These features are incorporated in the experimental steering gear fitted with a hydraulic cylinder for applying the artificial load, which is so arranged that the tiller leverage is the same when the rudder is hard-over at 35° as when in the midships plane. It was found that the currents required to produce a pressure of 980 lb. per sq. in. on the 5-in. ram were 60 amperes when hard-over, and 90 amperes when amidships, corresponding to a change of leverage of 1·5 to 1. The time required to cross from hard-over to hard-over was 23 seconds when moving against the above load for 35° out of the total of 70°, the voltage of supply being 90 volts. At this load, which corresponds to a torque of 20·4 ft.-tons in the rudder post, the overall efficiency is 48 per cent., indicating an efficiency of over 60 per cent. in the gear alone without hydraulic cylinder or motor. Under normal conditions the slip of the clutches when engaging was found to be small, estimated by means of a contact-maker at between 1 and 2 revolutions, and up to the present, after a considerable period of testing in the works, no wear has had to be taken up on the fibre blocks. When the motor is loaded up to 150 amperes, corresponding to a torque of 50 ft.-tons, the clutches slip, and this current is not exceeded, even when the tiller is butted against a solid obstacle or when the chain is drawn taut from no load to full load.

The arrangements for controlling the clutches consist of one of Brown's improved hydraulic telemotors with a cut-off attachment coupled to the tiller crosshead. The switchgear, which is operated by mechanism equivalent to cam-gear, is enclosed in a small case (14 in. by 12 in. by 4 in.) mounted above the telemotor. In many vessels the telemotors are now attached to the deck beams overhead, and this arrangement is very suitable for electrical steering, as it keeps the switchgear free from water. Being fitted with carbon contacts, and dealing with such small currents, the switches should require but little attention. The cams require to be carefully arranged and free from backlash, to gain sensitive steering; and to stop the gear promptly a quick-acting brake, not necessarily very powerful, is used. The amount of stored energy is minimised by using light steel clutch disks and a motor with shunt regulation, running at its lowest speed when engaging and disengaging.

In installing electrical steering gear it is preferable to avoid the use of fuses or circuit breakers in the supply mains, as these are liable to operate just when the use of the helm is most urgently required, and any possible damage to the electrical plant is greatly outweighed by risk in navigation. When a gear with friction clutches is used a circuit breaker, adjusted for something over the limiting current of the clutches, may be fitted in the engine-room along with an auxiliary motor starter, so that the gear may be immediately restarted without leaving the main switchboard.

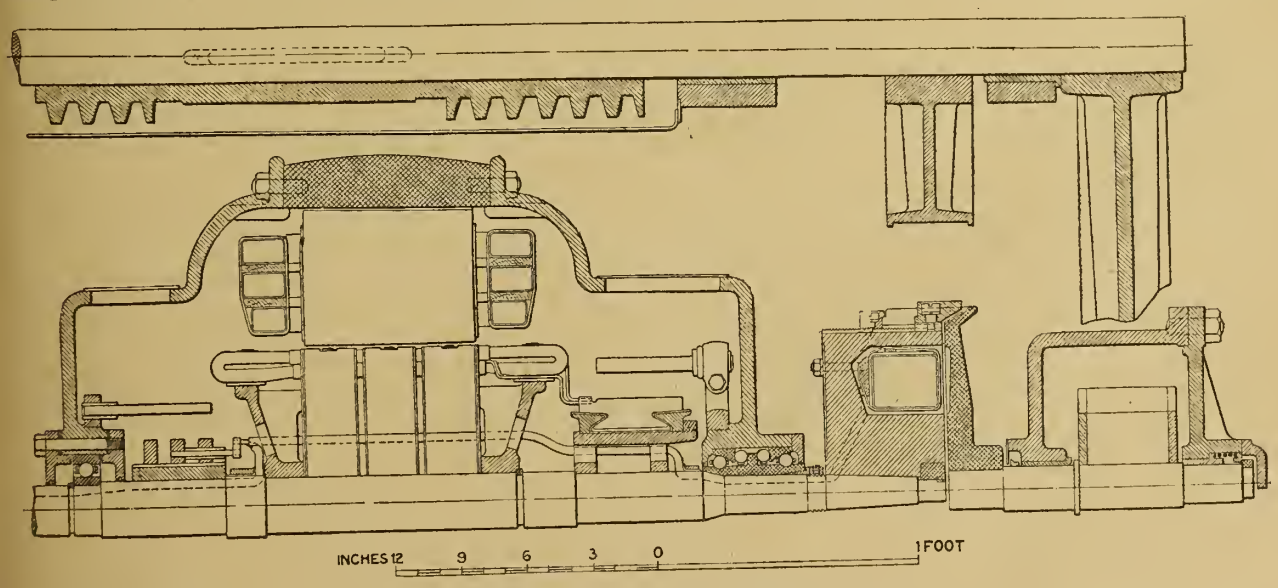


Fig. 2.—Section of Motor, Clutch and Gearing.

Some Preliminary Notes on a Study as to Human Susceptibility to Vibration.

Section G. (Abstract.)

By W. Pollard Digby and Capt. H. Riall Sankey.

The authors point out that the variation of individual human sensitiveness has been investigated in regard to senses of taste, sight, sound and weight; and remark that the fact that different persons are affected in different manners by the same conditions of vibration calls for investigation. The phrase "human susceptibility to vibration" was coined to cover the range of sensitiveness of various people to vibrations of short duration of different amplitude and frequency, together with their opinions as to when these vibrations approached or exceeded the point of being a nuisance.

The authors have employed both verbal standards of degree of vibration and a precise unit of measurement. The former ranges from 1 to 8 degrees, imperceptible vibrations being classed as 1, and perceptible vibrations constituting an excessive nuisance at 8. The precise unit of measurement is that of a vibration having a maximum linear amplitude of one millimetre at a frequency of one cycle per second. From their investigations, so far confined to only a limited number of cases, the authors deduce that:—

1. The range of vibration classed as imperceptible is a wide one. Generally vibrations having an intensity of 0·10 to 0·20 units are imperceptible, but are in a lesser number of cases classed as faintly or very faintly perceptible.

2. In regard to very faintly perceptible vibrations, three cases class this as under 0·10 unit, six as between 0·10 and 0·20, six as between 0·40 and 0·50, while seven cases could only distinguish vibrations in excess of 0·50 unit.

3. All individuals show a fatigue effect and lose their sense of discrimination after 30 or 40 minutes. Generally the sensitiveness is diminished.

4. Individuals are divisible into two broad classes. Those capable of discrimination of vibrations of small intensity do not give con-

sistent opinions as to vibrations of large intensity. The opposite effect is observed in those capable of classifying vibrations of larger intensity.

5. That so far the general consensus of opinion points to conditions of perceptible vibration just attaining a nuisance being reached for a mean of intensity of 1 unit. Persons of delicate intensity rate this in the neighbourhood of 0·70 unit, and persons of coarse perceptiveness at about 2 units.

The authors suggest that it will be of interest to ascertain the effect of variations of conditions of physical health, age, sex and occupation in this respect.

They conclude by appealing for the co-operation of members of the British Association by their acting as subjects for experiment, and urge that from many points of view, not least the legal one, there should be some definition of what exact intensity of vibration constitutes a nuisance. Assistance in the further research contemplated by the authors will only involve spending about 45 minutes in Westminster, during which time the visitor's hand is placed on a table and the opinions are expressed of the vibration of the table, whether imperceptible, just perceptible or a nuisance.

THE CENSUS OF PRODUCTION.

The preliminary tables under the Census of Production Act have now been concluded, and are published in an official report (Cd. 5,813) being Part IX of the series.

The present tables include, amongst other enterprises, gas undertakings, electricity undertakings, tramway and light railway companies, and the National Telephone Co., as well as the telegraph and telephone undertakings of the Post Office.

In his report to the Secretary of the Board of Trade, Sir G. R. Askwith says:—"The completion of the preliminary tables affords an opportunity of summarising the principal figures contained in this part and those already issued. This is done in the following table, which covers the returns relating to mines and quarries, iron and steel, and other metal trades, shipbuilding, engineering, the building, woodworking, and furnishing trades, the chemical and allied trades, the textile, clothing, and leather trades, food, drink, and tobacco manufacture, and public utility services with sundry minor industries, not clearly assignable to any of these principal groups." (Agriculture is excluded.)

Production in the Year 1907.

—	Gross output. Selling value or value of work done. (1)	Materials used. Cost. (2)	Work given out. Amount paid to other firms. (3)	Net output. Excess of Col. (1) over Cols. (2) and (3). (4)	Average No. of persons employed (excluding outworkers). (5)
	Million £	Million £	Million £	Million £	
England & Wales	1,483	860	20	603	5,764,000
Scotland... ...	208	116	5	87	885,000
Ireland	66	43	1	22	287,000
United Kingdom	1,757	1,019	26	712	6,936,000

In the Report of the Director of the Census accompanying the tables, it is stated that under Sec. 7 of the Census of Production Act, 1906, it is provided that "the exercise and performance by a local or other public authority of the powers and duties of that authority shall be treated as the trade or business of that authority." Public authorities were, therefore, required to furnish particulars not only in respect of their gas, water, and electricity undertakings, but also in respect of other works involving construction, alteration, upkeep, and repair. In the returns from these authorities, tramway and light railway companies, and the National Telephone Co., the amount stated as the value of the output is a sum covering wages, cost of materials, and the establishment charges attributable to the works in question. It thus represents the cost of the works, and is not strictly comparable with the value of the output returned by building and contracting firms, which is on a profit basis.

A statement is given showing for the United Kingdom as a whole the gross output, the cost of materials used, the amount paid for work given out to other firms, the "net output," the number employed, and the net output per person employed for the industries covered by the Report.

From this statement we make the following extracts:—

—	Gross output. Selling value, or value of work done. (1)	Materials used. Cost. (2)	Work given out. Amt paid to oth'r firms. (3)	Net output. Excess of Col. (1) over Cols. (2) and (3). (4)	Persons employed. (5)	Net output per person (6)
Gas:	£	£	£	£		£
(*a*) Companies	20,838,000	9,292,000	—	11,546,000	54,946	2
(*b*) Public authorities	10,769,000	5,037,000	—	5,732,000	28,585	2
Electricity:						
(*a*) Companies	3,182,000	1,186,000	—	1,996,000	8,499	2
(*b*) Public authorities	5,721,000	2,149,000	—	3,572,000	14,119	2
Post Office (Teleg. and Teleph. undertakings) ...	2,872,639	2,048,557	169,263	654,819	10,171	
Nat. Tel. Co. ...	1,503,784	837,191	156,364	510,229	7,028	

Adding together the amounts returned to the Census Office on the schedules for the building and contracting trades, public authorities, &c., a total of £54,775,000 is obtained. A further sum of nearly £7,000,000 was included in the returns of iron, steel and engineering firms in respect of iron and steel structural work on buildings, bridges, &c.

From the details given for the various classes of work we extract the following:—

Construction and repair of—	
Railways, light railways and tramways ...	£14,087,000
Gas mains and works (other than buildings)	1,508,000
Telegraphic and telephonic lines and works ...	4,701,000
Electric lines and works	2,913,000

The value of coal gas and water gas supplied by companies and public authorities was £23,157,000, coke and breeze, £4,434,000. By-products (including £1,322,000 for fixing stoves, fittings, &c.), bring the total output of gas undertakings to £31,607,000.

The total quantity of electricity generated by companies and public authorities (exclusive of that generated for their own use by industrial and commercial establishments and by railway and tramway companies) amounted to 1,430,069,000 B. of T. units. Further, 174,607,000 units were generated by railway companies, and 54,743,000 units by tramway and light railway companies for their own purposes.

Companies purchased from other companies or from local authorities 32,922,000 B. of T. units of electricity, the estimated value of which was about £230,000, and local authorities purchased from companies or from other local authorities 14,042,000 B. of T. units of electricity, the estimated value of which was about £105,000. Eliminating these duplicated amounts, the value of the electricity supplied by distributing companies and public authorities was about £8,568,000.

The quantity of electricity generated by companies other than railway, light railway and tramway companies amounted to 573,510,000 B. of T. units, and the selling value of the electricity supplied to consumers or used in the works was returned as £3,182,000.

The quantity generated by local and other public authorities amounted to 856,559,000 B. of T. units, and the selling value was returned as £5,721,000.

The works of construction, alteration and repair in connection with telegraph and telephone lines, and the manufacture and repair of telegraphic and telephonic apparatus executed by Post Office employés is summarised as follows:—

	Construction.	Alteration or repair.	Total.
Work done on—	£	£	£
Telegraphic lines and works...	403,253	421,574	824,827
Telephonic lines and works ...	1,361,775	290,133	1,651,908
Electric lines and works ...	21,027	1,227	22,254
Other works of construction...	5,637	651	6,288
Total value of work done ...	£1,791,692	£713,585	£2,505,277

Telegraphic and telephonic apparatus made and repaired amounted to £248,172.

The National Telephone Co. carried out works of construction to the value of £1,129,510, and of alteration and repair to the value of £374,274, a total of £1,503,784.

t is of course to be understood that the above figures for telegraph and telephone services relate only to the work he employés of the Post Office and National Telephone and do not cover the work of contractors and supplies n manufacturers for services which will have been uded in other returns.

'or convenience of comparison we summarise from the es the following particulars of the cost of materials l shown in relation to value of output (for the United gdom) :—

	Cost of materials used.	Value of output.	Value of output less cost of materials used.
undertakings :—	£	£	£
ompanies	9,292,000	20,838,000	11,546,000
ublic authorities ...	5,037,000	10,769,000	5,732,000
tricity undertakings :—			
ompanies	1,186,000	3,182,000	1,996,000
ublic authorities ...	2,149,000	5,721,000	3,572,000
t Office telegraphs ...	2,217,820*	2,872.639	654,819
ional Telephone Co.	993,555†	1,503,784	510,229

* Includes £169,263 for work given out.
† „ £156,364 „ „

And of the persons employed :—

Gas Works :—	
Companies	53,679
Public authorities	28,209
Electricity undertakings :—	
Companies	8,499
Public authorities	14,119
Post Office Telegraph s...	10,171
National Tel. Co....	7,028

The figures given in this and the preceding preliminary les are subject to revision, but it is believed (says G. R. Askwith) that the alterations will be of comparatively ior importance. The revised figures will be shown in the l report, which is in course of preparation.

Pending such final report, the preliminary tables are of at value in themselves, and will be of still greater value the purpose of comparison with similar censuses to be ducted at subsequent periods. We hope then to see portant changes in some of the figures we have given ve.

E MODERN INSULATION RESISTANCE TESTING SET.

By W. A. TOPPIN.

TESTING set for the measurement of insulation resistance sed to ascertain whether the wiring for motors or lights ether with any apparatus connected thereto is capable withstanding the maximum pressure to which it will be jected when connected to the source of supply. The use this testing instrument is often ridiculed, it being med that bad wiring or badly designed apparatus may ly give a high reading in megohms and yet be quite it to connect up to the supply mains. It is true that re is no testing set at present in use that will show presence of two bare joints in dry wood casing, but ess a testing set will indicate the majority of defects is a waste of time to use it. The writer is of the nion that the present tendency in the design of this s of instrument is to render it less efficient than the aratus manufactured several years ago.

Let us consider in what way the modern testing set differs m the old-fashioned one. The use of small batteries to ain the required testing pressure has become obsolete, quite rightly so. The small permanent magnet hand-ven dynamo is now almost universally used, and these d to be powerful little machines contained in a separate from the ohmmeter. The competition between the nufacturers to produce a lighter and cheaper apparatus ised them to put the generator in the same case as the hmmeter. They had, therefore, to reduce the weight of the erator as much as possible, and it consequently became ch less powerful. It was impossible to grip the terminals an earlier type machine owing to the severe shock obtained, but the modern machine causes no inconvenience, although it is declared to give the same pressure.

In fig. 1 are shown some results obtained from two testing sets made by the same firm, and similar results were obtained from apparatus designed recently by several other firms. The pressure was measured by means of an electrostatic voltmeter connected between the "line" and "earth" terminals, an ordinary voltmeter being out of the question owing to its possessing a closed circuit. Both generators were stated to give a pressure of 500 volts, and the number of revolutions per minute was kept as uniform as possible during the tests. For the sake of convenience there is a break in the curves at 200,000 ohms and a sudden

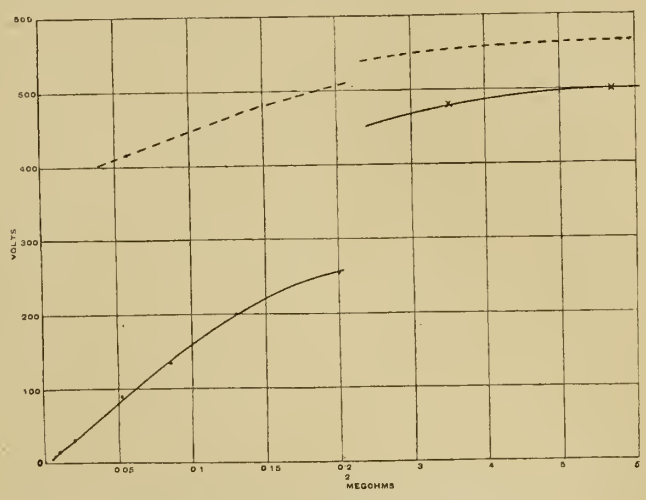


Fig. 1.—Showing Drop of Pressure at Terminals when Testing Low Resistances.

jump is made to 2 megohms. The dotted curve was obtained from a machine made about 10 years ago, in which the ohmmeter and generator were contained in two separate cases. The full line curve was obtained from a modern machine, self-contained. The contrast between the pressures obtained when testing low insulation resistances is very marked.

The attention of manufacturers, contractors and installation inspectors should therefore be drawn to the fact that although there is a greater need for a high pressure when testing doubtful wiring or plant, it is just in these cases that the modern testing set fails. When testing lighting installations with a large number of points or motors with complicated switchgear, it is not often that a result of more than 500,000 ohms is obtained, and thus the pressure at which the test is made is too low to be of much value.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—A Customs order recently issued by the Australian Government states that, for the purposes of prepayment of the duty in London on advertising matter transmitted through the post to the Australian Commonwealth, the Commonwealth Minister of Trade and Customs has approved of the issue of ½d. and 1½d. duty stamps, in addition to those already available for this purpose. The following scale of charges will apply, in substitution for those previously levied :—

Up to 1¾ oz.	½d.	Over 8½ oz., up to 9¾ oz.	3½d.
Over 1¾ oz., up to 3¼ oz.	1d.	„ 9¾ „ „ 11¼ „	4d.
„ 3¼ „ „ 4½ „	1½d.	„ 11¼ „ „ 12½ „	4½d.
„ 4½ „ „ 5¾ „	2d.	„ 12½ „ „ 13¾ „	5d.
„ 5¾ „ „ 7¼ „	2½d.	„ 13¾ „ „ 15¼ „	5½d.
„ 7¼ „ „ 8½ „	3d.	„ 15¼ „ „ 16 „	6d.

The stamps may be obtained from the office of the High Commissioner for Australia, 72, Victoria Street, London, S.W. Firms should remember that when the duty on any one mail sent by any one consignor to any one State in Australia does not exceed 1s., payment of duty is waived.

The following decisions as to the duties to be levied on certain electrical and similar goods have recently been issued by the Australian Customs Department :—

Electrical Appliances, &c.—

Coils, shunt, imported separately for arc lamps... ...	20 %
Telephone parts imported separately, viz.:	
Bases, porcelain (fitted); escutcheons; hooks, receiver; knobs, ebonitc; knobs, metal; springs, table telephone; vibrators	Free.
Nuts, round milled brass; pillars, bell, for wall telephones	25 %

Irons, hot-point domestic. Parts imported separately, viz.—

Cable (extra) with attachment; cable suspenders; contact tongues, brass; heating elements...	10 %
Studs, with washers and nuts	20 %
Switch plugs (extra), complete	Free.

Note.—The rates quoted are in all cases those leviable under the British preferential tariff.

CHILE.—A Bill has recently been framed by the Finance Committee of the Chilean Chamber of Deputies which proposes to increase the Customs duties on goods imported into Chile, with the object of raising additional revenue.

The Bill provides that goods which now pay 5 per cent., 15 per cent., 25 per cent., or 35 per cent. on their official valuations, shall pay an additional 5 per cent. on those valuations; and that the specific duties levied on certain goods under Article 6 of the Tariff Law of December 23rd, 1897, shall be increased by 10 per cent. These additional duties are to remain in force for 27 months.

A duty of 5 per cent. on the official valuations is to be levied on goods—with a few exceptions—which are now duty-free under Article 7 of the Tariff Law; coal and crude petroleum (which are at present duty-free) are to pay a duty of only 2½ per cent. on their official valuations. Merchandise imported through Punta Arenas is to pay a duty of 5 per cent., except in the case of goods which, in accordance with the present Bill, remain duty-free or subject to a duty of 2½ per cent. The duties mentioned in this paragraph are to be permanent.

The stipulations respecting Customs duties contained in Government contracts are to remain in force, notwithstanding the provisions of the present measure.

It is further proposed that the foregoing tariff modifications shall take effect from October 1st next.

For information as to the duties originally levied, which will be increased if this Bill is passed, readers should refer to the Electrical Review, of April 23rd, 1909.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,610. "Sparking plugs for internal combustion engines." W. W. Longford, H. G. Longford and W. A. Clark (trading as Sphinx Manufacturing Co.). September 4th.

19,614. "Vapour electric apparatus." Brush Electrical Engineering Co., Ltd., A. E. Salisbury and C. O. Bastian. September 4th.

19,615. "Apparatus for electrically-operating and controlling planing machines and the like reciprocating tools." Lancashire Dynamo and Motor Co., Ltd., and A. P. Wood. September 4th.

19,616. "Apparatus for electrically-controlling planing machines and the like reciprocating tools." Lancashire Dynamo and Motor Co., Ltd., and A. P. Wood. September 4th.

19,643. "Method and apparatus for forming quartz bodies fused by means of electric resistance heating." A. Voelker and N. Meurer. September 4th. (Complete.)

19,645. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, October 12th, 1910, Germany.) September 4th. (Complete.)

19,661. "Speaking switches for automatic telephone systems." G. A. Betulander. (Convention date, September 5th, 1910, Sweden.) September 4th. (Complete.)

19,677. "Method of and apparatus for measuring electric energy, more particularly for the purpose of charging or sale of same." F. W. H. Wheadon. September 4th.

19,678. "Magnetic separation of ores." I. S. Daigleish. September 4th.

19,685. "Spark plugs." G. Wright. September 4th. (Complete.)

19,741. "Self-regulating electric hot pad." S. Otto. September 5th.

19,747. "System of electric propulsion for vehicles." J. T. Lister. September 5th. (Complete.)

19,760. "Method of and apparatus for cooling electrical generators and motors." F. G. Baum. (Convention date, September 7th, 1910, United States.) September 5th. (Complete.)

19,779. "Telegraphic relays." S. G. Brown. September 5th.

19,800. "Sparking plugs of internal combustion engines." F. A. L. Johnson. September 6th.

19,815. "Manufacture of tungsten and incandescence bodies therefrom." E. Scharrer and G. Ludecke. September 6th.

19,825. "Devices for varying the length of suspension cords of electric light." E. Slade. September 6th.

19,829. "Receiving apparatus for use in radio-telegraphy and telephony." A. de C. Bower. September 6th.

19,845. "Multiplex telegraphy." G. Banzati. September 6th.

19,856. "Electric safety fuse." J. Muller. September 6th.

19,870. "Automatic switches or cut-outs for use in charging secondary batteries from dynamo-electric machines." A. H. Midoley and C. A. Vandervell. September 6th.

19,914. "Manufacture of tungsten and incandescence bodies therefrom." E. Scharrer and G. Ludecke. September 7th.

19,922. "Fuse switches." L. Weekes. September 7th.

19,942. "Means for automatically controlling heat in electric heating apparatus." V. Nightingall. September 7th.

19,948. "Transmitting apparatus for wireless telegraphy." L. Rouzet. September 7th. Complete.)

19,962. "Method of and apparatus for electrically treating plants a like." F. Muller and Veifa Werke Vereinigte Electrotechnische tute. (Convention date, June 20th, 1911, Germany.) September 7th. plete.)

19,970. "Signalling systems." British Thomson-Houston Co., (General Electric Co., United States.) September 7th.

20,012. "Process of superficially metallising the surface of cast-iron, gypsum, paper, and other porous substances or articles for the purp electrically depositing metals or alloys thereof." P. Marino. Septembe (Complete.)

20,019. "Magneto ignition apparatus." C. & E. Fein (Firm of). (C tion date, January 14th, 1911, Germany.) September 8th. (Complete.)

20,031. "Methods of mounting overhead wires for electric railways a like." Siemens Schuckertwerke G.m.b.H. (Convention date, Septembe 1910, Germany.) September 8th. (Complete.)

20,032. "Portable telephones and electric batteries therefor." W. Dickson. September 8th.

20,033. "Electric furnaces." A. E. Bourcoud. September 8th.

20,051. "Method of invoking a relay and apparatus for applic thereof." A. Orling and Orling's Telegraph Instruments Syndicate September 9th.

20,068. "Dynamo-electric machines." H. Newton. September 9th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be ot of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Switches. G. A. G. Davies, W. H. Kent, and D. Davies, Ke Stewart, Ltd. 19,071. August 13th.

Means for Regulating the Closing of Electric Bell Circuits. C. F 19,199. August 16th.

Ignition in Multi-Cylinder Internal-Combustion Engines. Firm of Bosch. 19,241. August 16th. (December 12th, 1909.)

Separation by Magnetic Influence of Zinc, Copper and other Su Ores. W. M. Martin. 19,449. August 19th.

Motor Supports for Electric Tramcar Trucks. Brush Electrical Engir Co. and S. Leech. 27,725. November 29th.

Condensers for Electrical Systems. G. Giles. 28,179. Decemb (December 4th, 1909.)

Suspension for Mariners' Compasses. Kelvin & James White, Ltd F. W. Clark. 29,411. December 19th.

Supports for Metallic Filaments in Electric Incandescent Allgemeine Chemisches Laharatorium Oskar H. Arendt and Schle 29,505. December 19th. (December 18th, 1909.)

Dynamo-Electric Machines. British Thomson-Houston Co. (General E Co.) 30,283. December 29th.

1911.

Electrical-Contact Devices. O. Engel. 320. January 5th. (Addi No. 6,765 of 1908.)

Incandescent Electric Lamps. G. F. Richardson and R. J. Crowley. January 25th. (April 1st, 1911.)

Overhead Electric Trolley-Wire Construction. Oesterreichische I Motoren Akt.-Ges. 4,597. February 21st. (October 2nd, 1910.)

Lug-Joints for the Lids of Electric Accumulator Boxes. P. J. 6,984. March 20th.

Telephone Intercommunication Sets. Siemens Bros. & Co. (Siemens Halske Akt.-Ges.) 9,375. April 15th.

Apparatus for Galvanising Metal Tubes, Rods and the like. F. 9,931. April 24th.

Voltaic Cells. S. Benkö. 10,156. April 26th.

Depolarisers for Galvanic Cells or Batteries. Chemische Griesheim-Elektron. 11,966. May 17th. (October 10th, 1910.)

Manufacture of Electrodes for Electric Arc Lamps. A. Blondel. May 18th. (Addition to No. 6,060 of 1903.)

Saturn's Rings, and Sunspots.—The well-k Norwegian, Prof. Birkeland, in a lecture at Christiani launched a very interesting hypothesis regarding the nature ring system of the planet Saturn. For a long time astron have considered the rings to consist of an immense mass of particles encircling the planet. Prof. Birkeland, on the con supposes the rings to be an electrical phenomenon produced radiation of luminous matter from the planet, and that the ri thanks to the continuous radiation—are being constantly ren By experiments during the lecture he demonstrated that Sa rings may be imitated on a small scale. He points out that is good reason to believe that such a "radiating ring" will effects of light and shadow like those observed, and th means of the hypothesis of radiation, it will be possible to satisfactory explanation for all the peculiarities of the ring to the sun and its activity, Mr. Birkeland sets up new the he opines that the sunspots are huge electric arcs penetratin photosphere, with negative poles on the outer surface. explanation which Prof. Birkeland has given with reteren the nature of Saturn's rings is, in his opinion, also applicable Zodiacal light. This phenomenon, he says, shows that the encircled with a ring similar to that of Saturn, but of greater dimensions.

Accident.—William Phin, 24, an electrical enginee Paisley, sustained serious injuries through a fall while at w Messrs. Fullerton, Hodgart & Barclay's engineeering works. had been working on a 12-ft. ladder putting up wires wh insulator giving way, he lost his balance and fell to the gi He was removed to the infirmary suffering from injuries head and body.

THE
ELECTRICAL REVIEW.

VOL. LXIX. SEPTEMBER 29, 1911. No. 1,766.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE INTERNATIONAL EXHIBITION AT TURIN.

THE Exhibition at Turin, while disappointing to our national pride in several particulars, affords ample satisfaction in other respects. The Exhibitions Branch of the Board of Trade, which made its first appearance at Brussels in the co-ordination of exhibits, and in securing the support not only of important, but of organised, sections of British trade, has, at this second exhibition on the Continent, done even better. Those who read our remarks about the Brussels Exhibition will remember that we then indicated one or two administrative features as capable of improvement. In the preface to our notes on the exhibits themselves, which will appear in a later issue, we deal with these. At this juncture, however, we wish to deprecate the apathy of the British electrical manufacturer. Our showing, save in regard to electro-physical apparatus, is paltry in the extreme. In high-class scientific apparatus the British display is admirable, and has attracted considerable attention, demonstrating beyond doubt our national ability to take a leading part in practical electrical research. In this column it would be invidious to single out the name of any manufacturing firm, but we cannot withhold our highest praise from the firms showing in this section. Under Dr. Glazebrook's guidance, the exhibits of electrical apparatus from the National Physical Laboratory, reinforced by exhibits from instrument-making firms, form a special feature, not only of the British Section, but of the Exhibition as a whole. One can only compare it with that superb, but all too short, exhibition of apparatus required in the laboratory of a modern steel works which followed Sir Robert Hadfield's "James Forrest" Lecture at the Institution of Civil Engineers several years ago.

But apart from this, the British electrical display, or rather its absence, is a standing memorial to short-sighted ineptitude. The impression conveyed to the visitor is that we are able to make a few small motors, and nothing more. There is no indication in regard to switchgear, for instance, that we have ever made anything for more than a 500-volt service, save some leaflets printed in English only of some 10,000-volt material. The largest generators shown are only in the neighbourhood of 100 KW. These, moreover, are belt-driven by internal combustion engines. Whereas French, German and Swiss firms show extra-high-tension switchgear and insulators for duties up to 100,000 volts, our Commissioner was unable to find any British-made oil-break switchgear at all. We had imagined that Great Britain had had more than a little to do with the development of the turbo-generator, yet Continental firms showed these up to 5,000 KW. with not so much as the exhibition of a blade by a British firm. Again, take cables both for mains and for house wiring. Here the cable maker will indignantly remark that it is universally known that Italy is a country of overhead

distribution, and that, with regard to house-wiring, twin flexible carried on insulators is common practice, so that under these conditions the market for first-class VIR, or lead-sheathed paper-insulated cables, is not worth seeking. Yet if any member of the C.M.A. visited Turin, he would see Continental cables exhibited, and find even that Continental firms who were not exhibiting had sent representatives to Turin to feel the pulse of the market.

Just as underground cables are replacing a great deal of the overhead work in American cities, so in Italy and the adjacent countries the demand must certainly arise in time for permanent material to take the place of the temporary. What we have said about cables applies with greater force to tramway overhead material, for in this case the day of replacement of flimsy by solid articles cannot be far distant, if excessive activity on the part of tower wagons in Turin is any criterion.

Leaving for the moment engineering matters, we have nothing but praise for those exhibits representative of the greatest technical skill in other branches of British manufacture. Whether it be photography, or woollen goods, or decorative textiles, or cut-glass, or ceramics, or book printing and binding, we have at Turin organised displays, arresting in their uniform dignity, and compelling attention alike for artistic conception, for delicacy of finished craftmanship, and for solidity. The Bradford Chamber of Commerce not only shows its finished products, but in a series of nine tableaux exhibits the chief stages of manufacture, sorting, combing, spinning, weaving and dyeing from the raw material to the finished costumes. The latter, indeed, cover three stands, representative of garments for Henley, for a shooting party, and for the opera at Covent Garden. Why have not our electrical manufacturers done what has been done for the British automobile industry by the Society of Motor Manufacturers and Traders, who have organised a display of British-made motor-cars? On first thoughts one would have considered that the organisation of such a sectional exhibit in a city which has within its borders no fewer than 14 factories devoted to the automobile industry (one of which has a very high reputation in London), was a piece of magnificent but futile assertion. Yet the display has attracted wide interest, and several of the cars have found Italian purchasers.

Or, again, we could cite the excellent exhibits of British agricultural machinery, and two good displays of internal combustion engines, and two of machine tools. So far as machinery in motion is concerned, the small British display is very good of its kind.

In the railway section there is not a square millimetre of space devoted to British products. Germany, France, Italy and Belgium show some superb locomotives, high-class passenger rolling stock, mineral wagons, and electric locomotives. These exhibits are practically left to advertise themselves, and it was impossible for our Special Commissioner to obtain information. Generally the attendance of exhibitors' representatives at German stands is poor, and also at some Italian stands. Other Italian stands are well staffed. Perhaps most attention is paid to the visitor in the French and British sections. The French official catalogue is the best of the sectional catalogues in the whole Exhibition. The British catalogue is published in English and French, and exhibits in British showcases are invariably described in two languages—English and Italian, and often a third description in French appears. The German catalogue is published in German only, and the items on the stands are very indifferently described. One good point is common to both the British and American organisations, and that is that the custodians looking after groups and showcases have seats and desks. The American custodia were not very efficient, and seemed (when they were visit to be chiefly interested in reading American papers. T British custodians were alert, and always bi-lingual, a occasionally tri-lingual. The Swiss exhibits are fairly go

In heavy central station machinery—turbines, Pelton whe Diesel engines, and materials for high-pressure transmiss lines—our Continental rivals make an interesting displ From these, and from a study of those of the Italian St Railways, which are electrically operated, there is much to learnt. Our own conditions are such that we have not had, and it is debatable whether we shall have, to constr 100,000-volt transmission lines in Great Britain. We mi do a little with the Pelton wheel. Both will be required the Colonies. Ought we not to fit ourselves for such wo The Diesel type of engine we have already taken up. one would have thought that in regard to so purely Brit a conception as the steam turbine some showing might h been made.

We hope that the Turin Exhibition will be the occasion on which we shall have to deplore the almost t absence of British electrical exhibits. If France, Germ and Switzerland, faced with heavy railroad charges, thin worth the expense to exhibit on such a large scale, it ou to be worth our while to make a bid for the trade wh they seem so confident of securing.

The Competition for Street Lighting.

The superiority of the electric li whether as regards the excellence of illumination or its economy, has bec so manifest since the introduction of metallic-filament lamp, that the gas c panies have to rely for the maintenance of their l continued monopoly upon exceptional circumstances, ra than sound commercial principles.

They have in their favour the being, in most case possession, mains laid and the business well established u contracts for more or less long periods. Local gas c panies undertake the supply, and to a large extent shares held locally are frequently in the hands of mem of the local authorities, whose interest is naturally in fa of securing dividends upon their investments.

In the majority of cases, no electric supply is yet availab many small towns and villages, although the growth of p companies supplying electricity over wide areas by l distance transmission will gradually fill these requirem by the establishment of local works for distributing current.

In but few towns where electricity is available mains been laid throughout the public thoroughfare that the only practical competition is limited to por of the roads and streets; this gives the gas compani present monopoly. But when the local authorities reco the great advantage of lighting by the "up-to-da system, contracts will be offered for sufficiently long t to warrant the outlay of capital on mains; otherwise must wait until the gradual extension of the use of tricity warrants putting them down throughout the tow

In the meantime it is interesting to note the struggl the gas interest to hold their own in the competition can have but one result in the "survival of the fittest."

Among the most recent cases is that of the town of Le where an electric supply has been available for 12 ye among the first customers of the company were present Mayor, Mr. Alderman Holman, and a former M Mr. Alderman Gates, both of whom certified as far as 1902 that they found it cheaper and better than gas. company have, therefore, always had influential suppo in the Corporation, but until the present year have ha chance of obtaining a contract for street lighting.

In June last tenders were invited from the gas electric supply companies, with the result that the High

Works Committee recommended the acceptance of the er of the electric in preference to that of the gas pany.

he respective tenders were reported upon by the borough eyor. The cost of lighting by gas was £447 15s. 6d., by electricity £390 5s., showing a difference of 10s. 6d., equal on the five years' contract to a saving of 7 12s. 6d.

part from this actual economy in cost, the lighting by ricity was better, and Councillor Fowler, in the discus- upon the recommendation of the Committee to enter the contract with the Electric Lighting Co., put position into the proverbial nutshell when he said "the Committee went carefully into the matter, and thoroughly conversant with the details. They could get away from the fact that electric light was cheaper, gave a better light than gas. This was a matter in ch members of the Council should look beyond their own rests, and consider the interests of the general body ratepayers." In spite of these facts, an amendment he recommendation of the Committee was carried by 10 s to 6.

efore the vote was taken a significant question asked as to whether shareholders of the gas company e entitled to vote, and the town clerk advised the Mayor . "as no actual change was involved, shareholders could ."

he terms of the amendment, as originally proposed and ussed, were "that the tender of the Lewes Gas Co. as to 127 lamps be accepted as from September 29th next; that such company be approached as to their future rge for the other 167 street lamps in the town"; but mover (Councillor Verral) ultimately agreed to substitute ds to the effect that the recommendations of the Com- tee be referred back for further consideration.

We do not know how many of the members of the Council voted against the recommendation of the Committee to pt the tender of the electric supply company were share- lers in the gas company, and it would be interesting to w if they were sufficient to turn the majority of 4 into inority; but in any case, we question the legality of r votes, as it is perfectly clear that they were voting as reholders in the interest of the gas company.

The reasons given by the speakers in favour of giving the tract to the gas company, notwithstanding that it was osed to the interests of the town, are curious.

For instance, Councillor Verral, who moved the amend- nt, argued that the gas company had not been treated in a per manner, because their manager called upon the town k, the borough surveyor and the chairman of the com- tee, but was unable to ascertain particulars of the Council's uirements; but the gas company made a formal tender ler similar circumstances to that of the electric company. Another reason was that the gas company paid more in s than the electric company; but he let the cat out of the when he argued as a reason for paying more for an erior light that *a great number of the shareholders of the company were Lewes people.*

But the most extraordinary argument was the assertion t the Board of Trade had power to revoke the provisional er of the electric supply company, if they did not pay idends! And if they stopped the electric light pany, where would the town be in regard to public ting if the Committee's recommendations were adopted?

He trotted out the venerable mis-statement that Brighton Railway Station, Westminster, Holborn, ddington and a comprehensive "other places," gas l superseded the electric light, which scarcely uired the counter-blast of Councillor Savage, who was pared to give the names of at least nine places that l adopted electricity since last March.

The reference to Holborn was a specimen of the apparent norance on the part of such advocates of the gas interest, Councillor Verral was evidently unaware of the fact that the street lighting of that metropolitan borough the s and electric companies had combined, and made a joint der for lighting the streets partly by gas and the mainder by electricity, an arrangement which indicates a licy of lighting by electricity where the company's cables laid, and by gas where there are only gas mains. Under this plan of operation the joint interests of the rival systems are preserved and the cutting of rates is prevented.

It is the general interest of the ratepayers that ought to be the chief consideration of the Town Councils, but in cases like that of Lewes, it is clear that neither economy nor efficiency has been allowed to interfere with the personal gains of shareholders in the gas company. This is a matter which, doubtless, the inhabitants will bear in mind when the selection of their representatives next takes place, and meanwhile, perhaps, on the *reconsideration* it will be decided to adopt the proposal of the special committee and to accept the electric company's tender.

In considering the respective merits of electricity and gas for street lighting, it is essential to have regular tests made of the candle-power of the lamps, as it is well known that the gas mantle deteriorates so rapidly that after a few weeks the illumination is considerably reduced, whereas there is little or no reduction in the light of the metallic-filament electric lamps during a period of 2,000 hours.

In an article upon "Street Lighting by Modern Electric Lamps," in our issue of December 9th last year, the result of tests of the gas and electric lamps at Sheerness was given, and this should be studied by every local authority dealing with the public lighting question. The gas burners rated at 80 c.p. in no case averaged as much as half that value, whereas the electric lamps rated at 50 c.p. averaged in one street 53, in another 51·5, and in no case below 50.

After a high wind, which did not affect the electric lamps, the gas mantles were described as "ragged and tattered apologies"!

Atlantic Cable Amalgamation.

The issue of circulars mentioned in our last issue with regard to the leasing of Atlantic cables seems to raise certain important points for consideration. The pioneers of Atlantic cable enterprises were chiefly British, and the danger of loss of the ownership and control of these British undertakings is shown by the expansion of German, Dutch, French and American lines. The manufacture of submarine cable, at one time practically a British industry, within the last 10 years has, to some extent, gone to Germany and France, and must reasonably be expected to go to the States when full American control is established of the most important lines of communication in the whole world. The value of telegraphic communication for diplomatic administrative and defence purposes does not appear to be secured by the provisions under the terms of the lease that the working staff shall be British; and the use of cables is not necessarily greatest after war is declared, and so long as a cable is controlled, the work must be subject to the direction of leaseholders and subject to scrutiny and censorship from any point on other than British territory. Whether the Sherman (Anti-Trust) Law will be infringed when a full and effective lease has been approved does not seem problematical if there was any objection to the previous pooling arrangement, and it seems to require some greater knowledge to understand why an agreement should be made while this question remains unsettled. In the event of the agreement falling in, there does not appear to be any provision made for the repayment to the Anglo Co. of the purchase price of the Western Union Cable, and if after some years this should occur, after the canvassing has been in the hands of others, we wonder what will be the chance of the Anglo Co. regaining their old position.

We do not yet see that it is necessary that the complete operating control of all these companies should be necessary to perform a homogeneous and expeditious service. It has always been well known that the managers of the Anglo Co. have little to learn, and seeing that in Great Britain, it is within the power of senders of telegrams to route them by whichever system they choose, so that foreign and British systems have equal facilities and all companies have alike the liberty to open receiving offices in the United Kingdom, and rent lines or hand telegrams to the Post Office without any restriction, it seems strange that British cable companies have not to-day the same facilities in the United States.

THE INTERNATIONAL CONGRESS OF APPLIED ELECTRICITY AT TURIN.

By our special commissioner.

The Opening and General Meetings.

Overlapping the closing stages of the International Electrical Conference at Turin, but possessing no administrative functions, came the meetings of the International Congress of Applied Electricity. It must be confessed that the number of English delegates was small, and that even of those registered as subscribers to the Congress several were not able to get over to Turin. Among those present our representative noticed Mr. Alexander Siemens, Mr. Robert Kaye Gray, Colonel Crompton, Mr. Duddell, Major O'Meara and Mr. Rowell. (Some of the incidents of printers' errors were amusing; for instance, Mr. Major W. A. J. O'Meara, London, and Ing. Kinellim Edgumbe, London, and Mr. R. S. Glazebrock, Teddington).

The Congress opened at 10.30 a.m. on September 10th, when Signor S. E. Boselli, the chief of the Royal Polytechnic School (in whose rooms the Congress held its meetings), delivered the inaugural address. He greeted the members of the Congress in the name of the Italian Government, and recalled the traditions of the building in which they met, created by the school of Galileo Ferraris, which was continued by his successors. He referred to the paramount importance of their investigations, and mentioned that he was himself keenly interested, in his capacity as a Minister of the Crown, in the relations between the State and electrical undertakings. (Those relations in Italy, we would note in passing, cover a heavy tax on landowners whose water-power is utilised in the generation of electrical energy. It would be akin, of course, to a tax on each ton of coal mined in a coal-producing country.) Continuing, Signor Boselli expressed his warmest wishes for the success of the Congress and the development of applied electricity.

Prof. Lombardi, the president of the Organising Committee, also welcomed the delegates, and referred briefly to the origin of the Congress and the labours of the sectional committees. He referred to the great progress made in Italy—poor in fuel, but rich in water-power—and her aspirations to occupy therewith a leading place among the nations. He invited the members of the Congress to visit the more important of the Italian installations, or, if this was impossible, at least to examine their fundamental characteristics, concerning which various publications would be presented to each member. Much of the success of the Congress was indirectly due to His Royal Highness the Duke of the Abruzzi, who had graciously extended his patronage to their labours, to His Excellency Signor Calissano, who would deliver an inaugural address, and to the Ministers of the Interior, of Agriculture, Industry and Commerce, of Education, of Public Works, of the Army and of the Navy who had sent delegates to the Congress. After thanking Prof. Grassi and Signors Lignana, Nizza and Luino for their assistance, Prof. Lombardi thanked their two secretaries, Signors Curti and Semenza, in particular the latter, for their invaluable work. He then called upon His Excellency Signor Calissano, Minister of Posts and Telegraphs, to open in the name of the King the second Congress of the Applications of Electricity.

Signor Calissano, in the course of a speech which was widely applauded, referred to the great importance of the subjects they were about to consider, and claimed that in this field, Italy was not inferior to other countries. In the name of Signor Nitti, the Minister of Agriculture, Industry and Commerce, he presented to the Congress a volume of statistics of Italian electrical installations which would indicate the enormous progress made in Italian electrical work during the past 10 years. He also referred to the progress made in telegraphy and telephony, and mentioned the approaching conference at Rome on wireless telegraphy.

Speeches were then made by leading delegates, and honorary presidents and honorary vice-presidents were appointed. Amongst the latter were Mr. Alexander Siemens and Prof. Silvanus Thompson. The following sectional officials were appointed :—

Section.	*President.*	*Vice-President*
1. Electrical machinery and transformers.	Boucherot (France).	Morelli (Italy). Feldmann (Holla
2. Installations, central stations, power supply.	De Bast (Belgium).	Ferraris (Italy). Landry (Switzerl
3. Instruments and methods of measurement.	Kennelly (U.S.A.).	Dina (Italy). Armagnat (Franc
4. Illumination and electric heating.	Rossander (Sweden).	Mengarini (Italy) Sharp (U.S.A.).
5. Electric traction.	Mailloux (U.S.A.).	Sartori (Italy). Barnet Lyon (Ho
6. Telegraphy and telephony.	O'Meara (England).	Larsen (Denmark Di Pirro (Italy).
7. Accumulators, electrochemistry and electrometallurgy.	Beekman (Germany).	Nuolati (Italy). Duddell (Englan
8. Tariffs, taxation and electrical legislation.	Arno (Italy).	Dettmar (Germa Banghi (Italy).

The first general meeting was held on September when the President of the Congress, Prof. Lombardi, the chair. The President, in opening the proceedings solely on the subject of the organisation of future Con of Applied Electricity. He reminded the meeting 1908, when a Congress of Applied Electricity was Marseilles, the proposal was made to constitute an national Commission for the purpose of organising technical congresses. The provisional Commissio nominated, however, arrived at no conclusion on the

However, when the official meeting of the Interr Electrotechnical Commission was held at Brussels, it was agreed that this Commission would undert work of organisation. The present Congress was undertaking the organisation of local committees same Commission. The President concluded by sayi he considered the time had come to adopt some resolution.

M. Feldmann, saying that the International technical Commission should undertake this work, a resolution to that effect.

Prof. Silvanus P. Thompson, Messrs. Mailloux, Stecker and De Chatelain spoke in support of M. Fel resolution on behalf of the countries which they sented. M. Boucherot also agreed to the propos Prof. Grassi, in the name of the Executive Comm the Congress, pointed out that in the Congress of this arrangement had already come into effect. M mann's resolution was then carried unanimously. detail :

Considering that the provisory Committee named International Congress of Applied Electricity at M with a view to forming a permanent International sion for the organisation of Electrotechnical Congres not present any resolution ;

And seeing that the International Electrot Commission regularly constituted since 1906 is in by its composition, authority, and statute, as the permanent organisation to assure continuity of the national Electrotechnical Congresses, and so give e the work done by them :

"The Congress decides to ask the International technical Commission to accept the task of organising Electrotechnical Congresses, both as to the times an where they are to be held, and as to their object, the the details of organisation of each Congress being to the National Electrotechnical Committee of the in which the Congress will be held, with the assistanc technical societies of those countries, if any."

At the final meeting on September 15th the f resolutions, already adopted by the various sections, to and carried by the Congress as a whole :—

Section III.—By Prof. Grassi, a resolution congra the American Institute of Electrical Engineers practice of quoting in all its publications the metrica alent of any value expressed in English units, and ex the hope that the Societies of all countries where the system was not in universal use would follow its exan

Section IV.—A resolution (originally proposed Gaster) that an International Commission be appo study all the systems of illumination and all the questions relating thereto, and that the Illu Engineering Society of London be requested to f Commission, and enter into relations with the othe

Commissions, national and international, at present
ng.
tion V.—A resolution by M. Donati, determining a
rd expression for the acceleration of trains, &c.,
—That the acceleration of trains be expressed in kilo-
s per hour per second (quoting the Marseilles Congress
)S in support of this definition).
tion VIII (first resolution).—In order to simplify the
ng-out of installations involving large networks of
ution, a resolution recommending :—
That in drawing up laws on the subject the technical
e kept entirely distinct from the legal.
That the technical side be revised by a permanent
rical Council in each State.
That every State should compile laws, which, without
ering with the powers of local authorities, shall facili-
he installation of electrical concerns involving large
rks, avoiding obstruction either through objection to
being carried out, or to necessary sales, by the local
rities.
ond Resolution.—For the better regulation of taxation
ctrical concerns, formulating the principle that electri-
or lighting purposes only should bear taxation :—
That the State declares untaxable the production
ale of electrical energy, with the exception of private
ng.
That such taxes be applied in such a way as not to
electric lighting to be in an inferior condition in com-
on with other methods of illumination as regards the
mer, and not as regards production, permitting the
rtakers to supply to the consumer without being subject
s or hindrance in such service on account of the State.
That the contribution to the local authority be not left
ie decision of such authority, but be according to a
regulation, and cannot exceed a reasonable amount.
That the financial statistics be made out in agreement
the customs of the industry, and are furnished with all
ls which will render them useful as records.
hese last resolutions are, of course, due to Italian fiscal
itions, which impose an annual tax on all undertakings
ating electricity.)
ie deliberations of the Congress, as a whole, were con-
d by the customary votes of thanks. To these formal
tes our representative would add his own special
eciation of Signor G. Semenza's courtesies during a
of overwork amounting almost to an avalanche.

FACTORY LIGHTING.

By CECIL TOONE.

lighting, both by day and by night, is as important
ie factory worker as proper ventilation and sanitation of
workroom. Consciously and sub-consciously, the nature
ne lighting provided affects both his will and ability to
, and the fact that artificial lighting is generally used
comparatively few hours per week is no excuse for the
neglect in its provision. In the average factory,
icial lighting is required at those times when the workers
need, and most benefit by, proper illumination. Yet,
e deficient lighting leads to accidents and mistakes and
arious eye troubles (such as myopia), it must be
mbered that excessive intensity of illumination is equally
rious. The minimum and sufficient condition is always
sufficient light be provided of such quality and dis-
ition that all desired operations can be carried out with
mum fatigue and cost and with maximum safety and
llence of results.
henever available, daylight is far preferable to artificial
nination, not only on economical grounds, but also by its
luable germicidal powers and beneficial effects on the
th and spirits of workers. Nevertheless, very inadequate
vision is commonly made for the natural lighting of work-
s, and in no case is the daylight illumination
ssarily a standard on which to base the design of
ficial lighting equipment. The provision of "high
le" daylight is very desirable ; increasing the height of wall windows by 1 ft. (at the top), may increase the total daylight illumination of a workshop by 50 or 100 per cent. From the illuminating standpoint, single-floor workshops lighted by "skylights" are preferable to all others ; the provision of sufficient, suitable natural illumination then offers no difficulties, and the problem of even artificial lighting is usually simplified (though diffusion from walls and ceilings can now be utilised to a very limited extent). The use of prismatic windows for improving the central lighting of shops dependent upon wall windows is liable to lead to intense local reflection of light in some directions.

In designing an artificial lighting installation for workshops, one of the first points to be decided is whether "general" or "local" illumination is to be provided. Sufficient "general" illumination is, in any case, essential to avoid too great contrast between adjacent areas, to facilitate general attention to machinery, and to enable adequate supervision and safe passage from part to part of the shop. Thus far there can be no dissentients, but, whereas some authorities advise a sufficiently high general illumination to render all "local" bench lamps unnecessary, others prefer a moderate general illumination augmented by local lighting over each machine tool. In the writer's opinion a purely general lighting (derived from high-slung flame arcs or H.T. mercury vapour lamps*) is best for foundries and all shops where no specially fine work is in progress, while a high general illumination, augmented by comparatively small local lamps, is best for detail machine shops. Generally speaking, in shops where the old-fashioned, haphazard, usually deficient lighting system has been discarded, there is a tendency to provide too low general lighting and too intense local lighting.†

Local "drop" lamps over machine tools give a slovenly appearance to a workshop, and the loose wires may easily become a grave source of danger, particularly where there is much overhead shafting and belting. In any case, there should be no bare lamps in the direct line of vision of any worker, and employés should not be given unrestricted control over any local lamps which may be installed, or they will invariably draw them as close as possible to their work, thus destroying the efficacy of any special distribution of light which may have been arranged ; hampering their movements possibly to a dangerous extent ; heating their eyes, and working under too intense an illumination. Further, they will probably inconvenience their neighbours by subjecting the latter to directly incident light. To avoid direct vision of unshielded lamps is an easy matter in lofty shops ; but in low rooms, lighted by metallic-filament or mercury vapour lamps, diffusing globes or inverted lighting must be adopted.

Tolerably even illumination over the whole of a workshop favours minimum eye fatigue, and enables maximum accuracy of perception, while reducing the actual lamp candle-power required. On the other hand, it is extremely necessary to have a correct appreciation of relief, hence too uniform illumination by indirect lighting, and multiple shadows cast by a number of exposed lamps, are alike unsatisfactory. The best all-round results are attained by the use of combined diffusing and indirect lighting fittings. All walls and ceilings should be periodically whitewashed to take full advantage of the excellent diffusion thus enabled.

Polished reflectors should be avoided except for very special purposes, the cheaper types invariably giving streaky and irritating results. Such a wide adoption of the "Holophane" class of fittings as is found in America has yet to be realised in English factories, but simple enamelled reflectors and opalescent globes of good quality have many more virtues than are often admitted.

The direct reflection of light from bright metal work should be carefully avoided. The reflected intensity of even dull steel may easily exceed 1 or 2 candle-feet, so that

* It is tacitly assumed that electric lighting is employed. The only possible advantage of gas over electric lighting, in the present connection, lies in the total working cost, and, while not admitting that a comparison on this heading is at all favourable to gas, it is shown below that the cost of electric lighting is so small as compared with the wages bill of a works, that the monetary aspect may be neglected in favour of more important considerations.

† By the misapplication of "local" lamps, it is quite possible to obtain a range of illumination at various points of 20 or 40 : 1 over a 7-ft. bench.

the component parts of all machines should, as far as practicable, be painted a matt grey or green. For a similar reason, bare lamps should not be suspended directly above any pools or tanks of oil; though the lamp itself be out of the direct line of vision, the intense reflection from the oil is annoying and harmful. All work involving the handling of bright metal parts, varnish, or other reflecting material, requires specially careful illumination.

The proper inspection and maintenance of a lighting equipment is no less important than its initial design. Diffusing globes as at present used seldom absorb less than 15-30 per cent. of the light emitted by the contained lamp (this figure falling to 10 or 15 per cent. for prismatic globes), even when thoroughly clean, and the collection of dirt on globes and reflectors may easily cause a further loss of efficiency of 15-30 per cent. Periodical inspection and cleaning thus becomes essential to maintained efficiency; the cost of such special attention may be reduced by encouraging each workman to keep clean his own "local" lamp and fittings. Frosted and prismatic glassware is specially favourable to the collection of dirt, particularly in damp and oily situations.

The very faulty lighting provided in innumerable factories naturally excites the casual observer to a demand for legislation on the subject, but the difficulty of subjecting, to even the broadest regulations, conditions which depend so essentially on individual circumstances will be at once patent to all who have had any practical experience of illuminating problems. Indeed, if manufacturers would only realise the great benefits inseparable from a well-designed lighting installation, and the relatively low cost of providing and maintaining the latter, legislation would become as unnecessary as it must now be ineffective. Thus, the cost per hour (at 2d. per B.T.U.) of providing :—

25 50 100 200 candle-power per man
= 0·075d. 0·15d. 0·30d. 0·60d. using lamps requiring 1·50 w./C.P.
or = 0·025d. 0·05d. 0·10d. 0·20d. using lamps requiring 0·50 w./C.P.

Assuming so liberal an allowance as 100 C.P. per man at 1·25 w./C.P. and 2d./B.T.U., the cost of energy for lighting is ¼d. per hour, and if the worker's wage be 1s. per hour, an increase in his output of about 2 per cent., due to the excellent lighting provided, will fully cover the energy cost of the latter. If only 16 C.P. had been provided by carbon lamps (at 3½ w./C.P.), the energy cost per hour would have been 0·11d., so that an increased output of only 1 per cent. would pay the additional cost of the improved lighting first assumed.* Taking the overall cost of a well-designed lighting installation, employing flame arcs, mercury lamps or m.f. units, the net cost of lighting per worker is considerably less, and the ease of recovery by improved output correspondingly greater, than shown by the above example.

For the handling of light coloured or large articles or goods, an illumination of 2½-4 ft. candles should be provided; where dark goods or fine work is concerned, from 3-5 ft. candles is necessary, and 10 ft. candles is (subject to proper distribution) not excessive; 50-100, or even 200 ft. candles is often provided near the working centre of various machine tools, but such an allowance is excessive and injurious. Under favourable circumstances, an engineering workshop may be satisfactorily lighted by metallic-filament lamps by the expenditure of 1·0-1·3 watts per sq. ft. of floor area, but, under unfavourable circumstances, from 1½-2½ watts per sq. ft. may be necessary. In a certain American typewriter works covering 13 acres floor area, and employing 8,000 workers, the average power expenditure for lighting is 1·03 w./sq. ft. floor area, or 73 watts per employé.

In textile mills and similar applications, the correct appreciation of colour values is usually of great importance, and in such cases D.C. open arcs burning unimpregnated carbons give very satisfactory results. In a general engineering factory the colour of the light employed is only of importance in so far as it affects the visual acuity of workers and the quality of their output; the psychological effect of colour is then of the greatest importance.

The effective illuminating power of any light depends fairly closely on the yellow component of the latter (on this fact, Crova bases his system of colour photometry) roughly 87 per cent. of the effective luminosity of white lies between the scarlet and deep green lines of the spec Deep red light has a high power equivalent and is very to cause retinal burning, while the irritating effects of violet rays are well known (no light containing the should be used without a lead-glass screen).

According to Steinmetz, the illuminations at various colours just cease to be visible are as follows :-

	Metre-candles.	Relative power radiation.
Red	0·06	10,000
Orange ...	0·0056	1,000
Yellow ...	0·0029	100
Green	0·00017	1
Blue	0·00012	2
Violet	0·00012	20

—a result which clearly favours a greenish-blue lig being of maximum illuminating value while having min power equivalent. The low-voltage (Cooper-Hewitt) m arc gives such a light, and is undoubtedly of high illu ing value. On the other hand, the psychological ef this ghastly light is very depressing, and it seems pe reasonable to argue that our eyes, which have been dev by nature for use in white light, cannot be otherwis injuriously affected by prolonged exposure to a radiatio sisting almost entirely of colours in which daylight is r deficient.

Probably as a result of the latter fact, the pupil co very little when exposed to blue or green rays, a retina is thus exposed to a far greater energy abs than would appear possible from the above data. Ow this lack of natural protection of the retina, excessiv mination by the mercury arc is specially dangerous. quartz and silica high-preesure mercury lamps are superior to the earlier Cooper-Hewitt patterns, and least open to question how much of the popularity latter, with some of its advocates, is due to *(a)* its novelty, and *(b)* the very inferior nature of the equ it replaces.

Most persons feel most cheerful and natural under a or yellow illumination, and such should, therefore, b ferred for the general lighting of factories. W should be conscious of nothing unusual in their surro illumination, and the more closely artificial l approaches efficient natural illumination in distributi value, the more satisfactory should the former be dee

The arrangement of all lighting facilities—whet natural or artificial lighting—should be guided so illuminating considerations. Ill-planned work, arran suit the contractor's convenience, has undoubtedl responsible for the adoption of one or the other form lighting in numerous cases, but recent equipments sh the folly of subordinating the permanent worth of an ation to considerations of temporary convenience a time of its erection, has at last been widely realised.

* As at present available, the renewals cost of metallic-filament lamps is little, if any, higher than that of carbon-filament types; from 2,000 to 3,000 hours' life can be confidently expected for the former.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appe the following week. Correspondents should forward their c cations at the earliest possible moment. No letter can be p unless we have the writer's name and address in our possessi*

Rail Corrugation.

In your issue of September 15th, I notice that Mr. Beaumont, in his recent address on the subject of rail gation, stated it as a general axiom that corrugation with all types of trucks. This is just one of those sw statements which seem to me to divert the study of gation from its proper direction. What is the outc Mr. Beaumont's investigation of this subject? It s me that he has studied only the materials on wh corrugations make themselves apparent. I have no d criticise his work in so far as it is confined to those m I do say that the remedies he proposes are impra ones, and what I shall probably not be alone in objec is that he attempts to close every other avenue of in

n. The whole appearance of the marks called corrugation gests to my mind the action known as chattering. Yet if ttering occurs on a piece of steel which is being turned on the, it would be just as reasonable to examine the phenonon by studying the piece of steel only and overlooking importance of the method of holding the tool, as to mine, as Mr. Beaumont has done, the rail alone, and to rlook the tool which has made the corrugation—that is to , the truck. It seems to me that the only investigation which lly carried us some distance towards a sound theory of rugation, and therefore its possible cure, was that of of. Carus-Wilson, which he explained some years ago before Tramways and Railway Association, and it is noticeable at in his investigation he went particularly carefully into changes of action which are known to occur, or which y logically be presumed to occur, between the wheels and rails when the vehicle is in motion.

I have always maintained that just as one's mechanical se, unaided by mathematics, would lead one to expect attering in a lathe when the tool is placed too high, so same sense would lead one to expect corrugation or nething analogous to it when a vehicle with a fixed wheel se is run along a rigid track. In my opinion corrugation ll be cured before the exact cause of the disease is clearly derstood, and this will be done by stopping the present deavour to make "an irresistible force meet an immovable dy," or, in other words, to expect a rigid truck and a rigid ack to work harmoniously together. It really seems that the udy of the action between wheels and rails when the wheels rm part of the ordinary practical vehicle, and are not under e conditions of a laboratory test, is neglected. In my own tempts to follow the arguments of writers on the subject corrugations, I received the impression that the amway truck is not taken seriously, and I feel mild astonishment when I read that tramway trucks ve reached the highest point in their design, and that tention need only be given now to some of the details of eir construction. It is true that I have only seen such a atement in an advertisement, but I suppose that must be ie opinion of engineers generally; otherwise, the brains hind the advertisement would have avoided making a atement so obviously out of keeping with public opinion, id so difficult to reconcile with the continued existence of rrugations.

I look forward, Sir, to a sound study on the part of an pert of the action between tramway trucks and rails, and is a simple prophecy to say that until such a study is ade we shall be no nearer overcoming the troubles due to rrugation.

J. A. O'Brien.

London, E.C., *September 20th*, 1911.

High-Voltage Testing.

With reference to the article on "High-Voltage Testing," y Mr. D. H. Ogley, in your last week's issue, I attach herewith a few remarks bearing on the subject, which may be of nterest to your readers.

The class of high-voltage testing apparatus which is enerally installed for the purpose of making accurate tests f the dielectric strength of insulating materials, &c., is uch more elaborate, and, consequently, more expensive han that which is required by the manufacturer for testing is machines, &c., in their different stages of manufacture.

What the manufacturer requires is a small testing quipment which is easily portable and capable of giving the equisite voltage for the different standard tests which have o be made when connected to a constant low-voltage supply djacent to the job.

All that is necessary in this case is to have a double-round transformer provided with a series of tappings on he H.T. side. The tappings dividing the H.T. winding nto equal divisions, may be taken to one switch dial, while nother series of tappings, sub-dividing one of the main livisions, may be taken to another switch dial. This rrangement will give sufficient variation of voltage for all practical purposes. The transformer and switch dials complete would be contained in a suitable wooden box, mounted on wheels, and provided with a handle for convenience in moving about. On the outside of the box would be mounted a single-pole overload circuit breaker, and a double-pole switch and fuses. In addition to the above, it is usual practice to fix a red lamp on the box, which will indicate to the tester and those near by, when the transformer is alive.

With regard to the equipment for any technical school laboratory, it is always desirable to raise the voltage very gradually from, say, zero to a maximum value, with as much accuracy as possible. Regulation obtained by variation of generator excitation is good, but at low values is not accurate. Perhaps the best arrangement is the use of an auto-transformer provided with a large number of tapping on one half of the winding, and arranged so that the secondary voltage may be varied from zero to twice the normal supply voltage, in twice as many steps as there are tappings on the auto-transformer. In addition to this, the L.T. winding of the H.T. transformer may be designed for series parallel connection, in which case a greater range will be obtainable on the H.T. side.

With reference to the method of regulating the voltage, shown in the connection diagram printed in the above-mentioned article, it will be noted that this method has the advantage that no preventive resistance is required, whereas in the case where an auto-transformer is used, a steady variation of voltage can only be obtained by using a preventive resistance; but it has a serious disadvantage in addition to the watts lost in the resistance, and that is, that at low voltages the wave shape may be anything, and thus accuracy is out of the question.

R. G. Parrott.

Manchester, *September 23rd*, 1911.

Charging Ignition Cells.

With reference to your correspondent "P.'s" letter in last week's issue of the Review, I should like to state that I do not consider the method of charging small cells from the regulating cells of a lighting battery a good one.

First, because, unless the regulators are always properly charged, and have an extremely large capacity (the capacity depending as much on their condition as their size) in proportion to that required for charging other cells, they are liable to be often run down, or possibly reversed, and their useful life considerably shortened thereby.

Secondly, this method requires constant attention in order to ensure that the ignition cells are getting a steady charge at the proper rate, as this will vary whenever the regulators are cut of circuit, or put on charge, or discharge.

Thirdly, separate regulating resistances have to be rigged up if different size cells are to be charged, the $C^2 R T$ loss in these, although small, being absolutely wasted.

Although charging cells through lamps is considered a wasteful method, it has the advantage of ensuring a steady current in the right direction, and if the lamps used are placed in positions where their light can be utilised (the reduction in candle-power being almost imperceptible in the case of the higher voltage lamps), the factor of waste entirely disappears.

E. C. E.

The Electrical Exhibition: An Impression.

The Executive Committee and the exhibitors are to be sincerely congratulated on this fine Exhibition. It will have far-reaching results, not only on the internal, but also on overseas trade, and it is the latter which needs to be cultivated most assiduously.

The various Imperial Conferences in London, especially those at which the journalists foregathered, have, however, opened the eyes of the native born Colonial and foreigner to the fact that we are not so backward as we think we are. This Exhibition will still further help to bring that fact home to purchasers overseas.

I doubt very much if the Germans or the Americans could get together such an exhibition, for the very good reason that two or three large juggernaut trust concerns would practically monopolise the whole show. That sort of thing may be pleasing to the people of countries where trusts can thrive, but it won't suit us. Personally, the more I learn about trusts the more I hate the idea of them. I feel sure

that in the end they will be found to be a distinct bar to progress, and will place any country that submits to them behind the times. It stands to reason that when any firm can monopolise a market the tendency is to manufacture in great quantities certain lines of goods and force them on the market willy nilly.

On the other hand, our specialist firms making a few items really well, are in a position to adopt improvements at short notice and take the fullest advantage of their employés and purchase ideas. I, personally, am delighted with the novelties that are to be seen on the various stands. One feels that after all the electrical John Bull is as much alive as the shipbuilding, textile and banking John Bull. There are plenty of good ideas floating around, and inventors are only too glad to find firms enterprising enough to take them up. Purchasers like to deal with firms which they think are quick to adopt new improvements.

The *bonhomie* of the representatives of the various stands is pleasing, and you do well to emphasise that one of the objects of the Exhibition to bring about a greater intimacy between those directly interested in electrical industry. We have all been at times perhaps just a little too suspicious of the other fellow, and resentful when he booked the order, &c., but that is not British; it is not sportsmanlike. Rubbing shoulders at this Exhibition will do a world of good and make it all the easier for the N.E.M.A. to rope in those firms that have hitherto held aloof. I hope they will succeed in getting them all, for an association together of firms for fostering the industry generally is just as good as the trust movements and cartels are bad.

There was a time, not so long ago, when German, Swiss, Belgian and American electrical apparatus came into this country like a flood because the foreigners quoted lower prices. But they cannot do so now. The hard schooling through which home firms have passed has taught the need of specialisation and standardisation, with the result that even Belgian firms—and they are most favoured so far as freight is concerned—cannot get down to British prices, and what is more, are not able to deliver promptly. It is satisfactory to note that the traditional British reputation for solidity and soundness has not been sacrificed. If anyone is doubtful on that point, he should make a close examination of the exhibits at Olympia. I venture to say that, for fine lines of design, for finish, solidity and novelty, nothing better can be turned out anywhere in the world.

The world is, in fact, beginning to find out that the best value for money in electrical apparatus and machinery is to be obtained in this country; also that improvements are more readily adopted by our specialist firms than by the unwieldy foreign trust organisations. If properly fostered, the trade overseas should now grow at a great rate, and every opportunity should be taken to let people who live in the Colonies and abroad know what British electrical manufacturers can do.

In this connection I would make two suggestions:—First, let the secretary supply all the offices of the Agent-Generals, the agents for the Crown Colonies, the offices of overseas (Colonial) papers which are represented in London with a bundle of tickets for the Exhibition, at the same time asking those in charge of the offices to hand the tickets to any visitors from overseas who may call. For example, at the offices of the *British Australasian* paper, visitors from Australia frequently call to leave their names and addresses, there are also reception rooms at most of the Agents-Generals' offices. A few tickets distributed judiciously at such places and at others one could suggest, would catch the visitors from overseas. Secondly, let the professors and lecturers at the various University Colleges, Polytechnics and technical schools in or near London take their students, not once, but several times, to the Exhibition. Having first noted the interesting points, let them personally conduct the students round to the various stands. This might very well take the place of a lecture and laboratory demonstration and count as an attendance. If, further, the students were given to understand that some examination questions might bear on what they could see at the Exhibition, it would make them all the more keen. I did this with my students at Sydney University during the Railway and Tramway Exhibition, and did it also at the Business Exhibition last year for a quantities and estimates class. A large number of students from overseas are resident in London and many that are British born wi in a year or two find their way out there.

Visits to the Exhibition when at an impressionable ag have a lasting effect. I remember most vividly certai details which I saw at the Electrical Exhibition at the Crysta Palace.

Both the above suggestions mean that the Executive wi have to hand out a good many free tickets, but I think will pay to do so for the above.

E. Kilburn Scott, M.Inst.E.E.

Free Tickets for Olympia.

In your leading columns this week you complain of th apathy of supply authorities in connection with the purcha of tickets for Olympia. I am inclined to think that it is n so much a case of apathy, but that the authorities concerne discovered at the time of the 1905 Exhibition that it w easy enough to purchase tickets, but it was not so easy force recipients to make use of them. The supply com pany with whom I was then connected purchased a lar number of tickets and distributed them with some care. took the trouble afterwards to discover what use had bee made of the tickets, and I was considerably surprised an disappointed to find what a small proportion had bee utilised.

Probably others had similar experiences, and hence th present reluctance to purchase tickets wholesale. Of cours if one is to look upon the purchase of tickets as a form subscription to the funds of the Exhibition, there is, doubt, much to be said in favour of such a course, but n present purpose is merely to reply to the particular aspect the case brought forward in your leaderette.

Supply Engineer.

September 23rd, 1911.

[See our "Notes" pages to-day.—Eds. E.R.]

Trade Discounts to Private Customers.

We know that you have done your best to induce t trade to keep up prices legitimately, so that we think y will not object to publish the attached correspondence, we think that a dose of the pillory may do Mr. —— good.

Wm. Coates & Sons, Ltd.

Dublin, *September 25th*, 1911.

COPY.

September 14th, 1911.

Messrs. X. & Co.

Dear Sirs,—Mr.——, Dublin, informed us that he purcha certain fittings from you, and as we are his contractors we shall obliged if you will render the account through us.—Yours truly,

Wm. Coates & Sons, Ltd.

September 15th, 1911.

Messrs. W. Coates & Sons, Dublin,

Dear Sirs,—I have your letter of the 14th, and note you wi me to render the account through you, but I cannot see my w to do this, as the order was given to me by Mr. ——, and not yourselves.

When sending the inquiry he asked *re* my best discounts, an allowed him such discount as to reserve a 10 per cent. commissi for his electrician. This I am quite willing to allow you.

Would my electric fittings catalogue be of any service to yo If so, I shall be pleased to send same on hearing from you.—Yo faithfully,

X. & Co.

September 18th, 1911.

Messrs. X. & Co.

Dear Sirs,—We are in receipt of yours of the 5th inst., and reg that we do not at all understand your attitude in this case.

Surely you are not in the habit of selling direct to customers o side the trade, and, of course, the rule is that if a private custon chooses to select fittings for himself, the manufacturer inquires w is the contractor and sends the account in to him with the tra discount taken off. In this particular case, Mr. — has orde fittings from four different manufacturers, and you are the o one who has not complied with the general rule, and we do not our way to accept the absurdly small commission which you off without taking the matter further.— Yours truly,

Wm. Coates & Sons, Ltd

September 19th, 1911.

Messrs. W. Coates & Sons, Dublin.

Dear Sirs,—I have yours of the 18th, and note your remarks. It does not matter to me in the least what *you* consider to be right in this matter. I shall proceed to supply the fittings at the price I quoted Mr. —, and whether you accept the 10 per cent. commission or not is absolutely of no moment to me.

I am not in the habit of being dictated to by any electrician, and do not intend to start now.—Yours truly,

X. & Co.

[While we have pleasure in inserting these letters to show what takes place sometimes in the electrical trade, as the correspondence was of a private nature we do not feel justified in giving the name of the manufacturer.—Eds. E.R.]

Trade Discounts to Consulting Engineers.

I should like to know whether there is any generally accepted view as to the price which should be quoted consulting engineers who are acting for private users. My own practice is to invariably cover the trade, but I believe that some of my trade competitors quote trade prices. In a recent case I told a consulting engineer that I had not quoted a trade price, and he contended that it was not right that he should not get as good a price as, perhaps, a local ironmonger with an electrical department; and he put forward the view that the customer should not pay any more because he was buying his plant through a consultant than if he bought it through a contractor, and that his (the consultant's) fee should take the place of the contractor's profit.

I, however, look upon the consultant as the purchaser, and think that if the purchaser goes to a consultant it means his getting disinterested expert advice instead of having to trust to getting the best value for his money through a man whose idea is to make a profit, and that he ought to be prepared to pay for the advantage he thus obtains. Of course, I do not suggest that the trade should be covered in the case of large contracts with railway companies or similar people.

Manufacturer.

September 19th, 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The world's tribunal of electricians, as it may now be called, completed its meetings at Turin on September 13th last. They consisted of two plenary meetings with a two days' unofficial meeting in between. A council meeting was also held, at which the request of the International Congress of the Applications of Electricity, to which we referred last week, was considered. The meetings were held in the Prefecture, kindly lent for the occasion by the local authorities. The first meeting was presided over by Prof. Elihu Thomson, who had journeyed all the way from Lynn, Mass., for the express purpose of attending these meetings. His Excellency the Minister of Posts and Telegraphs, Signor T. Calissano, welcomed the Commission in the name of the Italian Government. Prof. Elihu Thomson, in a most interesting address, complimented the Italian nation on the influence its great men such as Thomas d'Aquinas, Dante, Galileo and others, had exercised upon the history of the civilised world. He also mentioned our special indebtedness to Galvani, Volta, Ferraris and Pacinotti, whose labours had made this very meeting of electricians possible. Coming to the present day, he mentioned Marconi, who, with such remarkable ingenuity and skill, had put to practical use the discoveries previously made by savants in their laboratories, and had thus given to the world a new and powerful civilising agent, by means of which human thought could be transmitted through the ether. To the Italians, so young in their unity, but so mature in their thought, he offered, on behalf of the Commission, the most sincere congratulations upon their splendid achievements.

He drew attention to the kindness of the Germans who had waived their claim to the holding of the meeting at Berlin, and thus enabled the present reunion to be held concurrently with the Electrical Congress during a great Exhibition commemorating the first 50 years of Italian autonomy.

He also recalled the St. Louis Electrical Congress of 1904, at which he had had the honour to preside, when Colonel Crompton presented the paper which had really been the initial starting point of this international enterprise, fast growing into a body of paramount importance and influence. Having passed in review the various problems before the Commission, Prof. Thomson threw out the suggestion that the work be sub-divided by the appointment of a few small committees; he felt that matters of preparatory detail could be dealt with so much more efficiently by small committees than by the I.E.C. as a whole. He closed his speech by saying how much he appreciated the honour conferred upon him in 1908 when he was elected President of the Commission.

Colonel Crompton, as honorary secretary, made a report on general progress, in which he stated that there were now 21 countries taking official part in the movement. He mentioned the indebtedness of the I.E.C. to the British Indian Government for continuing its generous support, which was deeply appreciated. He also reported the appointment by the Engineering Standards Committee of a committee to undertake all matters electrical from the international point of view. This splendid piece of co-operation, which could not but materially assist the work of the British Section, had been obtained through the good offices of Mr. Alexander Siemens, President of the British Electrotechnical Committee, to whom they were much indebted. The officers of the I.E.C. were then appointed; Prof. Dr. E. Budde being proposed by M. R. V. Picou (France), was elected by acclamation as the new President; and Colonel Crompton, the father of the movement, as his proposer, Prof. Feldmann (Holland), called him, was re-elected honorary secretary, again by members rising in their seats. Prof. Luigi Lombardi was elected to preside over the unofficial meetings which were to start on the next morning. A loyal telegram was dispatched to the King of Italy, after which the meeting adjourned.

The following is a list of those present at the Turin meetings:—

Belgium.—M. Armand Halleux; M. G. A. L'Hoest; M. E. Gevaert; M. O. De Bast (Secretary).

Canada.—Prof. L. W. Gill.

Denmark.—M. S. A. Faber; Prof. Absolon Larsen (Secretary).

France.—M. R. V. Picou (President); MM. H. Armagnat; P. Boucherot; E. Brunswick; J. Blondin; Ch. David (Secretary); F. Laporte (Secretary adj.); R. Legouez; G. Roux.

Great Britain.—Mr. Alexander Siemens, Major W. A. J. O'Meara, C.M.G., and Dr. Silvanus Thompson, Delegates of British Government; Mr. W. Duddell; Mr. R. Kaye-Gray; Prof. T. Mather; Mr. P. F. Rowell (Secretary).

Germany.—Prof. Dr. E. Budde (Now President I.E.C.); Geh. Ober. Post. Prof. Dr. K. Strecker; M. Georg Dettmar (Secretary).

Holland.—Prof. Clarence Feldmann (President); M. L. M. Barnet Lyon.

Hungary.—Prof. Dr. Moritz de Hoor-Tempes; Mr. Antony Steller.

Italy.—Prof. Luigi Lombardi (President); MM. C. Clerici; E. Jona; P. Verole; Prof. G. Grassi; MM. E. Morelli; G. Duran; Guido Semenza (Secretary).

Japan.—Mr. A. Oya.

Mexico.—Senor Alfonso Castello.

Russia.—Prof. M. de Chatelain.

Spain.—Senor Don Luis de la Pena.

Sweden.—Mr. C. A. Rossander (President); Mr. E. C. Ericson (Secretary).

Switzerland.—Mr. K. Taüber; Prof. Jean Landry (Secretary).

U.S.A.—Mr. C. O. Mailloux (President and Government Delegate); Mr. Gano Dunn (President, A.I.E.E. and Government Delegate); Dr. Clayton S. Sharp; Prof. Elihu Thomson (Retiring President of I.E.C.); Dr. A. E. Kennelly (Secretary).

British Indian Government.—Mr. J. W. Meares.

Ecuador.—Mr. Richard Muller.

Panama.—Mr. G. A. Bona.

The Portuguese Consul.

Mr. Leon Gaster (Illuminating Engineering Society of London).

Col. R. E. Crompton, C.B., *Honorary Secretary.*
C. le Maistre, A.M.Inst.C.E. *General Secretary.*
E. L. Litton, *Assistant.*

The unofficial meetings presided over by Prof. Lombardi discussed in detail the work which has been before the National Committees for the past 12 months, and had as a basis for their discussions the *résumé* of the unofficial meeting held in Brussels last year. The main headings were Nomenclature, Symbols (including the symbols for Ohm's laws and vector rotation in A.C. diagrams) and the rating of electrical

machinery. The discussions were of the most amicable nature, and fully bore out the fact that the delegates were no longer strangers but veritable comrades, with one aim and object—the progress of the industry.

The following is the substance of the decisions on the main points referred to above, which were formally adopted at the second plenary meeting held on Monday, September 11th.

Nomenclature.—The list of terms and definitions, as proposed at Cologne in May last, and submitted to the National Committees and amended at Turin previously to the meetings of the I.E.C., is provisionally adopted in French and English, the official langnages. The term "provisionally" is introduced to imply that if at the next meeting in 1913 it is found absolutely necessary, modifications to the definitions will be considered with a view to adoption.

The list is to be published in two ways, one alphabetical, the other in order of sequence of ideas as suggested by the Danish Committee. The small Committee, consisting of one member each from Great Britain, France and Germany, is to remain in being for two years. Prof. Larsen (Denmark) is specially invited to attend. A Spanish representative is also requested in view of the importance of the Spanish language. Only the three principal countries vote.

Symbols (provisionally adopted by the I.E.C.).—

1. Instantaneous values of electrical quantities which vary with the time are to be represented by small letters.

2. Virtual or constant values of electrical quantities to be represented by capital letters.

3. Maximum values of periodic electrical quantities to be represented by capital letters, followed by the subscript "m."

4. Magnetic quantities, constant or variable, to be represented either by capital script, Gothic, heavy-faced or any special type.

5. Maximum values of magnetic quantities to be represented either by capital script, Gothic, heavy-faced or any special type followed by the subscript "m."

6. The following quantities to be represented by the following letters :—

Electromotive force	E, *e*	
Electric quantity	Q, *q*	
Inductance*	**L**	For type, see pars. 4 and 5.
Magnetic force	**H**	
Magnetic flux density	**B**	
Length	L, *l*.	
Mass	M, *m*.	
Time	T, *t*.	

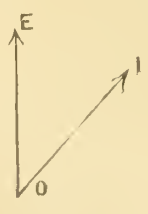
* Coefficient of self-induction.

The letters I, E, R were definitely adopted to represent the current, electromotive force and resistance in the simple expression of Ohm's law.

The term "Reactive power" was adopted to designate, in A.C. questions, the quantity $U I \sin \phi$.

A committee consisting of one member each from Belgium, France, Germany, Great Britain, Holland, Italy, Spain, Switzerland and the United States of America, was appointed to continue the study of international symbols.

Through the intermediary of the German Local Committee, it is confidently hoped that the I.E.C. will obtain the full benefit of the co-operation of the A.E.F., the Committee on Symbols, appointed by the Elektrotechnischer Verein, of which Prof. Dr. Strecker, a member of the German Committee, is President, and which has done such useful work during the past 10 years with regard to this particular subject.



Diagrams for A.C. Quantities.—In the graphical representation of alternating electric and magnetic quantities, advance in phase shall be represented in the counter-clockwise direction.

NOTE.—In consequence, the impedance of a reactive coil of resistance R and inductance L is $R + \sqrt{-1}\, L\, \omega$, and that of a condenser of capacity C is $\frac{1}{\sqrt{-1}\, C\, \omega}$ where $\omega = 2\pi \times$ frequency. It follows also that the diagram represents the phase relations in a simple A.C. circuit containing an impressed E.M.F. O E, and a lagging current O I.

Rating of Electrical Machinery.—1. The output of electrical generators is defined as the electrical power available at the terminals.

2. The output of electrical motors is defined as the mechanical power available at the shaft.

3. Both the electrical and mechanical powers to be expressed in international watts.

A committee consisting of one member each from Belgium, France, Germany, Great Britain, Italy, Sweden, Switzerland and United States of America is to continue the study of the rating of electrical machinery and apparatus. All the local committees are invited to put themselves in communication with the societies in their respective countries which have carried out work of this nature, in order to avail themselves of what has already been accomplished, and obtain the necessary co-operation so as to avoid overlapping of interests.

General.—All local committees are to be at liberty to send delegates to attend the meetings of any or all special committees, and they will receive notice of such meetings from the central office. The voting, however, is confined to the actual members of the particular committee.

Future Meetings.—The next official meeting will be held at Berlin in 1915, the exact date to be fixed later.

The I.E.C. accepted the invitation of the American Institute of Electrical Engineers, presented by Mr. Gano Dunn, its President, to hold an official meeting at San Francisco in 1915, and instructed the Central Office, on the request of the American Institute, to co-operate with it in the organisation of an International Electrical Congress at San Francisco at the same time.

At the meeting of the Council of the I.E.C., an official request of the Turin International Congress of the Applications of Electricity, with reference to future electrotechnical congresses, was received, and, after expressing its thanks to the Congress, the Council decided that, subject to the ratification of the National Committees, it would be prepared to undertake the task of organising future electrotechnical congresses.

It also accepted the invitation transmitted through the American Local Committee, with reference to holding an International Electrotechnical Congress at San Francisco in 1915.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Aston" Electric Radiators.

In the new pamphlet which has been issued by MESSRS. VERITYS for the coming season, showing their "Aston" electric radiators, they illustrate a variety of designs, including a specially cheap line for hiring out by supply companies. This we show as supplied in a form convenient for stocking and packing—being made to nest and so to economise space—in fig. 1. It is made for either two or four lamps, and has a wrought-iron base and real copper reflector. In addition to a variety of registered designs of luminous types,

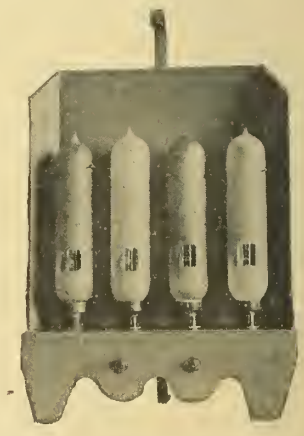


FIG. 1.—"ASTON" RADIATOR.

among them some in the Stuart, Chippendale and Tudor periods in antique brass or silver, gilt, colour, &c., a number of other types, non-luminous, for bath rooms, workshops, &c., are included. There are further some finely-finished examples of non-luminous radiators in rich ornamental cases of solid brass and other metals, made in Georgian, Adams, Elizabethan, Chippendale and other styles. Lamps and some other accessories for use in these radiators are also

d. Messrs. Veritys have now completed the extensions to their don sales depôt at 31, King Street, Covent Garden, W.C., where y invite an inspection of their engineering display, cooking and ing showrooms, and periodised fixture galleries.

Water Softening and Mud Extracting.

ESSRS. ROBERT BOBY, LTD., of 212, Upper Thames Street, E.C., e introduced the "Neckar" apparatus for softening water for ers and automatically extracting mud from them. In this ce, of which a section is given fig. 2, the untreated water ferably heated by exhaust steam) is admitted through a ball e to a dip pipe in a tank as shown, while the required amount oda solution is simultaneously admitted by a second valve; a esponding amount of hot water from behind the blow-off cock he boiler is allowed to flow in by a third valve at the same e, and mixes with the water and soda at the outlet of the dip e, without commotion. The impurities precipitated by the

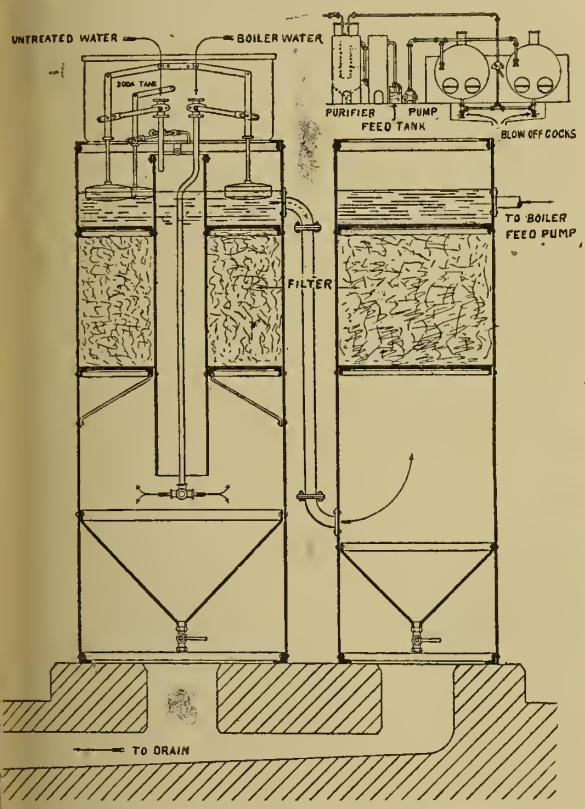


FIG. 2.—SECTION OF "NECKAR" WATER SOFTENER.

ent and the rise of temperature settle quietly in the conical base he drum, while the treated water rises through a filter and flows a second drum, whence, after passing through a second filter, drawn off by the boiler-feed pump. The continual flow of er from the bottom of the boiler, though very small in amount, tated to be effectual in removing mud and sludge, and thus pre- ting the formation of scale without waste of hot water, and amount of reagent required to soften the water is reduced to a small proportion of that required to treat cold water. The aratus has been adopted with satisfactory results in many er installations, having been in use on the Continent for ral years.

Two-Point Control.

ESSRS. A. P. LUNDBERG & SONS, of Pioneer Electrical Works, Liverpool Road, N., write us with regard to the inconvenience lting from the control of bedroom and staircase lamps from point only, for the sake of economy in first cost. One of most valuable features of electric lighting is the ease of control, in all such cases the advantages derived from the installation

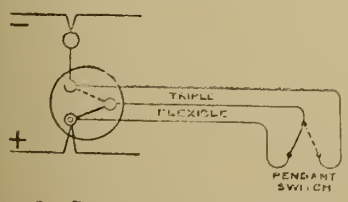


FIG. 3.—DIAGRAM OF CONNECTIONS.

he double control far outweigh the slight additional cost, going indeed, to gratify the user and make him an eloquent advocate electricity for lighting. Messrs. Lundberg point out that the iency above-mentioned can easily be remedied without inter- ng with the existing wiring at all, as shown in the adjoining ram; the conversion only involves the substitution of a two- surface switch for the single-way one, and the addition of a lar switch, or a two-way pear switch for bedroom use, which is nected with the former by a triple flexible carried on porcelain buttons or through insulated screw eyes. Contrary to the usual custom, the "common" terminals of the two two-way switches are interconnected in this case. If it is desired to restore the original connection on giving up the house, the two-way switch can be made to act as a single-way one by short-circuiting two of the terminals, the flexible and extension switch being removed. This simple and ingenious device is worth knowing, as there are very many cases in which it is applicable.

Volt-Hour Meters.

A new "volt-hour" meter, which, it is believed, will commend itself for use in various directions, but particularly in connection with tramway undertakings, has been suggested recently by Messrs. R. G. Cunliffe and J. G. Cunliffe, of the Manchester Corporation tramways, and developed by the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., of Trafford Park.

This meter, which is illustrated in fig. 4, is referred to in a paper on "Tramcar Meters," read by the Messrs. Cunliffe this week before the Municipal Tramways Association in Glasgow.

The new meter is in principle a direct-current motor in its simplest form, having a moving armature of a special and simple design. The meter is designed so that the speed of the armature is proportional to the voltage, and is arranged to read in volt-hours; thus at the end of one hour, the average voltage of the circuit during that hour is indicated directly on the dial.

The importance to tramway managers and engineers of keeping a constant check on the average voltage at various points on their systems, both during normal working and under special service conditions, is obvious.

When the voltage becomes unduly low, through long feeders, long trolley lines, or heavy loading, serious losses are incurred, as well as reduced speed, and to keep to schedule time a driver may be compelled to use energy in driving where otherwise with higher

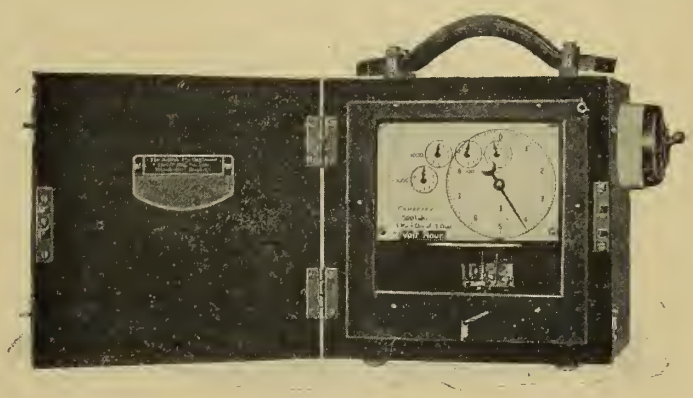


FIG. 4.—VOLT-HOUR METER.

voltage he would be able to coast. Another direction where a knowledge of the average voltage on a circuit is desirable, is in connection with systems using ampere-hour meters on cars. Conclusions drawn from readings taken in ampere-hours only may be misleading, and therefore the average voltage during the period of registration should be known, and the readings in ampere-hours corrected to represent the actual energy expended.

Up to the present time, instruments recording with a pen upon a paper chart have been used in efforts to determine average voltages. Under all conditions, however, the value of the results so obtained is impaired by the error resulting from friction between the pen and the paper, and when meters of this type are used on tramcars, a further error is introduced by the effect of frequent stopping and starting and vibration and jolting upon the pen.

The new meter has neither pen nor paper, and therefore is free from the drawbacks indicated. It can be used in a stationary position or upon a car. It has the advantage of recording directly upon a dial, and being exceeding simple in construction, it can be had at a comparatively low cost.

The Luxometer.

A compact and practical little photometer, made by MESSRS. EVERETT, EDGCUMBE & CO., LTD., of Collindale Works, has been brought out under this title, for the measurement of illumination, both interior and exterior. Fig. 5 shows the complete outfit, including the Luxometer (C), battery (S), and daylight attachment (B); the weight is only 1½ lb. Fig. 6 shows how it is used.

The scale is about 6 in. long, and in standard instruments is graduated up to 10 or 20 ft.-candles, as preferred, with two ranges. It is specially opened out at the lower part, so that great accuracy is possible even when measuring feeble illuminations, and is direct reading.

When in use the instrument is held in the hand, no stand or other support being required. For transport both the photometer and the battery can be carried in the pocket, or they can be supplied fitted in a small leather case with shoulder strap, if preferred. Illumination measurements can be made at any angle, and candle-power measurements can be readily made, irrespective of the colour of the light. The surface brightness or intrinsic brilliancy

of any surface can be instantly measured by viewing it through the instrument.

A simple attachment can be provided whereby what is spoken of as the "window efficiency" of a room can bo determined. Merely to state that the illumination observed in a certain room lit by daylight was so many foot-candles is quite meaningless, depending, as it does, entirely upon the state of the sky. By means of this attachment (B in fig. 5), on the other hand, a definite figure can be

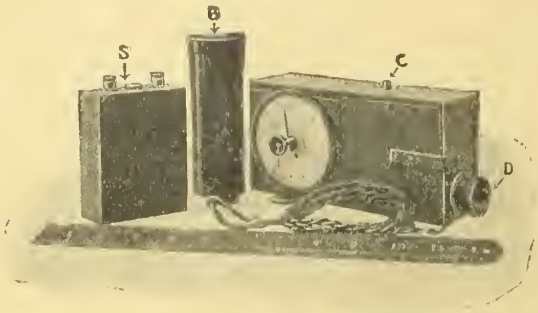


Fig. 5.—The Luxometer.

obtained for this illumination quite independently of the brightness of the day.

The principle upon which this photometer is based is a modification of the well-known Trotter method, in which the illumination derived from an electric lamp, contained in the case, is adjusted until it is equal to that to be measured. A pointer moving over a direct reading scale indicates this illumination without any calculation whatever.



Fig. 6.—Mode of Using the Luxometer.

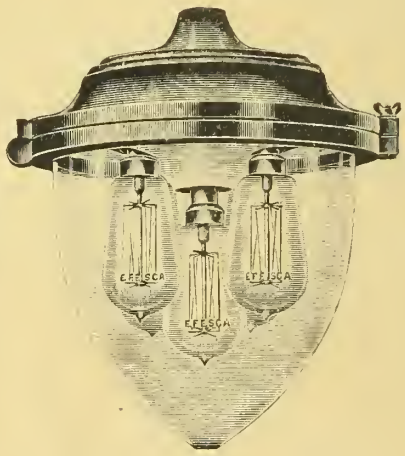


Fig. 7.—The "Eton" Lantern.

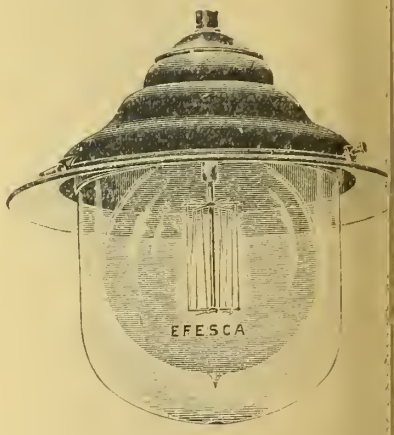


Fig. 8.—The "Arundel" Fitting.

The cell supplied with the Luxometer is of a special "non-spillable" type, contained in a celluloid or ebonite case, so that it can be used in any position or carried in the pocket without fear of spilling. It only requires charging at rare intervals, and this can be done at any motor garage.

The development of the method is mainly due to Mr. P. J. Waldram.

"Efesca" Outdoor Lighting.

Fixtures of the "Efesca" patterns for outdoor lighting form the subject of Messrs. Falk, Stadelmann & Co.'s new catalogue, No. 319. The fixtures have all been specially designed for use in conjunction with "Efesca" and other metal-filament lamps, and in addition to being of interest to those who have to do with the lighting of streets, railway stations, docks, &c., there are lines which should appeal to electrical contractors who purchase designs suitable for shop front lighting, doorways and interiors. In order to indicate the class of contents in the catalogue we illustrate two examples, fig. 7 being the "Eton" lantern, which is supplied for four or five 50-c.p. lights, and is a cast-iron, hinged watertight fitting, with vitreous white enamelled conic reflector and clear flint globe. Fig. 8 represents the "Arundel" outdoor lighting fitting. It has a vitreous enamelled iron casing, black outside and white inside, and takes one lamp up to 600 c.p. It has either a plain clear flint globe or a clear flint optic moulded globe. Other lines for use in outdoor installation work are included in the list, among them being watertight switches and fuses, lamp brackets and columns, &c.

Wireless Telephony.—According to the daily Press, Mr. A. W. Sharman has recently carried out a number of successful experiments with his system of wireless telephony, with which conversation can be carried on through more than a mile of water.

BUSINESS NOTES.

Showcard Competition.—We are informed that th Siemens Tantalum Showcard Competition has proved a unqualified success. Approximately 2,000 designs were su mitted by competitors, and we learn that each of the designs has had careful consideration by the staff responsib for the selection of the winning designs, and we are no able to announce the names of the successful competito It will be remembered that a first prize of £75 was offered, with second prize of £25, together with a prize of £5 for any designs more than average merit which the firm decided to adopt and r produce. Owing to the large number of designs received, the ta naturally proved somewhat difficult, and eventually it was decid by mutual arrangement with the two artists that the two be designs should be bracketed as being of equal merit, and the £1 prize divided between the two successful competitors. Therefore prize of £50 goes to Mr. L. Sutton Wood, 3, Featherstone Buildin Holborn, W.C., and a similar prize of £50 to Mr. Frank M. Bartc 2, Montague Road, West Ealing, W., who are to be congrat lated upon their success. Further accepted designs were submitt by Mr. Reginald E. Higgins, 8, Grenville Place, Maida Vale, W who was the recipient of a £5 prize, and Mr. F. Insall, Water La Brislington, Bristol, was also the recipient of a similar prize £5. We are informed that the designs of non-successful co petitors will be duly returned. The number of attempts made obtain these prizes demonstrates that the distinctive features tantalum metal-filament lamps are well known, and for the comfo of the host of disappointed competitors it may be said that it quite possible that if a further opportunity occurs a differe method of displaying these advantages may ensure th obtaining a prize.

Book Notices.—*Electrical Power Generation a Transmission for Main Marine Propulsion.* By W. P. Durtna London: From the Author. Price 1s.—This booklet has be written by Mr. Durtnall, a pioneer in this branch of engineeri to explain the advantages of electricity for the purpose propelling vessels, and the means by which he proposes to ap it. The various known systems are described, including, course, the "Paragon" system of transmission, which the aut has developed, and of which he gives particulars. This system based upon the use of three-phase motors, and the necess variation in speed of the propeller is effected by an ingeni method of varying the frequency of supply, while the generator kept running at full speed.

Proceedings of the Incorporated Municipal Electrical Associati London: Wyman & Sons. Price 5s.—The issue for 1911 conta the following papers:—Presidential Address, by J. Christ "Electricity Supply viewed from the Municipal Committe Standpoint," by Councillor H. Leese; "Modern Wiring Practic by J. W. Beauchamp; "Internal-Combustion Engines in Po Stations," by H. L. Howard and R. M. Carr; "Purchase of Fu by C. E. C. Shawfield; "Street and Shop-Front Lighting," by A. Seabrook; "The Motor Meter as applied to the Measurement Single-Phase Alternating Current," by V. F. Bush; "Steam-Po Generation: The Advantages of Mechanical Draught," by J. Campbell Murray.

"Standardisation Rules of the American Institute of Electri Engineers." June, 1911. New York: The Institute. Price 10 ce

"The Electrical Nature of Matter and Radioactivity." By H Jones. 1911. London: Constable & Co. Price 8s. net.

"White's Engineering Pocket-Book." 1911. Wigan: T. W and Sons. Price 1s.

Prospectus of the Royal College of Art, London. 1911- London: Eyre & Spottiswoode, Ltd. Price 3d.

"Atti della Associazione Elettroteonica Italiana." August, 19 Milan: Stucchi, Cenetti & Co.

The Pavement Artist.—The Imperial Lamp Wo (Brimsdown), Ltd., are to be congratulated upon their uni method of attracting the attention of visitors to the Exhibit

the opening day at about 3.30 p.m., shortly after the official emony, a solitary ill-clad figure of an elderly man was seen ping towards the main entrance, where he set himself down, l commenced very diligently to cleanse the flagstones. His next cedure was to start upon a drawing of an electric lamp having a background a large Union Jack. Before giving any ling of what this picture was intended to represent, he trans- red his attention to another paving stone, and portrayed a louette of the City of London. The same electric lamp was then wn in on the sky. By this time a considerable number of people l gathered, and no doubt wondered what the affair was all about. e pavement man, however, was too much of an artist to reveal



The Pavement Artist.

l secret immediately, and kept his spectators in suspense while drew a picture of an old-fashioned candle, which drawing he med "Past." By the side of this he again designed a metal- iment lamp. Then the secret was revealed. He wrote "Support nae industries—use Brimsdown," on the first design, on the ond he placed the slogan, "After sundown—Brimsdown," and n sketched in colours the words, "See things in a better light— Brimsdowns now—to-morrow—and all the time." He then layed two Brimsdown show-cards with a large Brimsdown pter in the background. The enterprising artist then reaped the rard of his labours, and coppers were thrown to him by pronising electrical contractors, who, of course, by this time were e to recognise the advertisement behind the scheme. In return f the pennies they were presented with a pack of Brimsdown ying cards, a packet of Turkish or Virginian cigarettes, a Imsdown purse calendar, or a unique advertising novelty show- i the remedy "If your light is bad." This certainly formed an enious way of advertising the lamp. We have since learned t.t the decrepit old gentleman was no other than Mr. J. Conway Ice, of 151, Fleet Street, E.C., with some of whose advertising rk our readers are quite conversant. It is said to be Mr. Price's ention to have the 91 coppers presented to him, mounted and med, to be kept as a souvenir.

Trade Announcements.—Messrs. Chapple, Dalby & Co. have just started business as electrical and general con- ctors at 27, Phayre Street (Railway Block), Rangoon, India, and y desire catalogues and trade discounts from electrical, chanical and gas engineering and supply houses in England.

The United River Plate Telephone Co., Ltd., has changed address to 5, London Wall Buildings, Finsbury Circus, E.C.

Messrs. S. Bill & Co. announce that owing to the large demand their ironclad switches and fuses, they have removed into much ger ground floor premises at 387, Park Road, Hockley, Bir- righam.

Owing to lease termination, Messrs. Parker & Heagerty, tal merchants and agents, have removed to 6 and 8, Lime Street uare, E.C. The firm are acting agents for Messrs. Sperryn and C, Ltd., the Delta Metal Co., Ltd., Messrs. Hepburn, Gale & Ross, ll., Nederlandsche Fabriek van Werktingen en Spoorweg- terieel.

Messrs. Marryat & Place notify that their telegraphic dress has been changed to "Marryat, London."

The Union Engineering Co., electrical engineers, of Wood eet, Livesey Fold, Darwen, announce that they are retiring from siness.

On September 29th (to-day) Mr. J. R. Dennant is removing to ger premises at 106, Balls Pond Road, N. He asks for catalogues d lists from electrical manufacturers.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., have ned a new branch at 88, Albion Street, Leeds, with Mr. G. E. son, who has been representing them in the district, as manager the branch. Stocks of cables, wires, flexible cords, jointing terials, joint boxes, are being held there. Telegraphic address, Henletel, Leeds"; telephone number, "Central 3,006."

Checkogram (1908), Ltd., of 150, Oxford Street, W., are ending their business to embrace all branches of electrical tallation work, especially telephones. Catalogues and lists are ited from suppliers and manufacturers.

Dissolutions and Liquidations.—J. G. Childs & Co. Ltd., electrical engineers, Hawthorn Works, Willesden Green.—The following are the principal creditors, viz.:—

Unsecured.

Adams, F. E., Tool Co., Ltd.	£23	Glover, W. T., & Co.	£135
Allen, Edgar & Co., Ltd.	16	Green, Arthur	40
Anderson's Bristol Rubber Co.	19	General Electric Co.	108
Ash & Lacy, Ltd.	22	Harboro & Poole	23
Aston, D.	23	Highton & Son, Ltd.	41
Baldwin's, Ltd.	36	Hill, T. S.	12,596
Balmforth, T., & Co., Ltd.	34	Hymans, Alfred	54
Bedford Motors	45	Jackson, W. and T.	31
Berry, Skinner & Co.	42	Livermore & Hourder Bros. and Co.	66
Black and White Publishing Co.	22	London Electric Wire Co.	10
Booth & Brookes	24	London and South-Western Bank	28
British Press, Ltd.	47	Lysaght, John, Ltd.	23
British Mica Co., Ltd.	80	Martin, Paul, & Co.	18
British Manufacturers' Publishing Co., Ltd.	15	Morton & Burt	60
Brookes & Walker	17	Myerson, F. T.	34
Brown, John, & Co., Ltd.	38	Newnes, Geo., Ltd,	158
Brown, W. B., & Co., Ltd.	109	Nilson Bros.	23
Buck & Hickman, Ltd.	51	Northgate Ironworks Co.	52
Buckley, Samuel	37	O'Brien, Thomas, & Co.	15
Builder, The	26	Oshy, T.	61
Butler & Jordan	32	Palmer, A. C., & Co.	49
Carr, Jas. W., & Co.	17	Perkins & Co., Ltd.	74
Canada Newspaper	24	Pfeil & Co.	57
Cargo Fleet Iron Co.	24	Phosphor Bronze Co.	84
Consuls, H.M., List	21	Potter, F. W., & Co.	237
Cory Bros. & Co., Ltd.	16	Pritchetts & Gold.	88
Credenda Conduits Co., Ltd.	29	Phipps, R., Executors of	3,708
Davis & Timmins, Ltd.	49	Quinney, W. M. & A.	46
D.P. Battery Co.	73	Rayner, T. J., & Sons	22
Dudley's, Earl, Round Oak Works, Ltd.	102	Rhodes Motors, Ltd.	40
Durant, H.	18	Rollett, H., & Co.	35
Edwards, C. J., & Co.	18	Thompson, W. P., & Co.	123
El Commercianti	51	Tortoise Foundry Co.	26
Electric Construction Co., Ltd.	278	Westwood, J., & Co., Ltd.	48
Engineer, Ltd.	16	*Whitehall Review*	27
Fitzgerald, Ltd.	19	Willesden District Council	52
Foster Engineering Co., Ltd.	46	Wood, Stannard & Hendre	82
Gane, Jackson & Co.	42		

Reno Electric Stairways and Conveyors, Ltd.—This company is winding up voluntarily with Mr. M. Lancaster as liquidator. The liquidator has been authorised to sell the undertaking, &c., to Reno, Ltd., receiving as consideration fully paid shares in the latter company. A meeting of creditors is called for October 9th at 1, Basinghall Street, E.C.

Howe Electrical Engineering Co., Ltd.—Creditors must send particulars of debts, &c., to Mr. A. Thraves, 7, Victoria Street, Liverpool, the liquidator, by October 11th.

Gatley & Co., electrical engineers and contractors, Water Street, Todmorden.—Messrs. W. H. Gatley and J. Morehouse have dissolved partnership. Mr. Gatley will attend to debts.

James Greaves & Sons, engine packing manufacturers, East View, Lightcliffe.—Messrs. A. Greaves and F. Greaves have dissolved partnership.

Westinghouse Contracts.—The following is a list of important orders recently received by the British Westinghouse Electric and Manufacturing Co., Ltd.:—

R. Jeffry.—Two 140-kva. alternators, transformer switchgear, motors and compressors, &c.
Montague Higginson & Co.—One 150-kw. alternator, exciter and rheostat.
L.C.C.—One hundred sets of controllers, &c.
Hetton Coal Co.—One 250-h.p. motor controller.
Noyes Bros. (Melbourne), for Adelaide Tramways.—Forty T.I.F. controllers.
Metropolitan District Railway.—One 1,200-kw. rotary converter, transformers and switchgear.
British Insulated and Helsby Cables, Ltd.—One 200-kw. rotary converter, transformer and switchgear.
Port of London Authority.—Three 300-kw. rotary converters.
Underground Electric Railway.—One 1,500-kw. rotary converter, and three 550-kva. transformers.
National Telewriter Co.—Fifty 1,406 G. double-gear machines.
Consolidated Goldfields of South Africa.—One 275-kva. steam engine set.
Consolidated Goldfields of South Africa.—One 940-kva. steam engine set.
Oceana Construction Co.—Two 200-kw. n.c. generators with equipment and switchgear.
Craigs, Ltd.—One 85-kw. a.c. generator and exciter, six 20-h.p. and various motors.
Noyes Bros., Sydney.—Two 60-kw. compound wound n.c. generator.
Rintoul & Davis.—One 118-kw. motor-generator set.
Cambrian Combine.—One 35-kw. motor-generator set.
Workington I. & S. Co., Ltd.—One 80-kw. n.c. generator, haulage gear pumps and control gear.
L.C.C.—Ten magnetic brakes.
Randfontein G.M. Co.—One electric main hoist.
Para Construction Co.—Lighting accessories.
Ingersoll Rand Co.—Two 540-h.p. d.c. motors, field rheostats, &c.
A. Ransome & Co., for Grangemouth Docks.—One 2-h.p., two 10-h.p., one 30-h.p., two 50-h.p., 220-volt G. motors, starters and switchboards.
Greenwich Inlaid Lin. Co.—One 100-h.p., one 50-h.p., and one 25-h.p. a.c. motors and control gear.
Sir W. G. Armstrong, Whitworth & Co., for Murray Docks.—Six 20-h.p., 2,315 G., six 4-h.p., 1,609 G., 460-volt G. motors, starters and switchboards.
M. Samuel & Co.—One 165, one 64, one 25-h.p. a.c. motors and pumps.
Central Argentine Railway.—Eight motors aggregating 70 h.p., 500-volt FFB.
Staveley C. and I. Co.—Sixteen 10-h.p. motors, and one 4,000-k.v.a. transformer.
Babcock & Wilcox, Ltd.—Sixteen motors aggregating 30 h.p., 220-volt G. motors, control gear and spares.
Leys Malleable Cast. Co.—Six 12-h.p., 550 FFB. motors and panels (one back geared).
Agar, Cross & Co., Ltd.—Various CCB. motors and auto-starters, also one 20-h.p., 563 FFB. and starting rheostat.
Thos. Barlow & Sons.—Two 312-h.p. slip-ring motors, pulley transformer and switch pillar.
Powell, Duffryn & Co.—Elliot pit pump ventilation.
Daimler & Co.—Switchgear.
City of Santos Imp. Co.—Spare parts for equipments supplied.
Metropolitan Railway Co.—One 1,200-kw. rotary transformers, switchgear, &c.
Stalybridge Trams.—Transformers.
West Ham Corporation.—Transformers and switchgear.
Strain & Robertson (Alianza Co., Ltd.).—Transformers and switchgear.
Daimler & Co.—Transformers.

Hungary.—It is reported that Messrs. Ganz & Co., of Buda-Pesth, are, in conjunction with the Siemens-Schuckert Co., preparing to establish a plant in that city for the manufacture of electric cables.

Catalogues and Lists.—Messrs. Falk, Stadelmann and Co., Ltd., 83 and 87, Farringdon Road, London, E.C.—Advance copy of 32-page catalogue of "Efesca" outdoor lighting fixtures, two examples of which we illustrate in our "New Devices" pages this week.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Sixteen-page list of "Aston" electric radiators, luminous and non-luminous, with illustrations and prices. We show a representative type in our "New Devices" to-day.

The Westinghouse Cooper-Hewitt Co., Ltd., 151-2, Great Saffron Hill, E.C.—Referring to our comment on their "Better than Daylight" booklet, the company have sent us a list of users, such as we suggested might with advantage have been included in the booklet. This list is issued as a separate small brochure, and shows that a remarkably large number of installations has been carried out in this country.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Reprint No. 117 relating to 110,000-volt aluminium transmission lines. Leaflet relating to aluminium panels, ceilings, &c., for railways and tramways.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—Price leaflet of the new "Star" switch for 600 volts.

The Unbreakable Pulley and Mill Gearing Co., Ltd., West Gorton, Manchester.—Leaflet with description, illustrations and prices of the Cooper roller bearings.

The Hoffmann Manufacturing Co., Ltd., Chelmsford.—Circular No. 303, consisting of eight pages of finely printed art illustrations, showing "Hoffmann" ball bearings applied to electrical machinery.

The Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, London, E.C.—Illustrated list, giving prices and particulars of the "Westminster" electric cookers, breakfast cookers and boiling plates, which they are now bringing under the notice of central station engineers.

Messrs. Hans Renold, Progress Works, Brook Street, Manchester.—Pamphlet comparing driving chains with belts, and giving the advantageous results of conversions to the former. Copies of the list can be obtained on application.

The Electric Adv. Co., 32, Union Square, E., New York City.—Illustrated leaflets regarding flashing electric sign projectors.

Messrs. Crossley & Hamer, Broad Street, Halifax.—Leaflet describing a new lampholder cord grip.

"L'Air Electrique," 38, Rue de la Folie-Regnault, Paris.—Illustrated lists of electric fans of all kinds, small motors, &c.

Messrs. Pope's Electric Lamp Co., Ltd., Willesden, London, N.W.—Catalogue showing admirably on art paper their various shapes and sizes of electric lamps, and setting out plainly beside the illustrations, the pressures, candle-powers, diameters and lengths. Miniature round bulb lamps for motor-car and omnibus lighting, train lighting lamps, "Focus" lamps for motor-car headlights, festoon lamps, mushroom, plain and twisted flame shapes, torch flame lamps, large tube lamps for shop window lighting, high candle-power lamps, and standard bulbs are all shown. Prices are tabulated at the end of the list.

The Victoria Dynamo and Motor Co., Craven House, Kingsway, W.C.—Twelve-page catalogue, giving specification and description of their bipolar and multipolar D.C. dynamos and motors, also tabulated powers, speeds, &c., and small half-tones of protected, enclosed, and totally enclosed types. Loose lists give illustrated information and prices regarding builders' hoists (friction or spur geared), two and three-phase A.C. motors, electric pulley blocks, small and large electric motor lift gears, and push-button switches for lifts.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—64-page catalogue giving illustrations, brief notes, and particulars of prices, of a variety of electric bells and bell installation parts, among these being indicators, burglar alarms, factory and colliery bells, pushes, wires, batteries, &c., some further lines in the list being speaking tubes, lightning conductors, medical batteries, &c. Some pages are occupied with connection diagrams.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—Catalogue of close upon 70 pages (Section T, ninth edition), containing illustrations, particulars and prices of a very full variety of telephones, including receivers and transmitters, micro-telephones, domestic telephones, battery and magneto call telephones, railway and portable telephones, gas and water-tight telephones, magneto call and central battery P.O. telephones, switchboards, bells, &c. At the end a number of pages are devoted to diagrams of connections.

Messrs. T. Harding Churton & Co., Atlas Works, Water Lane, Leeds.—Catalogue of 16 pages containing full descriptions of polyphase induction motors and single-phase motors, also tables of outputs and prices. A number of well-printed half-tones show the motors, their parts, starters, &c.

Messrs. Siemens, Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Catalogue (26 pages) in the firm's now well-known standard form and style, in which is given information, brought up to date, regarding Siemens-Obach dry cells for general and ignition purposes, also ignition coils, Hellesen dry cells, Dura cells, Siemens transport cells, &c. There are some full notes on the employment of dry cells and dry cell batteries for ignition purposes.

Bankruptcy Proceedings.—W. F. Flint, electrical engineer, 77, Haworth Street, Hull.—Receiving order made September 21st on debtor's petition. First meeting, October 5th: public examination, November 13th.

Exhibitors at Olympia.—The J.-L. Manufacturi Co., Ltd., of Southall, have a large stand in combination wi Submersible Motors, Ltd., in the gallery, Nos. 317 and 31 They were delayed in completing their arrangements for a sta until the last moment, hence their name did not appear in our la week's list.

Manufacturers and Wiring Work.—Messrs. Johns and Phillips, Ltd., ask us to announce that owing to represent tions which have been made to them by some of their contract friends, they have decided not to tender, or accept orders, f ordinary wiring work. Should any work of this nature be includ in any orders that they may receive for complete plant and cab installations, they propose, where possible, to sublet it and distribu the work among their contractor customers.

German Export Trade.—The Imperial Statistic Department is carrying out a much needed inquiry as to the mo appropriate method of estimating the value of goods in t German export trade. Questions such as whether the factory pri should be recorded only, or the frontier price (*i.e.*, plus railag insurance, &c.) are to be debated. Who is to furnish the bases estimates of value is also to be settled (*i.e.*, whether the man facturer or the Customs officials). The advisability of simil reforms in the import system is likewise to be considered. Fro the purely statistical point of view, such an inquiry is eminent justified, and if an international character were given to it so mu the better; the German restricted view, however, is that such refor as may be initiated "belong to the most important prelimina measures of the looming new regulation of Customs arrangemer and treaties of commerce," and will probably involve a readju ment of duties on many import and export articles.

Our Lamp Imports and Exports.—Commenting the English Customs statistics for July, the *Elektrotechnis Zeitschrift* remarks that the only items calling for comment a the imports of glow lamps, which have shrunk to the extent of 25 p cent., so that the imports in relation to the total consumption a now quite insignificant. That the exports of glow lamps are inconsiderable, arises from the fact that most of the English met filament lamp works are only licensees of German manufactori and therefore are unable to export.

Russia.—A St. Petersburg cotton spinning mill manag who is at present in Farnworth (Bolton) on a holiday, informe correspondent the other day that the owners of many cotton mi in St. Petersburg are contemplating adopting electric driving in t near future, and are making inquiries of English firms respecti cost, &c. The manager in question has been shown through one the electrically-driven factories in the Bolton district, and express himself satisfied with what he saw. The great mills of Mess J. & P. Coats, the famous Scotch thread firm, in St. Petersbu are electrically equipped.

The Constantinople Electrical Syndicate.—It announced that the meeting to formally constitute the Belg syndicate or trust—the Consortium de Constantinople—will be h at the beginning of October. The board of directors will incl representatives of the Deutsche Bank, the Dresden Bank, the Ori Bank, the Berlin Electrical Enterprises Co. and the Zurich Ba for Electrical Enterprises. The syndicate is to pave the w for the formation of the Belgian company which is to established on the acquisition of the underground electric railw concession for Constantinople. The capital of the company, whi is only to be raised gradually, is to be divided into three class The first will comprise £720,000 in shares and £720,000 4½ per cent. bonds, and will represent shares in the Constantino Tramways Co. and shares in the Galata-Pera Tunnel Railway The second class will also be formed of £720,000 in shares a £720,000 in bonds, and is intended for the taking over and worki of the concession for the underground railway previously m tioned. In the third case the shares will total £360,000, and t bonds £360,000, the proceeds being for the Ganz electric lighti concession and the gas works. The aggregate capital will amou to £3,600,000.

LIGHTING and POWER NOTES.

Acton.—At the last meeting of the U.D.C. the accounta in reply to a question from Councillor Ince as to what were various purposes for which electricity was purchased by the Cour during the year ended March 31st last, and what was likely to the consumption during the current year, gave the following sta ment: For the year ended March 31st, 1911, lighting, £1,1 heating and power, £547. Estimate for 1912, lighting, £1,0 heating and power, £722.

Argentina.—The Anglo-Argentine Electric Co. is treaty with the Mercedes Electric Light Co. for the purchase its business. The price mentioned is $440,000.—*Review of the Ri Plate.*

The Municipality of Punta Alta (Puerto Militar) has under c sideration an offer of Messrs. Parcus & Co. to establish an elect light station. As the tariffs are considered high, it is probable t a municipal station will be erected.

Australia.—Owing to the great increase in the demand for electricity supplied by the Electric Light and Power Supply Corporation, Balmain, Sydney, it has been found necessary to purchase additional machinery, and a Willans mixed-pressure turbine, with a British G.E.C. generator of 1,000 KW., is to be installed. In the last half-yearly report of the corporation the directors stated that the consumers in Balmain totalled 299 and in Newtown 178, that the municipality of Petersham had entered into an agreement with the company for the supply of electric light and power, and that several large applications for installations had been received. To meet the large extension of the company's area of operations, together with the purchase of additional machinery, an increase of capital had taken place.

The Sydney city electrical engineer, Mr. Forbes Mackay, has submitted an interesting report to the Council, asking a definite expression of opinion on the policy to be pursued by the electric light department. He says: "It is doubtless the wish of the Council that the department should be so conducted as to secure two results—(*a*) that the supply shall be as reliable and as effective for all purposes as practicable; (*b*) that the undertaking should be self-supporting financially. But there are two, or perhaps three, policies, any of which may be pursued, to a reasonable extent, without risk of failing to secure (*a*) and (*b*). No. 1 is to sell electricity at the lowest possible price for all purposes, to extend the mains in all directions, and to push the sale of electricity to the uttermost, not with the intention of making a profit, but for the purpose of helping the manufacturers of the city, and superseding obsolete, dirty and unwholesome methods of lighting and the production of power. No. 2 is to sell electricity at the price which will bring in the largest net profit, to extend the mains only where a remunerative return is certain, and generally to conduct the undertaking as a money-making concern pure and simple. No. 3 is a combination of Nos. 1 and 2. It is to aim at making a profit, but to limit that profit to, say, a definite percentage of the capital expended, the consumers to get the benefit of any surplus in reduced charges, &c." He adds: "I believe that the City Council will make a mistake if any policy but that which I call No. 1 is followed. The benefit to the inhabitants of the metropolitan area of a cheap and reliable supply of electricity will be much greater in value, though less impressive on paper, than the few thousands, or tens of thousands, of pounds per annum which might be earned as profit by selling electricity at the highest price which can be got for it. There is nothing which will more certainly stimulate the growth of Sydney as a manufacturing and business centre than a cheap supply of electricity."

Axbridge.—The R.D.C. has consented to an extension of the area supplied by the Wedmore Electric Light and Power Co. towards Cocklake, by means of overhead wires.

Bexley.—An assisted wiring scheme has been adopted by the U.D.C., which does not apply to less than eight lights. The Council's maximum contribution towards the cost of any installation will be £1 per point, with no charge for supervision of the work of installation, which will include wiring, fittings and the first supply of lamps. The maximum advance under the scheme is £50, and the minimum £8.

Braunton.—The establishment of electricity works by Messrs. Crompton is now definitely assured. The shares in the local company formed have been allotted, and it is hoped that energy will be available by Christmas.

Bury.—The generators at the Chamber Hall power station were coupled up to the mains, to assist the Rochdale Road works, about a month ago, and a regular supply from the new works has since been in daily operation between 8.0 a.m. and 6.0 p.m., with the exception of Saturday and Sunday.

Canada.—The provincial Government of Quebec has adopted a new policy as to water powers belonging to the Crown. In future no such water power will be definitely sold. Twenty years ago these water powers were allotted for nothing. Ten years ago such water powers as the Shawinigan and Grand Mere Falls were sold for $50,000. Now they will not be sold at all, but rented in long leases of 99 years. The Minister of Crown Lands, Hon. S. M. Ollard, has just decided to offer at auction this present month 10 water powers situated in different portions of the province.

The Ottawa Municipal E.L. authority has completed the measurement of the houses in the city, and the new scale of lighting will go in force next month. This scale provides for a flat rate of 4 c. for each 100 sq. ft. of floor space and 3 c. per unit by meter. This will be a big reduction over the former meter rate of 8 c. per unit. The Ottawa Electric Co., which lights, probably, two-thirds of Ottawa has adopted the rates of the municipal authority, thus giving customers the reduced rates. The City of Ottawa is negotiating for the purchase of Chatts Falls water power. This great waterfall is capable of developing 141,000 H.P., and is situated 20 miles from Ottawa. It is probably the largest power in Ontario outside Niagara, and is conveniently situated. It is not probable that Ottawa will ever develop more than a quarter of this power, as she cannot use it. It is intimated that 20,000 H.P. can be developed at Chatts Falls at a cost of $7·80 per H.P. A new street lighting system is being inaugurated in Ottawa, clusters of five tungsten lamps being mounted on ornamental posts placed 100 ft. apart. The property owners pay 5 c. a foot frontage; thus, a 20-ft. frontage pays $1 a month for the privilege of these lights.

Carlisle.—A L.G.B. inquiry has been held at the Town Hall relative to the Council's application for sanction to borrow £9,755 in connection with the electricity works. The amount is made up as follows:—Mains extensions, £5,000; Viaduct Unitarian Church (purchase and adaptation), £3,000; new storage battery, £1,755. Statistics as to the population, rateable value, and indebtedness to the city having been supplied, the officials explained the nature of the proposals, and replied to the inspector's questions. With regard to the item of £1,755, the city electrical engineer (Mr. Allen) stated that the output had increased to such an extent during the past two years that the present battery was totally inadequate to meet their requirements. No opposition was offered at the inquiry.

Carnarvon.—The T.C. has further considered the scheme for lighting the streets by electricity, together with a communication from the National Electric Construction Co., offering to fix along two or three of the main thoroughfares lamps providing 20,000 C.P., or 400 per cent. more than is at present obtained from gas lamps. It was estimated that this arrangement would cost £190 per annum, representing an increase in the rates of about 1d. The Council agreed to accept a scheme for lighting certain parts of the town on the understanding that the cost to the ratepayers does not exceed £100 a year

Chester.—Mr. A. C. Hurtzig, the expert engaged to report on the scheme prepared by the city electrical engineer for utilising the water-power at the Old Dee Weir for generating electricity, has approved the scheme, which he is satisfied will be a source of revenue to the Corporation. Three members of the Electricity Committee have been appointed to confer with the Dee Fishery Board on the project as it affects the interests of that authority. In his report, Mr. Britton stated that the existence of a hydro-electric installation on the site of the Old Dee Mills should not in any way affect the surrounding property or the rights of the Fishery Board. The site is conveniently situated for the transmission of electrical energy, either to the existing mains at the Cross during heavy demands for current, or to the electricity works, where it would be distributed or stored during light demands. The data upon which Mr. Britton made his proposals were based to a certain extent upon tests made of the flow of water by the river authorities and himself. The average flow was taken as 240 million gallons per day, and it was proposed to deal with it by putting down three turbines of 225 H.P. each, which would be capable of dealing with practically 600 million gallons. A capital expenditure of £10,000 is proposed, made up as follows: Two cofferdams, £320; clearing of site, £250: excavations and buildings, £2,000; three turbines, £2,830; three dynamos, £1,600: switchboard, £300; cable to electricity works, £1,500: sluices, £380; strainer racks, £220; pumping during construction, £200; contingencies, £400. In addition, there will be £1,059 operation and maintenance expenses. With regard to the disposal of energy, the great variety of trades and businesses now connected to the electric supply make it necessary to generate current at all hours of the day and night, therefore the almost continuous supply of energy from a plant of the capacity suggested can be disposed of completely. Mr. Britton takes the income from the units supplied by the plant at 1d. per unit, which gives the following financial results: Income, 1,021,490 B.T.U. at 1d., £4,297: complete cost, £1,059; surplus balance per annum, £3,238. If the scheme is approved, application will be made for a loan of £5,000.

Combe Martin.—The P.C. has decided to interview the representatives of a firm of engineers with the view of the electric light being introduced into the parish.

Continental Notes. — AUSTRIA. — The negotiations which have for some time past been under way between the Oesterreichische Union Bank and the Vereinigte Elektricitäts A.G. with regard to the purchase from the former of its generating stations and railway lines have reached a satisfactory conclusion. The latter company, which, as may be recalled, sold its Vienna works last year to the Austrian branch of the Brown, Boveri concern, is now only a trust corporation. It has taken over from the Union Bank the power station at Bielitz, near Knittelfeld; the generating station at Wels (Upper Austria); the electric lines from Teplitz to Eichwald; and the Teplitz Electric Works and railway company, as well as the Bielitz to Zigeunerwald electric lines. In connection with the transfer of these concerns, the Vereinigte Elektricitäts A.G. has increased its capital to 10,000,000 kronen, with a further 5 millions by the issue of debentures bearing interest at 4½ per cent.—*E.T.Z.*

FRANCE.—The city and port of Brest is to be lit by electricity, the Council of State having approved of the contract with this end in view provisionally come to between the T.C. and the Société Electrique. The station will be erected in the commercial harbour.

The Compagnie Electrique du Midi has under consideration a combination whereby 27 rural communes and thermal establishments in the Cantons of Olette, Mont Louis and Saillagousse, in the Eastern Pyrenees, which have made applications for an electric service, may be supplied from the company's station at Cassagne.

La Société Douaisienne de Distribution d'Energie Electrique is the name of a new company which has lately been formed at Douai, with a capital of £12,000, to undertake the supply of electrical energy for lighting and power purposes to a number of small towns and villages in the Douai district.

Croydon.—The T.C. has decided to lay a new feeder to the sub-station in Drummond Road for the direct current supply, at a cost of £1,700.

Durham.—The County of Durham Electrical Power Distribution Co. has fitted up an electric villa at Cleadon, a village some three miles to the north of Sunderland, and about the same distance from South Shields. The house has been handsomely furnished and equipped with suitable electric lighting, heating and cooking appliances. A room is set apart for the practical exhibition of electrical cooking, and a "Tricity" cooker is installed.

Ellesmere Port.—The U.D.C. is taking the preliminary steps to obtain an electricity order. Ellesmere Port is a busy little industrial place, now with rather over 10,000 inhabitants, which has sprung up at the junction of the Shropshire Union Canal with the Manchester Ship Canal. The Shropshire Union Co., whose system is leased to the L. & N.-W. Railway Co., has a perpetual monopoly of the gas supply. The charge was for long 7s. 6d. a thousand. It is now 4s., which the inhabitants think compares very unfavourably with 10d. (for power) charged at Widnes, just across the Mersey.

Epsom.—The U.D.C. had a long discussion at its last meeting on a recommendation of the Lighting Committee that it should call in an expert to advise on the installation of a Diesel engine at the electricity works. The chairman stated that the whole of the output could be put upon such an engine, that wages would be saved, and that the L.G.B. favoured it. The recommendation was eventually adopted, but with the addition of the words, "or any other plant." Another motion instructing the electrical engineer to submit an estimate of the cost of installing and maintaining an electric pumping plant at the waterworks, as an alternative to the purchase of suction gas plant, was defeated.

Fife.—Two paper mill installations have been completed within recent months, one at Fettykill Mills, Leslie, Fife, and the other at Dalmore Mills, Midlothian. The British Electric Plant Co., Ltd., Alloa, carried out the work. At Fettykill, three paper-making machines are driven by power obtained from a 600-KW. set coupled direct to a Howden engine. To each paper-making machine is fitted one of the company's patent variable speed motors, thus enabling the speed of the machine to be controlled from 20 to 200 ft. per minute. Variable speed motors drive the super and glazing calenders, and constant speed motors drive beaters. At the Dalmore Mills, a 300-KW. set is installed, with a Howden engine and a surface condenser.

Frome.—Considerable extensions are to be made at the electricity works, consisting of the erection of another cooling tower, the provision of another boiler, and a 300-H.P. reciprocating engine and condensing plant. The object of the extensions is to effect an improvement in the running of the station, and to enable the contractors to supply power to the large cloth mills at Wallbridge.

Herne Bay.—A meeting of ratepayers, called to consider whether the E.L. order shall be carried out by the Council or by a company, has come to no definite decision, but agreed to the matter going back to the Council, with the idea that when other terms have been obtained, another public meeting shall be called. The preponderance of opinion was in favour of the order being carried out by public tender.

Honiton.—The T.C. on Monday sealed an agreement with Messrs. Purvis, of Exeter, for the installation of the electric light in the borough.

Llangefni.—The U.D.C. has decided to enter into a contract with the electricity company for public lighting during the coming winter.

London.—Stoke Newington.—On Thursday night last week the electric light was switched on at the Library Hall by the Mayor, who defrayed the expenses as a Coronation gift.

Manchester.—The competition between the Manchester Gas and Electricity Committees is resulting in a brighter light for the city. The Electricity Committee has come forward with an up-to-date electric arc lamp, which, it claims, absolutely outshines any gas light in existence. In order to give an unprejudiced judgment on the merits of the rival lights, the Electricity Committee on Monday night decided to make a round of the streets before giving a verdict in favour of electric light. It inspected the lights in Piccadilly under a depressing rain, and voted the arc lamp a great success. It walked along Mosley Street and found the high-pressure gas lamps even more depressing; it emerged on Albert Square, where gas and electricity tried to outshine each other, and said that the gas lamps were scarcely discernible. It is intended to have a test made of the two lights as regards cost and illuminating power, with the object of putting the respective advantages and disadvantages of the rival lights before the City Council. Councillor Kay, late deputy-chairman of the Electricity Committee, has been appointed Chairman of the Gas Committee, and Councillor Dagnall has been elected deputy-chairman of the Electricity Committee.

In Albert Square 16 of the 6-ampere enclosed arc lamps have been replaced by a similar number of 10-ampere "Metroflam" arcs by Messrs. Johnson & Phillips. The height of the new flame arcs is 22 ft. 6 in. from the ground level, against the 17 ft. of the existing arcs. The maximum C.P. emitted by each of the new "Metroflams" is not less than 2,500, against 850 C.P. of the older lamps, so that there is an increase of 35,000 C.P. in the aggregate lighting of the square, which has greatly improved the illumination. In Portland Street central lighting has been adopted as far as possible by means of arc lamps suspended from duplicate cross-span wires, attached to rosettes fixed on the front or corners of the buildings. Where this course has not proved feasible, side poles with long arms are fixed so as to bring the lamp central with the street. Provision is made by means of tightening gear for the raising or lowering of the lamps to suit the best conditions for illumination. The maximum candle-power of each of the lamps is not less than 3,000.

Merthyr Tydfil.—The Electric Traction Co. has informed the T.C. that it has decided to embark upon an extensive scheme for the development of its system. A main feeder is to be run along the mountain top to Treharris and district, and by this means it is hoped to supply current to Bedlinog. The T.C. has approved of the scheme, which will now be laid before the B. of T.

Plymouth.—The Works Committee of the B. of G. has decided to have the laundry lighted by electricity instead of by gas.

Sowerby.—The P.C. has accepted the tender of the Northern Counties Electricity Supply Co. for lighting 74 lamps for three years at £105 per annum.

South Africa.—Owing to faults constantly occurring on the present arc lighting cable, which is of the lead-covered type laid direct in the ground, the Johannesburg electricity department proposes either to renew the cable entirely or to discard arc lighting altogether, and lay new cables for lighting the town with metal-filament lamps The first scheme would require approximately 44,000 yd. of cable at an estimated cost, including laying, of £4,800. The second scheme, including 400-C.P. lamps, is estimated at £8,379. In the comparison of the annual cost, there is an advantage in favour of the second scheme of £1,214, the figures being—present arc lighting £10,300, proposed metallic-filament lamps £9,086.

West Ham.—The electrical engineer reports that in accordance with the instructions of the Electric Light and Tramways Committee, he continued his negotiations with the London District Secretary of the Electrical Trades Union, with regard to their complaint that the Council were not observing Trade Union conditions with reference to certain classes of workmen engaged in the electricity undertaking, and that he has settled the whole of the points in dispute. The Committee reports having settled the claim of the Rowland Hill Permanent Building Society, by the payment of the sum of £275, including costs, without in any way admitting liability, for injury done to certain houses belonging to the society in Tucker Street, and other loss of rents due to an alleged nuisance arising from the generating station at Canning Town.

Whitworth.—At a special meeting of the U.D.C. on the 22nd inst., Mr. G. R. Peers, consulting engineer, of Manchester, was engaged to prepare a report and scheme regarding the carrying out of the electric lighting provisional order obtained by the Council some time ago.

Widnes.—Electric lighting is to be installed in the public library at a cost of £86.

Windsor.—Electric lighting is being installed at Cumberland Lodge, the Windsor Park residence of T.R.H. Prince and Princess Christian of Schleswig-Holstein.

Wirral.—When the Wirral Joint Hospital Board decided upon a scheme for the electric lighting of the hospital at Clatterbridge, it obtained the assistance of the Hoylake and West Kirby U.D.C.'s electrical engineer in the preparation of the scheme. It was reported at the last meeting of the Hoylake Council that the Hospital Board had applied for the electrical engineer to supervise the installation, and the Electricity Committee recommended this. Mr. Case thought they were not quite doing the right thing, as this should be given to a private firm, and he protested against the introduction of this method. Mr. Little pointed out that the engineer having made certain suggestions tending to economy as well, they thought he should finish the work. By a majority, the recommendation was approved.

TRAMWAY and RAILWAY NOTES.

Bingley.—At a meeting of the U.D.C. held last week, a deputation was appointed to discuss with the Bradford Tramways Committee the suggested extension of the tramways from the present terminus at Nab Wood to Crossflats.

Blackpool.—Remarkable figures were presented to the Tramways Committee recently, the quarterly report showing gratifying increases all round. Compared with last year, there was an increase of over a quarter of a million passengers carried (265,431), an increase of 3¾d. in the receipts per car-mile, and the total receipts of £12,237 showed an increase of £2,247. The total number of passengers carried was 1,704,832. From April 1st to September 13th the total number of passengers carried was 6,895,955, an increase of 963,403. The total traffic receipts were £46,421, an increase of £6,137, and the receipts per car-mile had jumped up by 3d.

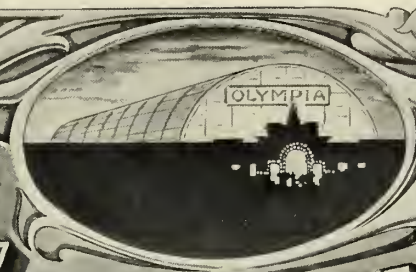
Bolton.—The Darcy Lever Committee has had before it plans prepared by the borough engineer, showing a proposed extension of the tramway from the present terminus to Hacken Lane. Consideration of the matter was deferred.

Doncaster.—The Tramways Committee of the T.C. has decided, by seven votes to four, not to run a service of cars on Sundays.

(*Continued on page 521.*)

Electrical Exhibition

Olympia, 1911.



The Inaugural Banquet.

The anticipatory dinner which took place on Friday evening last was thoroughly enjoyable, and we hope that its success may prove a happy augury for that of the Exhibition to which it owed its origin. There were about 170 guests, including, of course, most of the leading organisers of the undertaking; the entertainment provided was in all respects both ample and excellent, and the party did not break up until a very late hour. The President (Sir W. H. Preece), we are happy to say, appeared to be in excellent health and spirits, although, as he confessed, he attended the dinner in opposition to the advice of his medical adviser and his family

After the loyal toasts, Sir Albert Rollit proposed "Success to the Exhibition," in characteristic style, producing quite new stories from his inexhaustible stock of jest and anecdote. He paid a well-earned tribute to the public services of the President, and eulogised the science of electricity as one of the most universally useful agencies known to mankind. Exhibitions, he said, were a most convenient mode of advancing industry, and stimulated honourable rivalry. No more appropriate site could have been found, for it was from Olympus that Jupiter hurled his thunderbolts.

In his reply, Sir W. H. Preece referred to his connection with previous electrical exhibitions, and said that on January 1st, 1912, he would celebrate his diamond jubilee as a civil engineer, having spent 30 years in private work and 30 years in the service of the State. Seeking health in South Africa, he had seen in Johannesburg the energy and vigour of the British engineer, and was convinced that we were well ahead of our competitors in scientific progress. He made the interesting announcement that Lady Kelvin would shortly present to the Institution of Electrical Engineers a bust of Lord Kelvin. Referring to the approaching ceremony, Sir William expressed his admiration for the work done by Mr. Butler, the chairman; Mr. Hawes, the secretary; and Mr. Benjamin, the organising manager, in the preparation of the Exhibition.

Proposing "The Electrical Supply Authorities," Mr. Hirst said he was satisfied that this Exhibition was going to be a bigger success than any of its predecessors. These exhibitions were largely due to the initiative of the supply authorities; they succeeded in 1905, did better in 1908, and would now put previous results in the shade; but what of future exhibitions? He threw out several interesting suggestions calculated to attract the public, and to render



The Official Opening by Sir William Preece.

the next exhibition unique. For instance, they should try to make the hall a sea of light; they might divide the show not into individual stands, but into great specialised departments for lighting, power, &c. Our central stations, he claimed, were far in advance of any abroad, and the manufacturers were indebted to the supply authorities for their broad-minded assistance and encouragement. The thirteen London companies had formed a community of interests, of which Mr. Walker was the most able organiser, and they had joined in an exhibit which, he thought, would please them all, thanks largely to the excellent services of Mr. Peach; it would be one of the most interesting of all the exhibits. Alderman Pearson, also replying, said that municipal men were not so anxious for cheapness as for excellence of design, and they did not grudge manufacturers a fair profit.

As the chairman had to leave at this stage, Mr. Butler proposed his health, which was accorded with musical honours.

Mr. F. H. Nalder proposed "The Press," and Mr. T. E. Gatehouse replied; and lastly, Mr. W. M. Mordey toasted "The Visitors," for whom Mr. A. Siemens and Sir Hiram Maxim responded.

Saturday's Opening.

As had been anticipated, the ceremony on the opening day was quite a formal affair. To the public the doors were thrown open early on the Saturday morning, but those who visited the Exhibition before two o'clock, in the hope of seeing things in a complete form, would find it necessary to do as the first five outsiders—members of the fairer sex—were compelled to do. You cannot equip a modern exhibition as the ancient Israelites are reported to have built a temple, without the sound of hammer, saw or plane. Hence, some things being not altogether completed in the hall, these ladies, who, perhaps, hoped to see the Electric Home ready for their early visit, and expected to find a quiet hum or a soothing silence beneath Olympia's dome, retreated in fear of the carpenter, the fitter and the floorcloth layer, demanding their money back (to use the words of Sir William Preece) and receiving in lieu thereof new tickets for admission on another day. Some exhibitors seemed to us to have left far too much to be done at the last moment—it were needless now to inquire the reason, but it passes our comprehension why stands that had been arranged for months before were not in a more forward state. The joint electricity supply stands were conspicuous for their nudity and namelessness. However, it is little use expressing regrets now, for nearly a week has passed since then, and by the time these lines are in print everything will be in a perfect state, and remain so until the close on October 21st. At a little after two o'clock, members of the Executive Committee and others assembled near the main entrance, and as these later betook themselves down the main avenue, toward the small platform from which Sir William was to pronounce the Exhibition open, exhibitors and attendants gathered from all directions. Sir Wm. Preece addressed a few sentences to those about him, in the course of which he said that he proposed to ask the Institution of Electrical Engineers to hold a meeting at Olympia some two or three weeks hence, and he would then give them an address on the lessons that they had learnt from the Exhibition. He had now completed—or would do so at the end of this year—60 years incessant service in civil engineering, in that branch which was called electrical engineering. He had this record among them—that during his lifetime he had witnessed the birth of every single development of industrial electricity, and had taken an active part in connection with all of them. Therefore, he hoped that from what he saw around him, and from what he would learn, he would later be able to say something that would not meet with their disapproval. He then formally declared the Exhibition open.

Mr. H. W. Butler, as chairman of the Executive, called for three cheers for Sir William for kindly opening the Exhibition, and these having been given, plus one more because everybody felt like it, the company dispersed to their own or other people's stands.

"Honour to whom," &c.

With justice Sir W. H. Preece, at the inaugural banquet, commented upon the admirable and painstaking work done by the indefatigable organisers of the Exhibition. While the labours of Mr. Benjamin, the organising manager, and Mr. Hawes, the ubiquitous secretary, from their nature could not be concealed, the assiduous attendance of the chairman, Mr. Butler, at headquarters, and the immense amount and value of the assistance that he rendered to his colleagues, are known to but few. Mr. Butler has, in fact, been a tower of strength to the promoters, and has unobtrusively accomplished Herculean tasks, devoting almost his whole time to Exhibition matters. Mr. Bell, too, electrical engineer to the Hammersmith Borough Council, has been burdened with an immense amount of responsibility and manifold worries and anxieties, which he has cheerfully borne with patience and courtesy. He has on this occasion broken all records, having provided no fewer than four different systems of supply of electricity to the exhibitors, as detailed in our last issue. It is interesting to note that Mr. Bell was in charge of Ruston Proctor's exhibit in the first Crystal Palace Exhibition, and he, of course, supplied the energy for the 1905 show at Olympia, as well as for the present one.

The Present Position of Electric Heating and Cooking.

[COMMUNICATED.]

The attention of the electrical world is at the present moment fixed upon the Exhibition at Olympia. The attention of our friend the enemy will doubtless also be claimed to a certain extent by the same event. That the non-technical public will be attracted goes without saying, for it has been found over and over again, in many large centres of population, that an electrical exhibition has about it a subtle fascination that proves irresistible to the layman, whether a user of electricity for domestic or business purposes or not.

The present exhibition affords a splendid opportunity for everyone to observe the great strides that have been made since the exhibition in 1905. At that time the metal lamp was slowly being brought towards perfection. Flame arc lamps were a pleasing novelty. The application of electricity for motive power was already fairly well advanced, though the magnitude of the work now undertaken by electrical means was only vaguely forecasted.

Electric heating existed; there were radiators of several kinds, and the well-to-do citizen could afford to run one at odd moments in his bedroom or drawing-room. A few hotplates, irons, kettles, jugs, and the like, were to be found They were regarded with a polite and rather sceptical interest, as a freakish excursion of some enthusiastic electrician. Electric cooking might come in the very vague future, it was thought, but no one placed much faith in it either from the consumer's point of view, as a useful household aid, or from the electricity supply point of view, as a useful means of improving the load curve.

It will be both useful and interesting to survey the position which the application of electricity for the purposes of heating and cooking has now reached.

The only principle which is nowadays considered of any importance from the practical point of view is that of heating by resistances. Formerly the arc was applied for heating small crucibles, flatirons, cigar lighters, brands and so on, but the arc system is now only in use for large industrial purposes. The high temperature, and the necessity for skilled attention, made it useless in the domestic sense. Water was sometimes boiled by the passing of an alternating current through it, but the presence of chemical action rendered this method useless. This system is also used industrially, where an alternating current of electricity

is passed through a molten salt, such as barium chloride (for high temperatures) or calcium chloride (for lower temperatures). Such a hot salt furnace is used for hardening tools. The principle of induction heating, where there was a coil used as a primary winding, and around the coil there was placed a short-circuited secondary, is nowadays confined to certain kinds of furnaces for industrial work. Most of these systems are only applicable on alternating circuits, whereas the resistance system can be used for both alternating and continuous currents. Its universality of application is one of the many arguments in its favour.

The well-known radiators for heating rooms, which can be procured in so many forms and at all prices, are examples of resistance heating. On the Continent of Europe several large firms use central heating systems worked electrically. Fresh air is drawn in from outside, cleansed, and blown through pipes to the ventilators of the various rooms to be supplied. In the ventilators are placed electric heaters, so that the air supply can be regulated as to amount and temperature in the simplest possible manner. It is clearly a great advantage, not possessed by any other system of central heating, to be able to control each room individually.

In large offices and packing rooms electric sealing-wax heaters are frequently used. Lead pots, glue pots, soldering irons, stamps and brands are all largely employed. Printers often use electrical means for warming lithographic presses. Laboratories use the same means for obtaining a constant temperature for heating bodies. Many laundries are equipped throughout with all kinds of irons electrically heated. Electric bedwarmers will prove very acceptable now that the colder weather is coming, and they are largely used both in private houses and in hospitals. In hospitals there may also be found sterilisers and inhaling apparatus electrically heated, as well as incubators for germ culture. The ripening of fruit may be carried out electrically. The minor applications of electricity for heating, as for shaving pots, curling tongs, heaters, and other little devices tending to the increase of personal comfort are almost too numerous to mention. Many hairdressing establishments use electrical means for producing a current of hot air for drying. When this method is compared with the old dangerous plan of placing a lady's tresses in a gas-heated box, or of applying a hot flatiron to them (in domestic seclusion, this), or of sitting too close to the fire, its advantages are obvious.

Whatever be the purpose for which heat is required, that heat may be produced electrically. The advantages of this course, in the direction of cleanliness, convenience and improved hygienic conditions, are so numerous, and have been set out so often, that their very mention causes restless and futile indignation in the breasts of our gas friends. Of course, we are all aware that the only way to be healthy, clean, cool in the hot weather and warm in the cold, as well as to be wealthy and wise, is to keep the gas burning all day long in all the rooms. The method seems, however, to be lacking in popularity, and possibly those who urge it are a little lacking in—let us say—sincerity.

The use of electricity for heating is frequently attended by the possibility of a reduction in the number of servants, and consequently in the cost of household management. When it is used for cooking this possibility is still more prominent, and there are several avenues through which economy may be effected.

The design of apparatus for cooking food electrically has latterly received a good deal of attention. It may fairly be said that there are two schools of thought in connection with this subject. The one says : "We must proceed on the lines of the gas cooker." The opinion of the other is that we may usefully embark upon methods of our own.

It would be foolish to deny that the gas stove was a considerable advance upon the coal fire for cooking. Further, the coal kitchen range was much better than a pot hung from a tripod over a fire in the middle of the floor. However, the gas oven does not represent the last word in convenience, and a glance at the technical considerations involved may help us to form a conclusion on the subject.

The object to be attained is the production of the right amount of heat, and its direction to where it is required, with the avoidance of all unnecessary waste by radiation, convection and conduction. Conduction can be provided against by suitably insulating the heating element. Radiation and convection losses may be minimised by a little thought.

When we carried out experiments in the college laboratory in which the use of calorimeters was involved, it was necessary to provide against loss of heat by radiation. The means adopted was to polish the outside of the calorimeter. A bright, light-coloured, shiny surface does not radiate heat. A dark, rough surface gives up heat in this way to a considerable extent. If we attempt to minimise this loss of heat by lagging, we greatly increase the mass of material involved, and all this material must be heated before cooking can proceed. What is required is the minimum of mass to be heated, with adequate protection against loss. If these conditions can be fulfilled, electric cooking enters the realm of feasibility. They can be fulfilled, and are fulfilled, by certain cookers.

Much has been heard during the past few months of paper bag cookery. The advantages of this system are quickness and certainty of operation, and reduction of waste. When a joint of meat is cooked by means of gas or coal, it must be taken as certain that from one-quarter to one-third of its weight is lost by evaporation. With electric cooking this loss of weight is reduced to less than 5 per cent., or one-twentieth. Possibly a combination of the two systems, wherein food would be cooked in paper bags in electric ovens, would enable still better results to be obtained.

Grills, toasters, steamers, kettles, jugs, and other isolated utensils for cooking may be obtained, each containing its own heating element. Greater efficiency is claimed for apparatus of this kind, but experience has proved that there is very little in the contention, while the first cost is increased. Further, the attachment of special connections to each separate piece of apparatus is not so convenient. To a certain extent it is necessary to develop along established lines, and to contrive that any modifications shall increase the convenience of using, instead of placing fresh difficulties in the way.

The coal kitchen range has a large area upon which pots and pans may be placed, and when they are sufficiently heated, they are drawn aside a little way. There is no necessity to take them right off, or to alter the fire in any way, or to operate any switch, or to pull off any flexibles or plugs. In electrically heated cookers, one or other of these operations is necessary. Here is a direction in which, by a slight modification, convenience of working could be increased, and it may be commended to manufacturers for their consideration.

Results are now obtainable, and have been published, of tests of electric cooking apparatus which have been carried out over extended periods. When the reduction of waste is considered, together with the increased convenience, absence of smell and matches and other unpleasantness, it is found that electric cooking is no longer a luxury for the few, nor an interesting toy, but a practical every-day possibility for the man of moderate means.

The development of electric heating and cooking is of great importance and advantage to everyone. The consumer benefits, as has been indicated above, by the increased convenience and decreased trouble and expense. The central station benefits by the improvement of the load curve and consequent bettering of financial results. As the load factor is increased, so the output goes up and the cost goes down. This is being increasingly recognised by the reduction of the price per unit for electricity supplied for heating, in many towns.

Electric bath cabinets are installed in many public baths in the larger towns, and their use is extremely beneficial. They have the advantage over the ordinary Turkish bath that one does not breathe a vitiated atmosphere, while the perspiration is considerably more copious. The cost of operation of a large cabinet amounts to less than 1d. per bath.

Enough has been said here to show that the development of the application of electricity for heating purposes has made great advances. It is a matter for everyone's consideration nowadays. The question is no longer—"Can I afford to have electric heating for my rooms, my cooking, my bath and my hot-water supply?" but "Can I afford to be without it?"

SOME OF THE EXHIBITS AT OLYMPIA.—II.

(The figures in parentheses are the numbers of the stands.)

Simplex Conduits, Ltd. (148, 163),
116, *Charing Cross Road, W.C.*

This exhibit occupies a position in one of the main avenues, and has a frontage of 40 ft., with two gangways; it covers the many lines of electric lighting and power supplies now manufactured by

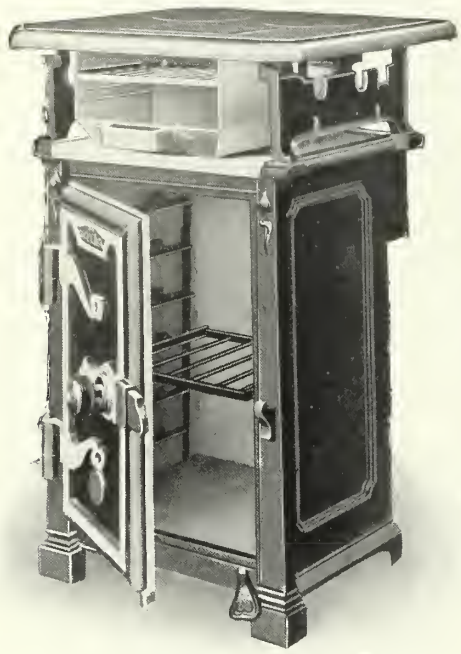


Fig. 46.—Simplex Oven.

the company in addition to their well-known steel conduits. We notice, since the last Exhibition, a great increase in the number of labour-saving accessories available for use with the Simplex system of wiring. For instance, considerable development has been made in the design of porcelain-mounted fittings for junction boxes. Though usually restricted to smaller wires, a number of these interiors are now available for cables up to 19 strands. Fig. 48 shows a switch and light-connecting block for use in circular junction boxes. The merits and convenience of this accessory will be obvious. To render the whole joint watertight, the box may be filled with Chatterton's compound.

The Simplex Co. have specialised on high-grade English-made lighting accessories, paying particular attention to durability and practical convenience. Typical of this class is the detachable "Duplex" ceiling rose shown in fig. 47. The two poles are kept widely apart, and all strain is taken from the flexible and the terminals of the holder and ceiling rose. Wiring may be done wholly at the bench, the pendant being merely plugged into position when the base has been wired to the main circuit. The fitting is specially suitable for heavy pendants and large "Holophane" reflectors in shop-window, factory and similar installations. The weight of the pendant is carried by the screwed metal plug E.

A very exhaustive range of heating and cooking apparatus is on view, from the humble two-pint electric kettle to the electric range capable of dealing with the requirements of 40 people. A smaller oven suitable for an average family of 6 to 8 persons is illustrated in fig. 46, and includes a griller and two boiling rings. The maximum consumption of this apparatus is 25 amperes at 200 volts.

The durability of the company's manufactures is evidenced by a 6-lb. 450-watt iron which has been running continuously at their works from 9 a.m. to 6 p.m. since October, 1910, and has not yet broken down. Irons of from 3 lb. to 18 lb. in weight are made for various purposes.

The company have lately acquired the business of Jesson, Birkett and Co., Ltd., and are now devoting special attention to art fittings of every description. An admirable showroom has been arranged to enable the various products to be exhibited to best advantage.

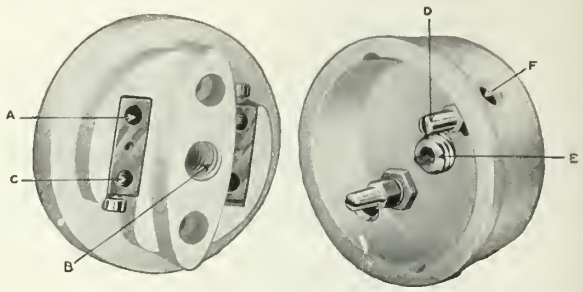


Fig. 47.—Detachable Ceiling Rose.

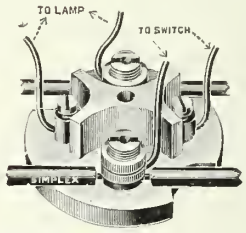


Fig. 48.—Switch and Light Connecting Block.

This room is lined throughout with black velvet, and is so wired that any single fitting can be lighted alone, and thus be seen in its proper aspect among other designs. The special exhibit of Holophane fittings is worthy of very careful inspection.

Electric heating is well represented by a dozen typical examples of the company's manufactures. The apparatus shown is mainly of the cheaper type suitable for middle-class houses, but a few fine examples of more elaborate designs are included in the exhibit.

Ozonair, Ltd. (53, 70),
96, *Victoria Street, S.W.*

The whole of this exhibit is shown in operation, and comprises portable apparatus in various sizes and types suitable for private houses, offices, hospitals, &c.; special surgical and dental appliances; laboratory and research equipment; and various complete installations as used in ventilation, water sterilising, brewing, bleaching and food preservation. The design of these ozone generators is such that the electrodes are kept cool, and no oxides of nitrogen are formed even when the concentration reaches 3 gm. per metre of air; generators placed in service five years ago are still perfectly efficacious. The ozone ventilating system is now applied to the stations and tunnels of the Central London Railway and to public buildings all over the world; in ships' holds and



Fig. 49.—Portable Ozoniser for Sterilising

similar confined spaces ozonised air is of the greatest hygienic value. A water sterilising installation treating 1,000 gallons per hour is shown in operation, and it is important to note that the water is treated three times by the same ozone in three different ways, being economical and complete treatment thus ensured. Ozone now plays an important part in brewing, and the portable apparatus illustrated in fig. 49 comprises a complete ozone plant, with pressure pump, such as is used for sterilising yeast and brewing vessels and pipes. Oils, fats, waxes and other materials can be bleached by ozone with results unapproachable by any other means. The disadvantages of completely freezing foodstuffs are well known; by the use of strongly ozonised air food can be kept indefinitely at 2° to 5° C., and for some time at 15° or even 18° C. Ozone stimulates plant life, and protects it against most parasites and diseases.

Fig. 50 shows a neat design of combined fan and ozone generator for domestic use, and attention may be called to the company's new apparatus for deriving a suitable alternating current when only D.C. supply is available. This apparatus replaces the ordinary converter hitherto used.

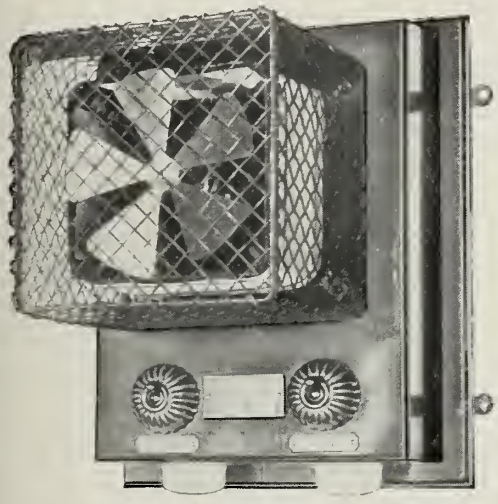


Fig. 50.—Domestic Ozone Generator.

Holmquist Electric Co., Ltd. (225),

52, *Regent Street, W.*

This interesting exhibit demonstrates the ever-increasing application of electrical apparatus to medicinal ends. In fig. 51 we illustrate a semi-reclining electric-light bath which offers many advantages over Turkish and Russian baths. The cabinet is made in sections easily fitted together, and 40 incandescent lamps are arranged in the corners of the cabinet and under the plate-glass couch in such a manner that the entire body is subject to direct rays. The lamps are controlled by eight switches within the cabinet, but accessible from without through a small flap. A 16-lamp sitting cabinet is arranged on similar lines for home use, and various more elaborate equipments (some with arc projectors) are made for hospitals and professional establishments. Combined hot air and light baths are also made by this firm.

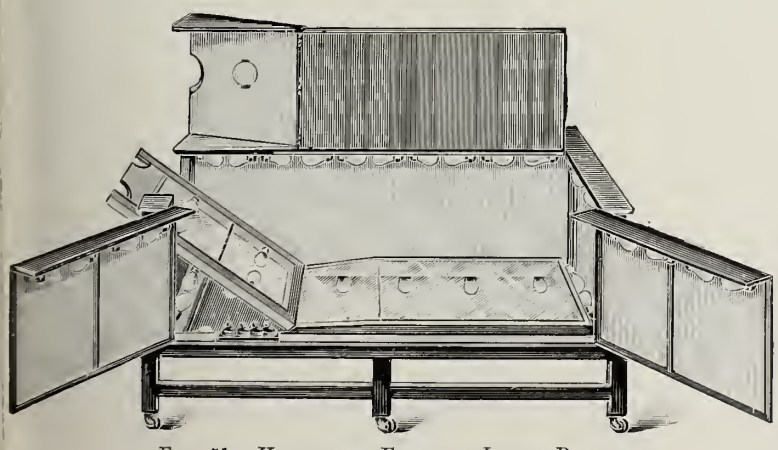


Fig. 51.—Holmquist Electric-Light Bath.

Since 1903 the company has made a speciality of electric vibrators, and one of the most popular models is illustrated in fig. 54. This is a three-stroke machine with seven applicators, and is driven by a ⅛-H.P. D.C. motor; if necessary the latter can be run from a battery of accumulators.

A representative selection of the hot-air douches, hot pads, medical coils and miscellaneous electro-medical accessories completes this exhibit. It should be remembered, however, that the Holmquist Co. also supplies the well-known "Therol" water-heaters and "accelerators" for the same.

Messrs. Eastman & Sons (Dyers and Cleaners), Ltd.; Messrs. Eastman & Warne (236),

241-243, *Acton Vale, London, W.*

A demonstration of electric ironing is given on this stand by Messrs. Eastman & Sons (Dyers and Cleaners), Ltd., who use electrically-heated irons in their own workrooms to give to dyed and cleaned work an excellent finish. The absolute cleanliness of these irons and their freedom from fumes or waste heat are matters of supreme concern in such a business. Messrs. Eastman find that the use of electricity for heating purposes ensures that the work turned out in the afternoon and at the end of the day is fully equal in quality to that done in the morning, and that—as the users work under the best possible conditions—more work is done by a given number of hands than when irons heated in any other way are employed. Some 300 electrically-heated irons are in constant use in the finishing departments of their works, and the cost of maintenance is negligible. Electric irons were first used by this firm in 1901, and were added to from time to time as improved types were available. The experience gained in repairing and rebuilding these irons has been put into the "Hot-Point" irons, which were developed by the engineering staff of Messrs. Eastman in an effort to procure the maximum economy in working, and, particularly, to keep the cost of maintenance at a low figure. This is secured by the use of plenty of heavy gauge wire wound on thin strips of mica, or similar material, embedded in a large number of slots in the back of the heating surface. The weight of wire used in these irons is considerably greater than in other types of iron. The 8-lb. laundry iron has 2,304 in. of wire so wound that over 80 sq. in. of heating surface are in close contact with the sole itself. Every unit of heat put into these irons is utilised for the work. No clamps or other heat-absorbing devices are used. The upper parts of the irons are designed for mechanical strength alone; they are well insulated from the soles, and remain cool. No heat is wasted here. The low stress on the wire ensures freedom from breakdown.



Fig. 52.—"Eadisk" Cooker.



Fig. 53.—"Hot-Point" Iron.

The success gained in Messrs. Eastman's factory has naturally led to inquiries for irons made in a similar manner and of the shapes and weights used for other trades. The officers of the Royal Army Clothing Department investigated the use of electricity for ironing, and after a prolonged trial of several leading makes, and various loadings, placed an order for the equipment of their factory at Pimlico with this firm. Some 25 distinct patterns of flat irons for laundries', tailors', blouse-makers', hatters' and domestic uses are exhibited at this stand. The method of suspending the cord for the irons working on this stand is worthy of notice.



Fig. 54.—Electric Vibrator.

The "Eadisk" cookers shown by this firm (fig. 52) are a development of an electrically heated stove that was made to heat ordinary flat irons. In construction the heating elements take the form of what is practically a solid inlay at least 1 in. in thickness. The 7-in. disk has been run for prolonged periods with a loading of 1,250 watts without any sign of failure. The form of construction makes easy the provision of means of regulating the input of current and amount of heat generated. In the standard 7-in. cooker are two distinct circuits with switches controlling respectively 300 and 600 watts. The low heat is suitable for frying, the medium heat is suitable for general cooking and for heating flat irons, and both heats together are available for boiling water quickly. Any ordinary household utensils, preferably with flat bottoms, can be used on these cookers, which are made in several sizes, from 4¾ in. upwards. An 8-in. disk taking altogether 1,400 watts with seven regulated degrees of heat is made for use as an oven top. The regulation is attained with three ordinary switches, and no complication with series-parallel switches or plugs is entailed. This disk, of course, gets red hot if left in circuit with no useful work being done.

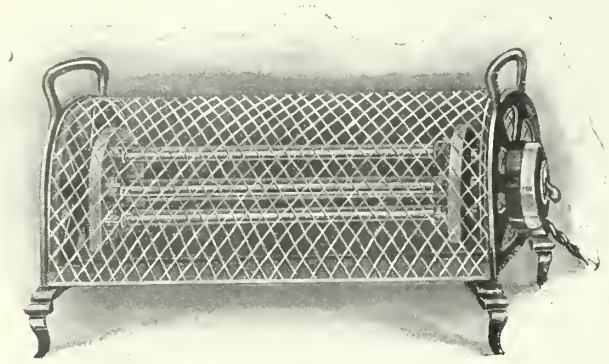


Fig. 55.—Bastian Patent "Quartzalite" Heater, A Type.

Branding-irons made in an exactly similar manner are also shown at this stand. The design is routed in relief from the heated surface, which is made of greater depth in these irons than in the cookers or flat irons. A number of these branders have been in use in various factories for a long time without sign of failure. Soldering-irons made on the same principle are shown in several sizes and patterns. A circulation heater for providing a supply of hot water during the months when the kitchen range or regular heater is not in use, is also shown here. The standard sizes of this heater take 6 to 9 kw., with provision for a switch for each kilowatt loading. If advisable, lower minimum windings can be provided and left in circuit as an all day load. The system of construction patented by Messrs. Eastman & Warne is applicable to hot plates of large dimensions and heavy loadings. A number of plates made under these patents are working with loadings of 6 kw. and 12 kw., under hydraulic pressures of as much as three tons per square inch.

The Bastian Electric Heating Syndicate, Ltd. (173, 190) 91-93, *Palmerston House, E.C.*

This company is showing practically all the various heating and cooking devices operated with the Bastian patent "glower," which, it may be remembered, consists of a quartz tube containing a spiral resistance wire, which is run at a full red heat, and is easily renewed when worn out. In fig. 55 we illustrate the A type, a small and compact device which is suitable for warming a ship's cabin, bathroom, &c. It is provided with a polished brass or iron



Fig. 58.—Calorite Iron on Stand.



Fig. 59.—Calorite Tea-Kettle.

frame, fitted with a wire guard and switch. Of the various other types of heater we select the "Medina" for illustration—so-called because heaters of this type have been installed in the Royal quarters on the P. and O. liner ss. *Medina*, in which our King and Queen will voyage to India in November. This is of the upright pattern, with a neat but handsome exterior (fig. 56). An "Exchange" type heater is shown in fig. 57, which can be substituted for the lamps used in lamp radiators, without alteration to the holders or wiring, and ovens, hot-plates, flat-irons, &c., are exhibited.

The British Thomson-Houston Co., Ltd. (124, 135), *Rugby.*

The chief feature of the B.T.-H. Co.'s exhibit is the well-known Mazda lamp; a complete range of these is shown, from 6 to 600 watts. This is, of course, a tungsten lamp. In this connection, special interest will centre on the new Mazda drawn-wire lamps,

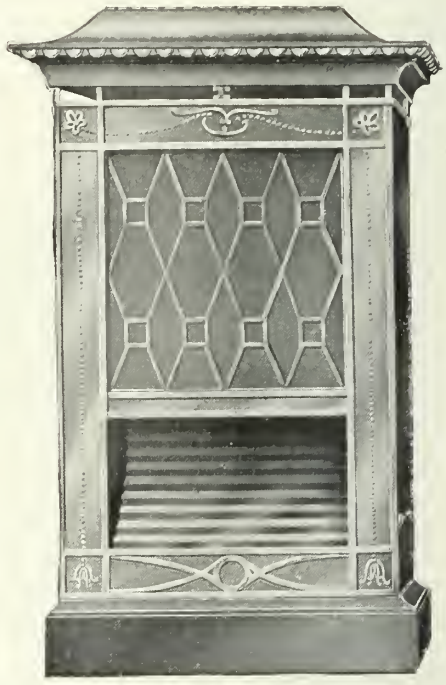


Fig. 56.—"Quartzalite" Radiator installed in ss. "Medina."

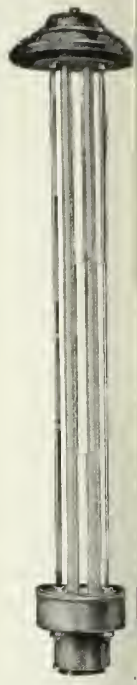


Fig. 57.—"Exchange" Heater.

now shown, we believe, for the first time in this country. Th filament, being made of tungsten wire, is naturally possessed of gre strength and durability, and the opportunity of examining th type should not be missed. It is illustrated in fig. 61. Lamps f lighting trains, tramcars, ships, motor-cars, &c., are shown, as w as B.T.-H. Edison and Gem lamps, and the company has inaugurat a special engineering branch especially for laying out schemes f lighting of every description, and advising clients free of charg which should enable the best results to be obtained. A spec range of Holophane and Mazdalux metal reflectors is shown in co junction with the lamps. A flashing sign at the exit of t

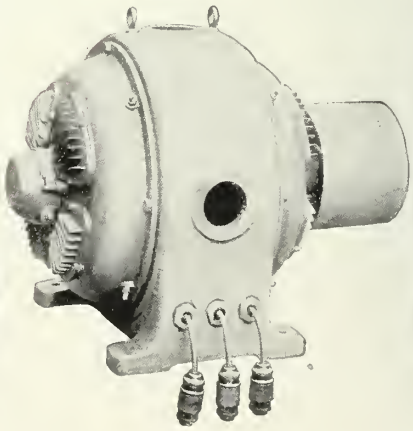


Fig. 60.—B.T.-H. Form K Enclosed Induction Motor, with Flange for Pipe Ventilation.



Fig. 61.—B.T.-H. "Mazda" Drawn Wire Lamp.

Exhibition, 32 ft. long × 3 ft. 6 in. high, which is composed nearly 3,000 Mazda lamps, and shows seven different change wording at 10-second intervals, is bound to claim the attentio the visitor.

Numerous motors made by the company are exhibited; of th we illustrate a form K induction motor with squirrel-cage ro enclosed ventilated with pipe connection (fig. 60). These motors suitable for working under the most adverse conditions, for and damp are wholly exeluded, and the pipe provides for

introduction of clean dry air for ventilation. Polyphase and D.C. motors are also exhibited, as well as a variety of mercury meters and watt-hour meters, motor starting rheostats and switchgear. The cooking apparatus shown comprises kettles, percolators and hot-water jugs; we illustrate in fig. 59 the "Calorite" tea-kettle, which is made of polished copper, and takes 500 watts. The heating element consists of Calorite wire wound on a mica former, enclosed between two cast-iron plates, from which it is insulated by mica disks.

Fig. 58 shows the Calorite flat-iron, which has a similar heating element, closely applied to the sole of the iron, but insulated from the cover by an air jacket.

Finally, the Tirrill regulator, various transformers, arc lamps, circuit-breakers, fan motors and D.C. generators are shown—the whole forming an extremely comprehensive and interesting collection of apparatus.

Messrs. O. C. Hawkes, Ltd. (19, 42),

69 and 70, Aldersgate Street, E.C.

Electric signs form the most prominent item in this exhibit. Many descriptions are shown, including glass-fronted box signs of railway type, ornamental copper *repoussé* window illuminated signs, outside shop lanterns for advertising purposes, lamp letter signs with numerous switching and writing effects, showroom signs, illuminated facias, and illuminated stall boards. The resources of the firm's glass factory at Birmingham enable it to present



Fig. 62.—Hawkes Electric Sign.

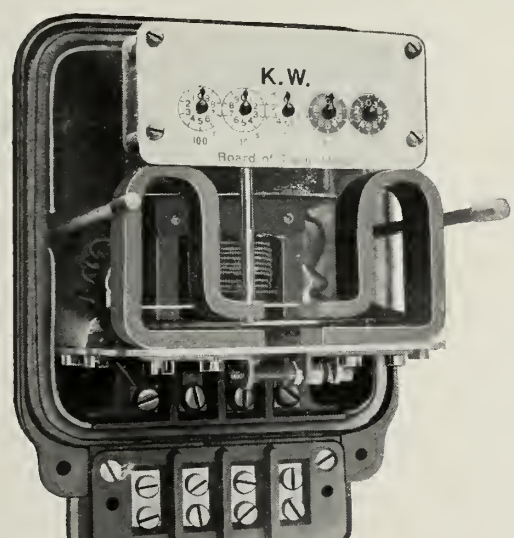


Fig. 63.—Bat Induction Meter.

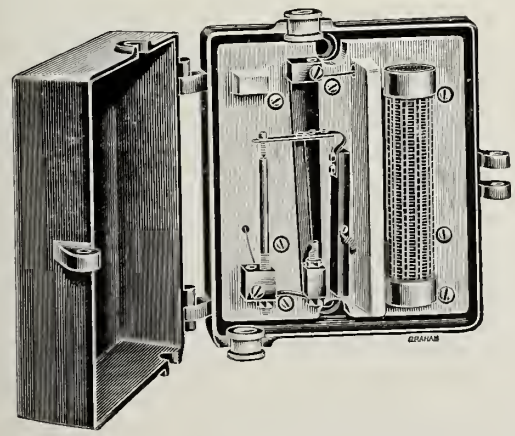


Fig. 64.—N.C.S. Thermal Limiter.

unlimited varieties of glass treatment, and some of the effects shown are novel and attractive. A sign for which economy in light distribution is especially claimed is the gold light letter sign, in which the letter itself is made of incised gilt copper, the light being transmitted through a concealed slot in the core of the lettering. A large facia sign of this type, worded with the name of the firm, is shown connected to a three-way motor switch showing the letters in three colours in rotation. The effect of this is excellent both by day and by night.

The crystalline glass patent is a process by which any artistic effect, even a landscape in full detail, can be reproduced faithfully on glass by specially trained artists. An example of this is seen in an illuminated picture of the Victoria Falls, on the Zambesi, as made for the British South African Co., showing the motion of the water in the Falls. This is a triumph of the glass craftsman's art.

The lamp letter signs are excellently made, every feature receiving special attention. The lampholders are practically weather proof, and at the same time accessible. One of the features of the exhibit is the artistic use of the Cooper-Hewitt lighting sign illumination, this being a line in which Messrs. O. C. Hawkes, Ltd., excel. Messrs. Hawkes, as our readers know, make a strong feature of electric stoves. Many styles of these stoves for heating rooms are shown, and practically every purse is provided for. Their patent induced-draught system of electric heating is employed, with its latest improvements giving easy interchangeability of elements with practically unlimited life. The advantages of the method of assembly is that purchasing firms can stock a design with the certainty of being able to render it available for any voltage at will. This is a new feature of this year's stove, and which, it may be, will encourage provincial buyers to stock for the winter.

The Hawkes patent electric cooking range is shown in practical use, the firm's qualified cook-demonstrator being employed in cooking and generally demonstrating the practical nature of the apparatus. The range can be put down in any kitchen to perform the work of any ordinary kitchen range. The firm also brings before the trade and the public a selection of electric Turkish baths, which are shown with every possible treatment that can be applied in the cabinet bath. The main feature of this bath is that it is designed for home use, and is being now installed in many private houses. It is not designed necessarily for invalids, although naturally used by them to a great extent, but is intended for daily use for healthy people.

Bat Meter Co., Ltd. (83),

3, Eden Street, Hampstead, N.W.

This stand contains a very comprehensive selection of electric meters, including prepayment, two-rate, single and polyphase meters, switchboard and tramcar meters. Among the standard types exhibited, special attention may be called to the A.C. watt-hour induction-meter, type "O" (illustrated in fig. 63); to the D.C. ampere-hour mercury meter, type "H"; and to the watt-hour meter, type "B," suitable either for A.C. or D.C. circuits. Compactness, lightness, strength, simplicity of design and facility for adjustment are the qualities aimed at throughout. The type "H" meter has a starting current less than $\frac{1}{200}$th of full load; less than $\frac{1}{10}$-volt pressure drop, and less than $\frac{1}{2}$ per cent. temperature error for 20° F. temperature variation. Meter "B" is exemplified by a 2,000-ampere instrument. The starting device, enabling accurate registration at $\frac{1}{500}$th full load, deserves special attention; a rocking device gives the brushes just sufficient motion to counteract their constant friction.

The current and potential transformers and the current limitors (the latter consisting of a cut-out with a trembler action, causing the lights on a circuit to flicker whenever and so long as a predetermined current limit is exceeded), are well worth careful notice

Messrs. Nalder Bros. & Thompson, Ltd. (86, 87),

34, Queen Street, London, E.C.

This firm is showing electrical measuring instruments on a large and complete scale, including those required for the measurement of current, pressure, power, power factor, frequency, &c. Exhibits which will be less familiar to most visitors are the N.C.S. thermal limiter and the Telethermometer. In the limiter

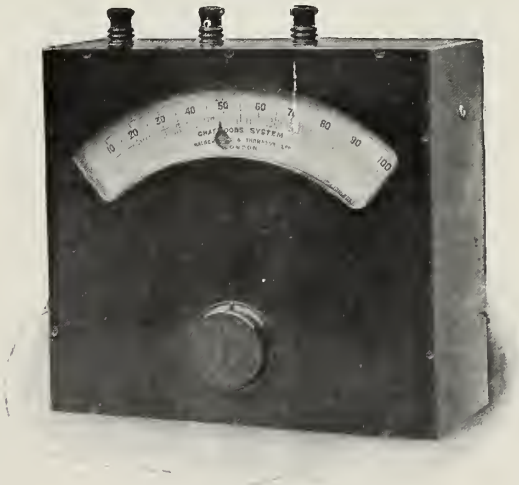


Fig. 65.—The Telethermometer.

the supply current is taken through a steel wire, which, by its thermal expansion, opens an auxiliary contact if the current exceeds a pre-arranged value. The opening of this contact places a resistance in series with the lamps, thus dimming them and reducing the main current flow. The steel wire then contracts sufficiently to reclose the dimming contact, after which the above cycle is repeated. This flickering goes on until the current demanded falls below the limit for which the instrument is set. The Telethermometer enables the determination, at a convenient central spot, of the temperature existing at any place which, for any reason, is difficult or impossible of access; it is thus applicable to cold storage chambers, tanks of liquid, hospital wards and so on. The instrument is built on the Wheatstone Bridge principle: three "arms" are wound with a

wire of practically zero temperature coefficient, while the fourth or variable arm is a coil of copper or nickel wire wound on a former and hermetically sealed in a metal tube. The latter arm is placed at the point, the temperature of which is to be determined. An indicating or recording instrument, calibrated in °C or °F, is used in the "galvanometer arm." This equipment constitutes a great advance on earlier systems of electrical thermometry.

Messrs. Johnson & Phillips, Ltd. (126, 133),

Victoria Works, Charlton.

These stands are illuminated by two circuits of "Metroflam" D.C. and A.C. flame arcs and two "Orb" enclosed D.C. lamps. The "Metroflam" lamps run four in series on 220 volts, and the "Orb" lamps, two in series on the same pressure (A.C. supply is at 50 cycles). The "Metroflam" lamp (figs. 67 and 68) is primarily intended for street, railway and dock lighting installations. The lamp burns about 80 hours per trim, and there are no dark intervals as the carbons change; cheap carbons and the absence of wastage when re-trimming contribute to the low running costs attained. The patent diffusing globe employed is very efficacious and remains unsoiled in use. Differential and shunt coils regulate the D.C. lamp, and, in the A.C. pattern, an induction motor feed is employed. Under contracts with the Croydon and Glasgow Corporations, and the G.C.R. Immingham Docks, nearly 500 of these lamps have been supplied. The standard "Orb" lamp has a single series regulating coil, and is a simple and reliable single and enclosed type lamp; the provision of a synchronous regulator renders it impossible for lamps burning in series to get "out of balance." The "Orb" lamp is supplied for D.C. or A.C. circuits, and is said to compare favourably with metallic-filament lamps; special patterns are made for factory and yard lighting and differential regulation is provided where required.

The cable exhibits include specimens of Messrs. Johnson and Phillips's V.I.R.; paper-insulated, lead-covered; and vulcanised bitumen cables, all of which are too well known to need any detailed mention.

A standard 10-KW. motor-generator set represents the firm's activities in this direction. At 1,000 R.P.M. the generator output is 100 amperes at 100 volts. The construction of this machine is thoroughly representative of modern practice, and a special feature is the provision of self-lubricating ball bearings, needing attention only once in 12 months.

Those interested in searchlights should certainly inspect the fine 24-in. 80-ampere marine projector exhibited. The lamp is,

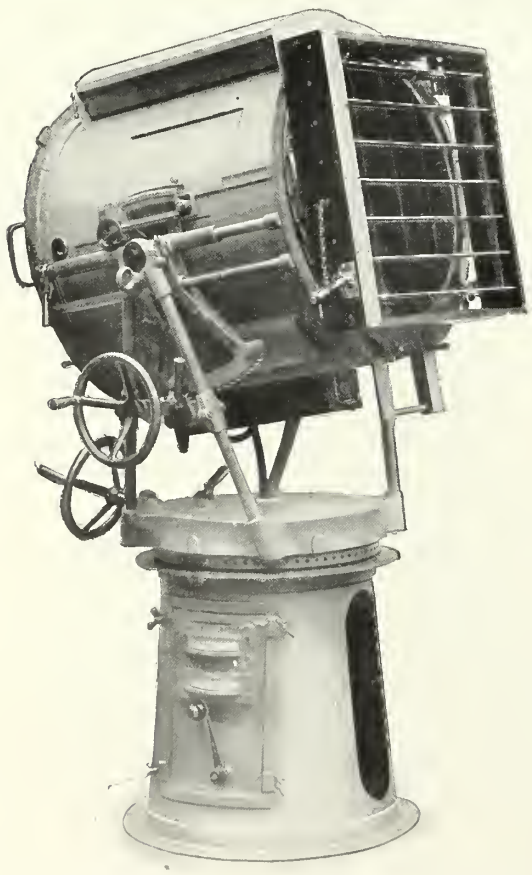


FIG. 66.—SEARCHLIGHT PROJECTOR, MARINE TYPE, BY JOHNSON & PHILLIPS, LTD.

as usual, arranged for hand or automatic working, and every provision is made for the convenient, rapid and accurate manipulation of the whole equipment and the resulting beam. Special attention is paid to the balancing and smooth working of the moving parts, and a venetian flashing shutter fitting over the front glass enables the lamp to be used for signalling. During the Exhibition this lamp will be supplied with current from the motor-generator noted above.

The switchgear exhibits cover practically the whole ground of modern English construction, and include—(1) A standard operating panel and glazed brick cubicle containing a complete remote control equipment for use on 10,000-volt three-phase systems. Oil switchgear is employed, and all the usual measuring instruments and safety and indicating devices are included. (2) A standard 3,000-volt "back of board" type of panel, complying with the latest Home Office Regulations, and suitable for use in central



FIG. 67.—"METROFLAM" FLAME LAMP, EXTERIOR.



FIG. 68.—"METROFLAM" FLAME LAMP, INTERIOR.

station and private plants. These units are very easy of extension, and the whole of the equipment is of Messrs. Johnson & Phillips's standard manufacture. (3) A two-panel low-tension board. One of the panels is a standard 600-ampere tramway feeder panel, the other controls the various D.C. and A.C. circuits on the stand.

In the temporary sub-station supplying current to the Exhibition two boards have been loaned to control the 2,000-volt two-phase supply, and to distribute 220-volt three-phase current to the various supply mains.

Among the smaller exhibits may be noted an assortment of switches and fuses, and fuse and distributing-boards, besides an accumulator-board for country-house and similar installations, and typical service-box, straight-through (colliery) box and crane plugs. A graphite powder limiting resistance for use in connection with horn type lightning arresters presents novel features of construction.

Jandus Arc Lamp and Electric Co., Ltd. (105, 110),

Hartham Road, Holloway, N.

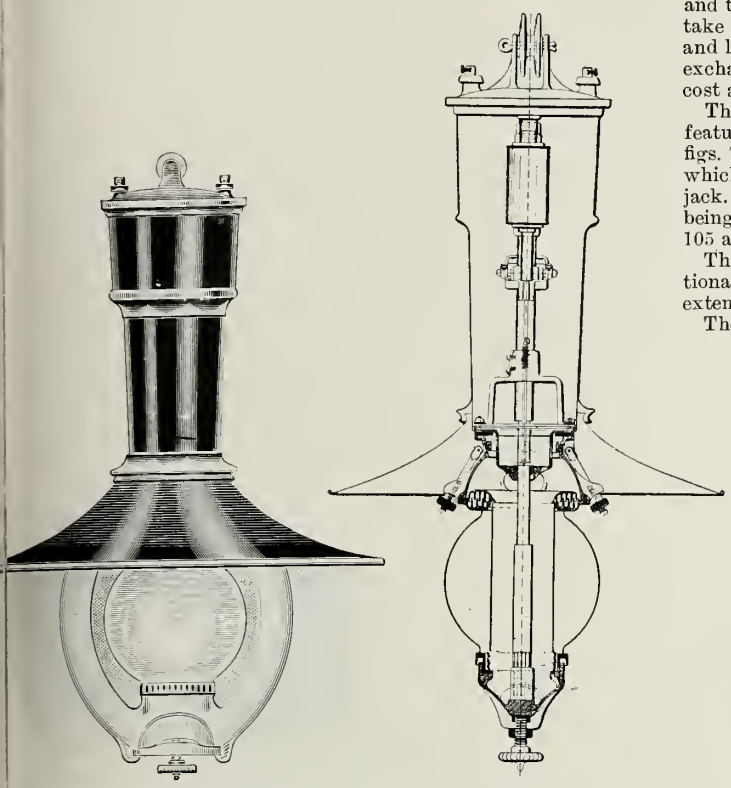
The Jandus patent regenerative flame arc lamp, the fame of which is now world-wide, operates upon a unique principle, viz., the combustion of chemically treated carbons in an air-tight enclosure. The accompanying illustrations (figs. 69 and 70) show the external and sectional appearance of the lamp. The lower framework consists essentially of two metal tubes carrying the inner cylindrical and outer spherical globes. The heated gases from the arc rise to the top of the inner globe and are returned to the bottom of the latter through the external tubes; the gases then re-ascend past the arc and this circulation is continuously maintained. As a result of the enclosure and the regenerative principle, the carbons burn very slowly, one pair lasting 70—120 hours, according to the particular adjustment of any one or series of lamps. Only one pair of vertical carbons is used per trim, and the carbons are mechanically strong and capable of withstanding rough handling.

With a current consumption of only 5 amperes, 4,000 C.P. is emitted in a direction 15° below the horizontal (a most valuable distribution for lighting streets and open spaces). The light possesses valuable fog and mist penetrating qualities and the overall efficiency is nearly 8 C.P. per watt (0·125 W./C.P.). The arc can be adjusted to suit voltages between very wide limits.

Constructionally the lamp is simple and strong; the top carbon having a vertical feed, there is no necessity for any clockwork mechanism. Such mechanism as is necessary is well finished and of substantial design.

The small-consumption regenerative lamp (yielding 1,800—2,000 C.P. at 15° below horizontal, with a consumption of only 250

watts, including line resistance loss), enables enormous economies in current, carbon and labour charges. As compared with the ordinary single-enclosure arc lamp and metallic-filament lamps, the small Jandus lamp shows double the candle-power for half the consumption, and 10 times the candle-power for the same consumption in the respective cases.



Figs. 69 and 70.—Exterior and Sectional Views of the Jandus Arc Lamp.

Visitors to the Exhibition will be afforded special facilities for inspecting the actual manufacture of the regenerative lamp at Holloway.

Western Electric Co., Ltd. (51, 72),

Norfolk House, Victoria Embankment, W.C.

This firm, pioneers in the introduction and development of the central-battery telephone system, are exhibiting telephones and switchboards for small and large central-battery equipments and for magneto-ringing systems. Telephones for residences, hotels and public buildings are shown in operation, and instruments for traction, mining and military purposes are on view. The exhibits also include specimens of lighting power, telegraph and telephone cables, cable laying supplies, fibre conduits, insulating materials, weld-clad copper wire, fuses and metallic-filament lamps. A special display of the improved Blue-bell dry cell for bell and telephone work has been arranged. Special attention may be called to the No. 4,010 Western Electric central-battery multiple switchboard with lamp signalling installed for the G.P.O. as a local exchange in the building and placed in full view of the public; also to various central battery switchboards suitable for use in private exchanges and to a table switchboard, arranged for office use, in which keys take the place of cords. Telephone systems with magneto ringing and local speaking battery are very reliable for private use and for exchanges of moderate size; their simplicity and low maintenance cost are greatly in their favour.

The No. 1,200 magneto-switchboard (fig. 73) has many unique features, among others the combined signal and jack shown in figs. 71 and 72. On operation, the signal displays a red "eyeball," which is restored automatically by the insertion of the plug in the jack. The jack is immediately below each signal, rapid working being thus facilitated. The board illustrated is a 60-line unit; 105 and 210-line capacities are also provided.

The No. 1,800 unit type magneto board is so arranged that additional units can be added as the requirements of the exchange extend, with no further outlay than that of the units required.

The new hexiphone arm may be fixed to either wall or desk. A tubular support carrying transmitter, receiver and switchboard is an integral part of a metal arm 40 in. long, which may be swung in any direction right out of the way, but which is instantly to hand when required.

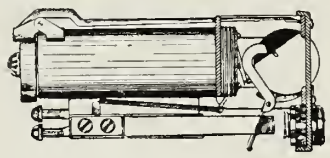


Fig. 71.—W.E. "Eyeball" Signal Operated.

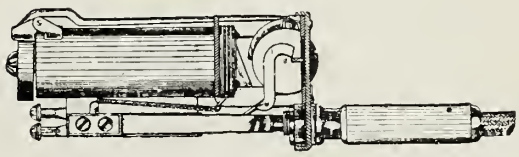


Fig. 72.—Signal Restored.

The "Interphone" illustrated herewith (fig. 74) may be arranged for metallic circuit, common return or central-battery operation on from 5 to 20 lines. Greatly improved button selectors enable the instant and accurate selection of the line desired. The sets are made for wall or desk use, and either may be changed to the other in a few minutes.

The type 40,028 all-metal interphone (up to 12 lines capacity) is intended for installation during the building or redecoration of any building. The back half of the set contains only a terminal strip sunk flush with the wall: the connecting cable is sunk in the wall and connected to the strip. When the building is complete the front half of the set is simply screwed to the back; the case then projects only 1 in. from the wall (see fig. 75). The selector buttons give the ring when pressed right home; when released, the speaking circuit is closed till the next call automatically restores the button. A central battery is employed and a modified pattern is arranged for desk use.

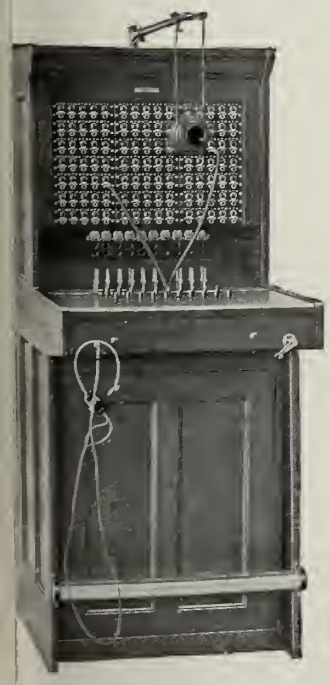


Fig. 73.—Magneto Switchboard.



Fig. 74.—Western Electric Interphone.



Fig. 75.—All-Metal Interphone.

A new farmers' line set is simple to install and exactly meets the facilities lately granted by the P.M.G. The powerful five-magnet generator provided will ring the equivalent of 40 2,500-ohm ringers on a 30-mile metallic circuit of No. 12 B.W.G. iron wire.

In concluding this brief review of a most interesting exhibit, we must note a pocket battery tester (measuring only 3 in. × 2 in. × 3 in. and weighing 4 oz.) and an instrument protector, having a self-soldering heat coil, which can be operated and used over again several times. Through the centre of the coil is soldered a pin with a cogged wheel at the end. A strong spring is hooked to the wheel, and when the coil is operated the solder melts, the pin turns and the spring flies off the cog and breaks circuit.

Foster Engineering Co., Ltd. (191, 221),
Morden Road, Wimbledon, S.W.

The well-known B.E. arc lamp of the Foster Co. is strongly in evidence at this stand. This lamp, burning equally well on A.C. or D.C., singly on 100-120 volts or two in series on 200-250 volts, yields 1,000 C.P. for a current consumption of 5 amperes. One pair

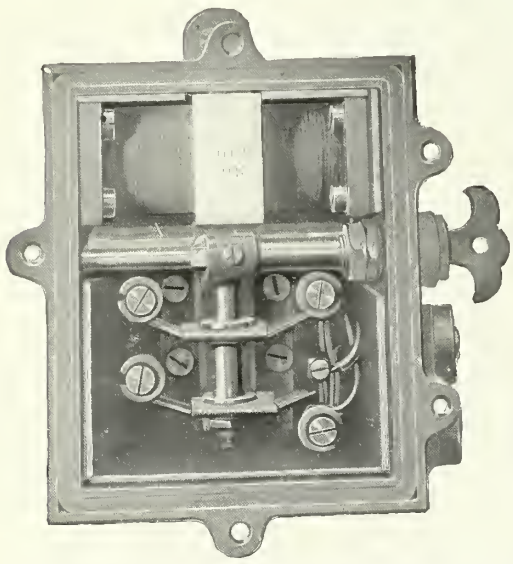


Fig. 76.—Foster Switch. (Cover Removed, showing Interior. Operating Key in Position.)

of carbons lasts 80-100 hours, or in the smaller size 40-60 hours. Messrs. Whiteley's new premises in Bayswater are lighted by over 350 B.E. lamps. Other well-known types are the photo-arc and the "Q" lamp made by this firm; the "Q" downward-feed lamp has a remarkably low carbon consumption. For some time past the Foster Co. have been paying special attention to the design and manufacture of every class of power, lighting and miniature transformer. The examples shown in this department are most creditable, and the portable oil-cooled testing transformer (giving pressures from 200 to 30,000 volts) will doubtless interest mining, central station and cable engineers.

The safety automatic switch and plug illustrated herewith (figs. 76, 77, 78) is intended for use in such dangerous situations as powder magazines, spirit works, &c. The switch is placed outside

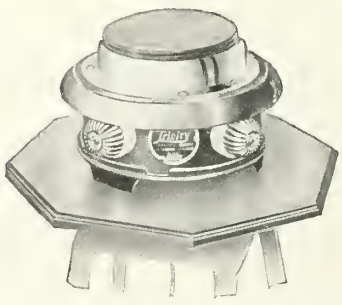


Fig. 79.—"Tricity" Single Cooker.

and the plug and socket together with a portable lead are within the danger zone. The plug cannot be withdrawn while current is flowing, and the switch is automatically opened should a lamp break or a "short" occur. The whole equipment is mechanically strong and perfectly gas and water-tight.

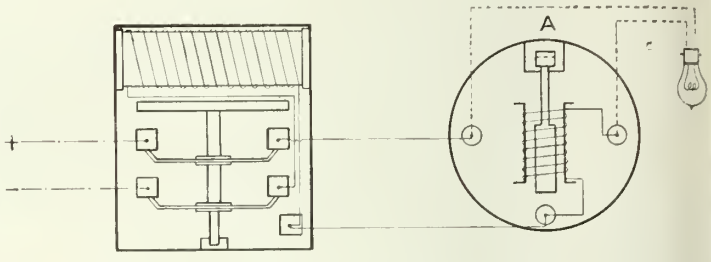
Consumers on A.C. supply will realise some of the advantages at their disposal on inspecting the Foster auto-transformers for lighting circuits, the efficient "dimming" switch (employing a choking coil), and the Foster alternating current bell, dispensing entirely with battery power. The Foster metallic-filament lamp is supplied for every class of lighting, and reliable tests have shown that after 1,000 hours' burning the lamps give more than their original candle-power, and this with a lower power expenditure per candle-power.

H. C. Slingsby (171),
Old Street, E.C.

Mr. Slingsby is again showing a number of his patent trucks and ladders, a selection of about 60 from 1,000 varieties made by him being exhibited. The Slingsby manufactures include patent sliding wheel trucks, "Collron" sack trucks, hand carts, portable and permanent railway material, carrier tricycles, wheelbarrows, platform trucks, castors, roller and ball bearings, steelback patent extension ladders and steelheld extension step-ladders.

L. Hervé (278),
90, *Clerkenwell Road, E.C.*

This exhibit consists of a showcase of samples of all kinds of screws, terminals, stampings and turned-metal parts for the electrical trade. The firm's manufactures are of considerable variety, and large stocks of screws and terminals are kept. Special turned



Switch (Key omitted). Socket and Plug.
A, Locking-bolt preventing withdrawal of plug when current is flowing

Fig. 77.



Fig. 78.—Plug and Socket.

or stamped parts are made to order in all kinds of metal, also in ebonite and fibre.

The Berry Construction Co., Ltd. (30, 31, 312),
29A, *Charing Cross Road, London, W.C.*

A full range of the "Tricity" cookers and utensils manufactured by the company is shown at this stand, comprising a duplex cooker, single cooker, extension cooker, large and small ovens, coffee and hot water

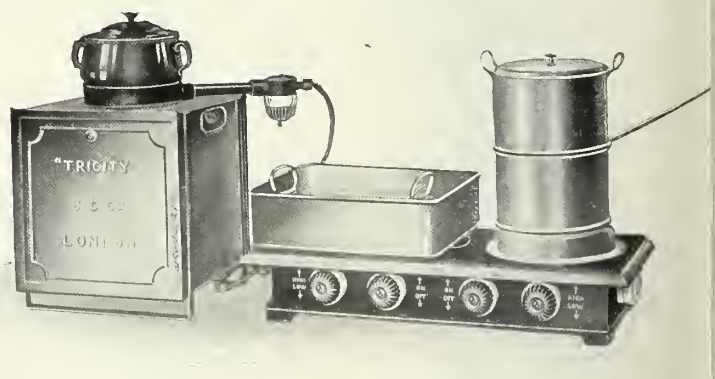


Fig. 80.—"Tricity" Kitchen Range.

urns, grills, flat irons, saucepans, steamers and the special chinaware utensils which the firm have introduced. Fig. 79 shows a single cooker, and fig. 80 a complete kitchen range. Noteworthy features of the "Tricity" system are the extreme flexibility of the apparatus which enables the same heating elements to be used for the various culinary operations, and the consequent saving in energy; the absolute cleanliness of the whole apparatus, the lightness of the oven, which can be brought on to the kitchen table to be scoured and the bright polished surfaces of the oven, which are most essential to get the highest possible efficiency. The great saving in the weight of joints cooked in the "Tricity" oven, by lessening the shrinkage while roasting, has been pointed out in our pages. Frequent demonstrations are given at Stand No. 119D in the gallery as well as in the main hall.

Callender's Cable and Construction Co., Ltd. (196, 219),
Hamilton House, Victoria Embankment, E.C.

Messrs. Callender's exhibit consists principally of assortments of various types of electrical underground junction boxes, which the firm has been making in great variety for a long time past. This portion of the stand contains samples of feeder pillars, both lighting

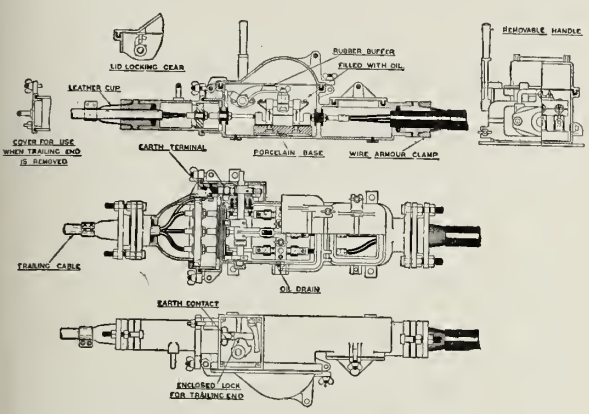


Fig. 81.—Callender Gate-end Box.

and traction, underground network boxes and mining boxes, as well as ordinary service and house fuse boxes.

Fig. 81 illustrates a gate-end box, designed for use in supplying and controlling electrical energy to coal cutters. The provisions

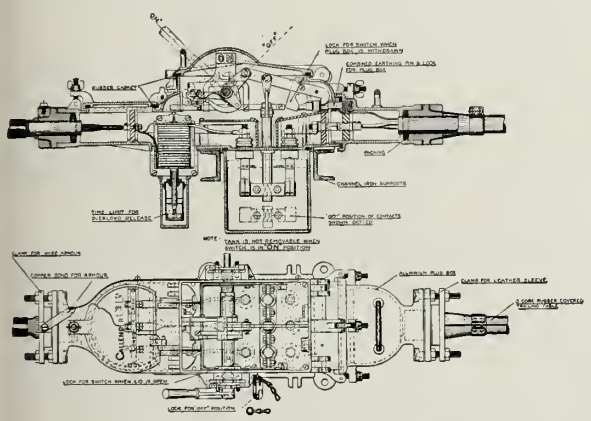


Fig. 82.—Gate-end Circuit-breaker.

made for bonding the various parts and hermetically sealing the box should be specially noted. The whole of the contacts are oil-immersed when in use, and the switch lid cannot be opened or the trailing cable plug removed till the switch is in the "off" position,

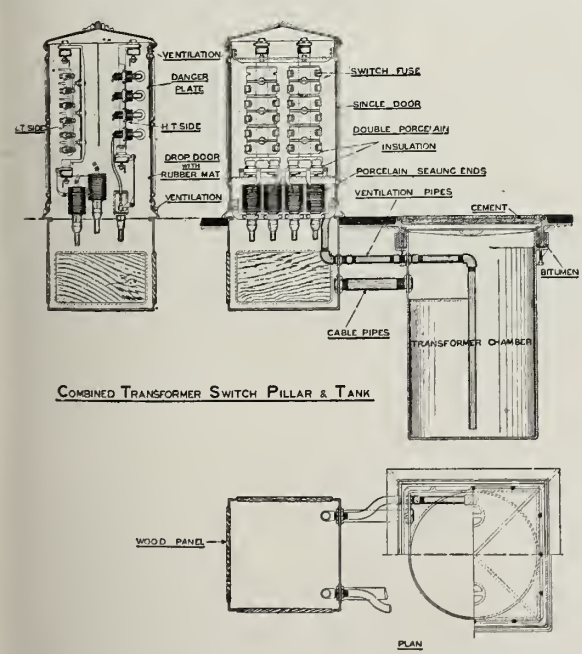


Fig. 83.—High and Low-pressure Switch Pillar.

nor, when the door is open or the plug removed, can the switch be closed. Absolute security of operation is thus secured. A special design of gate-end circuit-breaker (fig. 82) with oil-immersed gravity break should claim the attention of all mining engineers. The trip coil switch can be adjusted to cover a wide range of time limits, and the general construction of the whole is such as to enable easy inspection and repair while absolutely avoiding any possibility of sparking in the open.

A standard cable drum, for the supply of three-phase power to pumps, drills, &c., in sinking shafts, is made for pressures from 600 volts to 3,000 volts, with band brakes and winch or worm feed according to the weight of cable handled. Supply is taken to the inner end of the cable *via* enclosed slip rings on the axle, and sinkings 900 ft. in depth may be thus supplied. For the supply of current to the various levels of a mine from the main shaft cables, the three-way network boxes exhibited, of the Callender mushroom porcelain design, are specially convenient and reliable.

The combined high and low-pressure switch pillar illustrated in fig. 83 forms, in conjunction with the underground transformer tank, a small transforming and distributing station, which should be particularly interesting to engineers in charge of scattered A.C. supply areas. This equipment is far cheaper and more suitable for the development of electric supply in outlying districts, than the more or less elaborate sub-stations hitherto usual. The transformer chamber is protected by a footpath cover and inner lid forming a waterproof combination. Adequate ventilation is carefully provided, and the separation, insulation and general arrangements of the high and low-pressure switchgear are clearly shown.

Another feature of this exhibit is the alloy section. The firm took up the manufacture of alloys some years ago, and have already established a considerable reputation in this connection. Being themselves, by virtue of their electrical business, large users of the metals from which the alloys are manufactured, they are able to offer alloys of all qualities at low prices. This part of their exhibit consists principally of bronzes and anti-friction white metals.

They are also taking advantage of the present opportunity to bring their Kalbitum paint, for use with ironwork for preventing rust and corrosion, more directly to the notice of the public.

Kalanite, also shown, is an insulating material of high quality which can be moulded or turned into any shape, and can also be supplied in sheet or rod form.

For some time past Messrs. Callender's Co. have been manufacturing the "Fors" accumulator for Messrs. Richard Pape, Ltd., and a further section of the stand is given up to an exhibit of these accumulators.

Messrs. Duncan Watson & Co. (60, 63),
62, *Berners Street, London, W.*

The principal feature of this exhibit is an electric vacuum cleaner—a line for which the firm has now become fairly well known. The machine takes from 150 to 200 watts, runs on ball-bearing castors, and is suitable for residences of any size. The cleaner is shown in operation, and suitable illustrated booklets are, of course, available for the visitor. There is also shown a complete electric lighting plant with oil engine, dynamo, switchboard, and section of storage battery. The plant is shown running, and particulars are given in an illustrated leaflet as to the cost of plants from 1½ H.P. upwards. The stand itself was designed and



Fig. 84.—Duncan Watson Vacuum Cleaner.

built at the firm's own works in Marylebone, and consists of two pillars supporting a handsome and substantial signboard, on the top of which, fixed on a pedestal, is to be found one of the vacuum cleaners slowly revolving on a ball-bearing platform, driven by a small electric motor. On the signboard the name of Duncan Watson & Co. is written in small lamps. The decorations are in white and gold. In the centre of the stand an electric fountain plays continually. The stand is outlined with substantial brass pillars, while within the pillars rows of flowers in pots fixed in metal trays give a charming finish. Cartoons are shown of a country house lighted electrically, and also of a maid using the vacuum cleaner.

Messrs. Vickers, Ltd. (235, 241, 310),

River Don Works, Sheffield.

The exhibit prepared by the electrical department of this well-known firm consists of a 300-KW. Vickers rotary converter, six-phase, 50 cycles, running at 750 R.P.M., giving 220 volts on the D.C. side and 160 volts on the A.C. side, complete with starting

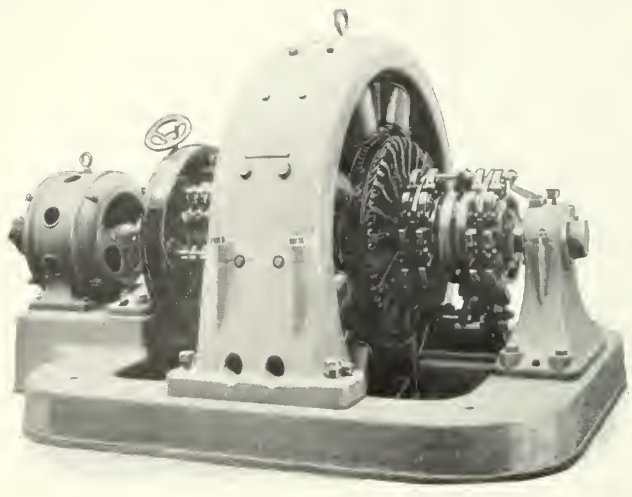


FIG. 85.—VICKERS 300-KW. ROTARY CONVERTER.

motor and switchgear. A similar machine is illustrated in fig. 85. The rotary can be seen at work, in a sub-station at the Exhibition. It is controlled by a three-panel switchboard made by Messrs. Ferranti, Ltd., and current is supplied to it by means of a transformer wound for 160 volts six-phase, to 650 volts three-phase. The transformer was made by the British Electric Transformer Co., Ltd.

In addition to the foregoing rotary converter, Messrs. Vickers are showing an imposing collection of various types of electrical machinery, switchgear and lighting, cooking and heating apparatus. A complete range of "Vickers" D.C. motors is on view, ranging from $\frac{1}{8}$ H.P. to 50 H.P. output and of various types according to duty. The makers report an exceptional demand for these machines, and further extensions of their manufacturing accommodation are already contemplated. The motors are characterised by their clean build and cool running. Commutating poles are fitted to all machines subject to reversal or heavy overload, and the fine adjustment provided on the box type brushes is worth special notice. According to requirements, the motors are "protected," "totally enclosed" or "watertight." The company now exhibits its first batch of A.C. squirrel-cage and wound rotor motors, made for all standard voltages, and any output up to 25 H.P. From the excellence of their mechanical and electrical design and construction, these machines deserve as wide popularity as the D.C. patterns.

A two-panel switchboard provides for the control of a 10-KW. A.C.-D.C. motor-generator supplying the various motors on the stand through three feeder cables. This board is a typical example of Messrs. Vickers's switchboard construction.

The Vickers centrifugal fans are largely employed in the Royal Navy and in mines, power houses and factories all over the world. The special scoop-shape of the blades reduces air-slip to a minimum, and results in very high efficiency. The propeller type fans are intended for exhausting steam, acid fumes, foul air, &c., from workshops and factories. All fans are supplied for every variety of electric drive.

Among the motor starters exhibited may be noted the standard open, enclosed and watertight patterns with no-voltage and (if required) overload releases. These have iron-wire resistances wound on porcelain bobbins; up to 15 H.P., button contacts are fitted, but above this capacity renewable contacts are employed. The overload release can be set at any limit between full and 100 per cent. overload. The "Autograd" type of starters is specially applicable to industrial work, being self-accelerating. The operator simply moves a handle carrying a pot magnet to the left; the magnet then grips an armature on the contact maker, and the whole is drawn across the contacts by a coiled spring beneath the face plate. An oil dash-pot provides for exact control and regulation of the starting up.

A wide variety of motor-control panels and pillars is on view. The Vickers control pillar comprises a double-pole overload and no-voltage circuit breaker, a drum-type starter, a shunt regulator for variable-speed motors, resistances for starter and shunt regulator and D.P. switch fuses. The pillar is designed to replace the ordinary motor-control panel in those cases where service is exceptionally severe; it is specially recommended for the control of motors driving printing and calendaring machines, machine tools, &c. If necessary the pillar can be operated in conjunction with push buttons at various points for normal or emergency control.

The standard Vickers controllers, for cranes, machine tools, printing presses and so on, have a deservedly high reputation for reliability and simple, cheap maintenance. The Vickers crane panel is of specially compact design; a 50-ampere 4-motor panel measures only 10 in. × 20 in. × 9 in. The positive and negative live parts are kept entirely apart, "Fireite" fuse-bases and partitions are used, and pilot and inspection lamps are provided; when required, ammeters are fitted to the panels. The Electric and Ordnance Co. will show a typical crane cage fully equipped with the "Vickers" crane panel and controllers.

Among the many other classes of switchgear exhibited may be noted the "Vickers" ironclad combined quick-break lever switch and fuses, specially recommended for house service and general industrial motor work (made in six sizes up to 400 amperes and for 250 and 500 volts, and in double and triple-pole types). A 15-ampere 500-volt quick-break switch ($6\frac{3}{4}$ in. × $5\frac{1}{2}$ in. × $5\frac{3}{4}$ in.) has been developed for house service and exterior arc lighting work. This switch is combined with wire fuses, and is completely weatherproof. The "Vickers" Star Delta switches are applicable to three-phase squirrel-cage induction motors up to 100 H.P. (starting against light loads), and are made in three types, viz., oil-immersed, with overload and no-voltage releases; oil-immersed, with no automatic releases; protected type completely enclosed in cast-iron case. The switches are of metal and mica throughout, and enable the complete isolation of motors from the mains. The automatic gear protects against every possible contingency, and the whole equipment meets the Home Office and Mines Regulations. A special type of lock-on-and-off switch is exhibited, in which a quick make and break is secured, and the blade "locked" by means of steel balls. The company's new line of knife switches is specially designed for efficient working and easy renewals of the flicker blade.

During the past seven years the Electric and Ordnance Co. have had considerable experience in the construction of electric heating and cooking apparatus, and the "Eclipse" devices exhibited will doubtless, secure many converts to electric heating and cooking. The timid should be reassured by the four years' guarantee given on convectors, and the one year's guarantee on all other

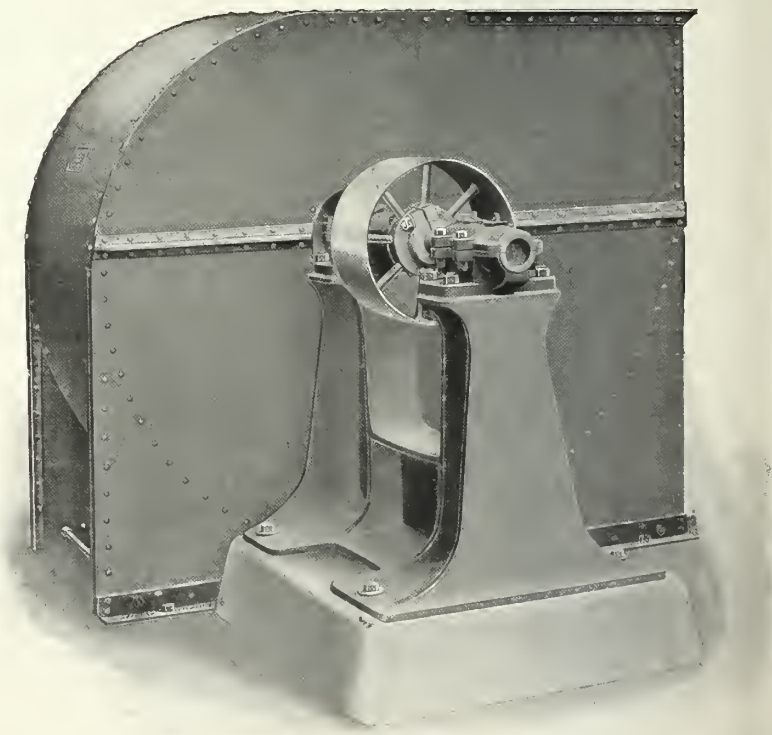


FIG. 86.—VICKERS CENTRIFUGAL FAN.

"Eclipse" apparatus. The many advantages of the "Eclipse" cooker will be demonstrated by a qualified cook at Gallery Stand No. 310.

The V.S.M. "Victor" arc lamps (flame, enclosed and enclosed miniature) are characterised by their extreme simplicity and low price. The only moving part in these lamps is the "Victor" patent magnetic clutch. Large numbers of these lamps are giving entire satisfaction in iron and steel works, among other applications. The lighting exhibit is completed by a complete range of the "V.S.M." incandescent lamps (colloid-tungsten and carbon types), and porcelain lighting accessories.

Interesting samples and examples of the application of the company's insulating material "Fireite" and aluminium alloy "Duralumin" will be on view during the Exhibition, and, in con

ision, we may call attention to the "Timken" adjustable roller arings, taking radial or axial loads, and built for loads ranging om 270 lb. to 1,935 lb.

Messrs. Bruce Peebles, Ltd. (119, 140),
Edinburgh.

This exhibit includes a very representative selection of the rious types of motors and converters manufactured by this well-

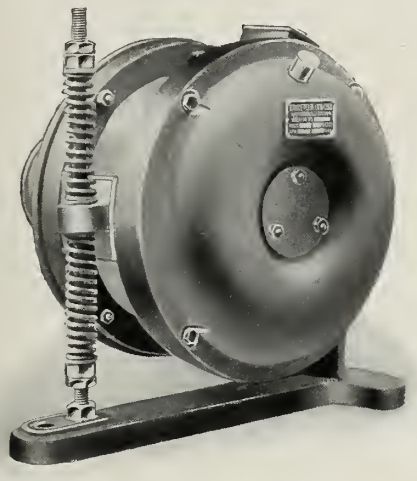


Fig. 87.—Peebles Loom Motor.

induction motor, conforming to the rules of the Fire Offices Committee for textile mills; a 10-B.H.P. slip-ring motor, fitted with short-circuiting and brush-lifting gear, and provided with an air-gap adjusting arrangement; and a 20-B.H.P., with automatic centrifugal starter, designed to yield a high starting torque with relatively small starting current. The Peebles loom motor (fig. 87) gives ½ B.H.P. at 765 R.P.M., on a three-phase, 40-cycle, 230-volt circuit. The machine is of the totally-enclosed squirrel-cage type, and has ball bearings and a flexible suspension, enabling very smooth driving. This motor is recommended for the vertical, horizontal, or inclined individual driving of looms and similar machinery.

The special brush gear designed for motors used on haulage and other severe work deserves special attention, as also does the three-phase 100-H.P. semi-enclosed liquid starter.

Lack of space prevents more than passing notice of the protected, semi-enclosed and totally-enclosed motors, the crane or capstan motor and the mining and traction motors which represent Messrs. Bruce Peebles' direct-current manufactures.

Messrs. Mirrlees, Bickerton & Day, Ltd. (8),
Hazel Grove, near Stockport.

The "Mirrlees-Diesel" oil engine shown by this firm is a four-cylinder, 160-B.H.P. engine, and is a duplicate of a considerable number of engines the company has made for driving dynamos on board warships, most of the recent British battleships and first-class cruisers being fitted with these engines. It is of the completely enclosed type with forced lubrication to all bearings, and is direct connected to a dynamo. Four separate oil supply tanks containing different grades of oil are connected with the engine in such a manner that the engine can be switched over from one grade of oil to another whilst running, the object of this arrange-

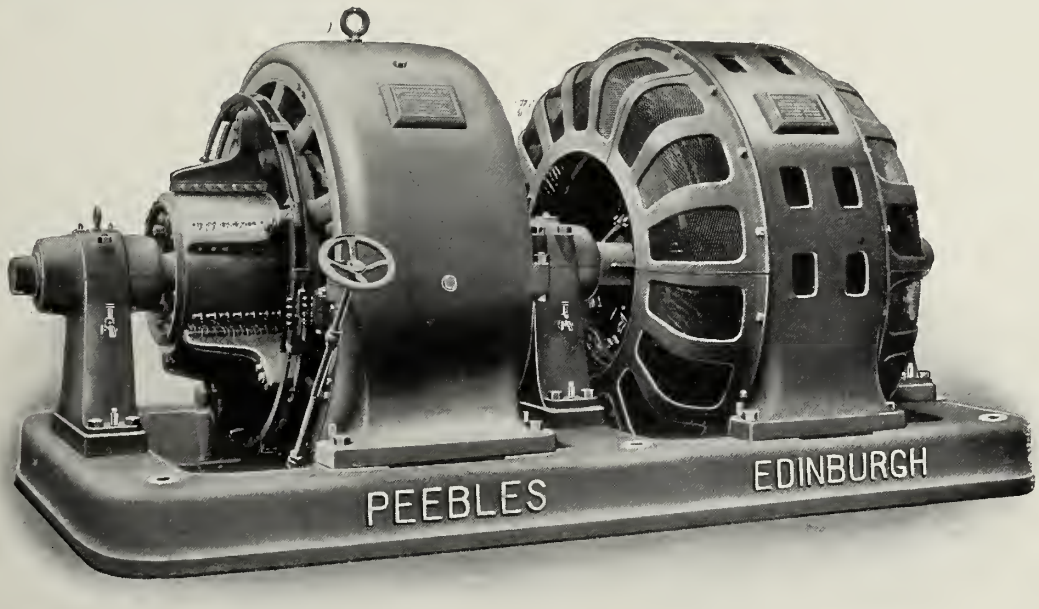


Fig. 88.—Motor-Converter of 500 kw.

wn firm. The 500-KW. motor-verter (built under the La r patents), is an excellent ex-ple of modern design. This set upies very small floor space, is specially stable when in chronism, and has a full load iency of 92 per cent. The hine exhibited (fig. 88) is gned to feed a lighting and er system at 450-550 volts when supplied at 6,000-6,600 s, 50 cycles three-phase; 16 ilar sets are now being sup-d to the Calcutta Electric ply Corporation, Ltd.

he split-pole converter ex-ited represents a type of hine designed to convert D.C. n a higher to a lower voltage single machine. The split-pole verter can be designed for any o of transformation between limits 10 : 1 and 1 : 1, and at all times 5 to 12 per cent. her efficiency than a motor-erator of similar output. The machine may have shunt compound characteristics as desired, and can be made to raise pressure of D.C. if required. The applications of the converter ude the supply of constant-current arc circuits, and variable-ed motors, driving, say, paper-making machines; it may also be l as a balancer or to effect a double voltage reduction.

he A.C. exhibits include a standard 10-B.H.P. squirrel-cage

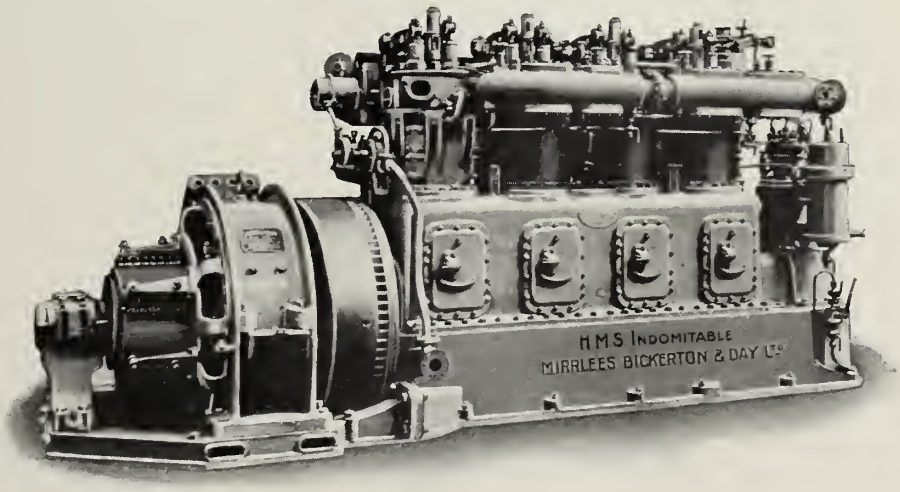


Fig. 89.—Mirrlees-Diesel 160-B.H.P. Oil Engine.

ment being to demonstrate that no alterations are necessary to enable the engine to work with widely varying qualities of oil. The dynamo is connected with a water resistance, and suitable switches are provided, so that full load or partial loads can be switched on and off as desired. Thus visitors will have an opportunity of noting the behaviour of the plant with widely varying loads. The engine is compact and occupies little space.

Messrs. Hans Renold, Ltd. (250),

Progress Works, Brook Street, Manchester.

Steel driving chains and wheels for the transmission of power are, of course, the keynote of this exhibit; silent chains suitable for speeds up to 1,300 ft. per minute, and powers up to 300 H.P.; roller chains for medium and slow speed driving, and block chains for slow speed driving and conveyor work are shown. An interesting item is a silent chain running at about 1,000 ft. per minute,

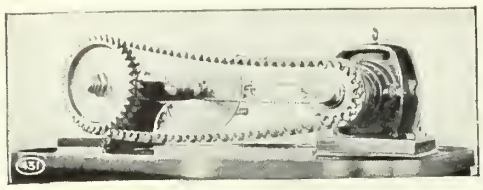


Fig. 90.—The Rotoscope as used for observing the Working of a Renold Chain.

with a rotoscope attached, by means of which visitors can see, while the chain is in motion, how the links mesh with the wheel teeth. How this is arranged is shown in the accompanying figure.

The Renold chains are so admirably adapted for use with electric motors—giving a silent positive drive, while affording great latitude in choice of position of the motor—that electrical engineers should not fail to take note of them. They are used in many textile mills driven by electric motors, and may pass through the floor to motors fixed to the ceiling of the room below, thus removing the objection sometimes raised to electric driving that more floor space is required.

The Westminster Engineering Co., Ltd. (165),

This company is showing its new enclosed flame arc lamp for street lighting, docks, railway stations, &c.: the lamp is fitted with carbons for long burning, and the fumes from the burning carbons are carried off by means of a system of circulating ducts contained in a chamber at the top of the globe. An equalising tube is fitted connecting this chamber with the bottom of the lamp, in order to prevent any rise of pressure in the chamber, and to maintain the circulation of the gases.

The firm's well-known types of enclosed lighting and photographic arc lamps, fitted with shades or reflectors to suit different requirements, are also exhibited, as well as an enclosed pattern lamp made

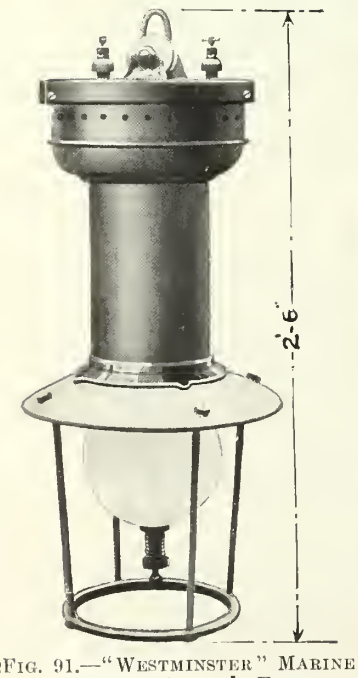


Fig. 91.—"Westminster" Marine Pattern Single Enclosed Arc Lamp.

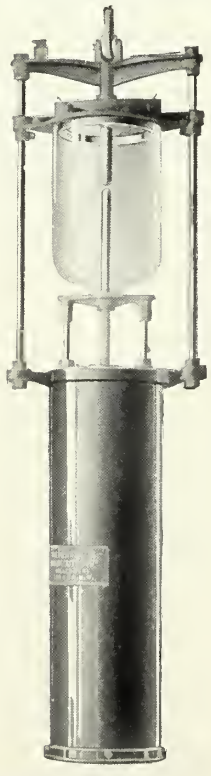


Fig. 92.—"Toplight" Photographic Arc Lamp.

specially strong and portable for ship use, with self-contained resistance and protected globe—so arranged that the lamp can be stowed away without damage or stood upon deck without hurting the globe. We give an illustration of this lamp (fig. 91), and of the "Toplight" photographic arc lamp (fig. 92). This is a powerful lamp specially made for portraiture and for use in low studios; by having the glass at the top instead of the bottom of the lamp, some 2 ft. is gained, which is of the greatest importance in studios 9 ft. or 10 ft. high.

The small hand-feed enclosed 2½ to 4½-ampere lamp, shown in fig. 93, has met with the greatest success for enlarging lanterns and small projection work; the positive carbon is horizontal, and is fed forward as required; on a 200-volt circuit, however, it will burn for three-quarters of an hour without touching. The positive crater

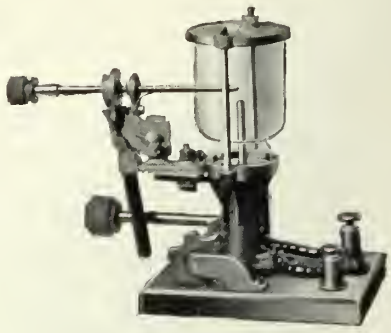


Fig. 93.—"Westminster" Semi-automatic Arc Lamp.

is directly in line with the centre of the lens, providing the brilliant point of light required for this work. A larger pattern lamp of the same type is also exhibited. In quite a different line the Westminster electric fresh-air heater is shown; this is provided with air inlets from the outer air, and the incoming air is warmed in passing over the heating elements before passing into the room

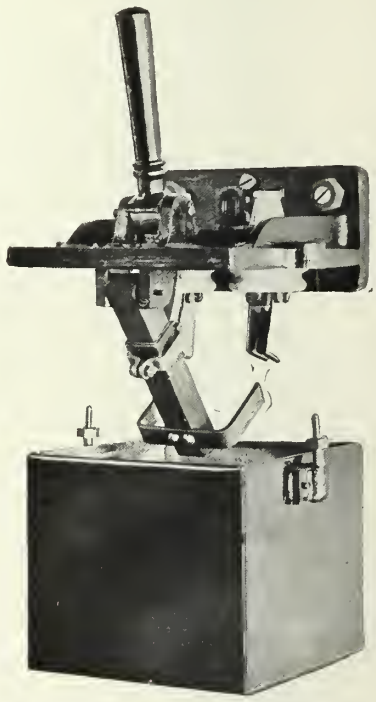


Fig. 94.—Partridge High-pressure Oil-break Switch.

thus heating and ventilating the room at the same time. The "Partridge" safety device for transformers, and the "Partridge" high-pressure oil-break switch for 2,000/3,000 volts, 20/15 amperes for house or transformer service, are other features of the exhibit; the latter is a simple and substantial device, as will be seen from fig. 94.

The British Aluminium Co., Ltd. (266),

109, *Queen Victoria Street, E.C.*

Aluminium in various forms, as used in the electrical industry is exhibited by this company. Aluminium is now extensively used for almost all classes of conductors where formerly copper alone could be economically employed. One of the largest fields for aluminium is in bare cables for overhead transmission lines, and the company is exhibiting samples of these cables for currents from 2 to 2,000 amperes, as well as all the jointing and other material. Aluminium in bar and rod form is also now extensively employed for all kinds of switchboard and central-station connections, and the company is exhibiting a complete switchboard panel with aluminium connections. The exhibit, further, includes examples of all the different forms in which the metal is supplied, together with a collection of electrical fittings and apparatus in which aluminium plays an important part. A very interesting feature of the stand is the bare aluminium coil as used for tramway motors, alongside of the equivalent copper coil, showing the large saving in dead weight of the former, together with better cooling. The exhibit also includes a number of samples of insulated aluminium cables of various types, as supplied by the company.

Phœnix Dynamo Manufacturing Co., Ltd. (59, 64),

Thornbury Works, Bradford.

In the exhibit of this company is included a 300-B.H.P. 3,000-lt induction motor, of the slip-ring type, running at a speed of 5 R.P.M. As this is for use in haulages underground, the slip igs and all bare contacts are enclosed in flame-proof boxes, fitted

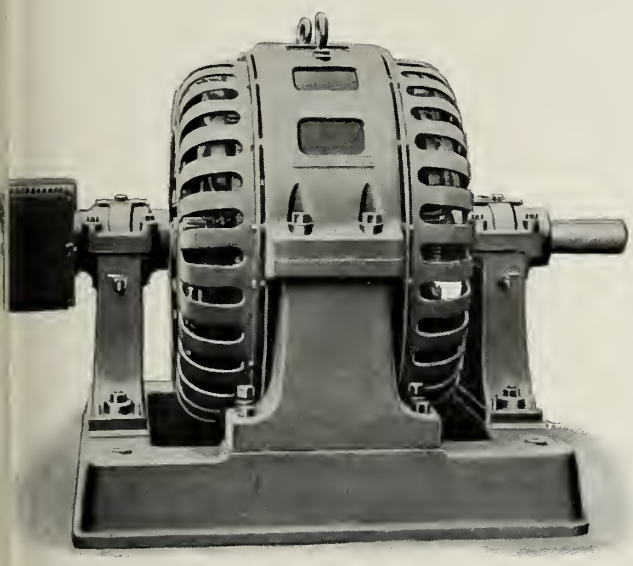


Fig. 95.—Phœnix 300-h.p. 3,000-volt Explosion-Proof Mining Motor.

th the "Phœnix" patent explosion-proof gland. The rotor is ovided with slip-rings and short-circuiting and brush-lifting ar. Special precautions are taken with this class of machine to event any possibility of moisture affecting the insulation, and in e whole of the construction no unimpregnated material is used, ca being the principal ingredient. The machine is illustrated in . 95. An explosion-proof "Phœnix" patent mining motor of B.H.P. at 500 volts is also shown, which can be run with safety a fiery atmosphere. Another exhibit of considerable interest d novelty is the "Phœnix" patent plating dynamo, in the mature of which a patent return conductor is employed. By

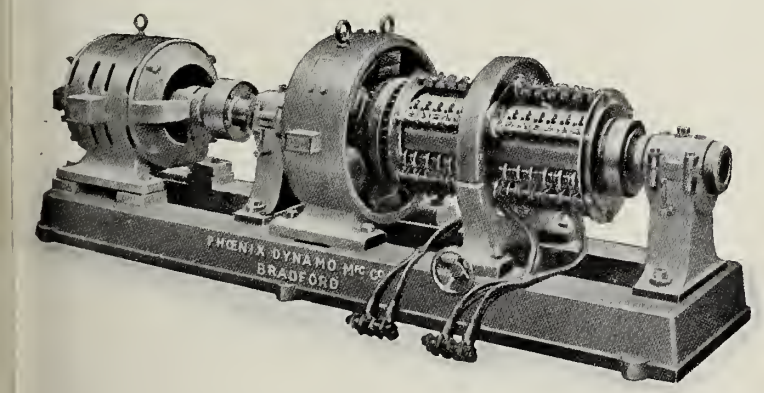


Fig. 96.—Phœnix Patent Plating Dynamo.

eans of this device, the reactance voltage of the machine is luced to about one-half of the ordinary reactance voltage. As is the reactance voltage which is primarily responsible r the commutation troubles which afflict heavy-current namos, resulting in rapid wear of the commutator, d a still more speedy wearing away of the brushes, is invention, as applied to this particular class of achine, affords an effective solution of the heavy-current oblem. Several large machines of this type are running in rious parts of England and abroad, and it is hoped that it will possible to have a 2,000-ampere machine running at 50 per cent. erload on the stand to demonstrate the immunity from sparking hich is possible with this type of machine. Our illustration, . 96, shows the machine as exhibited, driven by a motor.

The remaining exhibits include a "Phœnix" patent self-regulating unger pump—a small device driven by a "Phœnix" electric otor and controlling gear, as used in country houses and similar stallations, and designed to avoid the necessity of keeping huge orage tanks in the roofs of country houses and factories; the mp is coupled directly to the water pipes, and the switchgear is t for a certain definite water pressure. Immediately any of the taps nnected with the mains are opened, and the pressure is reduced, the motor automatically starts and runs until the specified pressure is again reached.

A patent electric sensitive drill and an electric grinding machine with emery disk and grinding attachment are also shown.

The Concordia Electric Wire Co., Ltd. (270),

Crown Parade, Cricklewood Lane, London, N.W.

This firm is exhibiting as its special lines the following:—H.C. copper wires and high-resistance wires in all dimensions from one mil upwards; cotton-covered magnet wires, enamelled copper wires, bare resistance wires, strips and sheets of various grades and for all purposes, having specific resistances from 18 up to 96 microhms per cu. cm.; and patent "asbestin" copper wires, round or square section, insulated with pure asbestos, the thickness of which is no heavier than that of an ordinary double cotton covering. This is specially recommended for traction motor work. Resistance wires covered in the same manner are also exhibited. Other manufactures shown include bare copper flexibles, asbestos-covered copper flexibles, charcoal iron wires, armature binding wires, fuse wires, rubber-insulated flexible cords, wires and cables for all purposes, telephone cords and cordage, insulating tapes and materials of all descriptions and for all applications, and ready-wound magnet coils of various designs.

Messrs. Laing, Wharton, Ltd. (56, 67),

7, *Great Newport Street, W.C.*

Messrs. Laing, Wharton are the sole British agents for Messrs. Vedovelli, Priestley & Co., of Paris, some of whose switchgear we recently illustrated; and at their stand they show a great variety of that firm's apparatus, including numerous patterns of switches for high and low-pressures, indoor and outdoor, circuit-breakers, remote-controlled switches, relays, fuses and lightning arresters. Of these we illustrate in fig. 97 the "Carter N.B." type, similar to the type which has been exclusively adopted for the French Navy; it is made for currents up to 8,000 amperes at 750 volts single-pole

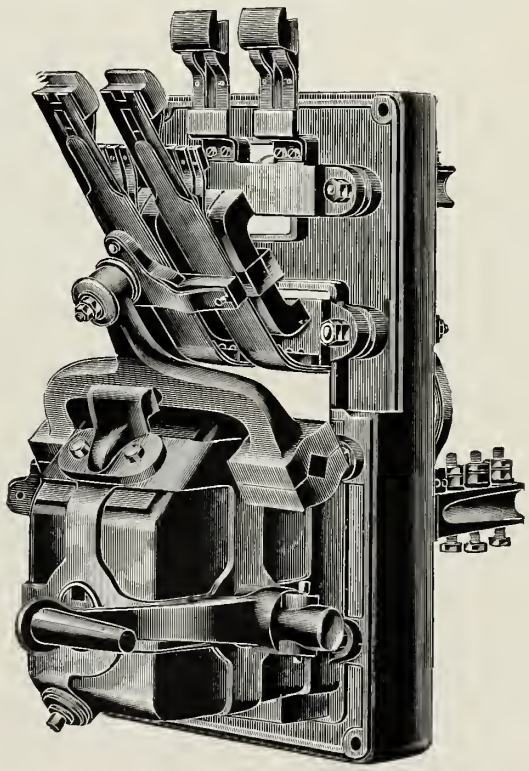


Fig. 97.—"Carter N.B." Circuit-Breaker.

or 3,000 amperes triple-pole, and is provided with carbon sparking pieces and free handle; in closing the switch, the hand moves downwards away from the contacts, and it is opened by means of a button at the bottom of the casing. A reverse-current no-volt release is provided if desired, in addition to or substitution for the overload release. A 100,000-volt transformer will be installed at the stand early next month.

Messrs. Drake & Gorham, Ltd. (61, 62),

66, *Victoria Street, London, S.W.*

This exhibit includes the following: The Frisby patent mechanical ammeter, for measuring the current passing in cables from the outside, also the Frisby patent current detector for detecting the presence and direction of current in conductors; and the Drake and Gorham magnetic clutch for shop driving, especially applicable for planing machines where a reverse motion is required. The firm are wholesale agents for quartz heating apparatus (Bastian patents) and Price's heaters for greenhouses, motor garages, &c., and in addition to these lines they also exhibit Holophane glassware, vacuum cleaners, a selection of decorative fittings in various periods, arc lamps, and general accessories.

J. Ciceri Smith (239),

32, Theobald's Road, E.C.

Direct-reading micrometer caliper gauges constitute this exhibit; the inventor has, as will be seen, improved the micrometer gauge by providing it with dials upon which the measurement can be read at once, without any of those tedious and error-introducing computations that are generally necessary. How clear is the reading is well shown by the woodcut, fig. 98, which represents a gauge reading by $\frac{1}{1000}$ in. up to $\frac{1}{2}$ in. The dials are actuated by a train of wheels geared to the micrometer spindle; the pitch of the

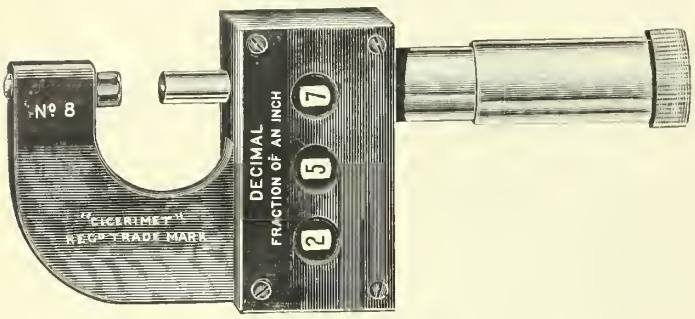


Fig. 98.—Direct-reading Caliper Gauge

screw is $\frac{1}{50}$ in., and the screw thread is protected by a sleeve. The knurled head drives the spindle through a slipping friction device, which prevents any possible injury to the screw, and ensures uniformity of pressure in measurements. The instrument is made in a variety of patterns embodying these principles in inches and millimetres; the dials save time and eyesight, besides preventing mistakes, and can be read by anyone without the preliminary instruction and practice required in the case of the older types.

The Linolite Co. (143),

25, Victoria Street, Westminster.

The Linolite Co. are showing the most recent improvements in Tubolite, their patented system of electric lighting, and its numerous applications. The economy of Tubolite, which has always been one of its characteristics, has now been largely increased by the introduction of metal-filament Tubolite lamps, which are made for 25 and 100 to 125 volts, and are run in series on higher voltages. On account of the special design of the reflector, the consumption of power by metal-filament "Tubolite" is less that 1 watt per candle-power of useful light.

Over 25 miles of Tubolite have been sold, a unique record. Tubolite is especially suitable for shop window lighting, as the



Fig. 99.—Tubolite Table Lamp, Pattern D.

light can be directed where it is most required, and there is no waste of light in the direction of the street.

For use in the office or study Tubolite table lamps are shown in several patterns, to suit varying requirements, one of which we illustrate in fig. 99. These table and desk stands are made in bronzed or bright lacquered brass, fitted with a length of Tubolite, and are capable of adjustment to suit the needs of the moment. English lamps are used.

The Sunbeam Lamp Co., Ltd. (55, 68),

Gateshead-on-Tyne.

The company are showing a remarkable display of carbon and metal-filament lamps, of which they are one of the oldest manufacturers in the kingdom. Amongst the lamps shown is everything from the small miniature or battery lamp to the huge bulb of 1,000 c.p. It is of special interest to note the exhibit, for the first time in this country, of the wire-type tungsten lamps which the company are developing. These are claimed to be as strong as wire, the principal feature being the filament of continuous length, obviating all the jointing which is usually the feature of the tungsten lamp. The lamp is made at the ordinary efficiency associated with tungsten lamps. Carbon lamps of every description are



Fig. 100.—Sunbeam Lamp Bracket.

also exhibited, including the original Sunbeam heating or radiate lamp. The company were the first, in conjunction with th Dowsing Radiant Heat Co., to put this class of lamp on th market. A special display is given of the Lux candle lamp an fitting.

Sunbeam accessories of every description, and a selection of choic designs of fittings and original signs, an electrical device for callin vehicles from the stand, ironclad switches, power material, insu lators and a motor-driven flasher for signs, are included in the com prehensive exhibit of this company, which is arranged in a strikin manner, a huge globe of the world forming the office to whic callers will be welcomed.

The London Decorative Metal Works, Ltd. (291),

44-46, Eagle Street, Holborn, London, W.C.

There is here to be seen an array of general metal work, includin an attractive assortment of ornamental electrical accessorie notably switch and plug plates, dome covers and bell pushes.

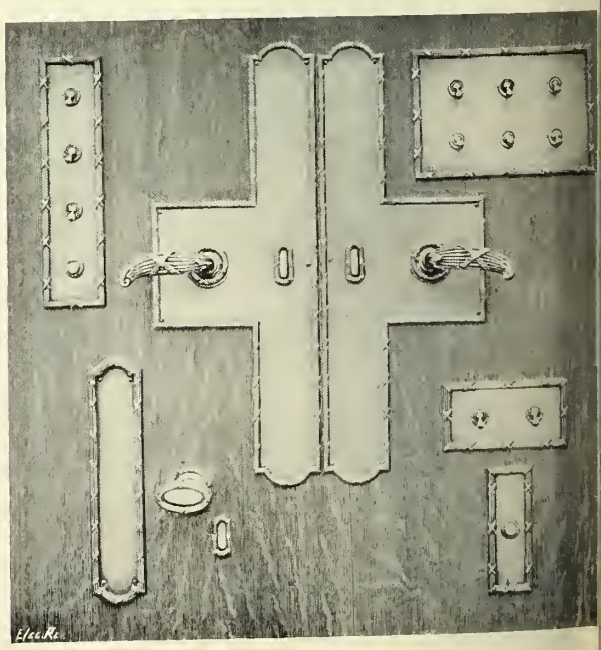


Fig. 101.—Show Panel in Louis XVI Style.

first sight switch covers would not appear to be an important it in an electric light installation, but it must not be forgotten th the switch top and switch plate are the only parts of the wiri

allation that are at all times visible, and a little care and fore-
it in the choice of these apparently small accessories count for
e in the eyes of the public than the highest perfection in
nical excellence invisible to the ordinary layman. The decora-
styles mostly favoured by the London Decorative Metal Works
the classic French and early English. Among the latter some
dsome multiway Georgian plates, finished in a soft antique
er, will attract attention. The accompanying illustration, which
give a good idea of the class of work made by this firm, is that
show panel fitted with a Louis XVI suite, in which the
oration is severely confined to the favourite reed and ribbon
ier. For the information of contractors, it may be said that
ll the designs shown, complete suites of interior metal fittings,
as door furniture, lock plates, cabinet fittings, sash lifts, table
tles, and so forth, are to be had in keeping with switch plates
domes. The effect of a good installation must be enormously
anced when its accessories harmonise with the other decorative
ures of the room.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 504.)

Continental Notes.—Denmark.—Since the tramways
he Copenhagen Tramway Co. were taken over by the municipality,
employés of the two private tramway companies—Frederiksberg
ctriske Sporvijs Selskab and Tuborg Klampenborg Elektriske
rvijs Selskab—have been on strike. As already mentioned in
e pages, a proposal to raise the wages of the staff was laid before
Town Council, and this proposal was afterwards agreed upon.
object of the strike was to get the men of the two private com-
ies put on the same wages as their municipal *confrères*. At the
nning of the strike the companies were willing to meet the
kers by offering 6 per cent. increase in the salaries, but this offer
unanimously rejected by the men. Now the companies have
aged quite a new staff, and by means of these and some of the
employés who have broken loose from their trade unions, the
em is being operated as usual. The result is that the men will
er regain their old employments, and the companies have got a
per staff, as the newly-engaged people have to begin with
ller salaries. But, nevertheless, the old functionaries are still
iking"!—*Teku. Tidsskr.*

Russia.—The municipal authorities at Archangel are negotiating
the conclusion of a loan of 1,000,000 roubles (about £105,000),
proceeds of which are to be applied to the construction of
electric tramway, the lighting of the town with electricity,
the construction of market halls.—*Board of Trade Journal.*

new section of the electric tramways in Odessa has just been
pleted and opened for traffic. There are now 12 miles of electric
ways at work in the city.

Austria-Hungary.—The Allgemeine Oesterreichisch Unga-
he Gasgesellschaft has purchased the Mödling gasworks for
0,000, and has made an offer to the communal authorities to
up in Mödling an electric generating plant for lighting and
er purposes, also to construct an electric tramway either
ct to Vienna or to Wiener Neudorf to join the Vienna-Baden
. The communal authorities have appointed a committee to
ider the matter. A railless electric system is to be built
n Müglitz through the northern Moravian towns of Meedl,
Stadt, Aussee, and Mürau.

syndicate has been formed, under the presidency of Privy
ncillor Gyula v. Szájbely, of Budapest, for carrying out a
ect of the engineers L. Fischer-Rainau (Zürich), Anton v.
ler, and Prof. Dr. Moritz v. Hoor-Tempis (Budapest), for the
blishment of hydro-electric works on the Danube, near Press-
g, with a capacity of 70,000 H.P.—*Board of Trade Journal.*

he movement for the extension of electric railways in Austria-
ngary shows no abatement, although in some cases temporary
rmissions have taken place. The great main line from Innsb-
ch to Munich through the Scharnitz and Mittenwald mountains
last winter stopped altogether, owing to the impossibility of
ng the concrete work during frosty weather; but the smaller
nels between Innsbruch and Seefeld have all been pierced,
the Schlossbachgraten and the Martinswand. The last-named
h been driven for more than 500 metres on the east side towards
sbruch and for some distance on the west side. The bridge
the Inn at Hötting is already under construction. The
tractors for the line, Messrs. Kuhl, of Innsbruch, have just
ived the sanction of the Ministry for Railways for an electric
dard gauge line from Rovereto to Riva on Lake Garda. The
portance of this connection for the foreign traffic of South
Tol and Lake Garda is obvious. The projected construction of
anging railway up the Plose near Brixen (South Tyrol) is
ured. From Brixen, 560 m. above sea-level, the line rises, in
e stages, to a height of 2,470 m., and is not only the highest
the longest mountain line in the Tyrol. The journey will
e 46 minutes, and the cost of the undertaking is estimated at
million kr.

urther schemes have been sanctioned as follows: The building
n electric railway from Gloggnitz (Lower Austria) to Semmering,
Schottwien and Mariachultz; a narrow electric line from Bad-
l to Weissenbach, on Lake Atter; also a line from Lake Atter to
klamarkt, 14 km. long, the promoters being the Gemeinde of St.
rgen, in the Attergau; and a line from Reichenberg, in Bohemia,
to the foot of the Jeschkenberg, near Reichenberg. Finally, the building of an electric tramway at Przemysl, in Galicia, and an electric railway from Zarnbek to Altbiela are among the new projects. On the electric express line from Vienna to Baden there has been for some time under trial an electric motor wagon equipped with a patented spring arrangement whereby a saving of 38 per cent. in power is stated to be achieved.—*Elektrotechnische Zeitschrift.*

Negotiations are already under way for the enlargement of the project to extend the Tatra suburban electric network to Barlangilet. It is now proposed to continue the line to Liso, on the Hungarian border, and thence on to Zakopane on Austrian territory.

Sweden.—The preparatory works are, says *Affarsvärlden*, being actively prosecuted for the introduction of electric traction on Swedish railways. The first to be completed will be the line from Gellivare to the Swedish-Norwegian frontier; this is the leading iron ore exporting line, its terminus on the coast being Narvik in Norway. The second electric line will be from Stockholm to Saltsjöbad, a fashionable seaside resort. The company owning this railway has just contracted a loan of 2 million kr. to cover the cost of electric conversion. The third line is very likely to be that from Goteborg.

Germany.—A long discussion took place at a meeting of the Berlin City Council on September 21st in regard to the proposed electric railway between Gesundbrunnen and Rixdorf, which has been under consideration for several years. The line would have a total length of 5·89 miles, and is estimated by the A.E.G. to involve an expenditure of £4,200,000, mainly as an elevated railway. By a large majority the City Council has now rejected the scheme as a high-level railway, and has requested the magistrate to enter into fresh negotiations with the A.E.G. with a view to the construction of the line solely as an underground railway. It is stated, however, that the company is not prepared to make any further concessions in the matter.

The Siemens-Schuckert Co., of Berlin, is reported to have secured the contract for the construction and equipment of a system of electric tramways in the town of Marburg (Hessen-Nassau).

Italy.—Official permission has been granted to the T.C. of Padua to construct and work an electric railway from Padua to Abano.

Spain.—Reuter says that the Bilbao tramway service was partially resumed on 15th inst. in spite of the opposition of the strikers, who had to be dispersed by troops.

The Sociedad Anonima Iberia Concessionaria of Bilbao has secured the concession for the construction and working of an electric tramway from Porrino to Vigo.—*Elektron.*

A new electric tramway which is being built by the Compania de los Ferrocarilles Vascongades between San Sebastian and the French frontier, *via* Loyola and Irun, is approaching completion.

The first section of the new electric tramway between San Sebastian and Tolosa has lately been completed and opened for traffic.

France.—A new company has lately been formed at Dunkirk, with a capital of £24,000, and the title La Société Nouvelle des Tramway Electriques de Dunkerque to acquire and carry on the electric tramways in the town.

Dudley.—An alarming accident, fortunately unattended by any serious consequence, occurred on Saturday afternoon. A Stourbridge car was going down Castle Hill, a steep declivity when owing, it is stated, to the dampness of the rails and the failure of the supply of sand, the brakes failed to act, and the driver was unable to pull up. The car, going at a fair speed, struck a Birmingham car, which it pushed into the depôt, smashing the upper part of the doorway. A horse and parcels' cart were involved in the accident, the cart being smashed to atoms, and the horse so much injured that it had to be slaughtered where it fell in the shafts. One passenger in the Birmingham car and two in the Stourbridge car, were slightly injured, but although taken to the Guest Hospital, they were not detained. Other passengers suffered from shock, but they soon recovered: a parcels' messenger, standing in the depôt at the time, was also a little hurt. The drivers and conductors of the cars apparently did their best under the circumstances and stuck to their posts while it was possible to do so. The failure of the brake power seems inexplicable. The rails were, however, very greasy with the rain, and the Stourbridge car appears to have skidded along the metals, the incline increasing the momentum as it proceeded. The B. of T. will probably hold an inquiry.

Glasgow.—The Tramway Committee has agreed to continue consideration of the proposal which raised much adverse criticism—to run a new line of tramways from South Portland Street to Sauchiehall Street *via* Buchanan Street and a new bridge over the river. At its last meeting the Committee was asked to review its conclusions and report again. The object the Committee had in view in making the proposals was to relieve the congestion of traffic generally over Glasgow Bridge, and it has now decided to hear a deputation from the Gorbals Ward Committee, which is to ask that alternative cars from certain of the southern districts should be diverted so as to cross Stockwell Bridge, where the traffic is normal.

It is recommended by the T.C. Committee that the Tramways Department should again make the annual contribution of £500 to be divided between the Royal, the Western and the Victoria Infirmaries.

At the last meeting of the T.C. it was reported that a sum of £470 had been paid for the provision of food, &c., for the police on duty during the recent tramway strike. The account was passed by the Council, it being pointed out the expense was incurred under common law, and that the sanction of any particular item was unnecessary.

Halifax.—At a special meeting of the Corporation Tramways Committee last week, it was decided to ask Mr. W. M. Rogerson to devote the whole of his time to the management of the electricity works on account of the increasing demand for electricity and possible development in the works, and to relinquish the post of tramways manager. It was resolved to place the management of the tramways in the hands of Mr. Caird and Mr. Galloway, two of the present chief tramway officials. It was also decided to discuss with the Highways Committee the question of transferring the work of maintenance of the tramway track to a special department of the Corporation.

Hayti.—Concessions have been granted (1) for the construction of a railway, 140 miles long, from Leogane to Cayes, including various branch lines, and (2) for the erection of hydro-electric works designed to supply electric power to the railway which runs from Port-au-Prince to Pićton-Town, a distance of 5 miles, and to the Port-au-Prince tramways, which have a length of 11 miles.—*Board of Trade Journal.*

Irlam.—Renewed efforts are to be put forth by influential ratepayers in Irlam to induce the Salford Corporation to extend its tramways from Peel Green to Irlam and Cadishead, which are developing into populous industrial districts.

Liverpool.—The Tramways and Electric Power and Lighting Committee has decided to recommend the City Council to grant one week's extra pay to all the employés in the general manager's department (including the salaried staff) who were in the service at the time of the strike in Liverpool and who remained loyal, and to the members of the salaried staffs in the resident electrical engineer's department who were employed on emergency work.

Newcastle-on-Tyne.—Whilst the North-Eastern Railway Co. have for some years past been operating their passenger traffic over the suburban lines in the Tyneside area almost entirely by electric power, the goods and mineral traffic has been conducted by steam power, with the single exception of the short incline leading up from the quay side, Newcastle, where two B.T.H. locomotives are in regular use. We understand, however, on the authority of a usually well-informed correspondent, that during recent months not only the question of working the goods and mineral traffic between Newcastle, Shields and Tynemouth, by electric power, but also the adoption of electric shunting engines in the marshalling yards at Heaton and elsewhere in the Tyneside district has been under consideration, and that, in connection with this subject, Mr. Vincent L. Raven, the company's chief mechanical engineer, has recently left for America, where he will inspect various types of locomotives in actual service on some of the American lines for the operation of freight traffic. Mr. Raven is accompanied by Mr. Charles H. Merz, of Newcastle-upon-Tyne, who is the consulting electrical engineer to the North-Eastern Railway, and was responsible for the electrification of the Tyneside branches.

Norwich.—The T.C. has abandoned the proposed purchase of the undertaking of the Electric Tramways Co.

Southend-on-Sea.—The T.C. has received the sanction of the L.G.B. to a loan of £1,261 for the improvement of the tramway at the shore end of the pier.

West Hartlepool.—With reference to the negotiations between the Corporation and the Tramway Co., the Corporation has proposed that the company shall lease the Park and Foggy Furze routes which the former has bought, and also a section of the Hartlepools system lying within West Hartlepool, which the Corporation proposes to buy, together with the two miles extension which the Corporation meditates making, the terms of the lease to be: The company to pay 5 per cent. per annum on Corporation capital expenditure, the company to establish a sinking fund and contribute £150 per route-mile per annum for the maintenance of the tramways, and the company also to pay a rental. The Tramway Co. reply that, calculating on past results, such an agreement would involve them in a heavy annual loss, and they regard the proposal as absurd. They offer to sell to the Corporation the remainder of the tramway system in the borough, or to lease the same on more favourable terms than the Corporation proposes to them. Alternatively they offer to accept tenure of 42 years of all running powers on terms previously submitted. Here the matter rests for the present.

TELEGRAPH and TELEPHONE NOTES.

Austria.—Great activity prevails at the present time in Vienna and throughout Lower Austria in connection with the extension of the telephone system. The whole area of the capital city is being equipped with telephone lines and exchanges at suitable intervals, and the work will extend well into next year. Besides the main scheme, a series of block systems will be set up. Outside Vienna and throughout the length and breadth of Lower Austria the improvement of existing installations and erection of new ones is in full swing. In some 30 towns, telephone services will be established for the first time, while in 16 others new installations are already under way, and partly completed. The public call for telephone conveniences is indeed so extensive and widespread that it already exceeds the funds available for such works. Next year's Budget will have provide a credit many million kronen in excess of that allott last year to telephone construction purposes, without, howev fully satisfying the great public demand. As a consequence of t cable-laying operations in progress in Vienna, Lower Austria a the several Crown lands, valuable orders for material are bei placed by the Post and Telegraph Administration. The cal manufacturers are especially affected, and several of them, a notably the firm of Felten & Guilleaume, have asked for time indu gence on the completion of contracts. The telephone apparat industry, which had previously been suffering under a period stagnation, has received the welcome fillip of some 6 million kro of orders for telephone station equipment, and others may expected to follow their completion, Austria having great leew to make up in the matter of telephone conveniences, as is sho by the fact that in 10 years the telephone network has o increased from 9,046 km. to 11,000 km.—*Der Elektrotechniker.*

The L. M. Ericsson Telephone Manufacturing Co., which lat founded an affiliated company in France, has now conclu negotiations to form similar companies in Austria and Hungs with the assistance of Swedish, Austrian and Hungarian bank *Affärsvärlden.*

Sweden.—It is reported from Stockholm that it been possible by means of the newly-introduced Murray system send 2,000 messages to Gothenburg a day. In view of Norweg and Danish competition, the Swedish Board of Telegraphs propo to reduce the coast fee for wireless telegraphy at Gothenburg fr 4d. to 1½d. per word, as the range of this station has proved to only 1,200 km. instead of the calculated 3,500 km.

Wireless Telegraphy.—The wireless station which been erected on the roof of the "G.P.O. West" consists of masts, which are 50 ft. high and stand about 240 ft. apart, s porting a system of bare copper wires forming the antenna: rest of the apparatus is fixed in the laboratory of the G. engineering department. The installation will allow experime work to be carried out with greater facility and at less expense t heretofore, and will enable new devices which inventors submi the Postmaster-General from time to time to be placed under cl observation than formerly, and to be tested under pract conditions.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Western Australia.—October 18th. coin-in-the-slot attachments for the P.M.G. See "Official Noti August 25th.

November 21st.—One automatic or semi-automatic switchb and equipment, for the P.M.G.'s Department. See "Official Not September 15th.

South Australia.—October 25th. Cable and paper sleeve the P.M.G. See "Official Notices" September 1st.

New South Wales.—October 30th. Five turbo-alternato 5,000 kw. each, for the New South Wales Government Railw Full particulars from Electrical Engineer's office, 61, Hunter St Sydney. This contract was advertised in the *Sydney Telegra* July 29th, and the matter is referred to fully in our "Tran Notes" of September 15th.

Queensland.—November 8th. Deputy P.M.G. Switchbo measuring instruments and protectors, telegraph instrum switchboard parts and accessories, telephone instruments. Commissioner in London, 72, Victoria Street, S.W.

South Australia.—November 1st. 5,000 insulators, porc No. 8, for the P.M.G.'s Department. See "Official Noti September 22nd.

New South Wales.—December 20th. One branching mul magneto switchboard at Broken Hill, for the P.M.G.'s Departr See "Official Notices" September 22nd.

South Australia.—November 15th. Deputy P.M.G. Telep cords and earpieces, seven magneto switchboards, three milamm six relays and oneset of Wheatstone fast-speed duplex repeate tons of hard-drawn copper wire, and one electro-motor.

Victoria.—October 3rd. 8,000 yd. of 3-in. fibre conduit, fo Melbourne City Council. See "Official Notices" to-day.

Queensland.—November 8th. Ironwork, measuring in ments and protectors, switchboards, switchboard parts and a sories, telegraph and telephone instruments, for the P.M Department. See "Official Notices" to-day.

November 22nd.—Cable for the P.M.G.'s Department. "Official Notices" to-day.

South Australia.—November 15th. Telephone cords an pieces, for the P.M.G.'s Department. See "Official Notices" to

Belfast.—October 9th. 2,000-ampere switchb apparatus, and field regulating rheostat and change-over sw for the Corporation. See "Official Notices" to-day.

Belgium.—October 4th. The Société Nationale Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science inviting tenders for the contract for the overhead electrical e ment in connection with the Salzinnes-Malonne (Malpas) sect the Onoz-Namur-Profondeville light electric railway.

Supply of two locomotive electric hoists and other rolling Particulars of the Bourse, at Brussels.

Birkenhead.—October 6th. Electrical sundries, &c., for the Mersey Railway Co. (form No. 12). J. Shaw, general manager and secretary, Central Station.

Blackley.—October 10th. Extensions and alterations to electric bell and telephone installation, Booth Hall Infirmary, for Prestwich B.G. E. W. Ogden, clerk. Cheetham Hill Road, Manchester.

Bristol.—October 2nd. One 10-ton and eight 2-ton high pedestal travelling jib cranes, electrically driven, Royal Edward Dock, Avonmouth, for the Docks Committee of the T.C. W. W. Squire, Engineer, Cumberland Road (returnable deposit of £5).

Broom (near Durham).—October 5th. For supply of material and erection of 22 new lights, at Aldin Grange, Auton Stile, and Ushaw Moor. J. Bradley, clerk to the P.C., Broompark.

France.—The Chemins de Fer de l'Etat propose to acquire 450 electric motors for the electrification of the suburban tramways. Particulars from Le Service Electrique, 43, Rue de Rome, Paris.

Tenders will shortly be called for the supply of the equipment of the electricity station about to be built at Dunkerque. Particulars of the Administration de la Guerre, Paris.

Algeria.—October 15th. Tenders are invited by the municipal authorities at Bona for an electric pumping plant designed to pump water from the Bou-Glès water main to the Chateau d'Eau des Santons, a distance of nearly half a mile. The apparatus, which must lift 55 litres of water per second, will include a continuous current 440-volt motor. Prices must be submitted for two similar pumping installations, and should include delivery free on wharf Bona, and installation of the plant. Particulars from "Monsieur le Directeur du Service des Eaux, Hotel de Ville," Bona.—*Board of Trade Journal.*

Grimsby.—October 16th. Paper-insulated lead-covered cables, house fuse boxes, and mains service boxes for the Corporation. See "Official Notices" to-day.

Hastings.—October 18th. Electric lighting of the workhouse, Ore, for the B.G. See "Official Notices" September 15th.

Italy.—International tenders are invited for the supply of three electric cranes for the Marine station at Venice. Particulars, Italian State Railways, Rome.

Liverpool.—September 30th. Electric lifts and electric fittings for the Select Vestry, at the Workhouse, Brownlow Hill. J. W. Coster, vestry clerk, Brownlow Hill.

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

Hackney.—October 12th. 100 000 pairs of white open type arc lamp carbons, for the B.C. See "Official Notices" September 22nd.

Manchester.—October 4th. One 4,000-4,500 KW. low-pressure exhaust type turbo-alternator, for the Corporation. See "Official Notices" September 15th.

October 3rd.—For (*a*) permanent way special track work; (*b*) permanent way points, tongues, and hardened steel centres; (*c*) granite setts. Specifications and forms of tender obtainable from Mr. McElroy, general manager. Deposit £2 2s. (returnable).

Perth.—The T.C. invites tenders for overhead coal storage hoppers, conveyors, capstans, and electric generating plant for stoking machinery, also alteration and extension of existing coal elevator and hoist. W. B. McLusky, gas engineer.

Spain.—The municipal authorities of Montemolin (province of Badajoz) have lately invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Tenders have recently been invited by the municipal authorities of Grazalema (province of Cadiz) for the concession for the electric lighting of the town during a period of 20 years.

CLOSED.

Admiralty.—We understand that the North British Rubber Co., Ltd., of Edinburgh, who recently secured a contract for india-rubber shoes for the Admiralty, have now obtained a further large order, for ebonite.

Broxburn, N.B.—The Uphall and Broxburn Lighting Committee (engineer, Mr. W. Sanderson) has placed the following contracts for the supply of new generating plant for Broxburn electricity station:—

125-B.H.P. vertical suction gas engine and open hearth suction gas plant.—Campbell Gas Engine Co., Ltd., £1,200.
90-KW. D.C. generator.—Siemens Bros. Dynamo Works, Ltd., £250.

Cleethorpes.—The U.D.C. has accepted the tender of the Western Electric Co. for cables, and that of Ferranti, Ltd., for meters.

East Ham.—The T.C. has accepted a tender from Messrs. Babcock & Wilcox for the installation of mechanical chain grate stokers on two of the boilers at the generating station at £325 per boiler complete. An offer from Messrs. W. Wood & Co., to supply two reels of figure-8 trolley wire (about 2,700 lb.) at 7¾d. per lb., has been accepted.

Egypt.—The contract for a new double-track bridge at Assiut, at the crossing of the Ibrahimieh Canal, on the direct line between Cairo and Luxor, has now been awarded by the Egyptian State Railways and Telegraph Administration to Messrs. Baume and Marpent, of Haine St. Pierre, Belgium. Included in this bridge will be an electrically-operated swing span with a length of 68·80 metres in 13 panels of 5·292 metres, together with an approach span of 39 metres. The competition for this work partook of an international character, and it is stated that the tender submitted by Messrs. Baume & Marpent was the lowest.

Glasgow.—The following offers have been accepted by the Tramways Committee:—

Switchboard for Barrland Street Yard.—British Thomson-Houston Co., Ltd.
Copper rail-bonds.—R. R. Todd.
D.C.C. copper wire.—London Electric Wire Co., Ltd.; British Insulated and Helsby Cables, Ltd.
V.I.R. cables.—British Insulated and Helsby Cables, Ltd.

Haslingden.—The following are the successful contractors for the electric lighting installation of the municipal buildings:—

Secondary School.—Halliwell & Co.
Free Library and Public Hall.—A. M. Cramp.
Destructor Works.—Whipp & Bourne.

Heywood.—A contract for two stokers and self-cleaning compressed-air furnaces for the electricity works has been placed with Messrs. Ed. Bennis & Co., Ltd. This is a repeat order.

Italy.—The A.B. Glödlampfabrik, of Stockholm, were lately successful in competition for the supply of glow lamps to the Italian arsenals at Naples, Venice, Spezia and Taranto; unsuccessful competitors being the A.E.G., Thomson-Houston, and the German Glow-Lamp Syndicate.

London.—Wood Green.—The U.D.C. has decided to enter into an agreement with the Chloride Electrical Storage Co., Ltd., for the maintenance of the accumulators at the baths for a period of 12 years, for a sum of £16 per annum.

Maidstone.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for 2,500 tons of Scotch screened washed peas, for the electricity works, at 11s. 6d. per ton, and 2,500 tons of York house-coal screenings, at 12s. 6d. per ton.

Mansfield.—Tenders for extensions to the specifications of the Borough Electrical Engineer have been accepted, and are as follows:—

Engines.—Belliss & Morcom, Ltd.
Dynamos.—British Thomson-Houston Co., Ltd.
Switchgear.—Bertram Thomas.
Buildings.—Vallance & Blythe.
Condenser, exhaust and water pipes.—Ledward & Beckett.
Electrically-driven pumps.—Rees Roturbo Manufacturing Co.
Steam pipes.—Mansfield Engineering Co.

Morecambe.—Mr. E. Ireland, of Bath, has secured the contract from the Morecambe Tramways Co. to reconstruct a section of their line totalling 1¼ miles. When the work is completed the section will be worked by petrol cars.

Pontymister.—Messrs. Babcock & Wilcox, Ltd., have, we understand, secured the contract for a complete plant for charging the open-hearth furnaces of the Monmouthshire Steel and Tinplate Co., Pontymister. The scheme includes an overhead crane and lifting magnet for discharging the pig-iron and scrap from the trucks, as well as for two of Messrs. Babcock & Wilcox's new ground-type slewing open-hearth charging machines, together with boxes and all accessories.

Portsmouth.—The E.L. Committee of the T.C. has accepted the tender of Messrs. W. T. Glover & Co. for cable, at £331.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

Unit, Automobile and Marine Motors, Ltd.—Motor vehicle, for the Tramway Department, £350.
Messrs. Boydell & Co.—Nine feeder-pillars, £114.
Messrs. John Spencer & Co.—53 traction poles, £241.
Messrs. Wallington & Co., Ltd.—53 bracket-arms and fittings, and eight pole bases, £195.

Stoke-on-Trent.—The Corporation's £60,000 scheme for linking-up its four undertakings and carrying out necessary extensions is now well in hand. Contracts totalling £54,969 in the aggregate have been accepted in connection with the central power scheme, the following being a complete list of the accepted tenders to date:—

Turbo-generators.—Jas. Howden & Co., Ltd.	£8,905
Rotary converters.—British Westinghouse Co., Ltd.	3,800
Motor-converters.—Bruce Peebles & Co., Ltd.	2,250
Motor-generators.—Siemens Bros. Dynamo Works, Ltd.	2,385
Mains and cables.—Callender's Cable and Construction Co., Ltd.	13,093
Switchgear.—British Westinghouse Co., Ltd.	6,651
Boilers.—Stirling Boiler Co., Ltd.	5,040
Cooling towers.—Davenport Engine Co., Ltd.	1,053
Land	750
Burslem buildings.—Grants, Ltd.	615
New power-house buildings.—Grants, Ltd.	5,745
Stoke buildings.—J. Meiklejohn	925
Steam pipes, &c.—Aiton & Co.	1,129
Coal bunkers, &c.—New Conveyor Co., Ltd.	1,426
Steam feed-pump.—G. & J. Weir, Ltd.	113
Secondary battery.—D.P. Battery Co.	91
Transformers.—British Westinghouse Co., Ltd.	364
Motor-generator (n.c.).—Bruce Peebles & Co., Ltd.	225
15-ton crane.—Herbert Morris & Bastert, Ltd.	229
Electric feed-pump.—British Westinghouse Co., Ltd.	180

West Ham.—The T.C. has accepted the tenders of Messrs. Willans & Robinson, at £11,348, for a 5,000-kw. turbo-alternator, and that of Messrs. Babcock & Wilcox, at £9,790, for water-tube boilers.

Wigan.—The tender of the Rees Roturbo Co. for the supply of two electrically-driven centrifugal pumps, for pumping water to the top end of Whelley, has been accepted by the Corporation Water Committee.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued :—

Drills for efficiency (1911-1912) will commence at Headquarters on Thursday, November 2nd, 1911, and Headquarters will be open as stated below from that date:—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Free Tickets for Olympia.—Referring to the letter of "Supply Engineer" in our "Correspondence" columns to-day, we wish to point out that the fact that only a small proportion of the free tickets was utilised by the recipients ought not to be accepted as an argument in favour of refraining from their distribution, but, on the contrary, the number distributed should be increased. There is bound to be a considerable percentage of wastage, but if by distributing 100 tickets a supply engineer succeeds in inducing 20 actual or prospective consumers to visit the Exhibition, we maintain that his money has been well invested, for some at least of these are sure to increase their demand for energy, and the cost of the tickets will probably be amply covered in the first year.

As for the purchase of tickets being a form of subscription to the funds, that is quite a minor matter, for, as our correspondent must be aware, the tickets are supplied at a considerable reduction, largely on account of the wastage to which he alludes. Indeed, we are informed that at a meeting of the Exhibition Committee on Tuesday last, a further important concession was granted to supply station authorities who purchase a certain minimum number of tickets, in the shape of a large addition of free tickets to the number paid for, so as to provide against the loss in question. The Exhibition is now in excellent trim, and no time should be lost in purchasing and distributing the tickets; it is wonderful how far a man—or woman—will travel, to make use of a free pass!

Appointments Vacant.—Station fitter for the Beckenham U.D.C. Electricity Works (£2). Junior assistant for the Dewsbury Corporation Electricity Works (27s. 6d.) See our advertisement pages in this issue.

Legal.—The hearing of the Australian lawsuit, Balmain Electric Light and Power Supply, Ltd., *v.* Cormack, was reported in our issue of September 15th. We now learn that Mr. Acting Justice Rich has delivered his reserved judgment. He said that on the facts before him, A. W. Cormack, Ltd., which company the plaintiff did not think fit to make a party to the suit, was not a wrongdoer. It was not suggested that the acts were unlawful when done by that company. There seems, therefore, to be no reason for intervention on the part of the Court to restrain the company from doing the acts by any agent it thought fit, which would be the effect of an injunction against the defendant in this case. He, therefore, refused the injunction. He did not think, however, in view of the facts of the case, that defendant was entitled to costs, and he dismissed the motion, but without costs.

Accident at Johannesburg.—A serious accident occurred on August 31st at the Bantjes transformer house, of the Consolidated Mine, when four employés of the Victoria Falls Power Co. were injured by two explosions of oil. The first explosion took place in the current transformer at the distributing station, the burning oil catching F. Lefert (district engineer), and J. Doloughan (fitter). The former was burned on his hands and neck, and the latter on his hands, arms, face and back. He is seriously injured. At the same time an explosion occurred at the transformer station, the burning oil being thrown out from the switch. J. Eggen (fitter) and J. Meyer (electrician) were caught by this and badly burned about the face.

Olympia Electrical Exhibition.—During the run of the Exhibition the Electric Supply Publicity Committee will be well represented. There will be specimens of the various publications already issued, and designs for circulars forthcoming in the future, which should be of interest to managers, engineers, &c. A representative will be in attendance all the time to give any information or to take instructions. The Committee is to be accommodated in the Reception Room in the main gangway, near the entrance.

B.E.A.M.A. Inaugural Dinner.—The British Electrical and Allied Manufacturers' Association have decided that the dinner to celebrate the reorganising of this Association will be held at the Hotel Cecil on Thursday, October 12th, when it is hoped that there will be a strong muster of members of firms exhibiting and their friends at the Electrical Exhibition. Advantage will, no doubt, be taken of the occasion to make some pronouncement as to the future policy of the Association. Further details will be published later. Meantime, early application should be made for tickets by letter addressed to :—Mr. F. B. O. Hawes, Olympia, Kensington, W., or 36 and 38, Kingsway, W.C.; they may also be had from the following firms :—

London	Berry, Skinner & Co., 78, Upper Thames Street, E.C.
	The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.
	Nalder Bros. & Thompson, Ltd., 34, Queen Street, Cheapside.
Birmingham ...	Chamberlain & Hookham, Ltd., Solar Works, New Bartholomew Street.
	The Electric and Ordnance Accessories Co. Ltd., Cheston Road, Aston.
Bradford	The Phœnix Dynamo Manufacturing Co., Thornbury Works.
Edinburgh	Bruce Peebles & Co., Ltd.
Gateshead-on-Tyne ...	The Sunbeam Lamp Co., Ltd., Park Road.
Glasgow	Mavor & Coulson, Ltd., 47, Broad Street, Mile End.
Manchester & district	Electromotors, Ltd., Openshaw.
	Ferranti, Ltd., Hollinwood.
	The Lancashire Dynamo and Motor Co., Ltd., Trafford Park,

or from the office of the Electrical Review, 4, Ludgate Hill, E.C.

St. Pancras Electric Lighting.—According to an evening newspaper, a case of legal anomalies was brought before Mr. Bros at Clerkenwell Police Court on 21st inst. A consumer of electricity supplied by the St. Pancras Borough Council had a dispute with that body about a fuse, and found that he could not appeal to anyone to decide it, as St. Pancras and Chelsea had their own Electric Lighting Acts,, which were passed before the L.C.C. got their Act giving them powers of inspection over the rest of the electric lighting concerns of London. The St. Pancras Act, he said, provided that an aggrieved consumer must ask a police magistrate to appoint an inspector, who should become the officer for the district. Neither the Board of Trade nor the L.C.C. could move in the matter. Mr Bros promised to take time to consider the novel proposal.

Inquiries.—A correspondent in South America who desires to run arc lamps on a 25-cycle traction circuit would be glad to know of any lamp that will burn satisfactorily (without flickering) on this frequency, or to receive suggestions that will enable him to get over the difficulty.

Electric Supply Cricket League.—We have received the following particulars of the points scored during last season by the clubs affiliated to this League, from which it will be seen that the St. James's Electric C.C. are the winners of the Cup this year :—

St. James's Electric C.C.	17 points.
City Electric C.C.	16 ,,
Kensington and Knightsbridge Electric C.C.	15 ,,
St. Pancras Electricity C.C.	8 ,,
Chelsea Electricity C.C.	4 ,,
Central Electricity C.C.	0 ,,

Mr. A. W. Seabright, hon. secretary and treasurer, 19, Cadogan Gardens, S.W., will be pleased to furnish any electricity supply cricket club with information concerning the League.

Overhead Wires.—According to a report in the *Times*, Mr. Hopkins sat at Lambeth Police Court as arbitrator to determine a difference which has arisen between the Postmaster General and the Southwark Borough Council on a proposal to place overhead telegraph wires in certain thoroughfares within the district of the Council. Mr. Percy McIntyre, who represented the Postmaster-General, said that when the solicitor to the Post Office wrote asking the Borough Council to waive their objection to overhead wires, the town clerk replied that they were unable to do so, as they were firmly opposed to the principle of allowing these wires to be placed overhead. The wires would not be used for any other purpose than that of connecting up the firm-alarm post with the fire station. The cost of placing these lines overhead would be something like £90, but if they were placed underground the cost would be £339, a difference of £250. Mr. A. Harrison, borough engineer, said his Council altogether objected to overhead wires in their district. The erection of the proposed posts and wires would be objectionable to the inhabitants and would tend to deteriorate the district. Mr. Hopkins reserved his decision.

Large Electrical Furnaces.—According to *Teknisk Ugeblad*, most of the furnaces now used at the saltpetre factories at Notodden, in Norway, have been built for 800 kw.; but experiments have been made with larger furnaces, even up to 4,000 kw., and the experience gained from the use of these has been so encouraging with regard to economy that it now has been decided to build a new type of furnace for 6,000 kw.

Institution and Lecture Notes.—The Iron and Steel Institute.—We learn from the secretary, Mr. G. C. Lloyd, that circumstances have arisen which have unfortunately led to the abandonment of the arrangements made to hold the autumn meeting of the Institute in Turin. Arrangements have therefore been made for the autumn meeting to be held (by kind permission) at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday, October 5th, at 10.30 a.m. If necessary the meeting will be resumed in the afternoon. The following is the list of papers which have been submitted, a selection of which will be read and discussed :—

"Report on the Iron Ore Resources of Italy." (*a*) Sardinia, by Ing. L. Testa. (*b*) Brembana Valley, by Cav. G. Calvi. (*c*) Central Italy, by Ing. A. Ciampi. (*d*) Southern Italy and the Island Dependencies, by Prof. G. la Valle.
"On Temperature Influences on Carbon and Iron." By E. Adamson (Sheffield).
"On the Mechanical Influence of Carbon on Alloys of Iron and Manganese." By Prof. J. O. Arnold (Sheffield) and F. K. Knowles (Sheffield).
"On the Autogenous Welding of Metals." By Dr. Francesco Carnevali (Turin).
"On the Application of Electric Energy to the Manufacture of Iron and Steel in Italy." By Cav. Ing. Remo Catani (Rome).
"On the Present State of the Metallurgical Industry of Italy." By Signor Comm. Luigi Dompé and Cav. Francesco Saverio Pucci (Milan).
"On the Origin of the Iron Ores of Swedish Lapland." By L. L. Fermor (Calcutta).
"On New Industrial Processes for the Cementation of Steel." By Cav. Prof. Dr. Federico Giolitti (Turin).
"On Cementation with Gas under Pressure." By Prof. Dr. F. Giolitti and Dr. Francesco Carnevali (Turin).
"On the Transformation of Steel within the Limits of Temperature employed for Heat Treatment." By L. Grenet (Argenteuil, France).
"Researches on the Nature of the Phosphates contained in Basic Slag derived from the Thomas Gilchrist Dephosphorisation Process." By Victor Adolphe Kroll (Luxembourg).

The Association of Engineers-in-Charge.—The following arrangements are announced :—

Saturday, October 7th.—Visit to the Marconi Wireless Telegraph Co.'s Works at Chelmsford. Party to leave Liverpool Street at 1.55 p.m.
Wednesday, October 11th, at 8 p.m.—Presidential address by Mr. W. H. Maw, LL.D., M.Inst.C.E., &c., at St. Bride's Institute.
Saturday, October 28th.—First Social (Ladies' Night), at Liverpool Street Hotel.

Two special popular lectures will be given by Mr. Frederic H. Taylor, A.M.I.E.E., A.M.Inst.M.E., on "Recent Developments in Electric Lighting and Other Applications of Electricity" on October 4th and 6th next, commencing each evening at 8 p.m. Tickets may be had on application to the secretary at the Willesden Polytechnic, Priory Park Road, Kilburn, N.W.

Educational Notes.—Technical College, Finsbury.—The evening courses in electrical and mechanical engineering at the Technical College, Finsbury, begin on October 2nd and 3rd respectively. The lectures of the advanced electrical course on Monday evening will be given by Prof. Silvanus Thompson on Alternating Current Work and Dynamo and Motor Design. Mr. Simmons will give a few lectures on the Transmission and Distribution of Energy. On Wednesday evenings throughout the session lectures on Magnetism and the Design of Magnets will be given by Prof. Silvanus Thompson, and by Mr. Howgrave-Graham on Electrical Measurements and Illumination and the Elementary Principles of Dynamos, Transformers, &c.

In the Mechanical Department on Tuesday, October 3rd, the inaugural lecture by Mr. G. K. B. Elphinstone will be given at 8 p.m., the subject of the lecture being "Gyroscopes and the Gyro-Compass." Particulars of other lectures are given in our advertisement pages.

University College, Gower Street, London.—The College Calendar for 1911 has just been issued : it is a bulky volume of over 700 pages, and contains, besides the usual information, examination papers, &c., full particulars of the many new developments in the various faculties. In the Faculty of Engineering, a new lectureship has been instituted in Heating and Ventilating Engineering, with Mr. Arthur Barker as lecturer, and the special postgraduate lectures in advanced engineering subjects founded in previous years are detailed.

A Steamer Installation.—Messrs. W. C. Martin and Co., of Glasgow, are at present carrying out an installation on the large passenger steamer *Kaiser Franz Josef I*, built at Trieste, for a company belonging to that port. The equipment includes three turbo-generators of 145 kw. capacity ; a switchboard in the engine room, by which power is conveyed to auxiliary switchboards placed at various points ; and about 2,000 electric lights. Six arc lamps light the gangways and decks, and cluster fittings of large capacity are supplied to the hatchways, holds and stokehold. In connection with the liner's navigating lights, Messrs. Martin are fitting in the chartroom their patent duplex automatic masthead and sidelight indicator. For ventilation, 16 electrically-driven thermo-tanks supply hot or cold air by means of trunking to the various compartments. To ventilate the stokeholds, six electrically-driven Sirocco fans are to be used, and over 100 fans of different sizes will be in use in the public saloons, passengers' and officers' accommodation, &c. Electric power will work the provision hoists, engineer's lathe, potato peelers, dough-mixers, dish washers, sounding machine, and other appliances. It is stated that this is the largest electric light and power equipment yet fitted on any Mediterranean-built steamer.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—We are informed that our statement of last week of the appointment of Mr. Souden to Dewsbury is incorrect. The name of the gentleman appointed was given accurately in our issue of September 15th, namely, Mr. S. H. Fowles, of Newcastle-on-Tyne.

The marriage took place at Eccles Parish Church on September 21st, of Mr. Horace Wentworth Angus, second son of Dr. J. A. Angus, of Newcastle-on-Tyne, and electrical engineer to the Eccles T.C., and Miss Emma Beatrice Cowell, younger daughter of Mr. R. M. Cowell, of The Larches, Bindloss Avenue, Eccles. The presents included a silver coffee service from the chairman and members of the Electricity Committee, and a silver salver from the Corporation officials.

Mr. N. Tuffin has resigned his position of shift engineer with the Wycombe (Borough) Electric Light and Power Co., to take up similar duties in Sydney, N.S.W. Mr. P. F. Arendzen has been appointed engineer-in-charge to fill this vacancy.

Mr. L. E. Comley has resigned the post of switchboard attendant at the Dewsbury Corporation electricity works, in order to take up a similar post at Devonport Corporation electricity works.

Tramway Officials.—On leaving Bournemouth, Mr. C. W. Hill, the retiring general manager of the Corporation Tramways, was presented by the staff with an illuminated address and a leather writing cabinet, and a pair of water colours for Mrs. Hill. The chairman of the Tramways Committee made the presentation, paying a tribute to Mr. Hill's successful work during the 2½ years he had been in charge of the Bournemouth tramways system. One of the conductors gave a direct expression from the ranks of the tramways workers of the great regret felt at Mr. Hill's departure, and the gratitude of the whole of the staff for his thoughtfulness and care for those under him. The recipient suitably acknowledged the gifts. The Mayor paid a tribute to Mr. Hill's sterling work in connection with the feeding of the poor children in the borough, and his efforts on the Committee of the Saturday and Sunday Hospital Fund. Prior to the presentation the tramway staff, numbering nearly 300, attended service at St. Peter's Church, Bournemouth.

Mr. Caird and Mr. Galloway, traffic superintendent and tramways engineer respectively at Halifax, have been appointed dual managers of the tramways in the place of Mr. Rogerson, who has been relieved of his appointment as general manager, so that on account of developments in prospect, he may be able to devote his whole time to his other work as electrical engineer. A conference is to be held between the Tramways and Highways Committees with a view to the supervision and maintenance of the track being transferred to a special department of the Corporation.

The marriage took place last week of Mr. Matthew Francis Sheahan, assistant manager of the tramways department of the Leyton U.D.C., and Miss R. A. Trumble, daughter of Mr. John Trumble, of Leyton.

General.—A West Australian newspaper reports that at the end of August a social was held to welcome and congratulate Mr. James S. Fitzmaurice upon his appointment as electrical engineer for Western Australia. Mr. Fitzmaurice has been for many years assistant engineer in New South Wales, and for some months past had officiated as acting engineer for the State of Western Australia. The social was attended by the clerical, mechanical, and line construction staffs of the local telegraph and telephone departments. Mr. P. Kennedy, assistant engineer, occupied the chair.

The *Sydney Daily Telegraph* states that it has been decided by the Postmaster-General to establish a branch of the electrical engineering department in Dubbo, which will be in charge of Mr. E. West, of the Sydney branch. Mr. West will have a staff of officers.

The *Indian Textile Journal* reports that the Secretary of State has sanctioned the retention of Mr. F. W. Wilson, electrical inspector to the Bombay Government, for a period of three years.

The Portsmouth T.C. has decided to increase the salary of Mr. H. J. Andrews, engineer and manager of the telephone undertaking, from £260 per annum to £300.

Mr. W. Scott Taggart, M.I.Mech.E., has taken an office at 22, Bridge Street, Manchester, as consulting engineer in general engineering and textile work.

Obituary.—Mr. T. C. Clark, of the firm of Messrs. T. Clark & Co., electrical engineers, 129, Sloane Street, Chelsea, passed away suddenly while away for a holiday with his wife and friends at Weymouth. Deceased gentleman had suffered from a heart affection for a couple of years, and he succumbed to an attack which seized him while seated on the esplanade. Mr. Clark was 52 years of age. The business will be continued by his two brothers, Messrs. W. & E. Clark.

NEW COMPANIES REGISTERED.

Industrial Plant Co., Ltd. (117,763).—This company was registered on September 22nd, with a capital of £40,000 in £1 shares, to carry on the business of manufacturers of machinery, apparatus, appliances, cables and all kinds of plant for use in connection with the generation and supply of electricity, &c. The subscribers (with one share each) are: J. E. Pigdon, Milburn House, Newcastle-on-Tyne, clerk; W. B. Glasson, Milburn House, Newcastle-on-Tyne, clerk; B. FitzGerald, 30, Windsor Terrace, Gosforth, clerk; D. Aitchison, 112, Brighton Grove, Newcastle-on-Tyne, cashier; T. W. Ward, 74, Tavistock Road, West Jesmond, Newcastle-on-Tyne, clerk; H. E. Nelson, 1, Maritime Terrace, Sunderland, clerk; H. W. J. Vertigan, 32, Honister Avenue, Newcastle-on-Tyne, clerk. Minimum cash subscription £5,000. The number of directors is not to be less than two or more than seven; the first are F. S. Newall and R. P. Sloan; qualification (except first directors), £500; remuneration as fixed by the company. Registered by Sayer, Ledgard and Smith, 13, Clifford's Inn, E.C.

Leitner Electrical Co., Ltd. (117,708).—This company was registered on September 19th, with a capital of £27,500 in £1 shares, to acquire from H. Leitner a licence to work the patents relating to inventions for the automatic electric lighting of trains, motor-cars and boats, &c. The subscribers (with one share each) are:—Right Hon. Viscount Templetown, 17, Victoria Street, S.W.; Captain J. D. Walker, D.S.O., Wilbury, Sunningdale; H. Leitner, Maybury, Woking, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are Right Hon. Viscount Templetown, E. T. Sturdy and Captain J. D. Walker; qualification, £100; remuneration (except managing director), £50 each per annum (chairman £25 extra). Registered office, 7, Princes Street, Westminster, S.W.

Glais Electrical Co., Ltd. (117,744).—This company was registered on September 21st, with a capital of £2,000 in £10 shares, to take over the electric light undertaking carried on by E. Lewis at the Electric Lighting Station, Glais, Clydach, Glam. The subscribers (with one share each) are:—E. Lewis, Graig-y-pal, Glais, mining engineer; E. Bevan, Tawe Stores, Trebanos S.O., colliery proprietor. Private company. The number of directors is not to be less than two or more that five; the first are E. Lewis, E. Bevan and W. Bowen; qualification, £200. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Municipal Tramways Association (Incorporated). (the word "Limited" is omitted from the title by licence of Board of Trade), (117 780).—This company bas just been registered with 300 members, each liable for £1 in tbe event of winding up, to promote, encourage and facilitate the construction, extension, working and interests of tramways, light railways, railless traction and motor omnibuses and similar works, and vehicles owned and worked by municipal corporations or other local authorities, and in particular of electric, steam and other modes of mechanical traction, and with a view to bring together officials and others interested tberein. The subscribers are:—J. Dalrymple, 46, Bath Street, Glasgow, general manager, Corporation Tramways Department; H. E. Blain, Greengate Street, Plaistow, E., tramways manager, West Ham Corporation; C. J. Spencer, 7, Hall Ings, Bradford, general manager, Corporation Tramways; A. L. C. Fell, 62, Finsbury Pavement, E.C., chief officer, L.C.C. Tramways; J. Aldworth, Beastmarket Hill, Nottingham, general manager, Corporation Tramways Department; H. Linsley, J.P., 7, Bank Place, Salford; A. R. Fearnley, Division Street, Sheffield, general mauager, Corporation Tramways. The management is vested in a council, the first members of which are:—J. Dalrymple, H. E. Blain, C. J. Spencer, A. L. C. Fell, J. Aldwortb, H. Linsley, J.P., A. R. Fearnley; A. Baker, County Buildings, 147, Corporation Street, Birmingham (general manager, Corporation Tramways); P. Fisher, Town House Buildings, Dundee (general manager, City Tramways); S. Flint, tramways department, Leicester (chairman, Corporation Tramways Committee); J. B. Hamilton, City Square, Leeds (general manager, City Tramways); J. H. McElroy, 55, Piccadilly, Manchester (general manager, Corporation Tramways); H. Mosley, Queen's Gate, Burnley (general manager, Corporation Tramways); W. F. Russell, 48, West Regent Street, Glasgow (Convener, Corporation Tramways Committee); L. Slattery, 62, Finsbury Pavement, E.C. (traffic manager, L.C.C. Tramways); and E. R. Pickmore, town clerk, Town Hall, Liverpool. Registered by A. R. Fearnley, Division Street, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Maxim Lamp Works, Ltd. (108,013).—Charge on the company's undertaking and property, present and future, including uncalled capital, dated September 4th, 1911, to secure all moneys due or to become due from the company to Barclay & Co., Ltd., 54, Lombard Street, E.C.

Corona Lamp Works, Ltd. (116,527).—Issue on August 22nd, 1911, of £200 debentures, part of a series of which particulars have already been filed.

Tubes, Ltd. (91,221).—Return dated June 27th, filed August 17th, 1911. Capital £100,000 in £1 shares. All sbares taken up; £1 per share called up on 82,859; £82.859 paid; £17,141 considered as paid on 17,141 sbares. Mortgages and charges: £51,500.

Hindhead and District Electric Light Co., Ltd. (75,361).—Issue on September 8th of £200 debentures, part of a series of which particulars have already been filed.

Llanelly and District Electric Lighting and Traction Co., Ltd. (64,341).—Two mortgages, datcd September 1st, 1911 (supplemental to trust deed dated August 3rd, 1911, securing £60,000 debenture stock). Property charged: Certain lands and premises in Llanelly. Trustees: Century Insurance Co., Ltd., 18, Charlotte Street, Edinburgh.

Electric Construction Co., Ltd. (39,292).—Return, dated August 3rd, filed August 10tb, 1911. Capital £400,000 in £2 shares (50,000 preference). 112,100 ordinary and 31,390 preference shares taken up. £2 per share called up on 2,100 ordinary and 18,245 preference. £40,690 paid. £246,290 considered as paid on 110,000 ordinary and 13,145 preference. Mortgages and charges: £182,700.

Electric and General Investment Co., Ltd. (31,506 C).—Return, dated August 10th, filed August 17th, 1911. Capital £200,000 in £5 shares (20,000 ordinary, 100 founders' and 19,900 preference). All shares taken up. £1 per share called up on ordinary and £5 per share on the founders' and preference. £120,000 paid. Mortgages and charges at date of return: £10,000; since issued, £22,500. Capital increased to £201,500 by the creation of 30,000 deferred shares of 1s. each, on August 18th, 1911. Return of allotments made up to August 18th shows whole of the deferred sbares allotted for oasb.

Ingleby & Co., Ltd. (117,463).—Particulars of £2,000 debentures, created September 13th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the wbole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594). Particulars of £10,000 second debentures, created July 17th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £4,700. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding certain patent rights, subject to £25,000 first mortgage debentures. No trustees.

Chesham Electric Light and Power Co., Ltd. (90,833).—Return dated July 14th, 1911; capital £25,000 in £1 shares; 15,007 shares taken up; £1 per share called up on 7; £7 paid; £15,000 considered as paid on 15,000 shares. Mortgages and charges, £8,200.

Chili Telephone Co., Ltd. (29,252).—Return dated August 3rd, filed August 18th, 1911; capital £360,000 in £5 shares; 66,000 shares taken up; £5 per share called up on 44,000; £220,000 paid; £110,000 considered as paid on 22,000 sbares. Mortgages and charges, nil.

Crompton & Co., Ltd. (27,200).—Return dated August 14th, filed August 15th, 1911. Capital, £300,000 in £3 shares; 85,000 shares taken up; £3 per share called up on 83,000; £249,000 paid; £6,000 considered as paid on 2,000 shares. Mortgages and charges: £175,000.

Ecuador Telephone Co., Ltd. (29,295C).—Return dated August 3rd, filed August 4th, 1911. Capital, £100,000 in £5 shares; 5,000 shares taken up; £25,000 paid. Mortgages and charges: Nil.

CITY NOTES.

German Electrical Companies.

THE first financial year of the Deutsche Gluhlampenfabrik, of Plauen, Saxony, which acquired glow lamp patents from the firm of J. P. Wild, for the sum of £15,000, comprises a period of nine months ended with June 30th, 1911. After allocating £300 to depreciation, the accounts show a loss of £2,400, which has been carried forward. The share capital amounts to £100,000, of which paid-up shares represent £56,000.

The Deutsche Elektrizitätswerke Garbe, Lahmeyer & Co., of Aix-la-Chapelle, have just celebrated the twenty-fifth year of the existence of the firm by the allocation of £5,000 to the provident fund for officials and workmen. Including the balance of £5,000 brought forward, the accounts for 1910-11 indicate gross profits of £102,000, as compared with £78,000 in the preceding year. After meeting management expenses, and placing £8,300 to the depreciation fund, there remain net profits of £38.900, as contrasted with £26,600 in 1909-10. It is proposed to pay a dividend of 5 per cent. for the year, being the same rate as in the previous 12 months, and to carry forward the sum of £14,800.

The report for 1910-11 of the Wolfram Lampen Gesellschaft, of Augsburg, states that notwithstanding the receipt of sufficient orders during the greater portion of the year, great exertions were necessary in order to keep tbe works constantly employed. Orders were more actively coming to hand in accordance with the approach of the lighting season, although an improvement in the whole situation of business could not be ascertained. The downward course of the movement in prices, together with the advent of difficulties in manufacture which could now be regarded as overcome, unfavourably influenced the results for the year. The years of efforts to secure foreign markets had been accompanied by noteworthy success in the past 12 months, but the business necessitated a considerable sacrifice. The time seemed to have not yet arrived for the formation of a combination of makers of metallic-filament lamps, although an agreement of the kind would be of far-reaching importance to the glow lamp industry, as it would only in that way be possible to again obtain better prices. The accounts show, after apportioning £8,900 to depreciation, as against £9,600 in 1909-10, a loss of £4,200 as compared with profits of £2,100 in the preceding year, on a share capital of £150,000.

Underground Electric Railways Co. of London.

THE half-yearly meeting was held on Tuesday last week, at Electric Railway House, Broadway, Westminster, S.W., Sir Edgar Speyer, Bt., presiding.

The CHAIRMAN, in moving the adoption of the report (see page 387), said he thought the shareholders would agree that they were satisfactory, both as regarded what had been done and what they might infer from them might be done in the future. They showed good progress, but he need hardly point out again that, although the results were better, the dividends paid on the share capital of the railway companies were not by any means a fair or adequate return on the large amounts invested in these enterprises. As regards the accounts, the revenue account showed total receipts of £158,536, an increase of £10,921, or 7¾ per cent. on the first half of 1910, and the net revenue, before allowing for income bond interest, was £39,497, a gain of £13,104, or 49 per cent. The income derived from investments was £105,975, or £15.678 more than in the first half of the previous year. This increase was chiefly due to the better earnings of the London Electric Railway Co. The revenue from holdings in the Metropolitan District Railway Co. in the half-year under review was practically unchanged, but the outlook in that respect justified the hope of some improvement in the current six months. The rents of properties rose from £1,462 to £2,679. In the first half-year of 1910, under the guarantee in respect of Metropolitan District assented first preference stock the company had to provide on balance £1,343, but on this occasion the Underground received on balance £2,686. Satisfaction wit

e results had already been expressed in the report, but he ed to emphasise this favourable feature, and to point out that company was now deriving, after having waited for many s, the full benefit of its guarantee of a 3½ per cent. dividend bout one-third of the Metropolitan District first preference k. Their administration expenses showed a decrease from 32 to £3,390. As in the case of the last half-year of 1910, had again abstained from taking credit in the revenue unt during the half-year under review for interest accrued on id calls on shares of the company. The interest accrued to the of the half-year, June 30th, amounted to £22,000. As pointed on a former occasion, the directors considered this a good debt, but it was conservative to keep the balance in reserve for the nt. He need not refer to the working results of the several panies in which the Underground Co. was interested, as chairman of these companies had fully explained the affairs eir undertakings, and it was not necessary for him to repeat of their statements, as they had no doubt read them. The important event of the half year from the shareholders' point ew had been the passing of the Metropolitan District Railway of 1911, which received the Royal Assent on June 2nd last. result of this Act, the arrangements for the sale of the power e to a Joint Committee of the London Electric and the Metro- an District Railway Companies had been successfully concluded. Lot's Road power house undertaking would be transferred to Joint Committee, which consisted of three members of the board ie District Railway Co., and three members of the board of the lon Electric Railway Co., and would be leased by the Joint mittee to the two companies for 999 years as from January 1912. The consideration payable to the Underground Co. was proceeds of the sale of £2,200,000 joint power house rent ge stock. The money thus obtained would redeem the e existing issue of £1,000,000 4 per cent. power house atures, and £1,088,700 4½ per cent. bonds of 1933, while sum realised by the sale of the London Electric prefer- stock referred to in his last speech had already liquidated £1,000,000 5 per cent. prior lien bonds. They would rom this that the Underground Co. within 12 months d have reduced its fixed-charge debt by no less than 88,700. Moreover, when the transfer of the power house had n place, the surplus of about £630,000 realised in excess of the value of the power house undertaking would be applied in ng out that amount of suspense items which now stood at about 00,000 on the assets side of the balance-sheet. He thought he justified in congratulating the shareholders on the successful ts of these transactions. He referred in his last speech to the inghouse award, and informed them that the Westinghouse ould appeal against it, but they were advised that the award good. The appeal had not yet been heard, but they hoped it d come on after the long vacation, so that when he had the ur of addressing them again at the next meeting, this matter ld be finally disposed of. The opinion then expressed by their advisers as to the validity of the award was unchanged.

RD GEORGE HAMILTON, G.C.S.I., seconded the motion, and the t was adopted.

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undee, Broughty Ferry and District Tramways Ltd.—The directors report that for the year ending July 31st, the profit (including the sum brought forward from last year), providing for interest on debenture stock, amounts to £5,163. n this there falls to be deducted, interim dividend paid on rence shares for half-year to January 31st, 1911, at the rate per cent. per annum, £1,500; leaving a balance of £3,663, h the directors propose to deal with as follows:—(1) In pay- of final dividend on preference shares at the rate of 6 per per annum for half-year ending July 31st, 1911, £1,500; (2) newals fund, £600; (3) to sinking fund for redemption of nture stock, £600; (4) to pay dividend on the ordinary shares e rate of 2 per cent. per annum for year ending July 31st, £574; (5) to carry forward to next account, £388. The ngs of the tramways remain approximately the same as last the traffic receipts on the working account showing a ase of £46. With better trade conditions traffic receipts ld substantially increase without affecting working conditions.

exican Light and Power Co.—A dividend of 3½ per has been declared for the six months ending October 31st, on the preference shares, and a dividend of 1 per cent. on the ary shares.

hawinigan Water and Power Co.—The directors unce an issue forthwith of $1,000,000 of new common stock at rice of $108 per share (Montreal terms), on the basis of one of new stock for each nine shares held.

abcock & Wilcox, Ltd.—The directors have declared nterim dividend at the rate of 24 per cent. per annum (2s. 4½d. hare), free of income-tax, on the ordinary shares for the half e to June 30th.

Winnipeg Electric Railway Co.—A quarterly divi- of 12 per cent. per annum is announced.

umberland Telephone and Telegraph Co.—The tors have declared a quarterly dividend of 2 per cent.

lexico Tramways Co.—A dividend of 1¾ per cent. been declared for the quarter ending September 30th, 1911, on issued capital stock.

Cleveland and Durham Electric Power Co., Ltd.

THE report, as abstracted in the *Financier*, states that the gross profit for the year to June 30th was £20,973, as compared with £12,942 for the previous year. After providing for debenture and other interest there is a net profit of £8,342, which it is proposed to carry to the next account. During the past year the capital expenditure on the works was £9,107. The connections to the company's system at June 30th aggregated 40,460 H.P., an increase of 4,177 H.P. connected during the year. In addition to this, 12,500 H.P. has been recently contracted for, and other important negotiations are proceeding. Arrangements are being made to work for a term of years further waste heat generating stations at the Tees Furnace Co.'s ironworks, Redcar, the Port Clarence Works, the Ayresome Ironworks belonging to Messrs. Mills & Co., and also the Redcar ironworks of Messrs. Walker, Maynard & Co. The scheme for the rearrangement of the capital of the company received the confirmation of the High Court in December, and the capital now stands reduced by £299,915, which has been applied to the writing down of assets.

The annual meeting was held at Newcastle-on-Tyne on September 26th. MR. JAMES FALCONER, M.P., chairman, presided, and in moving the adoption of the report, he said that the net result of the year's working was a gross profit of £20,973, as compared with £12,942 last year, an increase of £8,041. Contracts had been made with consumers this year amounting to 4,177 H.P. At the beginning of the year they had contracts amounting to 36,283 H.P.; the contracts now amounted to 40,460. In addition, though the works to be supplied had not been completed, they had secured further contracts to supply 12,500 H.P. These figures showed a steady and satisfactory progress. The progress had been hindered considerably through the trade disputes of the year. A satisfactory feature was the fact that the company had been able to secure arrangements for operating four additional waste heat stations, thus increasing the supply of electricity and effecting economies. With regard to the capital, it would be necessary to make arrangements for providing connections for the business which they had secured, and which it would be necessary to carry out in the next year or two. With a view, therefore, of providing for that, the directors had arranged for the issue of the remaining portion of the second debentures. This did not appear in the accounts, but it would appear next year. The amount was £28,000, and they would be issued on the same terms as the previous debentures were issued. In answer to a question as to the payment of an interim preference dividend, the chairman said they could not do that, as that dividend depended on the profits which it was intended to distribute in each year, and that could not be ascertained until the year's end.

MR. PHILIP NOBLE seconded the report.

MR. A. GEMMELL opposed the adoption of the report. He said he failed to see any satisfactory feature in the business at all. The gross profits were most unsatisfactory, and some £5,000 more would be required next year for the payment of interest. In the past five years the bulk of electricity supplied to the Northern Counties Co., which was a prominent feature in the prospectus, had failed to produce any dividend. After criticising the policy of the directors, Mr. Gemmell stated that the directors had spent all the money they had set out to spend five years ago, and now they found themselves in the position of having to hire plant from the Waste Heat Co. He advocated a thorough independent investigation by a business expert of the first rank.

The CHAIRMAN said he did not think it was desirable in the interests of the company to go into the matters referred to by Mr. Gemmell, as they had been fully discussed and satisfactorily explained at the previous annual meeting. Those matters had all been disposed of, and as a matter of fact, they had no bearing whatever upon the points before them, and did not really come into the scope of that particular company.

The report was then carried with one dissentient.

Mr. M. L. Bell was re-elected a director, and Mr. Wm. Swan was re-elected auditor.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 62,500 shares of $100; 62,500 shares of $100; 1,250 shares of $100; and 23,750 shares of $100 each.

Welsbach Light Co., Ltd.—265,000 shares of £1 each, fully paid.

And to allow the following securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 40,370 5 per cent. cumulative preference shares of £5 each, fully paid, Nos. 120,001 to 160,370.

Eastern Extension Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th last of 2s. 6d. per share.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1911, and payable on October 2nd next.

Continental.—SWITZERLAND.—The Oerlikon Engineering Co., of Oerlikon, near Zurich, is declaring a dividend of 4 per cent. for the last financial year, the same as for the preceding 12 months.

MARKET QUOTATIONS.

Wednesday, September 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	8/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£10 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	4½d.	..
a ,, Perchlorate	,,	7d.	..
a Potassium, Cyanide	,,	6d/-	..
a Shellac	per cwt.	£4 10	..
a Sulphate of Magnesia	per ton	£6 10	..
a Sulphur, Sublimed Flowers	,,	£5 10	..
a ,, Recovered	,,	£5 5	..
a ,, Lump	,,	£11	..
a Soda, Caustic (white 70 %)	,,	3⅝d.	..
a ,, Chlorate	per lb.	£3 5	..
a ,, Crystals	per ton	8d.	..
a Sodium Bichromate, casks	per lb.	7d.	..
a ,, Cyanide (basis 100 %)	,,		
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	..
c ,, Tube (brazed)	,,	9d.	..
c ,, ,, (solid drawn)	,,	7¼d.	..
c ,, Wire, basis	,,	7d.	..
c Copper Tubes (brazed)	,,	9⅝d.	..
c ,, ,, (solid drawn)	,,	8⅞d.	..
g ,, Bars (best selected)	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars	,,	£67 10	10/- dec.
e ,, ,, Sheets	,,	£73 10	10/- dec.
e ,, ,, Rods	,,	£60 10	10/- dec.
e ,, ,, H.C. Wire	per lb.	7⅝d.	½d. dec.
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	5/- to 7/-	Dec.
h India-rubber, Para fine	,,	4/9½	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	46/9	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£13 5	£1 7 6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 12 6	7/6 dec.
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½.	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8½d.	½d. dec.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£182 to £183	£1 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£33	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

United Electric Car Co.—The annual meeting was held on September 20th at Preston, Mr. G. Richardson presiding. Referring to a net profit for the year of £4,420, the chairman said the directors considered the returns satisfactory in view of the stagnant state of the car-building industry during the year. The available balance for the year was £5,482, and the directors felt satisfied in recommending a dividend of 6 per cent. on the preference shares, leaving £2,482 to be carried forward. Although their creditors were shown to be £17,000 more than last year, half that sum represented cash received on account of contracts not yet executed. The debts were rather heavier, but all were good. After regretting the loss on the Hadley and Trafford Park works, the chairman said the directors had decided to deal with the loss in the following way:—To write £10,000 from the general reserve, £36,171 for depreciation reserve—total, £46,171. This method would reduce their depreciaton and general reserve to £7,328. Replying to a question, the chairman said there were now 710 men employed by the company, against 327 in 1910. Messrs. Prestwich and Barningham were re-elected directors.

STOCKS AND SHARES.

Tuesday Evening

No sooner does one cause of trouble seem to be removed to so farther sphere, than another arises to take its place, and to unset the stock markets. Although the Moroccan difficulties supposed to be in a fair way of pacification, a fresh source of trou has appeared in the shape of friction between Italy and Turk over the question of Tripoli. Up to the present, however, much importance is attached to the threatened rupture in t direction, but its influence has certainly not made for the benefit the Stock Exchange at large.

The Home Railway market has been alternately buoyant depressed. Part of the heavy losses incurred last week have b wiped out by an upward movement started, there can be no do by the bear division. Last Saturday the market looked decide good, but on Monday the Tripoli *affaire* was used as an excuse letting prices down again. To-day, Tuesday, has brought be markets again, and once more Home Rails look stronger; the being based on rumours that the Tripoli dispute has been set amicably.

Central London stocks are weaker, the Deferred having fa back to 49. City and South London shed ½, and Metropolitan C solidated, after being a good market, went back to their prev figures, to rise again with the steam stocks. The moven amongst prior charge descriptions of the Home Railway compa continues towards lower levels, and Metropolitan 3½ per cent. vertible Preference is 2 down. District 3½ per cent. Guaranteed a point, although the Ordinary stock slightly hardened afte fall. Within the past few days the £10 fully-paid Ordinary sh of the Underground Electric Railways Company have been acco an official quotation, and are nominally 30s.

Hastings Tramways Preference are also back in the Official the price being 15s. middle, while the company's 4½ per cent. benture stock at 78½ is a point better. British Electric Trac Ordinary are ⅛ higher, the Preference being left unchanged a while the First Debenture stock eased off to 93½. The foreign is also a little dull. Latin-Canadians have recovered to extent from the free selling that came from the Continent. the market remains in a somewhat tender condition, and Sao P for example, show a loss of 2, Mexico Trams a fall of 1, while are ¼ better at 115¼. Fluctuations in the bonds are insignifi and a trifle irregular. Anglo-Argentine Trams First Prefe receded to 5⅛ upon a little selling, and British Columbia Ele 5 per cent. Preference put on a point, which was jestingly buted to the defeat of reciprocity between Canada and the U States. As a matter of fact, the landslide in Canadian politic not affected the markets in the securities with which we deal is it considered likely that it will carry much influence eithe way or the other.

Electricity Supply and Power shares are very quiet, chang the home market being confined to a fall of ⅝ in Newcastle ference, due to some slight selling pressure from the N Amongst the London Companies there is no alteration in whatever. The foreign group is also very colourless. M Ordinary suffered a nominal fall of ⅜, which took the price do 2⅝—a drop which surprised even some of the dealers in the m themselves. Calcutta Preference shares hardened to 5¼ o assumption that the coming Durbar should be a good thing f Calcutta Company. In the Canadian group, Montreal Ore rose 2, and Shawinigan Water was advanced a point. On the hand, Canadian General fell 2, and Northern Light and bonds have recommenced to crumble, the price at 38 showing a of 2 points. Mexican Light and Power issues are unchanged, the exception of ½ fall in the company's 5 per cent. First Mor bonds. At the present price of 93½ the yield is certainly attra and if it were not for the financial difficulties that still ex various centres where Mexican issues are favoured, there is doubt that this quotation would bring in investment buying.

On the eve of the Anglo-American Telegraph Company's me at which the agreement with the Western Union will be pas rejected, activity in the Anglo stocks has come to somethin standstill. The Preferred fell to 111½, and the Deferred, in there is most speculation, drooped to a shade below 25. United States Cable shares shed ⅛. The energetic campaign is being conducted by President Taft against the Trusts United States gives pause to many who otherwise consider American Preferred to be a good second-class investment, a result of the meeting is awaited with keen interest. West and Panama shares are again $\frac{3}{16}$ higher, and Eastern Tele Debenture stock hardened to 103½ middle. Marconis eased 45s., notwithstanding the fresh advertisement afforded to w telegraphy by the transmission of numerous messages fro *Olympic* after the collision last week with the *Hawke*. R shares continue to be steadily bought, and once more there i of ⅛, which lately seems to have become a weekly institution Eastern group is steady.

Buyers have come along again for National Telegraph De and the price has been taken up to 118½, more than wiping 2 points lost last week. The two Debenture stocks are higher, but the Second Preference sustained a small set-back.

Amongst manufacturing shares, Babcock & Wilcox hav ¼ to 5¾, but an excellent report from the Dick, Kerr Compa not prevent the Preference shares from easing off $\frac{1}{32}$, maki middle price 20s., at which the return is a round 6 per cent. money. For an industrial investment of this type, this good share, because the fluctuations in the price are as a rul small. British Westinghouse Preference are a little ha 7s. 6d. middle, while Castner-Kellner, receding to $3\frac{15}{16}$, drop $\frac{1}{16}$ improvement which they picked up last week.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Sept. 26th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7⅝ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅜ — 7⅞	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5	3¾ — 4¼	..	5 19 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	8⅞ — 4⅜ xd	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11⅜ — 12¾	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100½—103½	..	4 7 0
Edmundson's, Ord.	5	Nil	Nil	¼ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	5½	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	8½	9	6⅞ — 7⅛	..	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7⅛	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3¾ — 4¼	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	3⅝ — 3⅞	— ⅛	6 9 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8		..	..
Oxford	5	7	7½	6 — 6¼ xd	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87½ — 89½	..	5 0 7
Westminster, Ord.	5	10	10	7½ — 8	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5½	+ ¼	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	103 —108	—2	6 9 8
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85 — 87	..	5 14 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	23/32 — 25/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½—103¼	..	4 16 7
Madras, Ord.	5	Nil	..	2⅜ — 2⅝	— 3/8	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88⅜	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4	85 — 87	..	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	106 —108	..	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	92½ — 94½	— ½	5 5 10
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power	$100	6	7	167 —172	+2	4 1 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	37 — 39	..	12 3 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101⅓—103⅜	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	115 —117	+1	3 8 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105 —107	..	5 12 2

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	+ ½	4 19 0
American Telep. & Teleg., Cap.	$100	8	8	138 —140	..	5 14 4
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3¾	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111 —112	—1	5 7 2
Do. Def.	Do.	25/-	30/-	24⅝ — 25⅛	— ⅛	5 19 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6 15/16 — 7 3/16	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87⅜ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10¾ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17¼ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅝ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4¼	4½	7⅜ — 8¼	— ⅛	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegrapb, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102½—104½	+ ½	3 16 7
Eastern Extension	10	7	7	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10½ — 11	..	5 6 10
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	30½ — 31½	..	5 14 3
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	83 — 85 xd	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	74 — 76 xd	..	5 5 3
Marconi's Wireless Telegraph	1	Nil	Nil	2 1/16 — 2 1/8	— 1/32	..
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	117 —120	+3	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9 1/16 — 10 1/16	— 3/8	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 5/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	95 —101	+ ½	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	+ ½	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½—103½	..	4 7 0
Oriental Telep. and Elec.	1	8	8	1½ — 1⅝	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5	9 — 9½	+ ⅛	4 4 3
Submarine Cables Trust	Cert.	6	6	133 —136	..	4 8 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7½ — 7⅞	+ 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅜ — 3	+ 3/16	2 10 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅝ — 10⅞	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Sharc.	Dividends for		Closing Quotations Sept. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5	1 — 1	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1 1/8	+ 1/8	Nil
Do. 6 % Pref.	10	1½	1½	3 3/8 — 3 5/8	..	3 17 5
Do. 5 % Deb.	100	5	5	92 — 95	—1	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	65 — 67	—1	4 9 7
Do. Pref.	100	4	4	85 — 87	..	4 12 0
Do. Def.	100	2	2	48 — 50	—1	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1¾	28½ — 29½	— ½	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1/8 — 1 1/8	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1/8 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	76 — 81	+1	5 11 1
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3 — 3½	..	Nil
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3

NAME.	Stock or Sharc.	Dividends for		Closing Quotations Sept. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Metropolitan Railway Consol.	100	1	1⅜	41⅜ — 42½	+ ½	3 5 1
Do. Surplus Lands	100	2⅜	2⅜	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	—1	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	—1	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	—2	4 1 5
Metropolitan District Ord.	100	Nil	Nil	23½ — 24	+ ¼	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	8 18 5
Do. 4½ % First Prcf.	100	Nil	3¼	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	—1	4 13 4
Metropolitan Elec. Trams, Ord.	1	5	5½	3/8 — 1 1/32	..	5 6 8
Do. Def.	1	Nil	Nil	3/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	.5	1/8 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	102 —104	..	4 16 2
Potteries, Ord.	1	2	2	7/32 — 1/2	..	..
Do. 5 % Pref.	1	5	5	3/32 — 2 1/2	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	8	6	1/2 — 3/32	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways	10	..	..	1/2 — 1/2	..	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	Nil	1	59 — 61	..	1 12 9
Do. Power House Debs.	100	...	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2 3/8 — 2 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5¼	— 1/16	4 15 3
Do. 2nd Pref.	5	5	5	4⅜ — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6⅝ — 7⅛	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	138 —142	..	5 12 8
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	107 —110	+1	4 10 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½ xd	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5⅝ — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16 — 5/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 3/16	..	4 12 6
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf,	1	6	6	1⅛ — 1 1/16	..	5 13 0
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 6
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	+ ½	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7	114 —116	—1	6 0 3
Do. Gen. Con. 5 % Bonds	..	..	5	96½ — 98½	+ ½	5 1 6
Do. 6 % Bonds	100	6	6	97 — 99	— ¼	6 1 3
Para Elec. Rlys. & Lt., Ord.	5	..	10	6½ — 7⅛	..	7 0
Do. 6 % Pref.	5	6	6	5¼ — 5½	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 3
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1 1/16 — 1 1/8	..	2 7
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9
Rio de Janeiro Trams	$100	1	4⅓	114⅜—115⅞	+ ¼	3 17
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	— ½	4 18
Do. 5 % Mort. Bonds	100	5	5	97½ — 98½	..	5 1
Sao Paulo Tram, Lt. and P.	$100	10	10	171 —174 xd	..	5 14
Do. 5 % 1st Deb.	$500	5	5	102½—104½	..	4 15
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105 —107 xd	..	4 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	19/32 — 23/32	..	Nil
Do. 6 % Pref.	1	12	9	1 1/16 — 1 3/32	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜ — 5⅝	+ ¼	4 8 5
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅜ — 7 1/32 xd	..	6 17 11
Do. Pref.	5	6	6	5⅜ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	Nil	1/4 — 1/2	+ 1/8	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 1/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 17 11
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3½ — 3⅝	— 1/16	4 16 7
Do. Deb.	100	4½	4½	103 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2
Dick, Kerr	1	6	5	1/2 — 15/16	..	5 6
Do. Pref.	1	6	6	15/16 — 1 1/16	— 1/32	5 12
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	9/16 — 11/16	..	Nil
Do. fully paid	5	Nil	Nil	1½ — 2½	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3
Electric Construction	2	Nil	2½	1/4 — 3/8	..	6 13
Do. Pref.	2	7	7	1 1/16 — 1 1/8	..	7 4
Greenwood & Batley, Pref.	10	7	7	7/8 — 8/4	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	8½ — 9	..	5 11
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 5
Do. Deb.	100	4½	4½	106½—108½	..	4 2
India-Rubber, G. & T.	10	10	10	13⅝ — 15½	..	6 9
Do. Pref.	10	5	5	9⅞ — 10⅜	..	4 16
Telegraph Construction	12	17½	20	34½ — 36½	..	6 11
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	Nil	3/32 — 5/32	..	Ni
Do. Pref.	5	1½	Nil	3/4 — 1	..	Ni
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

THE BRITISH ASSOCIATION.—IV.

The Manufacture of Nitrogen Compounds by Electric Power.

By Ernest Kilburn Scott, A.M.Inst.C.E., M.I.E.E.

Section G. (Abstract.)

The following paper draws attention to several methods of fixing the nitrogen of the air with the help of cheap electric power, and it also gives particulars of some of the products. The processes were started on a commercial scale in Norway and Italy about six years ago and they are now well established, the principal products being the artificial manures :—

(*a*) Nitrate of lime, containing 12¾ per cent. nitrogen.

(*b*) Calcium cyanamide or nitrolim, with 18 per cent. nitrogen.

These manures are now being made at prices which compare favourably with the older artificial manures such as nitrate of soda and sulphate of ammonia when calculated on the nitrogen contents. For actual delivery to farmers, prices are perhaps not so favourable, because the quantities handled are small and the selling organisation is not so complete. The prejudices of the farmers have also to be overcome, and much propaganda expense is therefore necessary.

Detailed descriptions of the two processes are given below, but it may be here mentioned that in the nitrate of lime process, as introduced by Birkeland and Eyde, the nitrogen is fixed *directly* from the air in the electric furnace, and nitric acid made from this fixed gas then acts on carbonate of lime. In the calcium cyanamide process, which was first introduced by Frank and Caro, the nitrogen is first isolated from the air and then absorbed by carbide of calcium, itself an electric furnace product.

It will thus be seen that a principal difference between the two processes is that the cost of raw materials for nitrate of lime is low, whereas in the case of calcium cyanamide the nitrogen has to be specially prepared by the Linde process, and the carbide of calcium, by which it is absorbed (made from lime and coke or anthracite) costs about £6 a ton.

The nitrate of lime process is certainly unique amongst industrial processes in using a raw material—nitrogen—that costs nothing ; but, on the other hand, more electric energy is required for a given amount of nitrogen fixed. The prices of the resulting products are therefore very similar.

Many agricultural experts have tested these manures, and conclusively proved that when properly applied they are very valuable for increasing plant growth, also that they are especially useful for cereals—wheat, oats, &c., that require large quantities of nitrogen.

As the Chilian deposits of nitrate of soda and the virgin soils of the world are rapidly becoming exhausted, and, at the same time, there is a steady increase in the number of wheat-eating people, it is fortunate that new sources of nitrogen manures have been developed. The output is small at present, but it promises to be the greatest development of electrical engineering science of the near future. Already, by steadying the prices of the older manures, the new electrical methods have been of great benefit to agriculturalists.

Besides manures, many other materials are made by these processes, and the writer specially draws attention to the manufacture of nitrogenous products for explosives.

The nitric acid made by the nitrate of lime process can be concentrated to any value, and sold for the manufacture of explosives, such as gun-cotton, dynamite, smokeless powder, &c.

Ammonium nitrate, which is the main constituent in the manufacture of safety explosives and laughing gas, is made by the very simple process of mixing the weak nitric acid that comes from the absorption towers of the Birkeland-Eyde process, with ammonia liquor obtained from English gas works. The solution is crystallised and dried, and the resultant, containing 35 per cent. of nitrogen, is sold freely in England at £27 a ton.

This material is also made from calcium cyanamide, and the Lothringen Works at Gerthe, near Bochum, produce about 2,000 tons per annum. As this does not come on the market, it is presumably all taken by the German Government as a substitute for nitroglycerine.

As it contains so large a percentage of nitrogen it would make an excellent manure, and, of course, it may be possible at some future time to manufacture it cheaply enough for fertilising purposes.

Dicyandiamide, which is made from calcium cyanamide, is an extremely valuable material for explosives, because it acts as a deterrent, and by reducing the heat it is not so liable to destroy the rifling.

At the present time this country is largely dependent on overseas supplies for the manufacture of explosives, and we should be in an extremely serious position in case of war. It may be remembered that at the time of the Napoleonic wars the French were in great straits for saltpetre with which to make powder : it behoves us, therefore, not to be caught in the same predicament. In a few rounds a modern gun blows away into the air as much nitrogen as was used right through a war of the last century. The necessity of having factories where explosives can be made quite independent of materials from overseas is therefore all the greater.

It would be well at this stage to describe briefly the processes for manufacturing nitrate of lime, as carried out at Notodden, and calcium cyanamide, as carried out at Odda, in Norway.

It should be mentioned that calcium cyanamide is made in the following countries : Italy, France, Switzerland, Dalmatia, United States, Canada, Mexico and Japan, whilst in Germany alone there are about half-a-dozen factories.

The Birkeland-Eyde magnetic arc furnace, as installed at Notodden, consists of a circular sheet steel drum about 8 ft. in diameter and 2 ft. wide, lined with refractory fire-brick, and having a disk-like space in the centre, 6½ ft. in diameter and 1¼ in. wide. Air is supplied at the centre of the furnace at a gentle pressure by a Roots blower, whilst a channel round the periphery of the disk space carries off the gases and unoxidised air.

Two electrodes project into the centre of the furnace, and are generally approached to within about one-third of an inch. They are copper tubes, 6 in. in diameter and ⅝ in. thick, and have water circulation to keep them cool. Surrounding the points of the electrodes there is a magnetic field of about 4,500 lines of force per square centimetre. Alternating current at 5,000 volts, 50 periods per second, is supplied to the electrodes, whilst, of course, direct current flows round the coils to produce the magnetic field.

When an arc is struck between the electrodes, it is at once deflected in a direction perpendicular to the lines of force. The necessity of having alternating current applied to the electrodes will be appreciated from the fact that with direct current the arc would be deflected to one side only. As each electrode is alternatively positive and negative the arc is projected outwards first to one side and then to the other, thus giving a disk of flame about 6 ft. in diameter. The speed at which the arc moves outwards is extremely rapid, and as the formation of a new arc is practically instantaneous, it appears to the eye as a constant sheet of flame.

When the extremities of the arc retire along the electrodes, the arc increases in length, its resistance also increasing, until the tension is such that a new arc strikes between the points of the electrodes. The resistance of this short arc being smaller, the tension of the electrodes suddenly sinks to a point that will not sustain the long arc, which is thus extinguished. It should be noted that an inductive resistance is a very necessary piece of apparatus to have in series with the arc, because its self-induction automatically effects a displacement of phase according to the currents flowing, thus enabling the arc to burn steadily. The power factor is, of course, thereby lowered, so it is necessary to make an allowance when estimating sizes of alternators and cables.

A curious feature of the arc flame is that it is not quite concentric. When looked at through coloured glasses the extremities of the arc appear like glowing spots upon the sides of the electrodes ; and on the positive electrode, they are small, and fairly close together, whilst on the negative electrode they are larger, and farther apart. The reason for these spots appears to be that the arcs solder themselves, so to speak, to the electrodes, and the magnetic lines of force make the extremities of the arcs move along in leaps. For some reason not yet explained, the extremities of the arc cling more closely to the negative than to the positive electrode, and, therefore, the flame extends farther along the positive electrode than along the negative.

When the flame is burning it emits a loud noise, from which the furnace attendant can judge roughly the number of arcs formed per second. The electrodes are changed and repaired every 300 hours, and the fireproof lining every fourth to sixth month. The temperature of the flame is about 3,500° C., and the temperature of the escaping gases is between 800° and 1,000°. A furnace of 1,000 H.P. costs with its inductive resistance and fittings about £1,000, but as a good deal of the expenditure is common to any size of furnace, the 4,000-H.P. furnaces recently made only cost about 50 per cent. more.

On leaving the furnaces, the air only contains about 1 per cent. of nitric oxide gas. This gas and the unoxidised air pass from the channel round the periphery of each furnace into two collecting pipes, lined with fire-brick. They convey the gas and air to steam boilers, where the temperature is much reduced, the heat given off being used to raise steam for concentrating the products, and for driving the air compressors for pumping the acids and soda. The gas and air then go through tubes in the evaporating tanks, which brings the temperature down to about 200°. At 600° C. the nitric oxide gas begins to change to nitrogen peroxide, but complete conversion only takes place at 140° C., and then only slowly.

The temperature is lowered still further, to 50° C., by passing the gas and air through a number of aluminium tubes over which cold water is flowing. They then enter oxidation tanks, which are large vertical iron cylinders having acid-proof linings. The gas stays here some time and gradually changes to nitrogen peroxide, the percentages being now about 98 per cent. air and 2 per cent. nitrogen peroxide.

The next process is to bring the nitrogen peroxide into contact with water to form nitric acid, and this is done in two series of towers, built of granite and filled with broken quartz, these substances being chosen because they are not affected by acid.

The gas and air enter the bottom of the first tower, travel up through the quartz, and then pass by an earthenware pipe to the top of the second tower. They travel down this and pass to the bottom of the third tower, and so on, aluminium fans being fitted on each tower to help the circulation. Water and nitrous and nitric acid slowly trickle down through the quartz of each tower, and this meeting the nitrogen peroxide gas, the latter becomes absorbed. It will be noted that the liquid moves from tower to tower in the opposite direction to the gas, so it is worked to some extent on the contra-flow principle.

When the liquid reaches the bottom of the first tower it contains about 40 per cent. of acid ; the liquid in the tank at the bottom of the second tower contains 25 per cent., that at bottom of third tower 15 per cent., and that at bottom of fourth tower 5 per cent. The liquid is pumped from tower to tower by compressed air.

When the nitric peroxide gas first comes in contact with the water and acid it forms the two acids, nitric acid and nitrous acid. The nitrous acid then decomposes into nitric acid and nitric oxide, and the latter gas again oxidises to nitric peroxide. This

nitric peroxide, meeting with more water, forms more nitric acid and nitrous acid, and so the process goes on until nearly all the nitrogen peroxide is absorbed.

It would only be possible to convert all the nitric oxide into nitric acid by having exceedingly large absorption towers and by giving plenty of time. Therefore, the last traces of the gas are removed by two extra alkaline towers in which sodium nitrite is formed.

Pure nitric acid is made by taking the 40 per cent. solution which is obtained by direct absorption and concentrating it up to 60 per cent. by distillation. Then repeating the distillation with twice the weight of 92 per cent. sulphuric acid to take up the surplus water gives 98 per cent. nitric acid. During the process the sulphuric acid is reduced in strength to about 80 per cent., and it is then concentrated back again to 92 per cent. The waste heat of the gas and air coming from the furnace is used for these concentrations.

It may be noted that nitric acid can also be concentrated electrolytically, and the Salpetersaure Industrie Gesellschaft, of Gelsenkirchen, in Austria, has such a process in operation.

Nitrate of lime can be bought for £7 15s. per ton of 20 cwt. c.i.f. English port, guaranteed to contain 12¾ per cent. of nitrogen, but in no case has it contained less than 13 per cent. Nitrate of soda containing 15 per cent. of nitrogen should cost £9 2s. 6d. c.i.f. English port to compare in equal unit value.

Nitrate of lime probably acts on the soil in much the same way as nitrate of soda, but it has the advantage over nitrate of soda of depositing calcium carbonate. The other manure, sulphate of ammonia, not only does not add lime to the soil, but it can only do its work by acting on the lime already in the soil, and therefore it gradually impoverishes it of that material.

In 1905, Dr. Schonherr, working in conjunction with Mr. Hessberger and the Badische Anilin und Soda Fabrik, of Ludwigshafen, invented a furnace by which an arc of great density is made to burn steadily inside a long iron tube, air being blown through the tube with a whirling motion, so that the air moves in a path like a screw.

In a plant at work at Christiansand, the furnaces are worked in sets of three, one to each phase, each taking 600 H.P. at 4,200 volts. Each tube is 16 ft. long, fixed vertically, and the electrode at the bottom consists of an iron rod which passes through a copper water-cooled tube. The iron rod is pushed upwards as it burns away to ferric oxide, fresh rods being screwed on as required, so that the process is not stopped.

Air enters the tube tangentially by a number of holes near the electrode, this giving the important feature—namely, the whirling motion of the air. At the top of the tube there is the water cooler, and it is inside here that the arc ends by striking across from the centre to the side of the tube.

Before it reaches the arc the air passes through annular tubes, on each side of which there are the hot gases from the furnace. The air is thus heated to about 500° C. before it reaches the arc. After passing through the arc, where some of it is heated to about 3,000° C., it reaches the water cooler, and its temperature is then suddenly reduced. Where the arc strikes into the side of the tube there is a sudden mixing of the highly heated nitric oxide next to the arc, with the cooler air that is whirling past, and at this point the gas becomes permanently fixed. The nitric oxide and air leave the top of the cooler at about 1,200° C. and pass away to a gas flue, common to all the furnaces, where the temperature is reduced to about 850° C.

Up to this point the gas has been colourless nitric oxide, but directly its temperature sinks below 600° C. a further quantity of oxygen is taken up, and the reddish-brown nitrogen peroxide gas begins to form. The gases are still further cooled by being taken through boilers, where they raise steam, and then to an oxidation tank.

The balance-sheet of the heat energy is roughly as follows :—

40 per cent. goes in heating the water of the cooler.
17 per cent. is lost in radiation from walls of furnace, pipes, &c.
30 per cent. raises steam in the boilers.
10 per cent. is lost by cooling with water after passing the boiler.

Leaving only 3 per cent. as actually used for making the nitric oxide gas.

In the 600-H.P. furnace at Christiansand the arc is 16 ft., but in later 1,000-H.P. furnaces it is 23 ft. long. This larger furnace requires about 40,000 cb. ft. of air per hour.

The inductive resistance is an important adjunct of this, as well as the Birkeland-Eyde furnace, because it effectively prevents another arc starting at the bottom of the tube and running up. When the arc is burning steadily the voltage sinks to a point at which it cannot jump across from the electrode to the tube near it.

The plant at Christiansand is employed solely in making sodium nitrite for the Badische Analin und Soda Fabrik.

The sodium nitrite made from the nitrogen of the air is so satisfactory and cheap compared with the old methods that now practically the whole supply of the world, valued at £160,000, is obtained from electrical furnaces. It may be mentioned, however, that it only takes about 12,000 H.P. to give such a supply, so that the proposition is a very different one to the manufacture of nitrate manures, where the demand is practically unlimited.

The Pauling furnace is being exploited by the Salpetersaure Industrie Gesellschaft at Gelsenkirchen, Austria, and at other places. This furnace is made on the lines of the well-known horn break lightning arrester, and it consists of two hollow iron electrodes (cooled with water) arranged to form a vee which at the lowest point is about 4 cm. across. At this point there are two lighting knives which can be approached to within a few millimetres, and are readily adjustable. The arc strikes across and runs up the diverging electrodes by reason of the natural convection currents, and the repelling action of its own magnetic field, but principally because of a blast of heated air from a nozzle immediately below.

The arc is caused to diverge so as to follow the shape of the electrodes, and it attains a length of about a yard before it goes out. At each half-period of the alternating current a fresh arc is formed, so that the result is the equivalent of a triangular sheet of flame.

The furnace gases cool off rapidly as they mount upwards, and they are further helped by a draught of air, which is introduced sideways into the upper portion of the flame and at a lower speed than the main current. This has a kind of suction effect, drawing out the flame sideways, and thus increasing the cooling area. The gas and air leave the furnace at about 700° to 800° C., and contain about 1½ per cent. of nitric oxide.

At Gelsenkirchen there are 24 such furnaces each taking 400 KW. at 4,000 volts. Some larger furnaces of 1,500 H.P. are also at work on this system.

The discovery of calcium cyanamide came about as the result of a research by Profs. Frank and Caro, who were following on the lines of some previous work of Playfair and Bunsen.

As carried out at the Odda Works, the calcium carbide broken into lumps is delivered to crushing machines, from which it passes to mills, in which it is ground fine. The whole of these operations are effected automatically in an air-tight plant, so as to prevent acetylene gas being given off.

The powder is then filled into retorts for the electric furnaces, of which there are 196, each holding 300 kg. When filled, each of these retorts is lifted by an electric traveller, and dropped into its respective electric furnace. It should be mentioned that down the centre of each retort there is a cardboard tube to provide a space for the carbon pencil which takes the current. After these pencils have been fixed in the centre of each furnace, the lids are fastened down and made air-tight.

Alternating current is now switched on, and the temperature is raised to 800 to 1,000° C. The cardboard tube and certain corrugated paper partitions which had been placed in the retorts when the calcium carbide was run in, are burnt up. The spaces thus left allow the nitrogen gas, which is admitted under pressure, to circulate freely through the carbide.

In about 48 hours, including cooling, the whole mass has been made into calcium cyanamide. The furnaces are then opened, the recipients lifted out and emptied, and the cyanamide is ground to a fine powder. Slowly moving conveyors carry it along a tunnel through which a current of air is passing in the opposite direction, so as to aerate the material.

The 196 furnaces turn out about 30 tons of calcium cyanamide containing 18 per cent. of nitrogen per day of 24 hours. The nitrogen gas is supplied by a special Linde plant.

We now come to the question whether it is possible to manufacture these nitrogen products in Great Britain. From a strictly commercial point of view this depends on whether power can be obtained cheaply enough. In such countries as Norway and Switzerland, where there is plenty of water power, and *no coal*, the science of harnessing water powers has been brought to great perfection, and there are several plants which, having inexpensive hydraulic works, are said to produce power at £2 per KW.-year. For the total number of hours in a year £2 is equal to

$$\frac{2 \times 240}{8{,}760} = \cdot 055\text{d.}, \text{ or } \tfrac{1}{18}\text{th penny per KW.-hour.}$$

At Notodden the power is said to cost 33s. per KW.-year, or ·045d. per KW.-hour, and at Odda 30s. per E.H.P.-year is paid for power.

It is interesting to compare these figures with the well authenticated statistics of the largest hydro-electric plant in the world, namely, Niagara. For 1909, 362 million KW.-hours were sold for £210,000, of which 322 million units went to 33 electrochemical and metallurgical consumers at ·133d. per KW.-hour. The remaining 40 million units were sold to electric light and traction consumers at an average price of ·19d. per KW.-hour.

Now, electro-metallurgical works have usually a 100 per cent. load factor, and unfortunately there are very few such works in this country. There is, however, good reason to suppose that waste heat power stations in Great Britain could produce as cheaply as Niagara for such a load factor. Even to-day electrical energy is sold in Yorkshire and Durham at extremely low rates to collieries and ironworks, &c., where the load factor is nearer 33 per cent. than 100 per cent. The actual prices charged do not transpire publicly, but ·25d. per KW.-hour has been mentioned.

Suppose an electric power plant of 10,000 KW. is erected at a cost of £10 a KW., and that on a 33 per cent. load-factor the energy is sold for ·25d. per KW.-hour, on a 100 per cent. load-factor the energy could be sold at ·168d. per KW.-hour.

If, therefore, the initial cost of the plant can be brought down to, say, £6 a KW., which seems feasible, then the cost of electric power should fall to a figure that is comparable with the most favoured hydro-electric plants.

The writer considers that the time is ripe for the establishment of many electrochemical and electrometallurgical processes, which at present are only carried on abroad. Amongst these the manufacture of nitrate manures, and especially nitrogen compounds for explosives, is very important, especially the explosives, for reasons put forward in this paper.

Egham.—The Lord Mayor of London will to-morrow, Saturday, perform the ceremony of laying the foundation-stone of the new power station, in Egham Causeway of the Egham and Staines Electricity Co., Ltd.

THE METER DEPARTMENT.

By "INTERESTED."

Meter-Reading Methods.

There are in use in this and other countries many different methods of recording meter readings; in fact, they are common. Some are very much similar to others, all running im a kind of groove, whilst a few strike out on more or less novel lines, and again, one here and there claims to be "right bang up to date," as they say "over the other side." Below will be found brief descriptions of two arrangements for carrying out this work; one is of a rather peculiar character, whilst the second is claimed (by some) to be right bang up to date and the last thing in meter-reading records. Both systems are retained in use after trials with other forms, so that a certain amount of credit can justly be claimed by them for passing successfully through their initial stages without being discarded in favour of others.

With the first method cards are used, in size about $5\frac{1}{2}$ in. × $4\frac{3}{4}$ in., as per the following pattern (see fig. 1 below). These cards are carried by the meter inspectors in peculiarly formed boxes made of aluminium for the sake of lightness. These are open at the top and have a sliding panel at the bottom. A strap affixed to buttons situated in the centres of the two ends forms a handle for convenient carrying. In bad weather the whole concern can be turned over so as to bring the sliding lid on top, in order to protect the contents from damage by rain. Cards are inserted at the bottom by removing the sliding lid, and a ledge or ridge in the top of the casing prevents them passing right through and falling out. When sufficient cards, which have previously been arranged in order by the meter reader according to his requirements, have been placed therein to fill the box comfortably, the lid is once again put into its place, and the box inverted—*i.e.*, with the sliding lid at the bottom, because in order to drop the cards into their place it will be found handy to turn the box over before commencing operations, and the top card then is ready for writing upon. Directly an entry is made, the card is slipped out from on top, and pushed in at the bottom of the pack through a slot left at the end of the bottom lid, thus bringing to view the card next in rotation. Differently coloured cards are used for various districts, for convenience' sake when sorting.

Electricity Works

Name..... *No.* .....

Address..... .....

Meter Type ..... *No.* ..... *Size* .....

Date.	Reading.	Advance.	Remarks.	Inspector's initials.

Fig. 1.

The sketch, fig. 2, shows a section through the box when filled with cards, and will convey to the mind more clearly than words the idea intended.

The second method is based upon the loose-leaf principle and is claimed by certain gentlemen "on the road" to be the latest thing in this line. In size, printing and ruling, the leaves are much about the same as the cards described above, and have holes punched at the side or top, as may be deemed advisable, for insertion in loose-leaf-holders. Each cover holds about 100 leaves, and, when filled, is near the size of an ordinary pocket-book. Dozens of different makes of loose-leaf binders are on the market, and I believe every business man to be more or less conversant with the principle, so that an illustration here would be superfluous. One of the big advantages claimed for this system is that only the requisite number of leaves need be put in the cover for 20 calls, or for a whole day's reading. The same can quickly be taken out and transferred to spare binders and passed on to those whose duty it is to make up the accounts, without in any way interfering with or delaying the reading of other meters, as is the case where books are used for this purpose. In order to enable the holder to be opened at the correct page from time to time, a marker is used much like those found in many forms of diaries, either attached to the cover or loose, as may be desired. Call-backs, or, in other

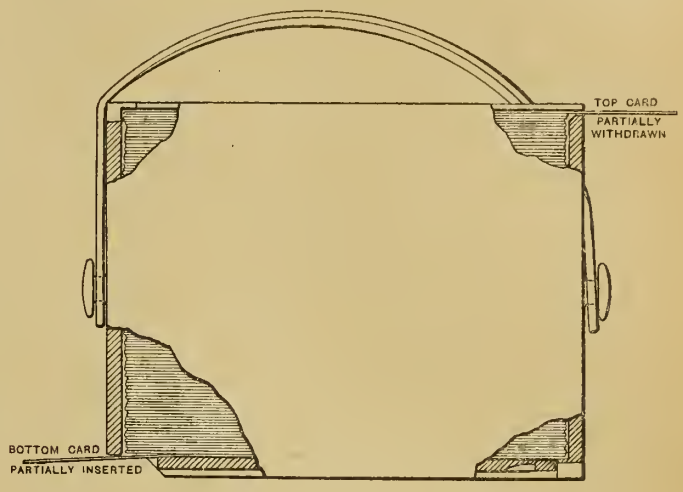


Fig. 2.—Section of Card Box.

words, those readings unable to be obtained in the ordinary round for various causes, are retained in the cover by the meter inspector, ready for use when he is next in that neighbourhood. Books defeat this purpose, inasmuch as the accounts for those meters actually read have all to be made out before the book can be returned to the reader for the purpose of his call-backs. Of course slips of paper could be used, or even a common pocket-book, for these call-backs when only one or two are in question, but in a large undertaking of any kind where consumers run well into four figures, and the number of premises which have to be visited a second or third time is considerable, these slips of paper and odd notes in books are unsatisfactory and a source of trouble.

The main disadvantage with the loose-leaf system is that paper is not so convenient to handle as cards. Cards lend themselves to quick handling, whereas thin sheets are liable to crumple and tear if used without due care. Thin linen cards answer admirably in loose-leaf covers, and keep in better condition than do stout sheets of paper, but their weight and the space occupied by them in the holder are against them. Cards could have been quite easily introduced in the before-mentioned loose-leaf covers, but the true system as worked in actual practice uses paper leaves, and this is the reason for specifying them here.

Consumers' Complaints.

Prompt and proper attention to complaints from consumers is essential to the well-being of any electricity supply station. Dissatisfied customers are likely to show up as very bad advertisements; therefore, for that reason alone, it should be part of the business of every works to pay careful attention to all complaints, whether received by letter, telephone or verbally. During the periodical visits of the meter reader to consumers' premises, many little complaints are received by him, which, if allowed to pass without attention, are likely to grow into sore grievances. Care should be taken that all these secure prompt attention, and that suitable answers are forwarded without delay. A polite note setting forth all the points in question may prove the means of retaining a customer, where otherwise he might continue in an offended spirit, and ultimately revert to the rival gas. On the other hand, satisfied customers are likely to extend their installations, especially if a cute "publicity" man is on the staff of the supply works, who will keep an eye open for all possibilities. Again, the satisfied consumer can be likened unto the well-known show-card — a good advertisement.

One useful method of dealing with complaints is as follows:—Directly upon receipt of a complaint a card,

such as is illustrated (fig. 3) below, is filled in by the person in charge of the office, and attached to the letter, meter reader's report or telephone message, and passed on at once to the engineer in charge of the consumers' department for attention. When dealt with, and details recorded on the card, it should be brought before the chief

COMPLAINT.

Name .....
Address .....
Date received .....
Nature of complaint .....
.....
Date answered .....
Text of reply sent .....
.....
.....
.....
Engineer .....

FIG. 3

or chief assistant, so that he will not be in complete ignorance of the facts should any further grumbling take place. Prompt attention is an important factor which is sometimes neglected. When dealing with complaints regarding consumption of energy and such like, a record after the manner shown here will be found an advantage (see fig. 4). In the illustration I have assumed that meters are read monthly, and that part of the inspector's time between readings is occupied by filling in the necessary details, as shown in the diagram. Books on the loose-leaf principle are recommended here in preference to fast bound ones. Each month the head of the consumers' department should make it his business to inspect the books and initial every account. This enables the engineer to keep in close touch with the accounts, and, naturally, when any appreciable fluctuation is noticed, inquiries will be instituted as to the cause. A few special visits in order to inspect any instruments on premises of consumers whose average daily consumption shows a decided increase or decrease may prove the saving of many complaints in that direction. Accounts based on estimated amounts of energy consumed are always sources of contention, and by the above method of keeping in touch with meter readings no meter can remain long in a faulty condition without its being noticed.

METER READING ANALYSIS.

Date. 1911.	Reading.	Units consumed.	No. of days since last reading.	Units per day consumed.	Engineer's initials.
May 27th	198	—	—	—	—
June 28th	463	265	32	8·28	A. B.
July 26th	711	248	28	8·85	A. B.

FIG. 4.

These are small matters in themselves, but it has often been proved in practice that minor points such as these are well worth a little time and trouble spent upon them.

The Aerophone and Aeroplanes.—It is reported in the *Daily Express* of the 25th inst., that on Saturday last Mr. Grindell-Matthews, with the wireless telephone apparatus which he has devised, and which is known as the aerophone, succeeded in communicating with Mr. C. B. Hucks while the latter was flying in an aeroplane at Cardiff. This is the first occasion, we believe, on which wireless telephony has been carried on under these circumstances, and the inventor is to be congratulated on his success. So far as the report goes, speech was effected in one direction only—from the ground to the aeroplane.

The Grindell-Matthews Wireless Telephone Syndicate has been formed to put the invention on the market.

THE NEW SERVANT.

BY "MAUD."

AT one time or another ladies who have to manage and ensure the sweet running of their households have been troubled by that most vexatious question known as the servant problem, which crops up at all sorts of undesirable periods and upsets the general routine of things. It is not of much use waiting whilst the legislature or the elementary schools endeavour to mitigate it; as the former does not like female labour questions, and the latter are endeavouring to make a generation of school teachers. It therefore behoves ladies to use every new appliance which will tend to lessen the amount of daily work necessitated in the home, by our usual methods of living.

Before one thinks of spending an amount of money on a holiday, the question is carefully considered as to where to go either for health or pleasure to ensure getting the best ultimate results. So it should be with the household; there should be time spent in thinking out how to best spend money to reduce the amount of cleaning necessary in the home. Now I claim that there is one thing, if thing it can be called, which when introduced into the home will immediately effect untold savings. As I am writing within the pages of an electrical paper, it will easily be foreseen that I refer to electricity. I have heard it argued by people, quite seriously, that electricity is in its infancy, and when it is properly understood it will be used for everything. Now, although neither electrical appliances, nor, for that matter, anything else is perfect, or ever will be, I think electricity can be likened to a child who has rapidly grown with the flight of time into the strength of youth; at least, so it appears to me when I think of the things it can do in my home.

Undoubtedly the first thing that electricity will be used for in the home will be for lighting. Now, it is my experience that when one has a cold each of one's friends will recommend a different remedy for its cure until one assumes the calm demeanour of the martyr, listens to all, and then pleases oneself.

So with your lighting question; hear all that your friends have to say and then please yourself. One of the first things one has to decide is the question as to the amount of light needed in the different rooms in the house. This should not be such a difficult question in a house where gas is already installed, as one has the existing lights to go by as a guide. Suppose that gas is the offending illuminant, and owing to your having been worried by the persistence of mantle travellers, whom you have doubtless disposed of by purchasing a trial mantle, you have doubtless become quite conversant with the various types of mantles, and ultimately arrived at the conclusion that the inverted type gives the best light. These mantles when carefully adjusted, a by no means simple process to the uninitiated, are claimed to give about 70 C.P., a claim which I have seen repeatedly disputed after the mantle has been in use a few times, therefore you will be about correct if you take it that your inverted mantle gives you about 45 C.P.

Now, in your dining room you will probably have two or three such lights situated over the table, and shaded so as to give a nice soft effect. Therefore, it becomes an easy matter to decide what lights you require. If the existing lights are sufficient, choose electric lamps of the same size, or, better still, think of how you use the room in the ordinary way; and then have just sufficient lights fixed over the table to give a pretty effect, but don't forget a handy light fixed in your favourite cosy corner where you can read your fashion paper or book whilst your husband has his paper and pipe in comfort. If you have not inverted mantles, I believe it is usual to reckon on the upright mantle as giving 38 C.P. and the ordinary bat's-wing burner 11 to 16 C.P. Therefore, reasoning upon these figures and lines, it becomes an easy matter to tell the electrician who is to install the light your exact requirements.

I believe in a large number of towns the electric supply people have canvassers who are fully qualified to give you free and valuable advice, which will be of use to you in having the lights fixed in the most economical manner, both in first cost and, more important still, with regard

to the amount of electricity you will use. As it will be seen that the question of the amount and position of the lights is one chiefly of common sense, there may be one or two points upon which a little information by one who has used electric light for years may not be out of place. In your drawing-room have a switch and plug fixed, as then you can easily fix and use an electric kettle or fan, which you will be sure to purchase. Have a similar switch and plug fixed in the two largest bedrooms, dining-room and kitchen, as they will be most useful, and you can connect to them numerous small electric labour and trouble-saving appliances, which can easily be removed from room to room, and which take such a small amount of current that they are economical even where the current used is charged for through the lighting meter.

Whatever you do, make sure that you use metallic-filament lamps, as these take about one-third of the current which the old carbon lamps take, and they give a lovely light, just like sunshine. If you want to get an illuminant which will give a nice soft light, but one which will be equal in all parts of the room, I should recommend the use of Holophane glass bowls. I have one of them fixed near the ceiling in my drawing-room, which has a 100-c.p. metallic-filament lamp fixed inside it, and which lights the room evenly all over, and quite as well as it is lit in the daytime. There is one most useful appliance that should be found in every electrically-lit home, and that is the new Watkin switch, which enables one to turn down the electric light just like gas. This is most useful in halls and bedrooms, as it effects enormous savings, and at the same time enables the light to be subdued and adjusted in the sick room.

When counting the cost of lighting your house by electricity as compared with any other form of illuminant, do not be misled by considering only the cost of the electricity used. First of all, taking the comparison on the basis of electricity cost alone, I find that, comparing light for light, the cost of electricity does not exceed the cost of gas lighting, and I am aware of a number of cases in which it is cheaper. In most houses, owing to the cumbersome nature of gas fittings, there are as few lights as possible, but when this objection is removed, due to the convenience and artistic nature of electric fittings, the householder naturally increases the number of lights, and then, of course, the electricity bill is sure to be larger than the old gas bill, but the slightly increased cost is far outweighed by the increased comfort. Indeed, in a number of houses it would be quite possible to increase the number of lights, and by the judicious use of switches, and especially regulating switches, the cost would not be increased.

Apart from the question of the cost of the electricity alone, there are savings effected by the use of electric light which really are larger than the annual electricity bill. First and foremost is the question of decoration. If the house is to be clean and attractive, then it is quite essential in rooms regularly used where either gas or oil is the illuminant that the ceiling be whitewashed or repapered each year, and at least every two years the wall paper wants renewing or recolour-washing. This is usually a great expense and inconvenience, and the total cost of doing this, including the cost of labour in getting straight again, will be found to be about half the annual electricity bill. Whereas if electricity had been used, both the ceiling and the walls would have lasted for years. Then again, the house as often as not is not your own, and you are therefore expending money on the property of others; but in addition to this, think of the damage that the obnoxious fumes of the gas or oil lights do to those treasures of your own, books, paintings, leather work, draperies or curtains, some of which, for sentimental reasons, are dearly prized, and which, while you carefully keep the children and maids from them, you allow to be spoilt by the nasty fumes referred to above. These cannot be replaced except at a large cost, and surely their value is far above the mere paltry cost of the electric light which, whilst it lights your home without the usual jumpiness of the gas, does not spoil your possessions or those of the landlord.

Before leaving the question of the cost of electric lighting, it is most essential that the personal part of the aspect should not be forgotten. I claim that electric light is the most healthy illuminant that can be used, chiefly because it does not give off fumes, such as those of gas or oil, which, when breathed in large quantities, are most injurious to health. If you have any doubt of the presence of these, go into a room that has been lit with gas or oil for a few hours, take a pair of steps and climb high enough to sample the air near the ceiling, and you will then decide for yourself if you can allow such a gigantic evil in your home. At the same time, never forget the safety of electric light when compared with gas or oil. Think of the large number of gas explosions and oil lamp fires that occur annually and compare them with the number of fires actually due to electricity in the home, and you will soon be convinced as to which is the safer for you.

I will now leave this important question of lighting and turn to the new sphere in the home which electricity is making solely its own.

(*To be concluded.*)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

FIJI.—The Customs Authorities have recently revised the tariff on goods imported into Fiji, so that all electrical goods which may not be admitted free of duty under the free list, are now dutiable at the rate of 15 per cent. *ad valorem*, instead of 12½ per cent. *ad valorem* as was previously the case. In this connection readers should refer to the information as to duties in Fiji published in the Elec. Rev. of July 23rd, 1909.

SWEDEN.—According to notices published in the Swedish Press, the Swedish Customs Administration desires to draw the attention of foreign exporters of machinery to Sweden to the fact that, in accordance with the new Customs Tariff Law which is to come into force on December 1st next, machinery imported into Sweden on and after that date must be accompanied by a statement of the gross and net weight of every package, and a full specification of the contents of each package, as well as all information of a nature to facilitate the assessment of duty.

Special attention is called to the following general provision applicable to the category "Machines and Apparatus" in the new Swedish Tariff:—When machines imported in a "knocked-down" state (*i.e.*, taken to pieces) are declared for clearance or warehousing, the owner must supply an explanatory statement and specification of the parts, together with a drawing showing how the parts together form a machine—so far as these may be required for the guidance of the Customs.

Information as to the rates of duty proposed to be levied under the new Tariff referred to above has been published in the Elec. Rev.

FRANCE.—The French Customs Authorities have issued the following decisions which affect the classification of certain electrical goods for duty purposes:—

Cables imported for submarine telegraphic or telephonic lines, submarine portion, free; portion installed on land from the limit of the water to the point of junction, dutiable as "wire and cables insulated, for electricity."

Transmission pulleys furnished with other parts, especially axles or brackets, dutiable as "detached parts of machines according to class."

Transmission pulleys with toothed wheel forming part of the pulley, dutiable as "transmission pulleys."

Note.—For details as to the actual rates of duty leviable under the denominations referred to, readers should consult the statement of duties published in the Electrical Review.

JAPAN.—The enforcement of the new Japanese tariff does not involve any change in the procedure which has hitherto been followed with regard to certificates of origin for goods exported from the United Kingdom to Japan. It is, however, no longer necessary to forward certificates of origin for those goods which figured in the former Japanese "Conventional" tariff, but are not included in the present "Conventional" tariff. Information as to the electrical goods affected by the new "Conventional" tariffs, *i.e.*, special tariffs arranged as a result of treaties, has been published in the Electrical Review.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,078. "Electric tramway trolley standards, current-collecting devices and the like." A. Colman. September 11th.

20,100. "Electric traction." R. C. Sayer. September 11th. (Complete.)

20,106. "Electric telegraph systems." W. S. Stelzes. September 11th.

20,107. "Typographic and like receiving instruments for electric telegraph systems." W. S. Stelzes. September 11th.

20,149. "Electric contact devices for clock movements." L. P. E. Appoullet. (Convention date, September 9th, 1910, France.) September 11th. (Complete.)

20,161. "Automatic electric circuit-breakers." J. Cuculic. September 11th. (Complete.)

20,170. "Electric switches." A. F. Berry. September 11th.

20,171. "Electric switches." A. F. Berry. September 11th.

20,172. "Electrically-heated cooking ovens and the like." A. F. Berry. September 11th.

20,201. "Method and arrangement for producing electrically luminous letters, inscriptions, lines, figures and the like by means of high-tension discharges." A. Laszlo. (Convention date, March 16th, 1911, Germany.) September 12th. (Complete.)

20,223. "Incandescence bodies for electric glow-lamps." E. Hurwitz. (Convention date, January 30th, 1911, Germany.) September 12th. (Complete.)

20,224. "Process for the manufacture of electric metal-filament lamps." K. Schwab. (Convention date, May 4th, 1911, Germany.) September 12th. (Complete.)

20,262. "Shade-holders for electric and other light fittings." W. J. Wilson. September 12th.

20,263. "Electrical time-limit devices." British Thomson-Houston Co., Ltd., and J. J. Ash. September 12th.

20,264. "Electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 12th.

20,268. "Electrically-operated time-indicating devices." L. J. Aron and C. E. Harrison. September 12th.

20,296. "Manufacture of tungsten and incandescence bodies therefrom." E. Schaarer and G. Ludecke. September 13th.

20,298. "Direct-current motors." F. Vlaminck. September 13th.

20,302. "Method of and means for voltage regulation in stage transformers." R. Richter. September 13th. (Complete.)

20,311. "Double-pole electrical switches." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. September 13th.

20,314. "Apparatus for connecting conducting wires, cables, and the like." Baron A. del Marmol, G. Voos, Baron W. del Marmol and W. Grisard. September 13th. (Complete.)

20,320. "Relays for streugthening weak electric currents." J. Schiessler. September 13th. (Complete.)

20,342. "Conjunction of cords or wires with electrical apparatus." G. St. J. Day. September 14th.

20,355. "Cooling commutators of dynamo-electric machines." A. D. Railing and T. Duckitt. September 14th.

20,380. "Manufacture of incandescent electric lamps and apparatus therefor." K. Schwab. (Convention date, January 11th, 1911, Germany.) September 14th. (Complete.)

20,383. "Electrically-operated boat hoists." J. Fielding. September 14th.

20,402. "Electromagnetic valves for gas apparatus." E. Tellier and Compagnie Anon. des Allumeurs Extincteurs du Gaz a Distance, Systeme Gote. September 14th. (Complete.)

20,409. "Arc-rupturing devices for electrical apparatus." Allgemeine Elektricitats-Ges. September 14th. (Convention date, September 15th, 1910, Germany.) September 14th. (Complete.)

20,429. "Apparatus for regulating electric circuits." H. A. Carney and J. A. Pearn. September 15th.

20,434. "Diaphragms of telephonic receivers and like instruments." A. Marr. September 15th.

20,437. "Production of tungsten filaments." J. A. Scoular. September 15th.

20,442. "Brushes for dynamo-electric machines." H. Cooch. September 15th.

20,451. "Telegraphic relays." S. G. Brown. September 15th.

20,452. "Electric measuring instruments." H. W. Brown. (Convention date, October 8th, 1910, United States.) September 15th. (Complete.)

20,512. "Control of alternating-current electric motors." R. H. Barbour. September 16th.

20,523. "Electrical transformers." E. Haefely. September 16th.

20,524. "Electrical transformers." E. Haefely. September 16th.

20,534. "Electric controllers." H. R. Canfield. (Convention date, September 21st, 1910, United States.) September 16th. (Complete.)

20,555. "Electric cooking ovens." C. G. Nobbs and C. G. Nobbs, Jun. September 16th.

20,565. "Portable electric lighting systems." H. H. Hirsch. September 16th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Transformers. H. F. Berry. 12,355. May 19th.

Wattmeters. E. Weston. 17,091. July 18th.

Electric, Hot Air and Steam Heating and Ventilating Systems for Railway Carriages and the like. J. Stone & Co. and A. H. Darker. 17,537. July 23rd.

Means for Electrically Transmitting Orders or Signals and for Indicating their Nature and the Points of Transmission. H. Quertier. 19,701. August 23rd.

Electrical Transmitting, Printing, Indicating and Recording Apparatus. N. Quertier. 19,703. August 23rd.

Electric Resistance. M. Kallmann. 19,993. August 27th. (August 31st, 1909.)

Current Collectors or Contact Columns for Electric Cranes and the like. Allen, West & Co. and W. J. Moggridge. 20,107. August 29th.

Electric Time-Switch for Lighting Circuits. J. Liddle. (Rudolf Budcrer and Co.) 22,760. October 1st.

Supporting Wire for Metal Filaments of Electric Lamps and a Method of Manufacturing the same. L. Mond. 23,404. October 10th.

Mechanism Operated by the Passage of a Railway Train or Vehicle for Actuating Electric Switches. W. R. Sykes Interlocking Signal Co., J. C. Sykes and R. W. Tarrant. 23,983. October 15th.

Electrical System for Indicating an Alarm of Fire or such like Simultaneously at any Required Number of Points or Stations. A. W. Brown. 24,183. October 19th.

Process for Decarbonising Metallic Filaments for Incandescent Electric Lamps. Westinghouse Metallfaden Glühlampenfabrik Ges. 24,637. October 24th. (November 12th, 1909. Addition to No. 2,983 of 1910.)

Electric Annunciating Apparatus. H. G. Alther and C. W. Gill. 25,368

Selective Electric Signalling. J. T. Irwin. 29,206. December 16th.

Electrical Heating Apparatus. A. F. Berry. 18,115. July 29th.

Control of Electrically Operated Lifts, Elevators and the like. H. C. Walker and R. Waygood & Co. 20,118. August 29th.

Electrically Driven Ring Spinning Machines. A. C. Eborall and Brown Boveri & Co. 20,249. August 30th.

Receiving Apparatus for Wireless Telegraphy. Marconi's Wireless Telegraph Co. and H. J. Round. 20,441. September 1st.

Railway Block Telegraph Indicator. A. T. Blackall and C. M. Jacobs 21,554. September 16th.

Electromagnets. Soc. Anon. "Phi." 23,831. October 14th. (August 6th, 1910.

Electric Switches. J. H. McLean and W. L. Madgen. 24,994. October 27th

Spark-Plug Insulations. A. Herz. 25,539. November 3rd. (Convention dat not granted.)

Variable-Speed Alternating-Current Induction Motors. British Thomson Houston Co. and J. Martin. 25,683. November 4th.

Electric Switches. M. D. Scott. 25,756. November 5th.

Electric Hoists or Pulley Blocks, Winches and the like. Adamson Ramsbottom & Co. and H. Ramsbottom. 27,299. November 23rd.

Electric Switch with Quick-Make and Quick-Break Action. J. McFarlane 27,825. November 30th.

Telephone Call Recorders. A. J. Boult. (Mills.) 28,368. December 6th.

Means for Holding or Detaching Electric Wires on or from Insulator Alfred Wiseman, Ltd., and J. W. Harris. 29,114. December 15th.

1911.

Telegraphy. P. B. Delany. 55. January 2nd.

Insulating Compounds. British Thomson-Houston Co. (General Electric Co 176. January 3rd.

Rotary Field Induction Generators. Siemens Bros. Dynamo Work (Siemens-Schuckertwerke Ges.) 223. January 4th.

Electrical Chest-Warmer. A. Selvatico. 1,481. January 19th.

Electric Motors. J. C. Crawshaw and Phœnix Dynamo Manufacturing C 1,543. January 20th.

High-Frequency Alternator for Radio-telegraphic and Radio-telephon Plants. E. Girardeau. 3,948. February 16th. (May 9th, 1910.)

Automatic Regulators for Electric Circuits. W. E. Lake. (United Sta Light and Heating Co.) 5,490. March 4th.

Apparatus for Measuring the Relation of Two Electric Curren J. Carpentier. 5,961. March 9th. (March 18th, 1910.)

Electric Flame-Tight Fuse and Switch Boxes. W. Creswick and J. Bentha 9,037. April 11th.

Electric Motor Controllers. Siemens Bros. Dynamo Works and E. Schu 9,606. April 20th.

Arc Lamps. C. G. Perez. 11,275. May 10th.

Process for Treating Finely Subdivided Substances by Electric Osmo B. Schwerin. 11,626. May 13th.

Spark Plug. F. E. Harpst. 11,811. May 16th.

Telephone Mouthpieces. G. S. Bennett. 12,200. May 20th.

Electrical Relays. Siemens Bros. & Co. (Siemens & Halske Akt.-Ge 12,295. May 22nd.

Controllers for use in Connection with Electric Motors. Electric & Ordnance Accessories Co., J. R. Gardner and M. R. H. Mueller. 14,6 July 26th. (Divided application on No. 17,349 of 1910. July 21st.)

Control of Electrically Operated Lifts, Elevators and the like. H Walker and R. Waygood & Co. 15,933. July 10th. (Divided applicat on No. 20,118 of 1910. August 29th.)

Joints or Couplings for Piping and Electric Cable. J. T. Carr. January 11th.

Single-Wire Telephone Systems. C. J. Ellison and W. J. Thorrowgo 3,730. February 14th.

Interrupters for Electric Ignition Machines. Firm of Robert Bos 7,632. March 27th. (December 3rd, 1910.)

Electric Arc Lamps for Alternating Current. Korting & Mathie Akt.-Ges. 10,290. April 28th. (April 30th, 1910. Addition to No. 26, of 1909.)

Electric Photographic Printing or Copying Machines. J. Halden & and H. R. Watts. 10,701. May 3rd.

Gas Lighting in the U.S.A.—The danger of asphyx tion from the accidental continued inhalation of illuminating is very generally understood, but the poisonous effects of so-cal water gas are, perhaps, not so well appreciated. The best qual of artificial illuminating gas is a mixture of a gas obtained by distillation of coal in retorts with water gas. Water gas is m by blowing steam through red-hot coke, and is an extrem poisonous product, for the reason that it contains a large percent of carbon monoxide. It is stated on good authority that breath a mixture consisting of 99 per cent. of pure air and 1 per cent. water gas will produce fatal effects within a very short ti Water gas is cheaper to manufacture than high-grade illuminat gas, and its illuminating value is good. The average consumer no way of telling whether the product supplied him is stand illuminating gas or water gas. Hence, because of the better pr derived, the gas manufacturer frequently supplies the latter inst of the higher grade gas.

Two members of the teaching staff of a leading eastern techn school have recently published the results of a series of invest tions on the relation of illuminating gas to the public health. report expresses surprise and alarm at the prevalence of ill eff resulting from the widespread commercial use of water gas. asserted that in some States the deaths from gas poisoning ar numerous and as frequent as those from many of the com diseases. The remedy suggested is immediate and stringent le lation to prohibit the sale of water gas to the public.—*Electroc.*

THE
ELECTRICAL REVIEW.

VOL. LXIX. OCTOBER 6, 1911. No. 1,767.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE COAL TRADE.

THE past few days have been momentous in the history of the coal trade, as the Miners' Federation of Great Britain has been sitting to decide whether there shall be a national strike of the miners of Great Britain, but at the moment of writing we have no idea what the decision will be. We can only hope that in the interests of the country the leaders will calmly and carefully reason amongst themselves, and consider the terrible hardships such a course as they propose to pursue would bring to thousands of poor workmen and their families—many, we may point out, at the best of times considerably worse off than the miners—without bringing to themselves any lasting benefit, if, indeed, it would result in any good to them at all.

There can be no doubt that the miners throughout the country are filled with a spirit of discontent, though the different districts have their own particular grievances. In South Wales it is the "abnormal place" question, in Scotland it is a "minimum wage," and in Northumberland and Durham it is the "three-shift" system. The miners in the county of Northumberland have already voted on their particular grievance, and having obtained the requisite majority of two-thirds of the membership to strike, are really only waiting for the approval of the National Federation in ordering a national strike, before carrying the threat into execution. We sincerely trust, however, that the Northumberland miners and their leaders have given due consideration to the note of warning uttered by Lord Furness in his address to the shareholders of the Broomhill Collieries, Ltd. In this his lordship pointed out that the substitution of a two-shift—which the men require—for the three-shift system would entail a loss to the company of some £30,000 to £40,000 per annum, a loss which no company could possibly face, and that they had definitely decided, in the event of a successful county strike, to close their collieries. Further, he referred, and rightly, to the increased competition of the Westphalian coalfield in Germany, and to the increased competition of the coalfields of Yorkshire and Scotland for markets once looked upon as belonging solely to Northumberland, and he added that if the whole of the Northumberland pits were closed to-morrow, the gap would very soon be filled. He quite recognised that men should have fair pay for their work, but he also thought that 7s. 3d. to 7s. 6d. per day of seven hours' work with *free* house and coals was not bad pay for hewers. If *no man* were to receive less than 7s., and as much more as a good working place might give him, the county average in that event would probably reach 10s. per day of seven hours, and "prices in the home trade would rise accordingly, their export trade would be diminished, and they might in sober earnest have 'coals brought to Newcastle.'" Further, he said, "It was a comparatively simple thing to fix the hours of toil and the rate of pay, and

to say that all else must be adjusted thereby; but with this done they had not touched the real governing factors, and the man with labour to dispose of would have *at last to realise* that in the long run, and despite artificial manipulation, it must find *its own level in the markets of the world*," which is much the same thing as we ourselves said a week or two ago, when we pointed out that the miner would have to be taught that the selling price was fixed, not by the colliery-owner, but by the purchasers in the open markets.

The other two questions, which are really the most important, are those relating to "abnormal places" and a "minimum wage." Both these resolve themselves into a wage question, as the demand in regard to "abnormal places" is that a fixed minimum wage shall be fixed for any workman called upon to work in what is termed an "abnormal place," which means any working place in which the conditions, such as the hardness of the coal, lowness of the seam, wetness, or other difficulties, prevent the workman "hewing" as much coal as he could do in a "normal" working place in the same seam. On the 28th ult. the Coalowners' Association met the miners' representatives to discuss this question, but the parties could not come to any agreement. It will be at once seen that it is a proposal fraught with the most serious consequences to the industry, and naturally the coal-owners cannot look upon it in any other way than in a spirit of grave distrust. As mentioned by Lord Furness, if "*no man* is to receive *less* than, say, 7s.," naturally the best men will require much more to stimulate them to put forward their best efforts, and in consequence the average earnings cannot but be increased, or as a corollary to this the output per man would be reduced to the quantity which the officials of the mine could obtain by constant supervision. In fact, a state of things would occur similar to what happened in our engineering workshops, when it became necessary to create a new official in the shape of the much maligned and hated "feed and speed" man.

Unfortunately, there is amongst the ranks of the miners —probably to a greater extent than in any other industry— that type of Socialist, who, being a poor workman himself, is constantly sowing seeds of discontent amongst his mates, and what is worse is that, with an eye to a well-paid office in the union, he is encouraged to do so; hence the miners themselves provide the rod which flays them. It is this type of man who, by prating about the wealth of the country being in the hands of the few, and by arguing that such wealth being all earned by labour ought to be received and enjoyed by labour, is undoubtedly the sole cause of the present discontented state of the labouring world. But, however much this may be theoretically true, the miner must be taught that a national strike, far from making the wealthy poorer, and the poor richer, would have exactly the opposite effect.

In last week's issue the *Colliery Guardian* gave the results of an examination into the financial resources of the miners' unions and expressed the opinion that the funds would probably amount to £1,750,000, and that the membership would slightly exceed 700,000, thus giving a sum of about £2 10s. per head. Hence allowing for a payment of 10s. per head per week, and extra payment "where a number of mouths have to be fed," there would be no difficulty in carrying on a stoppage for a period of, say three weeks.

What would be the effect of such a terrible calamity w do not care to contemplate. Probably no one would be abl to forecast even a tithe of the amount of suffering by th poorer people and the dislocation of trade, and general hard ship and loss to the country at large. One thing is certain it would take months to repair—if it ever could l repaired—the damage done to the trade of the country i weeks, and the industry that would suffer most of all woul be that of coal-mining.

The M.T.A.: An impression of the Glasgow Conference.

All good things come to an end; o Friday last the 10th annual Conferen of the Municipal Tramways Associatio which was held in Glasgow and attend by some 200 delegates, was concluded.

The three days' proceedings opened, as is usual in Glasgo with a reception of delegates by the Lord Provost, and aft the morning's business, a midday luncheon, and dinner in t evening—at the invitation of the Lord Provost and membe of the Tramways Committee—served to remind the delega of the hospitality for which civic Glasgow is justly famed.

On the following day the venue was changed to t Newlands Car Depôt, about two miles south of the centre the city, where again, the morning was devoted to business a the afternoon to a visit to Rouken Glen—a favour pleasure resort of Glaswegians—while the evening was fu occupied by the Association dinner. The third day w devoted wholeheartedly to an excursion to Ayr a the Land of Burns, including once more a luncheon a afternoon tea, this time by invitation of the Ayr Tramw Committee.

Next to the festive side the most lasting impress gathered was the informal formality of the proceedings. T suave president kept order—by the interjected question a the ready retort—in a way which, conceivably, in m meetings might have caused disorder, but there was, usual, a pleasant spirit of genial *bonhomie* and *camarad* throughout the whole conference. The first day's pap were mainly on tramway finance and policy. Counci Nelson, of Glasgow, explained the city's "Common G Fund," and Councillor Rodgers, of Newcastle, gave his vi on "Tramway Finance and Policy."

Councillor Rodgers did not require to look for trouble- came upon him from all sides. He had been prying i figures and statistics, and was quite full of them — t exuded from every pore—and he had discovered that a sc or thereabouts of tramway undertakings were not financi sound, and so he had promptly blacklisted them. In re ing periods he denounced the immorality of having sinking fund, of not building up a strong reserve fund, of not charging a profit-making fare—whether a "fa fare or an "unfair" fare did not apparently matter v much so long as a profit was the result.

We then had Mr. Squires, L.C.C., asking how an night service of cars could be made profitable on 1d. fa "Charge 6d., if need be," said the author, but mak profit. The excuses were as numerous as the blacklist The Tramways Committee were overruled by the Coun said Burnley; we paid £120,000 to the old company some scrap-iron and a few horses, said Blackburn; Government auditor will not allow us to set aside a rene fund, said Plymouth; we *had* a bigger reserve fund, Wallasey, but we took some of it to build cars and car-sh It was all very humorous, but indicated very plainly the g need which exists for some independent, impartial thorough investigation into the whole question of tram

finance. The position at present appears to be very chaotic. Councillor Rodgers is evidently "a firebrand of the first wa'ther," as the Irish M.P. had it.

The first paper—read only in abstract—on the second day was by the brothers Cunliffe, of Manchester, on "Tramcar Meters." The discussion on this paper resolved itself mainly into a "battle of meters," as Mr. Spencer, Bradford, phrased it, the only dissentient voice being that of Mr. Hamilton, Leeds, who appears to think that the saving in energy obtained by the use of meters is sometimes attended with neglect of, and inattention to, the needs of passengers. The general opinion, however, was that meters were useful in discovering not only faulty drivers but also faulty equipment, badly adjusted brakes, worn bearings, faulty field coils, &c.

The concluding paper gave a tripartite report on "Replies to Queries," *re* tramway track construction and maintenance by the representatives of Glasgow, Manchester and Leeds. Queries had been sent out to a large number of tramway undertakings, and the collaborated replies formed the basis of these papers, but so varied is practice and experience, that no fewer than three varying and partially contradictory reports were the outcome.

Mr. Mozley, of Burnley, gave his opinion on the use of the oxy-hydrogen and oxy-acetylene welding and cutting processes, and mentioned figures showing the saving in building up crossings, &c., in the works. Mr. Grierson, of Glasgow, in his report stated that Thermit joints do not stand the wear, but Mr. McElroy, of Manchester, was confident that Thermit holds the day. Mr. Knowles, of Sheffield, challenged the statement made by Mr. Holt, of Leeds, that the steel used for tramway rails was "rubbish," and stated his conversion to Thermit-ism owing to the scientific manner in which the welding is now done. The President (Mr. Dalrymple) closed the discussion by pointing out that on the ·65 carbon open hearth steel used in Glasgow tramrails, the Thermit Co. had called off, as they could not guarantee the welds.

One felt sorry not to have had some information as to the electric welding of rail joints, for a good many have been so welded in Glasgow and other places throughout the country. The need for research into the best composition of rail steel was emphasised throughout the discussion, and the form of section recommended by the Engineering Standards Committee found very little favour. The whole question of track maintenance and construction was once more remitted to the Executive Committee, and the three experts who contributed the report, with the feeling in favour of standardisation very strongly emphasised.

As a result of the annual business meeting, Mr. H. E. Blain was elected president for the ensuing year, and the Association is to hold its next Conference at West Ham.

An innovation this year was an exhibition of tramway equipment and apparatus in the Newlands Depôt, a large number of firms being represented.

Electricity in Western Australian Mining.—A series of articles on "The Mining Industry of Western Australia" has recently been appearing in the *Times*. The author, Mr. G. W. Williams, arrives at the conclusion that a central power house is wanted. He expresses this conclusion in the following terms:—"Broadly speaking, the metallurgy of the field is of a high order, and, all things considered, compares more than favourably with any other field in the world. But metallurgical work in connection with complex ores must ever remain an expensive item, and material reductions in cost are not probable in existing circumstances. It is to be regretted that it is not possible to provide some central power house, owned by the mines and provided with the most efficient type of generators. Such a scheme, by supplying cheap electric power, would materially decrease power costs. On the Rand the problem of reduced grade was met by amalgamating adjoining low grade properties and by the erection of plants of large capacity. If such a scheme could be applied to several mines on this field, it would materially increase the productivity. There are difficulties in the way, but this is certain: a mine treating 10,000 tons per month in its own mill must reach the limit of profitable work sooner than it would were it worked as part of a larger mine and the joint product treated in a mill which had a capacity of, say, 30,000 tons per month. The cost of transport from the mines to the mill would be far smaller than the increased profit due to centralised work. Centralisation, intelligently carried out, must mean decreased cost, and that means increased profit and life. If this is not carried out in the near future there are many mines which will reach the point where no scheme of amalgamation could possibly save them from extinction."

THE ANGLO-BELGIAN LOADED TELEPHONE CABLE.

We were able recently to announce the laying by Messrs. Siemens of a new loaded telephone cable between England and Belgium.

It is interesting to note that about one week after the cable had been laid, a fault occurred, which was localised at a point about 2½ miles from St. Margaret's. The ss. *Alert* repaired the cable in about 12 hours, and the fault was found to be due to a bad joint between one of the cores and the insulation of the coils. The short time required to remove this fault, which naturally included the inserting of a new set of coils, shows that there is no difficulty in repairing this class of cable.

The cable differs from the one laid between Abbott's Cliff and Cape Grisnez (which cable, we understand, is still in perfect condition), in so far as special loaded coils have been introduced, which enable a superimposed or "phantom" circuit to be worked, in addition to the two ordinary loop circuits, an advance the importance of which is obvious.

We have been favoured with some interesting details of the "constants" of the cable, as follows:—

1.	Resistance per nautical mile of loop conductor without coils.	14·2 ohms at 15° C.
2.	Capacity per nautical mile of loop conductor without coils.	0·157 mfd.
3.	Capacity per nautical mile of phantom circuit without coils.	0·314 mfd.
4.	S/K at 800 cycles per sec. and 15° C., and is not proportional to frequency.	12
5.	Self-inductance of the coils for the transformer circuit.	0·1 henry.
6.	Ohmic resistance of the inductive and non-inductive coils in the transformer circuit.	6·6 ohms.
7.	Effective resistance of the inductive and non-inductive coils of the transformer circuit at 800 cycles with 1 milliampere at 15° C.	11·5 ohms.
8.	Self-inductance of the coils in the phantom circuit.	0·05 henry.
9.	Ohmic resistance of all coils in the phantom circuit.	3·3 ohms.
10.	Effective resistance of all the coils in the phantom circuit at 800 cycles with 1 milliampere at 15° C.	4·6 ohms.
11.	Capacity of the coils in the transformer circuit.	·004 mfd.
12.	Additional capacity of the coils in the phantom circuit, less than	·0001 mfd.

"βl" for 50 nautical miles, measured with the Franke machine:—

	$2\pi n = 3{,}000$	4,000	5,000	6,000	7,000
Transformer circuit	0·863	0·872	0·893	0·920	0·977
Phantom circuit ...	—	0·877	0·904	0·928	—

An interesting fact, we note, is that the βl values for various frequencies differ but little from each other.

Manufacture of Ice at Electricity Works.—In many places iceworks have been established in connection with electricity works; there are 212 such combined works of 50 to 500 KW. in America. The results show that a fair income may be derived from the industry. One factory, for instance, produces 25 tons a day and supplies cold, so to speak, to four great cold stores; 65 KW.-hours are consumed per ton of ice. The ice is sold for 12s. 6d. per ton, and the net profit amounts to 0·75d. per KW.-hour. A factory employing the compression method only consumes 50-60 KW.-hours per ton. Another electricity works is able to produce 10 tons of ice per day, and during June-September, 1910, delivered about 9,880 tons of ice, which was sold at prices varying between 2s. 9d. and 4s. 7d. per 100 kg. The income amounted to 26s. 5d. per ton; the expenses in connection with manufacturing, &c., were 12s. 4d. per ton. When administration and other expenses were deducted, there remained a net profit of £480, representing 13 per cent. on the capital. The sale price at this factory was, for a consumption of less than two tons a month, 4s. 7d. per 100 kg.; for two tons, 3s. 8d.; for 8 tons, 3s. 3d.; and for more than 8 tons, 2s. 9d. We do not often have a long hot summer, but there is always a demand for ice in the "off" season for electric lighting, and the business is admirably adapted for working in conjunction with electricity supply.

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THE EXHIBITION AND THE PUBLIC.

By the Engineering Correspondent of the *Daily Telegraph*.

If there is one branch of science which appeals to the general public it is that which deals with electricity. The "Man in the Street"—not the man in the gutter, but the intelligent citizen—is brought face to face with the applications of electricity to his convenience a dozen times a day. More particularly is this true of the Londoner. For in the capital of the Empire there are gathered together the leading lights of the profession—they are interviewed, they speak in public, and nearly all of the scientific societies of any importance hold their meetings in London. The Londoner is a more omnivorous reader than his country cousin. If it were possible to obtain exact data of the places where the newspapers reach, it would undoubtedly be found that the average Londoner spends more on that modern necessity than does the provincial man. This may be partly due to his less sociable instincts, and the longer time spent in travelling. But the fact remains. Then there are the electric trains, the brilliant scenic effects at the theatres brought about by electricity, the latest novelties in the great stores (such as Harrods', Whiteley's and the others), as well as the huge hotels.

For London contains wealth. It also contains—it draws as a magnet from the provinces and even from abroad—the picked brains of every profession. And when you have wealth and intellect you will certainly find progress. London also has its exhibitions. One of the best that has ever been held is that which is now on view at Olympia. The exhibits show quite clearly that the average standholder has caught hold of the fundamental notion of such an exhibition. He must first of all *interest* the prospective customer; then he will educate him. Then he will sell the goods.

The Electrical Era.

If anything is wrong with the public, it is that they expect too much, and are a little afraid of electricity. Anything bordering on the supernatural is put down to that agent. Not very long ago the writer was in the engine room of a warship. Behind the main condenser two stokers were arguing, so vehemently that our entrance was unnoticed. This was the conversation, translated and with superfluous adjectives of an emphatic nature omitted.

"What made the woman wash the baby in the picture?" asked Jack of his pal, who had been with him to the cinematograph show. "Electricity," replied his friend. "Oh—I forgot that," was the reply. No other suggestion was necessary. Of course, every reader of this paper knows that the fire which cannot be accounted for is put down to a fused wire. And the frequent message from the hoardings to the credulous is "Electricity is life." Even Miss Marie Corelli, with a circulation far beyond that of the technical journals, talks glibly about electricity and the soul. She, with the ease of the uninitiated, connects the two together for the benefit of her non-scientific readers.

Another great fault of the public is that they think electricity is so expensive. The "plumber and electricle engineer" (as one gentleman put on his sign) trades on that idea. It must be obliterated from the mind of the public, for there is a great market for the manufacturers when they can get rid of these superstitions.

It must be frankly confessed that very many foolish and impossible things about electricity have in the past appeared in newspapers. To some extent it is almost impossible to prevent occasional mistakes in the most highly efficient organisation, working under intense pressure. And a newspaper office is always working overload. Just as the paper is "being put to bed" there comes a curt cable that a warship is blown up or a foreign monarch has expired. It is news—it must appear, or the reader will comment on the lack of enterprise of his favourite journal. And there is such a demand for space. However, most of the great journals nowadays either leave applied science severely alone or place the matter in expert hands. During the last few years there have been fewer errors in the responsible Press concerning matters electrical. It is in the interest of electrical engineering that such an improvement should exist.

An Educational Effort.

As a frequent reader and contributor to the technical Press, the writer fully appreciates the absolute necessity for these journals and the competent manner in which most of them are conducted. They have a mission, which they admirably fulfil, of an educational nature. They deserve, most emphatically, the full support of engineers. They are the life blood which stimulates our thoughts. But they are not read by the public. And those who have at heart the welfare of the engineering industries of the country—upon which its greatness is based—desire three things: (1) that the public shall demand the latest applications of science to their households and their daily work; (2) that the politicians shall understand that every assistance, and no restrictions, shall be made by law in the development of applied science industries; (3) that the general public shall understand that the engineer is entitled to as high a status as the lawyer, the doctor or other professional man.

For those reasons the writer has gladly done all in his power to induce the public to visit Olympia, for he regards the exhibition as a great education for the twentieth century householder. But for the expense to the shareholders, it would be a most admirable arrangement to have an annual show. However, that is obviously a matter of which the promoters of the Exhibition know best. They have every reason to be proud of the manner in which the visitors to Olympia express themselves. They are delighted, entertained and instructed. While it is quite true that the Manchester Exhibition was a success, this one will certainly eclipse it from all points of view, for there is no place in the world like London if you have something that will interest the public. In the metropolis and its suburbs there are somewhere about 7,000,000 people. While there is abject poverty in that area, there is also wealth, undreamt of a century ago. And, after all, the public wanted at the Exhibition are those in a station of life which permits them to *buy* something electrical. Moreover, there have been many visitors from the managerial departments of the large hotels, stores and other places where the demand for electrical goods is created by the public.

THE NEW SERVANT.

By "MAUD."

(*Concluded from page* 535.)

There has been continued progress during the past few years with regard to appliances used for electric heating and cooking. It was not to be expected that men whose sphere is not cooking would arrive at perfect cooking apparatus at once, and neither was it possible, I suppose, for scientists to produce materials that would withstand for long periods repeated heating. At the present time, however, electric heating apparatus, including that for cooking, is very reliable indeed.

There are two chief purposes for which electricity can be used other than for lighting; these are heating rooms and cooking. As they are really both entirely different parts of one of the most expensive matters in connection with the upkeep of the household and its cleaning, anything which effects a saving will be of special interest.

Taking the question of heating, the chief rooms in the average house to be heated are dining room, drawing room, kitchen, and occasionally hall and bedrooms. Dealing with the dining room, I find from experience that it is healthful and comfortable to keep this room at a temperature of 60°. To do this, I should recommend the use of a six-light radiator with three switches and provided with the new Bastian heaters in place of the usual lamps, as they give out heat better. Such a radiator as this will keep the room hotter than the temperature I have given when full on in the middle of winter, and will cost 3s. 1d. per week to run with ele-

ty at 1d. per unit. The figure given represents the age cost per week taken over the whole year, the size of room being 15 ft. square × 12 ft. high. Following the ng room comes the drawing room ; the cost of heating is a very variable amount, due to the use to which this n is put. The heater should be the same size as for the ng room, but more elaborate according to taste and et. The average cost of heating this room per week 3. 9d.

ollowing the dining room comes the kitchen,. Here for a ber of reasons a large quantity of electricity can be ed, and it required careful thought to so install apparatus prevent waste. It is usual to have the electric oven other appliances either in the kitchen or the adjoining lery, and I find that the heat from these is sufficient to ly warm the kitchen until the afternoon, when a small light radiator can be switched on to keep up the heat n needed. Working on this system the average cost for week is 1s. 1d. The question of the heating of the oom and hall is quite simple, and can be carried out by ng switches and plugs fixed in these places to which ators already in the house can be attached.

he total cost, therefore, of heating a house whose rental tween £30 and £45 per annum is 5s. 11d. per week, allowing 7d. for the heating of the halls and bedrooms es the average cost per week throughout the year 6s. 6d., ally reasonable figure, which favourably compares with cost of coal in large towns without the attendant dirt, age and consequent round of cleaning.

urning to the question of cooking, this is undoubtedly most interesting part of the whole of the numerous ications to which electricity can be put in the home. most useful apparatus to have in a house of the size I already mentioned is an electric oven large enough to a joint of meat, and at the same time to bake a pie or ling. This oven should have at least four separate heaters, controlled by a separate switch, so as to permit of the being under perfect control, and consuming when all are bout 2 units per hour. Such an oven will seldom require e full on, but the heat is always there if wanted to do ed plaice or other such processes which require great . The oven looks nice mounted on a white glazed brick r on the kitchen floor. In addition to the oven it is rable that you have a quart size electric kettle, a large small electric saucepan, and a small hot-plate to take frying-pan or a small baking tin. This com- s a perfect heating apparatus which is extremely nomical to use, and which will do all the cooking required. cost of running this cooking apparatus will average oximately 3s. 6d. per week for the usual number of ls, a truly reasonable figure when making a comparison either gas or coal. The apparatus is perfectly clean, e safe, and there is no risk of fire from its use.

he cooking done by an electric oven is as nearly perfect is possible to get, owing to the scientific arrangement of heaters. There are no nasty fumes in the oven such as in with gas, which can be tasted in the cooked articles. cooking is so perfect that there is no need for the paper craze, which seems to have originated to overcome the t of the gas fumes ; the doing away with this saves at 3d. per week.

t will be seen by the reader who has carefully followed remarks as to the different applications of electricity in home, that the whole of the apparatus installed is such as effect considerable savings in the amount of cleaning lered necessary when gas is used for lighting, and coal for cooking and heating. This means that having done y with these dirt producers the cleaning will be less, and equently your maids will have less to do—a state of irs which will considerably inspire the whole atmosphere he home, as half the trouble with maids is due to the e amount of work to be done, which continues over a g period each day. Lessen the amount of the work reby saving yourself trouble and continual worrying), your maids not being overworked will have a better nce to do their work better and in a much better temper. some cases the amount of labour rendered necessary for ning will be reduced, with a consequent monetary ng, but this is not half so important to the lady of the se as to be saved the continual worrying of looking after maids who frequently shirk their work, generally due to the amount to be done. Surely a few years' extra life due to less worrying are worth something to us.

When it comes to be generally realised how great are the advantages which electricity presents for heating and cooking over any other of its rivals, and its general adoption comes as a matter of course, then some of the smokiness of our manufacturing and residential towns will vanish. The streets will be cleaner, due to the absence of coal dust, and a nearer approach to Utopia will be possible than at present. Really, with a diminishing coal supply, some of the awful waste which takes place by our present method of heating and cooking, will have to be reduced if we have any real consideration for the welfare of the future generation and our nation generally.

There are numerous small electrical appliances which will reduce trouble and add to the comfort of life generally, and which you are sure to inquire into when once you find out the difference electricity will make in your house. Surely at the high pressure of modern times a little extra comfort is extremely welcome, and now that you have the agent that will give you this, there should be no reason why you should not adopt it, especially when it costs no more than the existing crude methods.

It is usually stated that experience is the best and only school to teach us progress, and as I am speaking from experience, I trust that this article will carry some weight with it that will make for the welfare of the home generally.

THE MUNICIPAL TRAMWAYS CONFERENCE.

The tenth annual Conference of the Municipal Tramways Association opened at Glasgow on Wednesday, September 27th, with a meeting of the executive committee at the City Chambers at 10 a.m. ; thereafter a reception of the delegates and members was held by the Lord Provost and the Convener and members of the Glasgow Tramways Committee in the Council Chamber.

Lord Provost Sir Archibald McInnes Shaw welcomed the Municipal Tramways Association to the city, and trusted that their stay might be of benefit to the industry and pleasure to themselves. Subsequently the President, Mr. James Dalrymple, the general manager of the Glasgow Corporation Tramways, read his presidential address.

After recalling the fact that the M.T.A.'s second conference was held at Glasgow in 1903, with Mr. John Young as its first President, and that it was perhaps the smallest of the various associations of tramway men, he—with considerable truth—urged that in practice this was an advantage rather than otherwise. Large gatherings are apt to be unwieldy, and we can bear out the President's conclusion that in its smaller way the Association can make these meetings of greater practical value to the members than the larger bodies are able to do.

He went on to say that since the Association was formed in 1902 it had tackled every conceivable subject connected with tramways. For some years past he had been of the opinion that when a large and comprehensive subject was brought before the Association, the benefits derived from the short discussions thereon were scarcely sufficient to warrant the great amount of time and trouble expended in the preparation of the papers. He had, therefore, been anxious that the members should take up what might be termed the small change of tramway management.

He mentioned, as an instance, the subject of track construction and maintenance, which might be sub-divided into a dozen sections, each sufficient in itself for a good debate. The revenue side of the business is carefully watched, and the President is evidently of opinion that the expenditure side should have equal attention—as, we believe, it usually has.

The President, in conclusion, touched briefly on several other topics familiar to tramway men.

The President's desire for the continuance of the good work carried on by the Association will be generally shared by those in any way connected with electrical tramway work, and by none more than the technical Press, which did such good work for the tramways in the early days—but which nowadays does not, perhaps, receive the courteous recognition to which it is entitled at the hands of the Association.

At the conclusion of the Presidential Address, Mr. C. J. Spencer, Vice-President of the Association, in moving a vote of thanks to the President, said that the address just listened to might be described as "brief, bright, breezy, and—thorough." The railless systems in Bradford and Leeds had been a great success, and the only serious trouble they had had was to find a proper name for the system, whether "railless trams" or "trackless trolley."

Mr. Dalrymple, in his reply, stated that the executive committee of the Association were devising schemes for submission to Parliament in order to enable small local authorities to obtain powers for railless projects at less trouble and expense than the present procedure entailed. He called upon Councillor Walter Nelson, the sub-Convener, Glasgow Corporation Tramways Committee, to read his paper, entitled "The Common Good of the City of Glasgow, its origin, history and present position in relation to the Tramways Undertaking."

This paper is largely historical and wholly concerned with municipal finance in Glasgow, especially as regards that somewhat mysterious and reputedly wealthy fund known as the Common Good, the precise nature of which is now explained, although its credit balance still remains a mystery.

The following definition in the paper of the fund is perhaps as good as any:—"It is the common property of the citizens of Glasgow administered by the Corporation and to be used for the general benefit of the community, and as to the control and expenditure of which the Corporation are not fettered by statute."

The Common Good dates from the time when Glasgow was made a burgh; for the year ended March 31st last, the expenditure from the fund was over a million, but its revenues sufficed to produce a surplus of £55,912. This is really all we learn of its present financial state, as Councillor Nelson maintains a discreet silence in regard to the Common Good funds at disposal at the civic bankers.

The paper is of some interest, in that the Corporation tramways undertaking is, and always has been, part of the Common Good, and that its revenue and expenditure are in great part derived from, and due to the city tramways undertaking; so much so, in fact, that Mr. McElroy subsequently ventured the opinion that it would have been bankrupt but for the latter.

Tramway Finance and Policy.

(Abstract of paper by Councillor Jas. H. Rodgers, *Newcastle Corporation Tramways Committee.)*

There are some 88 Corporations who at the present time own and work their tramways, whilst there are some 86 others who own them; these are often a short length of line in small urban or rural districts, which are rented or have a working agreement with larger corporations or private companies to work them in conjunction with their own lines. My remarks will therefore be confined to the 88 who are at present working their own tramways. We ought not to be satisfied with the knowledge that some 30 of the 88 tramways may be financially sound, whilst the other 58 are either struggling to make ends meet, or are kept going by the assistance of the rates.

I have frequently been amused at these conferences, and elsewhere, by hearing speakers give figures in bulk to prove that the municipal tramways of this country are a financial success; the only correct way, to my mind, is to take separately the financial position of each concern.

The first consideration of a Tramways Committee ought to be to make their undertaking financially sound, by the building up of a sufficient reserve and renewal fund.

Their second consideration, to see that the travelling public is supplied with proper accommodation and facilities.

Their third, to see that good conditions of labour are given to all their workers.

And their fourth consideration, to see that when the first three are complied with the ratepayers who backed their bill and over whose streets they run their cars, should have some return in the shape of contributions towards the rates.

No fewer than 26 of our municipal tramways undertakings are to-day without any reserve or renewal fund at all, whilst many of the others are far from satisfactory in that respect. In coming to this opinion I have not set up a high standard and then judged them by it; I have really taken a very low estimate of what, in my opinion, the reserve and renewal fund ought to be.

By some committees provision is being made in their reserve fu for the depreciation of everything—track, car-sheds, rolling sto machinery and overhead equipment; whilst in others, and I beli this applies to most places, car-sheds, rolling stock, machin and overhead equipment are kept up out of revenue, and provisio only attempted to be made in their reserve fund for track renew It is from the latter basis that I propose to judge the finan position of our municipal tramways.

The money for the track is borrowed over 30 and sometin 40 years. While the foundation may last that time, I think every will admit the rails won't, and will need renewing long before t period is passed. This is demonstrated very clearly by the follow list, which shows the amount spent on renewals by the places nar since their tramways commenced:—

	Amount spent.	Years opene
Aberdeen	£45,024	12
Bradford	84,397	12
Bolton...	53,091	11½
Birmingham	11,803	4
Burnley	7,770	9
Cardiff...	9,255	9
Dundee	8,350	10
Glasgow	238,083	10
Huddersfield	124,615	10
Liverpool	190,321	12½
London County Council ...	45,248	12
Manchester	224,932	9¾
Portsmouth	25,310	9½
Rotherham	9,894	8
Newcastle-upon-Tyne ...	10,817	9½
Salford	19,051	10
Sheffield	122,529	11½
Sunderland	26,830	10½

Every penny of this money was spent out of their reserve renewal funds.

How, then, will the 26 places renew their track when it bec necessary, which have no reserve fund at all?

I certainly think they would have been well advised if had built up their reserve funds, even though it had requir rate to do this.

It is satisfactory to see that about 67 of the Committee attempting this. Many, I submit, do not place sufficient each thus their reserve and renewal funds are far from adequate. still very pleasing to know that they accept the principle.

We ought to take an average life of 15 years for the rails. generally accepted that the net cost of relaying will be £4,000 per mile of single track, but experience shows frequently higher. The Inland Revenue authorities, who are eager to make allowances, have agreed, I think, to the allow of £4,400 per mile of single track for this purpose. In one I find the cost of relaying a little over 6 miles was £33,000, w is over £5,000 per mile.

What I suggest is that £200 per mile of single track ought set aside each year, and if that amount was invested at 3½ per in 15 years you would have £3,800 for each mile of track, and be able to relay your rails as they were required.

It must not be overlooked that all the money would n invested during the 15 years; some of it would be drawn out before the time had expired to relay those places that had wor quicker than the others, and thus the interest on such money w not be earned. In that case the money would not represent £ per mile, but something less than that amount.

Some Tramway Committees have in the past given their p over to the rates, and now that renewals have to be done income is not equal to the increased expenditure, with this res that the present-day ratepayers have to make good the loss.

Last year 34 tramways showed a loss on their year's worl this is an increase of five over the previous year. I greatly that the list will be considerably extended unless some o Committees alter their present policy of handing over all, o greater part, of their surplus to the rates, and of granting fu concessions to the public and their workmen; the incomes of systems will not allow them to do so.

The author gives a list of 30 tramway undertakings whic in his view, doing well, only three of which placed less than per mile to renewals; this is followed by a list of 14 underta doing moderately well, but which, the author considers, wer justified in contributing to the rates as they have done. A list is of 16 tramways which show a surplus which is insuffi to provide £200 per mile; and a fourth gives 32 undertakings w show no surplus at all, only three of them not being a char the rates.

In regard to the fourth list, the author says it is surprisi find such a small traffic return, notwithstanding that many places have adopted the half-penny fare stages which are *su* to increase traffic, if not receipts.

He continues: I am a great believer in Corporations ownin working their own tramways; but I also believe that, whe done, it ought to be done on purely business lines.

Any chairman or manager will tell you that, at the present it is almost impossible to do this. You have members of the Co voting away the profits to the relief of the rates, irrespective c future requirements in the way of renewals.

There are others who contend that the ratepayers are not en to any financial assistance by contributions towards the rates. this I entirely disagree. The ratepayers have a right to ex return sooner or later; the streets belong to them, and by p the tramways in those streets they give them a marketable va

I believe in giving every facility possible to the public, cons

h the yield of an adequate profit; but I do not see why we should
cars at a loss, or even at a loss of profit, for the sole benefit of
riding public, when frequently one-third or more of those using
cars may be non-residents in our districts.
n no fewer than 12 towns where losses are made each year, the
nmittees have granted ½d. fares; whilst in six others, where the
fits are not sufficient to make proper provision for track renewals,
Committees have made the same concession.
n only ten places that may be looked upon as financially successful
½d. fares allowed; four of these are in Scotland, which, or course,
ludes Glasgow, and four are in England, viz., Leeds, Sheffield,
ndon (L.C.C.) and West Ham, each serving very large popula-
ns; the remaining two are Stockport and Warrington, both
which, I feel sure, would have done better if they had never
nted the concession at all.
n the numbers given above I do not refer to workmen's cars,
only the ordinary daily traffic; nor do I include Manchester,
h a circular route with ½d. sections on the outskirts of the
; or Halifax, Preston and Perth, with one short route only at
t fare.
his goes to prove very clearly, I think, that ½d. fares ought not
be given, especially by small tramway systems; even the
er ones should be exceedingly careful before granting such
ilities.
shall now refer to what I consider another mistaken policy
ich some of our Committees have adopted, viz.: the running of
s at cheap fares each morning. I notice in several towns they
w all passengers to travel at half the ordinary fare up to 8 and
clock in the morning, issuing return tickets at the same rate in
ny places; that, to my mind, is undoubtedly a great mistake
a decided loss to those undertakings.
Ve all, I believe, excepting six towns, run workmen's cars; I
nder how many make them pay; very few, I should think,
ny.
he loss may not be felt so much by the larger undertakings,
where tramways are established in small, thinly-populated
ricts, and where revenue is of the greatest importance to
m, it then becomes a very serious thing; it is one of the
eral causes that leave those undertakings with a debit balance
year.
fully recognise the difficulty there might be in correcting all
now that the concessions have been granted; but, in my
nion, this should be done by those tramways committees who
running their service at a loss, and are already a charge upon
rates; the financial stability of their undertaking certainly
ands it.
he author refers to the question of the employés and their con-
ons of work; he says that if a comparison is made between the
led mechanic and tramway man, "it will be found that the
es and emoluments of the latter, who are generally drawn
n unskilled labour, will equal the net income of the skilled
san; to place him higher still, either by granting more wages
y reducing his hours of labour, would be not only an injustice
he trained mechanics, but quite unfair to the undertakings we
e to manage and direct."
He concludes with a shot at the would-be popular members of
council or committee, who are never happy but when advocat-
further concessions, and a tabulated summary relating to
tal, income, &c., of the various tramways for 1910-11.

CORRESPONDENCE.

ers received by us after 5 P.M. ON TUESDAY *cannot appear until e following week. Correspondents should forward their communi-tions at the earliest possible moment. No letter can be published nless we have the writer's name and address in our possession.*

Quartz in Electrical Heaters.

Ve are surprised to read in your current issue a letter
n your correspondent Mr. Alfred A. Newman, intimating
t "Mr. Bastian can unblushingly (*sic*) claim to have been
first to successfully apply quartz" in the construction
lectrical heating and cooking apparatus. Unfortunately
your correspondent, however, facts do not bear out his
rtion, which to anyone at all acquainted with the subject
ld be characterised as absurd and preposterous. Quartz
ilica has now been used, we have reason to believe, for
10 years in the construction of electrical heating and
cing apparatus, and there are at least a dozen firms
various parts of the world who are now using this
erial for this purpose, some of whom have been
ig it continuously for the full period mentioned, and, we
add, quite successfully. The Thermal Syndicate, Walls-
, and Messrs. Johnson, Matthey & Co., London, have
a manufacturing this material on a commercial scale in
country for about eight or nine years, but it has been
in Germany for a longer period than this. Herren
aus, of Hanan, Germany, we believe, were the pioneers
his material for electrical heating purposes.

In addition to this firm there are also others in Germany, among whom we may mention the Brockdorf Witzemann Co. and the Kryptol Co., Berlin. In America, among the firms who have been using this material continuously for electrical heating purposes for the past six or seven years to our knowledge, we may mention the Hoskins Manufacturing Co., Detroit, and the Bristol Co., New York. In this country we have been using this material in the construction of electrical heating and cooking apparatus for the past six years, and it has also, we believe, been used by some other firms; Gallenkamp & Co., London, if we remember aright, were advertising some electrically heated appliances about six years ago, in which a tube of quartz wound with a coil of pure nickel wire on its external surface was employed. The use of pure nickel as an electrical resistant material is, however, fatal to success, and this was recognised years ago. The type of heating element we (and others) have been using for temperatures from a red heat up to 2,600° F., has been a thin-walled tube of quartz, alundum, or porcelain, wound on its outer surface with a coil of platinum iridium, nickel-chromium, or cobalt-chromium alloy resistant ribbon or wire. Mr. Bastian's patent, dated 1908, merely covers a detail of construction, viz., in place of threading or winding the resistant coil or spiral over the outside of the refractory insulating tube, he threads the coil inside the bore of the tube.

Whether this constitutes an improvement on the older method of construction is open to question. So far as our experience goes, we find that the former and older arrangement is perfectly satisfactory, while there is certainly no difference in the efficiency, the whole of the electrical energy being converted into thermal at any desired temperature up to 2,600° F., which is about the maximum temperature quartz will endure for any length of time. We may point out to your correspondent that success or failure in this direction is not so much influenced by the use of quartz alone, as he seems to suppose, but by the use of a suitable electrical resistant material. Up to about six years ago, although others were known, the only successful electrical resistant materials available commercially, capable of enduring a high temperature, were platinum and iridium. The excessive cost of these materials, of course, rendered their use in electrical heating and cooking apparatus somewhat limited, and prevented any considerable sale of the appliances. About this time the Hoskins Manufacturing Co., Detroit, developed the manufacture of an alloy of nickel and chromium, which they christened "Nichrome," especially for use as a resistant material in electrical heating and cooking apparatus, and they, and other firms, have been using it ever since.

The Hoskins Co. filed a patent specification in this country (No. 2,129, of 1906), but the Patent Office endorsed it with a reference to a previous Patent No. 202, of 1896, by Emile Placet, of Paris. This gentleman was undoubtedly the inventor of nickel-chromium alloy, and we believe that the Hoskins patent has since been abandoned in this country. This alloy of nickel-chromium possesses the peculiar property of being inoxidisable at a bright red heat, and comparatively cheap as it is, has probably been the greatest factor in making popular those electrical heating and cooking appliances, such as toasters, radiators, grillers, &c., requiring radiant heat for their operation.

There are other refractory insulating materials, such as alundum, steatite, porcelain, &c., which will give as good results as quartz, but, as it happens, quartz is cheapest. The use, however, of either platinum, iridium, nickel-chromium, or cobalt-chromium alloy is vital to successful operation. Mr. Bastian was apparently not aware of this fact, or of the existence of the above-mentioned alloys, as in his Patent Specification 19,333, of 1908, he mentioned that pure nickel was the best material to use for the heating spiral. That one contention that the electrical resistant material is of more importance than the kind of refractory insulator used is proved by the fact that Bastian's apparatus when first introduced employed nickel spirals, and, in consequence, proved unsuccessful; success was only attained when nichrome spirals were substituted for the nickel. The use of nickel was, in fact, distinctly retrograde to the extent of fully ten years. It is a matter for regret that patentees before placing their inventions on the market

do not make a point of making themselves fully acquainted with what has been done previously in the same direction, as the introduction of crude devices, especially when backed by ample capital, has a tendency to stop the sale and otherwise spoil the market for more perfect appliances, by their unsatisfactory operation. Another instance of this kind occurred only a few weeks ago in the columns of your journal, where Messrs. Isenthal pointed out that they had been using heating elements composed of a resistant wire threaded into beads ten years ago, and discarded the device, which was being re-introduced by another firm as new. A combination of quartz as an insulator with nickel-chromium as an electrical resistant material was early seen to be advantageous in the construction of electrical heating and cooking apparatus, and has been adopted by a number of firms, but we are not aware that the combination has ever been claimed as the monopoly of any particular firm.

Paterson & Co.

Newcastle-on-Tyne, *September 25th*, 1911.

Trade Discounts to Private Customers.

Re the correspondence sent you by Messrs. Wm. Coates and Sons, Ltd., published in your last week's issue, I should like to know in what way Messrs. Coates think they are placing Mr. — in the pillory. Candidly, I do not consider that they have stated a case; they are offered 10 per cent. by X. & Co. for doing absolutely nothing, and this ought to be enough for them in the circumstances, even if they had sent Mr. — to X. & Co.

As regards X. & Co.'s behaviour in the matter, I fail to see how any exception can be taken to this, more especially as if they had invoiced Messrs. Coates with the goods and the latter had disappointed them in payment, their only remedy would have been against the party who placed the order with them.

C. G. Fox.

Palmer's Green, *October 2nd*, 1911.

With reference to the correspondence you publish from Messrs. Coates & Sons, I think they will be wise to put their case before the secretary of the Contractors' Association. I have been "had" in the same way. Often my country house clients prefer to buy their own fittings in London, and ask me for the names of several fittings manufacturers. I have to be very careful what names I give, as some manufacturers will not reserve the trade discount for us unless the order is given in our name. On the other hand, some manufacturers—I might say the majority—are quite the reverse. I have just had a full credit note from Messrs. Galsworthy for the trade discount off some fittings that one of my country house client brought for his London house, that I did not know anythin about.

If all the contractors belonged to the Contractors' Asso ciation, it would save us a lot of trouble and expense.

A. F. Lord.

Plymouth, *October 2nd*, 1911.

Electric Power First Used in Collieries.

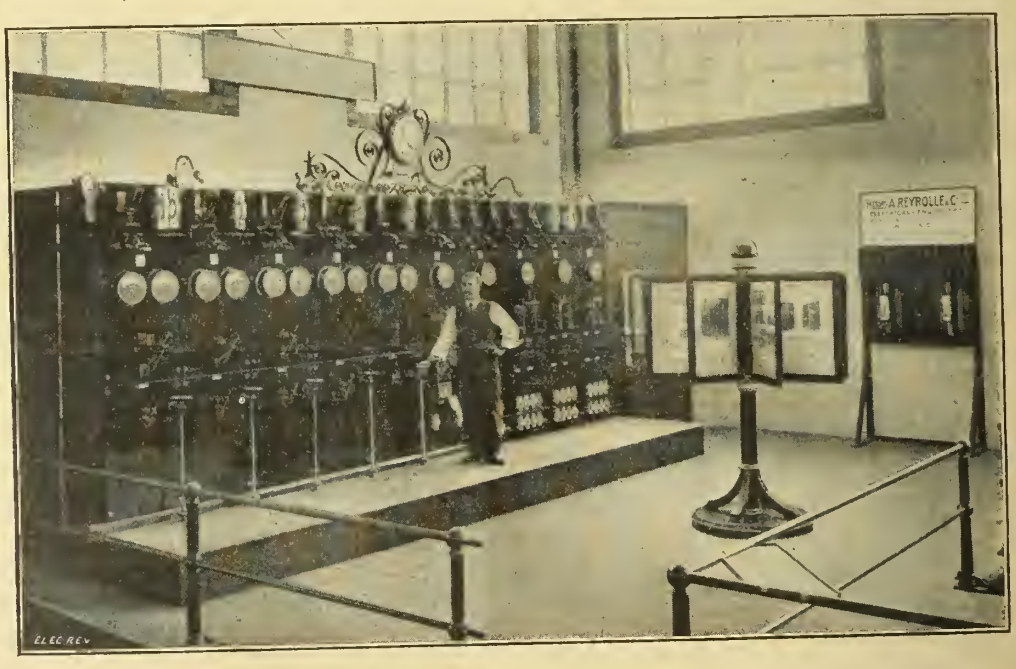
I should be much obliged if you could kindly inform m at which colliery in Britain, and also in the world, the fir electrically-driven pump and haulage gear respectively w in use in the mine.

Arthur O. Neal.

Carlisle, *October 1st*, 1911.

SWITCHGEAR AT THE TURIN EXHIBITIO

In our leading article last week on the International Exh bition at Turin, we commented upon the meagreness of t British exhibits of electrical plant, and the absence switchgear for pressures above 500 volts; it should not supposed, however, that there is no British switchgear the Exhibition. The whole of the British section is suppli with direct current through a large switchboard made Messrs. A. Reyrolle & Co., Ltd., of Gateshead, which illustrate herewith. This is a fine example of what can do in this line, and bears witness that one firm, at a rate, has made a strong endeavour to uphold the reputati of British switchboard manufacturers at Turin. The set



Reyrolle Switchboard at Turin.

mounted photographs seen in the foreground illustrates company's other principal productions, including their w known high-pressure ironclad switchgear, and switchgear mines, &c., with descriptions in Italian, French and Eng —an admirable example of the way in which these thi should be done.

Legal.—An objection was raised in the Court Chancery on September 27th, to the order dissolving an injunc obtained by a ratepayer. The motion was issued by Fleetw District Council to dissolve the injunction obtained by Mi Drummond, a ratepayer in Fleetwood, on June 21st, 1 restraining the Fleetwood Council from applying their fu towards assisting Thornton Council, in carrying forward litiga respecting the assessment of Blackpool and Fleetwood Tram The Deputy Chancellor directed the order dissolving the injunc not to be drawn up for a week, and not then if notice of person opposing was served upon the parties.

WORKSHOP LIGHTING.

By Wm. MANKTELOW.

The adequate and well arranged lighting—by day and by night—of workshops is as hygienically essential as the provision of proper sanitation and ventilation, but even to-day this fact is imperfectly realised. Very ill-planned lighting schemes are often installed, and outlay is unduly restricted by failure to recognise that its investment would be amply repaid by the greater and better output obtained, and the better health secured to the workers. When compared with the huge capital invested in buildings, power plant and machinery, the expenditure required to provide satisfactory illumination throughout a works is absurdly trivial, and is, moreover, little greater in the case of a scientifically designed equipment than in that of the inefficient installation so often considered adequate. The mere provision of a suitable lighting scheme must, however, be followed up by a systematic and thorough system of inspection and maintenance.

The golden rule of factory and workshop lighting must be to apply just enough light, of the right kind, in the right manner and at minimum cost, and then to maintain the working conditions at their initial level of efficiency.

The present notes are devoted to a consideration as to how these desiderata may best be realised.

Deficient lighting, whether as regards total amount or distribution, will lead to eye troubles—notably myopia—in the person working under it; will greatly increase the risk of serious accidents,* and will appreciably reduce the quantity and quality of the output from the workshops concerned, as well as causing psychological depression in the employés. So important are these factors, that all lighting installations should be regulated wholly by the nature of the building and the work carried on and by the nature and position of the machinery employed, and not by considerations of wiring and installation convenience.

The degree of accuracy required in modern manufacture calls for the provision of excellent illumination in all workshops to enable its attainment, and, though artificial lighting is normally required in factories only for a few hours per day (varying from two to six hours, according to trade and season), this amounts to 15-35 per cent. of the total working hours (54-90 hours per week), and, moreover, embraces mainly those hours in which the employés, tired by their day's work, need more than ever the provision of conditions favourable to efficient output. Among the remaining advantages to be derived from the good illumination of workshops may be noted the incentive to personal cleanliness and increased facility of efficient overseeing.

Legislation and Adequate Illumination.—In spite of the transcendent importance of this matter, it will be found that few States have enforced any statutory requirements as to the illumination provided in various workshops. Nor is the reason far to seek; it lies wholly in the very different circumstances of various manufactures and industries. What is adequate illumination for one purpose is too great for another, and as much too small for a third. In the present state of illuminating engineering, it is perhaps as well that most countries content themselves with requiring an "adequate" illumination in their workshops, leaving to the discretion of their factory inspectors, or similar officials, the decision as to whether or no this condition is conformed to in individual cases. "Adequate" illumination may be taken to mean that which allows of maximum perception of the work in hand with minimum eye strain to the worker. Excessive illumination is as far removed from "adequate" lighting as is insufficient illumination. Thus, small print, indistinguishable or distinguishable only with difficulty at 0·1—0·2 candle-ft., is best deciphered under an illumination of 1½—4 candle-ft., and becomes again illegible at the higher illumination of 8—10 or more ft.-candles.

Desirable as some guiding statutes may be, which would enable the provision of at least a certain minimum illumination in various instances where the inevitable looseness of the term "adequate" is open to abuse, such precise legislation is at present impossible, and all that can be done is to determine the actual illumination in as many definite cases as possible, note *by experience* whether it is sufficient or not, and thus gradually approach a reliable basis for legislative action in the various services examined.

Holland and Switzerland appear to lay down the most definite regulations concerning the lighting of workshops, and even their requirements on this point are very loosely framed. Thus, a Dutch Royal Decree specifies not less than 15 bougie-metres (about 1·5 ft.-candles) of illumination in certain trades,* and not less than 10 bougie-metres (about 1·0 ft.-candle) in "other works requiring good lighting." The Swiss Federal Council contents itself with certain definite requirements concerning window area and arrangement (see later), and the broad statement that "workshops must be provided throughout with '*satisfactory*' natural and artificial illumination." Our own legislation variously calls for "adequate" lighting and "efficient means of lighting, both natural and artificial." It will be noticed that the provision of natural lighting is throughout (very properly) considered as of equal importance to the provision of artificial lighting.

Considerably more detailed reference will have to be made to this point in a later paragraph, for, however widely it may be recognised by legislators and inspecting officials, it is still imperfectly realised, or at least neglected, by numbers of architects, contractors, and works managers.

In the suggestions made by the Incorporated Society of Medical Officers of Health, to secure uniformity under the Factory and Workshops Acts as applied to underground bakehouses, &c., may be noted an interesting attempt to specify a standard of illumination. It is suggested that the natural lighting should be such "that an official copy of the abstract of the Factory Act may ordinarily be read in all parts of the bakehouse between 11 a.m. and 3 p.m." This rule, though obviously somewhat crude, is a simple and practical means of attacking a difficult problem pending a more satisfactory and complete solution.

Illumination Desirable.—The general drift of the preceding paragraphs has been to show how impossible it is to state definitely what illumination is sufficient for various purposes, hence the following figures must be regarded merely as a useful guide, the final decision in each particular case being directed by local conditions and circumstances. It may be noted in the first place that by a very generally adopted convention, "bright" illumination means an illumination of more than 4 or 5 ft.-candles; "medium" illumination implies from 1 to 4 ft.-candles; and "low" or "dim" illumination means less than 1 ft.-candle. The use of such terms is liable to lead to confusion, since the various "code" words are apt to be used casually and in places where their arbitrary significance, as above fixed, is not intended; again, 4 ft.-candles, too bright an illumination for some services, is insufficient for the examination of many dark goods, and so on. Vague as many of the dicta of illuminating engineering must be for some time to come, it is unwise to accentuate this incertitude by unnecessary conventions.

In well-lighted workshops, the natural illumination near the windows should certainly not fall below 4 or 5 ft.-candles, while by artificial light, for reasons discussed later, 1-1½ ft.-candles will usually suffice, and even ½ ft.-candle may be sufficient in some cases. Bearing in mind the requirements already noted, the figures given in Table I may be taken as fairly representative of modern† practice.

In any lighting scheme employing illumination higher than 3 or 4 ft.-candles, special care is necessary in obtaining proper diffusion, particularly if the work handled is glossy or polished (see later sections).

Natural Illumination.—The provision of adequate natural lighting in a workshop or factory requires no less care than

* According to some recent returns, 75 per cent. of the accidents in factories happen after 4 p.m., *i.e.*, during the period in which artificial light is more or less employed.

* Embroidery and sewing; mechanical knitting and quilting; draughtsmanship; printing; engraving metal or wood; manufacture of instruments; clock and watch repairing; working in gold and silver or precious stones.

† That the qualifying adjective "modern" is necessary is proved by the steady increase in the illumination demanded for various services during recent years. Some of the increase has been necessitated by the greater delicacy of the processes involved, but a considerable part has merely followed the general tendency to higher illuminations, which has formed a prominent feature of the "educatior of the public

the arrangement of its artificial illumination; indeed, the former problem presents certain special difficulties of its own, which become ever more embarrassing in these days of close and high building (the overhead skylight being, of course, definitely fixed under all circumstances). The modern single-story factory, built on the "bay" system and lighted

TABLE I.—Average Candle-Feet of Illumination Desirable in Various Places, and for Various Purposes.

Foundries	¾-2	Various presses	3-3½
*Spinning sheds... ...	1½-2	Printing; type setting, &c.	4-5
*Weaving sheds from 2½-3 (light goods) to 3-4 (dark goods)		Inspection department from 4-4½ (ordinary work) to 5-10 (dark goods)	
Offices (ordinary commercial) from 2-2½ to 3½-4		Milling and automatic machines 5-7 (at work) 1-2 (over rest of m/c)	
Offices (drawing) ...	4-6	Lithography, engraving, &c.	5-10
Store rooms	2-5	Fine enamelling... ...	5-10
General engineering shops from 3-4† to 3½-5‡		Aligning and fine adjusting	10
Grinding and tool department	3		

* In textile factories in the past illumination has been very insufficient and badly arranged. Most of the processes of manufacture and inspection are very trying to the eyes, and the result of past neglect has been a great deal of eye-trouble with the operatives.
† Large rough work.
‡ Ordinary small work.

by "skylights," is a comparatively simple subject for the illuminating engineer; but in the older many-storied buildings, still so largely in use (and likely to remain so owing to the costliness of the surrounding ground), great difficulty is usually experienced in obtaining access to every part of the shops for the daylight which is so essential to the health of the workers.

In many works, provided with the most elaborate and satisfactory means of artificial lighting, the natural lighting is very defective; in most of such instances its improvement would be a costly, if possible, process; but it should be remembered that no artificial light possesses the full hygienic value of sunlight. The latter is invaluable in opposing anæmic tendencies and in the extermination of bacteria of every kind.

In all cases, and particularly where the total natural illumination is small, it should be noted that a given area of "high angle" window space is enormously more useful than an equal area drawing its light from a patch of sky low down on the horizon. It is for this reason that glazed roofs give such powerful natural illumination, and it is for this reason that all wall windows should be carried as high as possible in the rooms which they illuminate. This important principle is recognised in the Swiss Law of December, 1897, which decrees that "in new factories and reconstructed buildings of this class, all windows shall be at least 1·80 metres (5·90 ft.) high, and their distance from the ceiling shall not exceed 30 cm. (say, 12 in.)"; wide low windows, high set, give the maximum natural illumination per sq. ft. of aperture, but such a shape should never be used when the windows must be low set.

Underground workshops may be "naturally" lighted to a certain extent by skylights set in embrasures at intervals round the walls, the lights being in the pavement or ground plane (this assumes that ordinary windows, facing into light "wells," cannot be employed). The skylights should be glazed with prismatic glass, and beneath them should be placed an inclined bank of glazed white tiles—which must, of course, be kept very clean.

In other instances of overground workshops, prevented from obtaining adequate natural illumination by the close proximity of other buildings, prismatic glass may be used in the windows and will generally yield a better light distribution, and in a more pleasant manner, than the ordinary ribbed mirror, which is often hung outside the window at an angle of about 45° in such cases. Whichever be employed—prismatic glass or reflecting mirror—great care must be taken that the incoming light does not distress operators at the neighbouring benches or tools.

Where possible, a high-angle illumination should be obtained from a northern aspect, the well-known saw-tooth roof—so generally adopted in modern single-story factories—lending itself admirably to this requirement. Remembering the advantage of a high angle of collection of daylight, it will be seen that in place of the usual arrangement of saw-tooth roof (fig. 1) it would be much better to glaze the flatter pitches (fig. 2), a far more powerful (and equally uniform) illumination being thus obtained—area for area.

Fig. 1.

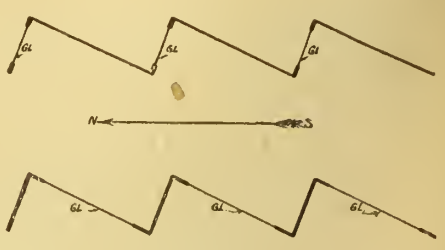


Fig. 2.

As in artificial lighting, the great aim is to obtain a uniform, diffused illumination of ample intensity, but it is no longer so necessary to guard against too high an intensity, for, so long as there be no serious contrast, the human eye is able to adapt itself without distress to daylight illuminations varying over so wide a range as that from 5 to 100, 200, or even 500 ft.-candles (see also notes concerning the ratio between artificial and natural illumination). Diffusion of daylight is, however, as necessary as diffusion of artificial illumination, and though generally easier to obtain, special provision has to be made in special cases.

Artificial Illumination.—In designing a scheme of artificial illumination, the existing natural lighting must not be taken as a criterion either of sufficiency or of correct distribution; in both respects it will often be deficient, and possibly inevitably so, but in an artificial lighting scheme there is excuse for neither defect, and the illumination must be designed quite independently of the daylight arrangements.

A considerably lower mean illumination should suffice at night than is necessary in daytime, owing to the greater sensitivity of the eye (a fact which may be noticed in ordinary domestic life as follows:—When the window blinds are drawn early, the artificial light substituted for daylight seems temporarily very insufficient, yet after a time it may seem painfully intense). It now becomes necessary, however, to guard against too great an illumination, for intensities which are tolerable by daylight become, by the greater sensitiveness of the eye, and the almost inevitable harsher contrasts under artificial illumination, quite unendurable by night.

Most machine tools require a comparatively intense illumination over one or more of their parts (*e.g.*, at the work in turret lathes), and, in addition, require a moderately strong general illumination:—(*a*) In order that oiling, adjusting and similar operations may be conducted in safety and (*b*) in order that the contrast between the local intense light and the surrounding dimmer illumination may not be too great. Local intense lighting is *per se* undesirable, and should be reduced to a minimum, but, in most machine tools the tool tip and the work itself demand an intensity of illumination which is unnecessary and undesirable over the whole area of the "shop." Moreover, this local illumination is generally of necessity adjustable to suit the work in hand, its provision is a relatively simple matter, and it is in the obtaining of a uniform* general illumination, as nearly as possible approaching daylight in its all-pervading nature that the chief obstacles have to be overcome. The difficulties in the way of satisfactorily illuminating the lower portion of machine tools, tool beds overshadowed by a massive turret, or, in other cases, by a dye or varnish tray, and so on, have to be experienced to be appreciated.

Our desiderata, then, are a good general illumination and a set of more intense local lighting sources. Among the difficulties to be contended with are overhead obstructions which, by hampering the erection of lamps and throwing conflicting shadows, impede the provision of an even general illumination, while, on the other hand, "local" lamps must be as far as possible under the operator's control, yet they must not be able to apply them in a manner injurious to his

* But not entirely shadowless, for all appreciation of relief disappears—frequently with dangerous results.

eyes or annoying to his fellow workmen. The three ditions to be avoided, or at least minimised, are :— 1) Contrast ; (2) too high intensity ; (3) reflected e.

General" Lighting.—Even distribution and freedom n heavy shadows is best secured by using a number of h-candle-power lamps slung as high as possible. If the imum height attainable still leaves the lamps too nearly he normal line of vision of the workers, inverted lighting ch suitable top reflectors) must be employed ; in any the latter, though costly, is the most satisfactory system

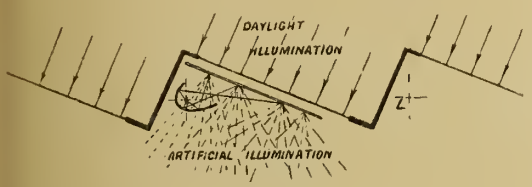


Fig. 3.

ilable. An excellent means of indirect lighting—applic- to most engineering shops, and particularly to those n saw-tooth roofs—imitates the natural lighting of the er class by arranging arcs or mercury tube lamps behind que reflectors throwing the emitted light on to large te enamelled reflecting plates, placed as shown in fig. 3 d, of course, arranged so as not to obstruct daylight mination). It is then necessary to keep the whole ector system very clean in order to realise efficient mination.

The illuminating source should not be directly visible ept at a great distance, otherwise the repeated accidental ght retinal images will, besides producing eye fatigue, ce the apparent general illumination much lower than it ually is. Preferably, no luminous surface of higher insic brilliancy than 5 c.p. per sq. in. (0·78 c.p. per cm.) should be directly visible to the eye.

n the very high shops now so frequently necessitated by e machine tools and overhead cranes, flame arcs, slung h among the roof girders, give an excellent "general" mination. A yellowish source of light is generally pre- able, though the greenish colour of the quartz mercury our lamp is admirably adapted to general engineering cesses.* In any case the walls should be whitewashed, or east finished in some light, efficiently diffusing colour.

"Local" Lighting.—The result which must, above all ers, be avoided in local lighting, is the production of ll areas of intense illumination immediately contiguous to iparatively dark patches. The only means of avoiding s effect is to provide no more "local" illumination than absolutely necessary, and to secure as high as possible a eneral" illumination. Every "local" lamp should be cially placed with regard to the requirements of the rator whom it serves ; it should be provided with an que metal shade, and should, in general, be capable of ustment by the operator. In some cases it is preferable fix the lamp once for all, so as to throw the best possible it on the "working centre," and in any case the operator uld not be able to place the lamp nearer than 12 in. to work he is viewing, otherwise the 16-c.p. lamp (which ually composes the unit) will give a harmfully intense mination ; for a similar reason it should not be possible the workman to replace the standard lamp by one of her candle-power. Conical reflectors, white enamelled ide, are generally the best type to employ, being robust, cient and free from the "streaky" effect given by all but best polished reflectors. If each man be made to keep own lamp and reflector in order, the efficiency of the tem will be excellently maintained.

One of the greatest dangers to be averted in machine shop hting is excessive reflected glare, which, even from dull steel, seriously fatigues workmen's eyes when intense local illumination is provided. This reflected light—possibly amounting to 10 per cent. of the incident radiations—together with the very intensity of the local illumination itself, often makes a far higher illumination appear necessary than would be required were a much lower intensity adopted in the first place. In other words, an intense local illumination will, together with its reflected glare, so fatigue the eye as to produce inferior perception to that obtainable with possibly $\frac{1}{10}$th-$\frac{1}{20}$th of the incident illumination.

The conclusions to be drawn from the preceding paragraphs are that a low local and a high and even general illumination should be provided, and all metal parts should, as far as possible, be covered with some dull paint ; a dull white would be preferable from an illuminating point of view, but, for obvious reasons, a dull slate or green colour is generally adopted.

Ratio between Artificial and Natural Illumination.—As already pointed out, a lower illumination should really suffice at night than is required by day, and that a much higher intensity actually appears necessary in many cases is due entirely to uneven distribution and too high local intensities. In support of this statement may be cited certain results abstracted from data obtained by L. B. Marks, in the course of tests made in a group of five American typewriter works. In all these factories the general illumination was very imperfect—usually varying in fact from less than 0·1 candle-ft. to 0·25 candle-ft.—while the local illumination provided at the various machines was injuriously intense. Thus, in several of the more flagrant examples, the normal daylight illumination, the local artificial illumination and the surrounding general illumination at night were as follows :—

TABLE II.

		Daylight.	Night.	
			"Local"	"General"
		Candle-feet.	candle-feet.	candle-feet.
Factory	1. Automatic screwing machine	2·3	15·0	0·25
	2. Milling machine	4·4	42·5	0·03
	3. Aligning department ...	65·0	250·0	0·25
	4. Enamelling department ...	21·0	150·0	—

Comment is hardly needed to emphasise the injurious conditions obtaining. These examples, though extreme cases, were typical of the mistaken lines along which the whole system had been installed. It was found that the night illumination at the majority of the machines equalled from 4 to 10 times that provided during the daytime ; the secret of the whole trouble was improper diffusion. On a certain 7-ft. bench, for instance, there was a 3,600 per cent. variation between the maximum and minimum illuminations ! In many departments the general illumination 3 ft. 6 in. above the floor was frequently only $\frac{1}{1000}$th of the local illumination.

As might be expected, eye troubles were common among the employés.

The Personal Factor in Workshop Lighting. — Under this heading may be grouped all those prejudices and foibles exhibited by the majority of workmen when any radical change is effected or proposed in the method of lighting their "shop" and their work. In the first place, few will acknowledge that an improved "general" lighting will minimise and, perhaps, obviate the necessity for many of the older "local" lamps : each wishes to have his own lamp and to be able to regulate its position according to his personal taste, and independently of what is good for his own and his neighbour's eyes. For this reason, because nine out of ten men will move their lamps so as to get the most intense local illumination possible,* and again, because the slack wiring and counterweights of adjustable pendants give an untidy appearance, throw many shadows and are liable to catch and be caught, it is often considered preferable to spend as much more on the general illumination of the shops as will render these troublesome local lamps unnecessary. Where such a course is economically possible, there can be no objection against it.† In many instances where local illumination is indispensable, and particularly where a bright

* In other instances (such as cleaning, dyeing, textile, litho. and colour printing works), an illumination as nearly as possible approaching that of daylight is necessary. Indeed, it may well be doubted whether the "restful" virtues of the green mercury light are as great as has been claimed, and whether, in general, it is ever wise to employ, without special reason, a monochromatic or strongly coloured light.

* Thereby straining the eyes, heating the head, impeding access to the work and increasing the danger of accidents.

† Napier's Motor Works (Acton)—among other important factories—are lighted throughout by high-slung flame arcs.

background is necessary (*e.g.*, for a levelling or straightening process), good results may be obtained by using an opaque lamp chamber with a ground glass front, the lamps being set far enough behind the screen to prevent local bright patches on the latter or any direct vision, however blurred, of the filaments through the translucent material.

The importance of requiring every employé to keep his (or her) own lamp and shade in order, when "local" illumination is provided at each bench, has already been noted. The necessity for a uniform rule on this point cannot be too strongly emphasised, but once the workpeople realise the advantages of scrupulously clean lamp fittings, little enforcement is required.

Illumination Provided in Actual Workshops.—In addition to the data of Table II, dealing with conditions as they should not be, the figures given in Table III may be noted as representative of more satisfactory installations.

TABLE III.

	Mean illumination (ft.-candles).	Watts per sq. ft. floor lighted.
Foundries	1½-2	Circa. 0·8
General machine shops	3-10	1-2½
Manfrg. miscellaneous small machines and mechanisms { General ...	1	1·1
{ Local ...	5-10	—
Screwing machines (at die)	50-100	—
Sewing machines (at needle)	100-150	—
Commercial depts., showrooms, &c., from ...	3½-5	1-2
to ...	6½-7½	2-2½
Office tables: under lamp*	3-4	—
Ends of table	2-2½	—

* Supposed centrally hung.

(See also Table I and notes thereon.)

Although such rules must be used with extreme caution, it may be taken that 1 M.S.C.P. per 4 or 5 sq. ft. of floor area will give a suitable general illumination for most workshops, while 1 M.S.C.P. per 1 to 2 sq. ft. will, according to circumstances, give a sufficient additional "local" illumination.

Workshop Lighting Load: Competing Illuminants.—It has been tacitly assumed above that electric lamps have been used to provide artificial illumination in the various cases, and though this assumption does not influence in the least the general principles laid down, it must be clearly understood that electric lighting cannot claim even approximate monopoly in the illumination of factories and workshops. In all cases, and especially where ventilation is difficult or fire risks considerable, electric lighting possesses its well-known advantages of cleanliness, non-vitiation of air and immunity from fire and explosion risks, as well as such important additional merits as operative simplicity and reliability. The surprising cheapness of high-pressure coal gas, petrol air-gas and similar illuminants enables them to compete favourably with electric lamps in many "general" lighting schemes, though the heavy cost of mantle renewals often removes practically the whole advantage due to low energy cost. For "local" illumination, electric filament lamps can hardly be ousted from their position of superior safety and convenience, but there can be no doubt that ill-planned and badly executed work in the past has alone lost many "general" lighting schemes to electrical contractors. A number of lamps placed along the centre of gangways, bays and other similar positions (convenient to the persons installing the lamps) is not—except by accident—a satisfactory solution of the illuminating problem.

A further decided handicap to the progress of the electrical illumination of factories has lain in the fact that central stations have not been able to offer very favourable supply rates to even the largest factory lighting installations, since their demand usually persists for a few hours only, and coincides with the ordinary lighting and traction peak. The extension of electric drive to the factories concerned largely remedies this condition, by enabling them to give the central station a good day-load in addition to their lighting demand.

Where all-night working is practised, the preceding remarks do not apply, for the supply station can afford to lose something during peak hours for the sake of gaining a welcome load during the remainder of the night. In many such works, however, steam plant and generators are installed to enable "home generation"; naturally the works seldom desire to take advantage of the favourable lighting rates which could then be offered.

No mention will here be made of the absolute and relative costs of various systems of workshop lighting, the main object of these notes being to emphasise the extreme importance of sufficient and properly arranged illumination and to discuss the conditions implied by these requirements and the means by which they may be fulfilled.

COPYRIGHT.

We have already (on April 21st) alluded editorially to the first debate in the Commons on the Copyright Bill, but, in view of the importance of the subject, we return to it. The debate at the end of July brought out still more clearly the contrast between the treatment proposed for the intellectual property of an author or an artist and that of an inventor.

So far all criticism is overcome, and amendments were rejected by substantial majorities, which appear to us to be due more to Government influence than to an innate love of the measure on its merits.

Many members on the Government side of the House, as well as amongst the Opposition, regard the Bill as a check upon the issue of cheap literature and music. Mr. Boon, one of the most powerful critics of the Bill, moved an amendment confining its operations to works actually published; but this was negatived along with the other amendments, and copyright in lectures was also affirmed.

A long discussion took place on the application of the Bill to architecture.

It was remarked by Mr. Joynson-Hicks that the architect is paid by his client for his work, and is not necessarily affected financially by any partial or complete imitation of it.

Who can say if an architect's work is original or artistic? It is merely a matter of taste and opinion, and not of fact. How then can it be decided? The education of an architect consists largely in the study of existing buildings, and study is the successful adaptation of old ideas. The truly original in architecture generally means the bizarre and the unsuitable.

The Solicitor-General, in pressing the clause upon the House, pointed out how extremely difficult it would be for an architect to prove that his design was original and artistic; and that his copyright existed, and had been infringed. He said that success in an action for infringement of copyright in an architectural design would be very rare. This appears to us to be a very good argument against the clause.

What becomes of the existing provision for registration of design? It appears to us that with such an extension of copyright as seems to be involved in this Bill, it will hardly be worth any one's while to register a design. It was stated that the provision respecting architecture would not increase the cost of small houses. In this we differ from him entirely, and we are not surprised that Mr. Barnes, as a labour member, was moved to vote for the amendment by the speech of the Solicitor-General against it. As was remarked, this clause is bound to lead to endless litigation and expense, and the cost must fall, in the long run, to be added to the cost of the buildings, unless some philanthropist is going to be brought forward by Government who is prepared to pay the whole hungry horde of lawyers, experts and officials who will be engaged.

Sir G. Marks made it clear that under the Bill the architect is not required to register his design, so there is no possibility of knowing beforehand whether any given idea is considered proprietary or not.

You have to build your house and take your chance of some one coming forward to say that you have pirated his ideas or picked his brains. The debate on this clause was wound up by the Solicitor-General, who said that the Law of Copyright, as applied to other than literary work, was concerned with things that were artistic in quality; while, on the other hand, the Patent Law dealt with things of utility.

But he would like to ask, again, how can a judge or jury decide what is artistic? and how can two judges or two juries come to decisions on similar cases with any semblance of conformity?

Generalisations of this character in Acts of Parliament are olific of lawyers' gains and litigants' losses. Take the case a new form of sea wall or breakwater, or a bridge, designed an architect or a civil engineer. Who is to say where the tistic begins or the useful ends? Or consider the main ilding of a central electricity station. Why should ere be intellectual property, to be protected for 50 years er the designer's death in a certain pattern of different-loured bricks or arrangement of windows, while the an that invented the most perfect mechanism within at building is deemed to have no rights in it, except that gation of property which is provided by the Patent Office?

Again, we can imagine plenty of room for litigation over e question, "Whose copyright?"

How many architects make their own drawings? The entific frontier between the architect and his draughtsman ll prove to be a delicate line to draw.

Once again we see the lawyer and the professional witness dowed, while the producer is spurned aside. Utility is thing, or less than nothing.

The parasitical growths are watered and nourished, and e solid useful tree is strangled in their interests. The an who builds is exposed to attacks and must turn aside om a useful occupation, and engage a lawyer to defend n however monstrous the claim or baseless the action.

We have nothing to say against a reform of the Law of pyright provided it is made practical, plain and simple, d that the benefits conferred are not given at the expense the public. But we must always protest against that fatal lusion of the legal and academic mind that useful things do demand the highest intellectual powers for their produc-n, and we must reiterate our conviction that continued ill-atment of those who think out the problems of material vancement, without which all the fine flowers of art and erature would become impossible, will end inevitably and eedily in national ruin and the defeat of all the cherished pes of intellectual greatness.

Not to excel in this race is to fall back, and we shall rtainly soon fall back unless inventors, engineers and men of ence are relieved from the senseless and serious handicaps w imposed upon them.

When it is seen to what risk we are exposed by the ppage for a few days of some of our railways, it can be alised, even by the least imaginative, that the application science and invention in our daily life is the most important nsideration for us all. In the competition of the nations is a question of life and death.

BUSINESS NOTES.

Argentine Republic.—The following is taken from a nsular Report, recently issued by the Belgian Foreign Office, on commerce of Argentina:—There are good openings in the gentine Republic for all kinds of electrical goods connected with hting, heating, locomotion, telegraphy, telephony and motive wer. Dynamos of 110 volts and 65 volts are in great demand; motors are continuous current, for 220 volts up to 2 H.P., and 440 volts beyond 2 H.P. Electric fans are also used extensively.

Installation Contracts.—The following contracts re obtained by Messrs. W. M. Scarth & Co., electric power gineers, of Newgate End, Bishop Auckland, during last week:—

uckland Carriage Works.—The whole of the motors, switchgear, cables lighting of works.
lackett & Son's Sawmills.—Arc and incandescent installation.
entley's Yorkshire Breweries.—Lighting of Black Boy Hotel.
[r. C. Elderton.—The electric lighting and signs for the Eden Theatre Theatre Hotel.

Catalogues and Lists.—British Petroleum Co., D., 22, Fenchurch Street, London, E.C.—Brochure of 90 odd ges on the subject of liquid fuel. The ground covered comprises following:—The advantages of liquid fuel, its use in the navy, industrial applications, its use on railways, in stationary boilers, internal combustion engines, and in electric lighting stations. e pages are brightened by a number of suitable illustrations, d we have no doubt that the booklet will be of some service to ose interested in what has been accomplished and what can be ne with liquid fuel.

Reduktor-Elektrizitats Gesellschaft, Frankfort, Germany. eaflet relating to a patent bell transformer for electric bells, rm signals, &c.

Messrs. L. Andrew & Co., 2, Whitworth Street East, Deansgate, Manchester.—Leaflet giving prices of "Wrendal" metallic-filament and "Capella" carbon-filament lamps.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Attractively got up brochure giving illustrations and prices for the season of their "Aegma" lamps of different shapes, and for various voltages. Views of street lighting and church interior lighting effected by these lamps are given. A picture appears of a lamp used for street lighting which had a life of 6,090¾ hours, and was switched on and off 699 times.

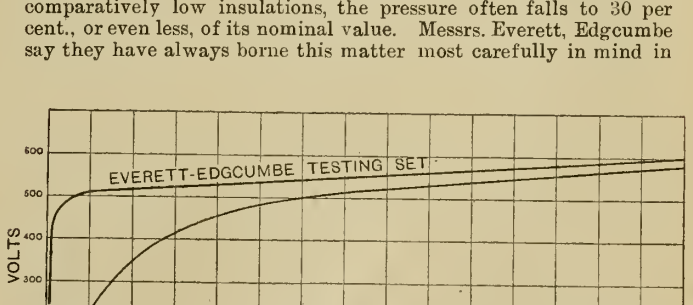
Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Two small booklets entitled respectively "Conduit Wiring Without Condensation . . . Kalkos System," and "A Universal Conduit Box." They form a brief and clearly illustrated account of the Kalkos system and the Sun screwed-tube system. Copies will be sent to any reader on application.

The Harris Patent Feed Water Filter (1910), Ltd., 24, Grainger Street West, Newcastle-on-Tyne.—Leaflet giving explanatory drawings and particulars of the Harris-Anderson patent water softener and automatic oil eliminator. A separate list gives the names of the numerous installations of their patent anti-corrosion system carried out for various electricity and other works, liners, &c.

The Cast-Iron Brazing Syndicate, 174, Dhurrumtollah Street, Calcutta.—Pamphlet containing an illustrated description of their cast-iron brazing process, and copies of testimonials from firms in India for whom they have employed it.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Two new publications, Supplements 12 and 13 (Catalogue 506). The former contains illustrated description and prices of their latest design of pillar stand for X-ray tubes, of solid construction offering perfect protection to patient and operator, and having universal movements for use in radiography, radioscopy and radiotherapy. The latter deals similarly, but at greater length, with the "Oscillothermex" for the treatment of diathermy in its surgical and medical applications. The apparatus may also be used as a small X-ray and high-frequency plant, connection being made to one terminal of the tube only.

Modern Insulation Testing Sets.—Referring to the article by Mr. W. A. Toppin on this subject, in our issue of September 22nd, Messrs. Everett, Edgcumbe & Co. write agreeing that an insulation test, to be of any real value, must be carried out with at least double the working pressure, but at that most makers appear to be quite satisfied so long as their testing sets give the specified voltage on open circuit, with the result shown in Mr. Toppin's curves, viz., that, when testing comparatively low insulations, the pressure often falls to 30 per cent., or even less, of its nominal value. Messrs. Everett, Edgcumbe say they have always borne this matter most carefully in mind in the design of their testing sets, with the result shown in the accompanying figure. The upper curve represents the actual pressure at the terminals of the insulation under test, when using one of their sets taken from stock, while the lower curve, which is added for the purpose of comparison, shows the pressure given by a testing set of another make, which will be seen to follow closely the lower curve given by Mr. Toppin in his article. The upper curve shows that in the case of their own set, there is, for all practical purposes, no fall of pressure until the insulation under test falls to about 30,000 ohms, a value hardly worthy to be called "insulation" at all. The instrument in question was of the self-contained (single box) pattern, so that, contrary to Mr. Toppin's suggestion, it is clearly quite possible to produce an ohmmeter and generator in one case, in which the specified testing pressure is maintained at the terminals of the insulation under test, throughout the whole range of measurement.



Relation of Testing Voltage to Resistance.

Dissolutions and Liquidations.—Havana Telephone Securities Co., Ltd.—A meeting is to be held at New Broad Street House, E.C., on October 31st, to hear an account of the winding-up from the liquidator, Mr. G. Banks.

A. Paxton and S. C. Fifoot, electrical engineers and electric supply merchants, Fynycoed Place, Cardiff, have dissolved partnership. Mr. Paxton attends to debts and continues the business.

New Lamp-Making Works.—There is a probability of an electric lamp factory being erected at Rugby. A Continental firm has asked for a site and promises to employ from 800 to 1,000 hands.

Book Notices.—"Report on the Fire at the Empire Palace Theatre, Edinburgh, on May 9th, 1911." By E. Marsland and M. Clarke. London: British Fire Prevention Committee. Price 2s. 6d.

"Electric Cranes: Their Design, Construction and Application." By H. H. Broughton. 1911. London: *Electrician* Printing and Publishing Co. Price 25s. net.

"*Transactions* of the Institution of Civil Engineers of Ireland." Vol. XXXVII. 1910-1911. Dublin: The Institution.

Bankruptcy Proceedings.—J. A. Bauer, electrical engineer, 17, Gracechurch Street, E.C.—Application for debtor's discharge is to be heard on October 25th, at Carey Street, W.C.

Trade Announcements.—Mr. A. R. Turner has resigned his position as chief electrical engineer to the Scottish Co-operative Wholesale Society, Ltd., which he has held for the last 10 years, and he is starting in business as a contractor for general electrical work, at 676, Eglington Street, Glasgow. He desires to receive catalogues and price lists, including those of ship lighting sets, fittings, &c.

The new address of Messrs. S. Bill & Co., is 388 (not 387), Park Road, Hockley, Birmingham.

The Western Electric Co., Ltd., state that their North Woolwich Works telephone number is now "3840 East" (10 lines), in place of "1400 East."

Market Quotations: Correction.—In our quotation of the price of English pig-lead last week, we incorrectly gave the figure £13 5s. per ton, instead of £15 5s. The latter being the correct price, there was an increase of 7s. 6d., as compared with a fortnight previously, instead of a decrease as shown.

LIGHTING and POWER NOTES.

Aldeburgh.—The undertakers of the E.L. order have applied to the B. of T. for permission to use overhead lines throughout the district, except as regards about 300 yards where underground cables will be laid, for the purposes of carrying out the order.

Bampton.—Steps are being taken to secure a supply of electricity for this parish. At a ratepayers' meeting Mr. Steele, of Exeter, explained a scheme for which a capital of £1,708 would be required, and a committee was formed to go into the matter, and to raise the necessary capital.

Barrow-in-Furness.—At the monthly meeting of the Corporation, held on the 2nd inst., it was decided, on the recommendation of the Highways and Lighting Committee, to replace existing gas lighting in Abbey Road, from the Central Station to the Furness Abbey tramway terminus, and also in Roose Road, from Salthouse Bridge to the tramway terminus, by electric lighting. This is to be by means of metallic-filament lamps suspended from span-wires fixed between the tram poles on either side of the road; the total length of road over which gas lighting is to be displaced is over two miles, and the number of electric lamps to be erected is 162. This decision has been arrived at as a result of a prolonged test between the two illuminants, in which the superiority of the electric lighting along the roads planted on both sides with trees has been very marked. Extensions of mains, at an estimated cost of about £900, are being carried out in connection with the supply of power to Messrs. Burt, Boulton & Haywood's sawmills at Devonshire Dock, where motors aggregating about 165 H.P. are being installed.

Basford.—It has transpired that the Stoke-on-Trent T.C., which proposes to supply current to Basford, has no power to do so, either in the town or on the Southlands Estate, where cables are already laid. The matter has been taken up by the local authority, the Wolstanton U.D.C., and the Stoke T.C. has undertaken that no further work shall be proceeded with until the matter has been further considered.

Bedford.—The T.C. has decided to have the electric light installed at the Isolation Hospitals, and has arranged to supply current to the C.C. for the new highway depôt in the town. The latter will cost £160 for connections, and the annual minimum revenue will be £50.

Belfast.—At the monthly meeting of the Corporation the question of the lighting of the new abattoir came up for discussion. As a deputation of the Gas Committee had waited upon the Market Committee to ask that the question of lighting the new abattoir premises by a system of high-pressure gas be favourably considered, the Market Committee considered the question, but passed a resolution voting for the installation of electric power and light. Councillor Dr. Trimble said there were objections to gas in the slaughter-house of the abattoir. Gas would also be unwise for the freezing apparatus. The city surveyor said he had prepared the specification for the electric light in accordance with what had been decided upon. With regard to the merits of gas and electric light, there was no denying that gas did give off fumes, and there was no question that the less fumes there were in the place the better. Another reason for the installation of electric light was that they would have to take in a supply of electric power, and they would take the current for lighting purposes also. Ald. Tyrrell thought it was to be deprecated that two departments of the Corporation should be pitted against each other. It was for the Corporation to say whether the new abattoir was to be lighted with gas or electricity, or both. The Corporation decided for electricity unanimously.

Brazil.—A decree of the Brazilian Government announces the reservation for the service of the State Railways of the waters of the River Coihain for 3 km., from its source downwards, and of Lake Chapo. This reservation will not affect the concession already accorded to Enrique Lang, No. 2,625, of December 16th 1910.

A concession has been accorded to Messrs. Astoreca i Cia., of a intake equal to 5 litres per second from the Rio Loa for motive power purposes at their saltpetre works at Pampa, near Sierra Rencoret, Department of Antofagasta. A condition of the concession is that the State Longitudinal Railway is to be supplied with water by the concessionaire if called upon.—*Boletin de Sociedad de Fomento Fabril.*

Bury.—Without any official ceremony, the new municipal electricity works, erected at Chamber Hall for the Corporation have been opened, and a regular supply of power is now being given. The largely increasing demand for current for industrial purposes necessitated the erection of this station to supplement the Rochdale Road Works, and there is evidently a prospect of a considerable increase in the output for industrial work in the near future. In connection with the projected light railway designed to cover the districts of Bury, Heywood, Ashton-under-Lyne and North Manchester, it has been announced by the engineer responsible for the scheme that the Bury Corporation will be invited along with the Ashton Corporation, to supply the electricity for operating the tramways. Last year's increase in the output for power purposes of 397,033 units, equal to 24·0 per cent., shows that manufacturers continue to appreciate the advantages of obtaining power from the public mains. The principal plant installed in the new generating house consists of two 2,000-KW. turbo-alternators, the turbines being of the Zoelly type manufactured by Messrs. Musgrave & Sons, Bolton, and the alternators are by Messrs. Siemens Bros. Dynamo Works, Ltd. There are three boilers of the Woodeson type, manufactured by Messrs. Clarke, Chapman & Co., capable of evaporating 25,000 lb. of water per hour. It is interesting to note that the new works have been erected on the site of Sir Robert Peel's birthplace.

Carluke.—Gas consumers in Carluke are evidently believers in the adage that competition is the life of trade. They are up in arms against the charge made by the local gas company for meter rents, and have sent a petition from a public meeting to the company asking that such rents be abolished. At the same time they are petitioning the Clyde Valley Electric Power Co. to extend its electric supply to Carluke.

Castleford (near Pontefract).—A Sub-Committee has been deputed to report upon the question of electric lighting of the market hall.

Continental Notes. — Austria-Hungary. — Messrs. Ganz & Co., of Budapest, have secured a contract for the establishment of what it is claimed will be the largest power plant in Europe. This is being erected near Almissa for the Società per la Utilizzazione delle Forze Idrauliche delle Damazia, of Trieste. The water power of the River Setina is to be utilised, and although it is stated that no less than 200,000 H.P. is available, plant to the extent of only 40,000 H.P. will at first be put down, this comprising two sets of 20,000 H.P. turbines and generators. Trieste already has a 32,000 H.P. plant at Jaruga, supplying electrical energy to a carbide factory at Sebenico Dalmatia.

A syndicate is reported to be in negotiation for the establishment of works near Oberndorf, in the Tyrol, for the electrical production of steel. It is proposed to utilise the water power of the River Achauer Ache in connection with the scheme.

Germany.—The electric generating station at the "La Paix" works of the Société des Hauts-Fourneaux Lorrains Aumetz-Paix, Lorraine, has been extended by the addition of two 3,100-H.P. gas engines and dynamos, in order to supply the current necessary for the operation of a rolling mill and a new finishing mill.

The Leitzachwerke Gesellschaft is the name of a new company which has just been formed in Munich, with a capital of £300,000, to establish and work a large central electric generating station. The municipal authorities of Munich are participating in the new undertaking to the extent of 51 per cent. of the capital. The Oberbayerische Ueberlandzentrale Munich has also been formed in Munich, with a capital of £115,000, this concern having entered into a contract with the Leitzachwerke to take its supply of current from the last-named undertaking.

France.—A new company has just been formed at St. Quentin (Aisne), with a capital of £48,000, and the title La Compagnie Electrique de l'Aisne, to control the distribution of the electrical energy for lighting and power purposes in the district supplied by the Compagnie Electrique du Nord.

Croydon.—On Tuesday, Mr. R. H. Hooper, of the L.G.B., held an inquiry into the application of the B.C. to borrow £10,000 for extending the electric supply by additional mains, sub-stations and transformers. The total capital expenditure on the undertaking to March 31st was £351,250, and yearly surpluses have been shown to the gross amount of £72,000. To date £22,000 has been allocated from profits to the relief of the rates. The Inspector, looking over the statistics presented by A. C. Cramb (borough electrical engineer) said the undertaking seemed to be in a very satisfactory position. He noted, as a spe

ure of interest, that about 11 per cent. of the total receipts came m public lighting. The inquiry was purely formal, there being opposition, and occupied only a few minutes.

Dunfermline.—In order to cope with increasing busi- s, the Fife Electric Power Co. has introduced into the Town- l generating station a 2,500-H.P. B.T.-H. turbine set, almost a plicate of the one originally installed at the works, and which was n the first of its type in Scotland.

India.—According to the *Daily Mail* a great innovation Hindu customs has been introduced at Calcutta. After several ings of learned Brahmin pundits and scientists, it was decided light the Great Kalis Temple by electricity, it being considered it there is nothing objectionable in electric wires. The in- llation has been received with immense delight by the Hindu mmunity.

Ingleton.—The P.C. has accepted the tender of the ctric Light Co., at £40, to supply energy for the lighting of the eets with electricity for a period of 12 months.

Itchen (Hants.).—A special meeting of the District uncil has been convened for October 31st, to consider an applica- n to the B. of T. for a provisional order authorising the Council supply electricity for all public and private purposes throughout e district.

Johnstone.—There is a proposal before the T.C. for a heme to provide electric power and lighting. The Corporation s reached the maximum production of its gas plant, and it is cessary to provide for the wants of lighting consumers.

Leyton. — At the last meeting of the Council the gineer reported that he proposed during the autumn to strengthen e main from Leyton Green to the Bakers' Arms by laying a plicate upon the opposite side of the road, also to complete the p in Canhall Road, so that the Forest Gate lighting can be sup- ied from two directions. This would take about 1,330 yards of cable, for which he is to obtain quotations.

Lewes (Sussex).—The Lighting Committee recommends e use of electricity, instead of gas, in the principal thoroughfares. he matter is to be considered at the next meeting of the Town Council.

London.—Poplar.—The Electricity Committee reports at, at a recent conference of the sub-committees appointed by the ectricity Committees of Poplar and Stepney Borough Councils, e following heads of agreement were approved with regard to pplies of electricity between the two Councils: "(1) Stepney to ford supply to Poplar under the present agreement, pending Poplar tensions, to the year 1913. (2) Poplar to afford supply to Stepney om 1913 to 1917, or until such time as the maximum demand of epney reaches, say, 7,270 KW. (3) Stepney not to complete exten- ons until 1916 at the earliest date, or until the aforesaid demand of 270 KW. is reached. (4) After the period of supply by Poplar to epney, Poplar to be under obligation to take from Stepney equal ilk supply as Stepney has taken from Poplar, before Poplar makes rther extension; Stepney, however, to have preference of exten- on at such time. (5) Three weeks' supply of coal, based on inter consumption, to be kept by each party immediately at and." The Committee states that these proposals were in accord- ice with the agreement entered into with the Stepney B.C. for ciprocal and stand-by supplies, with a view to co-operation in the tension of plant to meet increased demands in the most economical anner for both boroughs. The adoption would involve the laying wn in 1913, at an approximate cost of £20,000, of a further 000-KW. turbine generating set, with boiler power, &c., for the commodation of which provision has been made in the scheme for tension of the electricity station buildings, already approved by the uncil. It would also be necessary to provide mechanical means unloading and conveying coal, in order to safeguard the coal pply, as well as to reduce the cost of handling, and recommended at, as it appeared to be in the interests of the Council that Poplar ould provide a stand-by for Stepney until 1917, as proposed, the heads of agreement" should be approved of by the Council. At e meeting of the Council on Thursday last week, these recommen- ations were agreed to.

Fulham.—A new coal bunker, to store an additional 1,000 tons f coal at the electricity works, is to be constructed.

Maidenhead.—The T.C. has arranged to give a supply f power to the premises of Messrs. Cox Bros. & Co., Baltic Wharf. t is proposed to intall another Diesel engine at the electricity orks, owing to the economies resulting from the use of the one lready installed.

The E.L. Committee has reduced the charge for public lighting or the 38 main arc lamps to £14 10s. each per annum. This, with previous concession, will reduce the public lighting charges by 200 per annum.

Retford.—Once more the T.C. has taken up the subject f obtaining a public electricity supply. At a meeting on Friday ast, the Mayor moved that a committee be formed to consider and eport. Councillor Hollely seconded, commenting on the develop- ment of coalfields nearer Retford. Councillor Moss opposed the proposition, and referred to the obtaining of a prov. order in 1899, but nothing was done, and it was revoked. The subject had been discussed in 1904 and later. Mr. Mountain, of Huddersfield, pre- pared a lucid report, and both the Traders' Association and the Council decided that it would be a non-paying concern at Retford. No private company would undertake the risk. The Mayor's pro- position was, however, carried by 17 votes to 2, and a committee appointed.

Rotherham.—The T.C. has received the sanction of the L.G.B. to a loan of £14,780 for cables, and £6,287 for machinery.

Southborough.—The U.D.C. has decided to ascertain the cost of obtaining a prov. order for E.L. At present the only public illuminant is gas.

Stockton Heath.—The P.C. has decided to take steps to ascertain the wishes of the ratepayers respecting a supply of electricity for the parish. The promoters of the scheme are prepared to give a supply if there is a reasonable demand for current.

Swaledale.—The electric light has been introduced into Swaledale, the supply being by means of overhead wires.

Taunton.—After a prolonged trial of electricity as a motive power, the Somerset Manufacturing Co. has recently completely equipped its plant with electric motors. The whole of its South Street factory is now being driven by 14 electric motors of a total of 84 H.P., taking current from the Corporation mains, and the electric drive is giving entire satisfaction.

Wakefield.—The L.G.B. has sanctioned the borrowing by the Corporation of £4,500 for mains, £540 for transformers, and £500 for sub-stations.

Walthamstow.—The Council has decided to undertake the work of maintenance and repair of the electric light installations at the various schools, at the actual cost of the same plus 5 per cent. for establishment charges. Sanction has been received from the L.G.B. to the borrowing of £5,374 for the Blackhorse Lane feeder cable and spare stoneware conduit from Church Hill to Fulbourne Road, and £1,260 for the feeder cable from Barrett Road to Fulbourne Road.

Worthing.—The electricity undertaking came in for a good deal of criticism at the meeting of the T.C. on Monday, the two chief sources of complaint being the repeated failure of some of the arc lamps in the streets and the emission of black smoke from the chimney shaft at the generating station. With reference to the first of these grievances, the Electricity Committee submitted a report from the resident engineer, in which the latter explained that great difficulty had been experienced with the cable during the past summer, more particularly during the months of July and August. Ultimately the cause was traced to the expansion of the cables which took place owing to the abnormally high temperatures in the pits and conduits. As an instance, the engineer pointed to a concentric feeder where the cable was observed to "grow" to the extent of ½ in. in a one day observation. In cases where a bend in a cable at a street corner permitted the "growth" to be taken up by natural movement, the expansion had no ill effects (except in two instances where the insulation of the bends broke down), but in long straight lengths trouble frequently occurred in joint boxes, and small arc lamp cables also suffered through the cracking of the insulation. With reference to the complaint as to the smoke from the chimney at the generating station, the chairman of the Committee explained they were now accepting a tender for smokeless coal which would remedy the complaint. Commenting on the complaints as to the unsatisfactory lighting of the streets by electricity, Councillor Tree observed that it was a question whether they were getting the best value out of their electricity, and whether they ought not to revert to gas, but Councillor Gardner quoted some figures which showed conclusively that the town was getting good value for its money in the matter of its public lighting by electricity. The average candle-power of the electric arc lamps in the borough (not including the smaller bracket lamps) was 124,000, and the amount charged by the Electricity Committee for public lighting during the past year had been £3,116. The average candle-power of the gas lamps in use for public lighting (based on an average of 90 C.P. for an incandescent lamp) totalled to 64,300, and the cost of the lighting had been £1,925. Alderman White also pointed out that the time was approaching when the repayments on borrowings would be much smaller, and that this would be reflected almost at once on the cost of public lighting by electricity.

TRAMWAY and RAILWAY NOTES.

Accrington.—Mr. E. Woolley (Accrington) has reported to the Assessment Committee of the Haslingden Board of Guardians that he and the clerk, representing the Assessment Committee, and Mr. Higham and Mr. Beckett, borough accountant, representing the Accrington Corporation, had met and discussed with Mr. T. Wainwright, of Liverpool, the award of the latter in the recent arbitration regarding the assessment of the Accrington tramways. The union valuer had assessed the tramways at £1,650. Accrington contended that the figure should be £650. The arbitrator awarded £2,549 (rateable value). Accrington sought to reopen the question on the ground that the umpire had not given the basis of his finding. The umpire at the conference referred, to gave the reasons that led him to adopt the principles of his award, and also supplied a copy of his valuation which confirmed the award.

A special Committee appointed by the T.C. has presented a report in which it expresses the opinion that "considerable economies can be effected in the tramway department, partly by a

rearrangement and reduction of the staff, and partly by an adjustment of the work and duties and work of other members of the staff." No arbitrary dismissals are recommended, the Council to take these matters into consideration when the opportunity presents itself, and those officials whose positions are done away with are to be given full notice and amply compensated. Previously, the department has been worked under four heads—traffic, overhead equipment, permanent way and car maintenance and repair. The suggestion is to group two or more of these departments. The old manager, Mr. Wilson, has agreed to retire on £200, wages for one year in lieu of notice, and £50 per year for the next four years, his services to be retained as a consulting manager. The new manager, Mr. H. Pilling, has been promoted from the ranks, and he will receive a salary of £200 per year. Mr. Pilling, the Committee point out, is a member of the Institution of Electrical Engineers. The Committee is hoping to save at least £15 per week by contemplated changes.

Ardsley.—The U.D.C. has decided to object to and oppose the proposal of the Wakefield and District Light Railway Co. to abandon the tramway to the town.

Barrow.—At the T.C. meeting on Monday, reference was made to the new electric car service on Walney Island. Alderman Smith pointed out that the amount of patronage for the winter was problematical, and in order to prevent cars running empty there would be a curtailed service. If a person wanted to journey to Biggar Bank at a time when the ordinary car was not running over the line, he could by paying an extra 6d. have a car run for his use.

Brighouse.—A Sub-Committee has been appointed to inquire into the cost of providing a tramway by the Council from the centre of the borough to the top of Rastrick (to be leased to another authority, or to be worked by the Corporation), and also to ascertain the cost of introducing and maintaining a system of railless trolley vehicles. It was stated that the powers authorising the West Yorkshire Tramways Co. to construct the tramway expired on August 4th last.

Dundee.—Plans of the railless trolley system on Clepington Road, for which the Corporation is asking the approval of the B. of T., are now open for inspection at the tramway office.

Glasgow.—The T.C. is now becoming quite familiar with the records established by the drawings of the tramway undertaking. Several times this year the previous best income has been eclipsed, and last week brought with it yet another record. The takings for the seven days ending Saturday night amounted to £21,008. This was attributed to the spring holiday, the large number of football matches on that and on other days and the fine weather. The previous record—£20,953—was for a week in May at the opening of the Exhibition. Saturday's drawings reached £4,332.

Gloucester.—The minutes of the Light Railway Committee for a period of nine weeks, from July 20th to September 20th, show that during that time the cars ran 3,533 more miles, and carried 53,931 more passengers; the receipts were £190 more; £114 less was paid for current, and £55 more in wages as compared with 1910. There was, therefore, a net gain in revenue of £249. This was mainly brought about by the use of car meters.

London.—Application is being made to the City Corporation by the L.C.C. for consent to the introduction of Bills in Parliament authorising the construction of a tramway in Bishopsgate Street as far as Middlesex Street, and another from Charles Street to a point north of Ludgate Circus *via* Farringdon Road and Farringdon Street.

Nottingham.—An agitation which threatened to dislocate the tramway service has been averted by the Corporation making concessions, the principal of which are the reduction of the hours of motormen and conductors from 62 to 56 per week of six days, and a small increase of pay.

Preston.—Councillor Crompton, chairman of the Tramways Committee, speaking at a recent Council meeting, dealt with the requests for concessions by employés, and the Committee's reply thereto. He read a letter from Mr. C. T. Jackson, general secretary of tramwaymen, from which he said it was clear the threat on the part of the local tramwaymen to strike on the eve of the Preston holidays, unless certain demands were conceded within 24 hours, not only had not the approval of the men's leaders at headquarters, but the latter regretted the position the Preston branch had taken up. Councillor Crompton asserted that 75 per cent. of the men were perfectly satisfied with their conditions of labour and their wages. The Committee, in the matter of control, were determined to brook no outside interference.

Rotherham.—The T.C. has decided to proceed at once with the construction of the railless trolley route to Maltby, and to extend the tramways from Dalton to Thrybergh, and from Broom to the borough boundary.

Twickenham.—The representatives appointed by the Council to attend the conference at Hounslow *re* intercommunication between Southall and Twickenham *via* Hounslow, report that as all other means to connect those districts had failed, the Heston and Isleworth U.D.C. had determined to include in its General Powers Bill intended to be promoted this session, power to provide and equip a system of railless trolley vehicles.

West Hartlepool.—At a meeting of the T.C. on September 29th, a special report of the Committee appointed to deal with the tramways was considered. The report stated that the company had practically ignored the suggestions of the Council as to leasing the purchased lines, and had put forward offers previously made to the T.C. and rejected by it. A further letter had since been received from the company in reply to a letter from the town clerk stating that the company had no desire to lease the lines. A report from Mr. Hamilton had been received, from which the Committee formed the opinion that a sound and acceptable scheme for the operation of the tramways by the Corporation was practicable. The Committee recommended: That notice be served on the promoters for the purchase of the lines to Hartlepool; that all necessary powers for working all lines purchased, and for the construction of such additional lengths of line as were recommended by Mr. Hamilton, be applied for by provisional order; that the selection of routes for additional lines be left to a sub-committee; that the electrical arrangements connected with the running of the cars be referred to the Electricity Committee. Mr. Patterson moved the adoption of the report, which was seconded by Mr Charlton. Mr. Martin moved an amendment that the T.C. enter into negotiation with the Tramway Co. on the basis of the suggested agreement of October last. He said if they accepted the Committee's recommendations they would be committing the town to an expenditure of from £100,000 to £120,000. The tramways in that town would never pay. They had been losing something like £5,000 every year. After further discussion the amendment was negatived, and the report was adopted.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Amalgamation.—The extraordinary general meetings of the Anglo-American and Direct United States Companies, which are reported elsewhere in our issue to-day, passed after some discussion, the resolutions submitted. These have now to be confirmed by a second general meeting 14 days later, and the Court's consent must be obtained afterwards to the alteration of the memorandum. This will be the final act in handing over the above Companies' cables to the Western Union Co.'s management.

Denmark.—On October 1st the rate for telegrams to Denmark was reduced to 2½d. per word, with a minimum charge of 10d. per telegram.

Germany.—Last year Dr. Dieckmann was commissioned by the Bavarian Government to make the experiment of erecting a wireless station on the Zugspitze, the highest mountain top in Germany, near the Bavarian and Tyrol frontiers, and in a short time the station will be ready for working. Instead of erecting the antennæ on the summit, which stands at 2,964 m. above sea-level, and which was inadvisable on account of the violent wind storms which there prevail, they were fixed below on the rock-face without prejudicial result. Across the border, in Austria, the erection of an observatory in the Erwald has been projected, and it is now decided to equip it with a wireless plant with a view to connection with the Zugspitze station.

Russia.—A Government Bill has been introduced to authorise the complete reorganisation of the telephonic service under the control of the State.

The Aerophone.—It is reported that Mr. H. Grindell-Matthews, who was to have given a demonstration of his wireless telephone system before representatives of the War Office and the Admiralty on Friday last, abruptly withdrew his apparatus from the War Office, alleging that several Government officials tampered with the apparatus and made sketches of it during his temporary absence. There is to be an official investigation into the charges, which are absolutely denied by the War Office, the latter alleging that the experiment was a failure for some reason not explained.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—The electrical engineer having reported on the extension works, it has been decided to obtain tenders for the installation of a generating plant, and further switchgear in connection with the high-tension supply at Globe Works.

Australia.—Western Australia.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

Queensland.—November 8th. Deputy P.M.G. Switchboards, measuring instruments and protectors, telegraph instruments, switchboard parts and accessories, telephone instruments. High Commissioner in London, 72, Victoria Street, S.W.

South Australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" September 22nd.

EW SOUTH WALES.—December 20th. One branching multiple neto switchboard at Broken Hill, for the P.M.G.'s Department. "Official Notices" September 22nd.

UTH AUSTRALIA.—November 15th. Deputy P.M.G. Seven neto switchboards, three milammeters, six relays and one set Wheatstone fast-speed duplex repeaters, 10 tons of hard-drawn per wire, and one electro-motor.

ovember 15th.—Telephone cords and ear-pieces, for the P.M.G.'s rtment. See "Official Notices" September 29th.

ovember 15th.—Magneto switchboards, &c., for the P.M.G. "Official Notices" to-day.

EENSLAND.—November 8th. Ironwork, measuring instruts and protectors, switchboards, switchboard parts and acces-s, telegraph and telephone instruments, for the P.M.G.'s rtment. See "Official Notices" September 29th.

ovember 22nd.—Cable for the P.M.G.'s Department. See icial Notices" September 29th.

CTORIA.—November 28th. Ebonite carpieces calculagraphs, insulators for P.M.G. See "Official Notices" to-day.

Belfast.—October 9th. 2,000-ampere switchboard ratus, and field regulating rheostat and change-over switch, he Corporation. See "Official Notices" September 29th.

Blackley.—October 10th. Extensions and alterations to ric bell and telephone installation, Booth Hall Infirmary, for twich B.G. E. W. Ogden, clerk, Cheetham Hill Road, Manchester

Bulgaria.—Tenders are invited by the municipal norities of Plevna for the installation of an electric lighting em in that town. Estimated cost £20,000. Tenders received o November 4th/17th. Only firms which have previously carried similar contracts successfully will be allowed to compete. osit £1,000. Copies of the plans and specifications may be ined from the Plevna Municipality on payment of 25 fr. (£1).

Dunedin.—November 1st. The Corporation is inviting lers for one 800-KW. gas-driven generating set. Specifications be seen at the Commercial Intelligence Branch, Board of Trade, Basinghall Street, London, E.C.

France.—October 14th. The municipal authorities of ns are inviting tenders for the contract for an installation of tric lighting in the Lyons Municipal Library.

Glasgow.—The Clyde Navigation Trustees invite tenders a 32-ton electric crane for the east end of Rothesay Dock.

Great Western Railway.—October 16th and November Stores for a year. See "Official Notices" to-day.

Grimsby.—October 16th. Paper-insulated lead-covered les. house fuse boxes, and mains service boxes for the Corporn. See "Official Notices" September 29th.

Hastings.—October 18th. Electric lighting of the workse. Ore, for the B.G. See "Official Notices" September 15th.

South Africa.—November 22nd. Posts and Telegraph artment. Tenders for power-generating plant, consisting of tor-generator, accumulators, switchboard, &c. Forms of tender specifications from either District Stores Clerk, G.P.O., annesburg, or Controller of Stores, G.P.O., Capetown.

London.—L.C.C.—October 24th. Sub-station plant and chinery. See "Official Notices" September 15th.

HACKNEY.—October 12th. 100,000 pairs of white open type arc p carbons, for the B.C. See "Official Notices" September 22nd.

HAMMERSMITH.—October 11th. A.C. and D.C. motors for the ncil. See "Official Notices" to-day.

Perth.—October 14th. The T.C. invites tenders for rhead coal storage hoppers, conveyors, capstans, and electric erating plant for stoking machinery, also alteration and ension of existing coal elevator and hoist. W. B. McLusky, engineer.

Russia.—The municipal authorities of Archangel are at sent inviting tenders for the concession for the construction and rking of an electric tramway in the town.

Siam.—December 30th. Tenders are invited for five ctrically-driven centrifugal pumps for the waterworks at ngkok. Particulars, Local Sanitary Department, Bangkok.

Spain.—The municipal authorities of La Oliva de Menda ovince of Badajoz) have recently invited tenders for the cession for the electric lighting of the town during a period of years.

October 16th.—Tenders are invited for the supply of a transrmer, underground cables and accessories for three cranes for the rbour of St. Lucia Janta de Obras del Puerto, Corunna.

Taunton.—200-K.V.A. single-phase alternator, superheater, bles, and induced draught fans for the Council. See "Official tices" to-day.

CLOSED.

Belgium.—Six firms, including the British Insulated and Helsby Cables, Ltd., competed for the contract for the supply of the bronze overhead trolley wire required by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, during the year ending September 30th, 1912, the lowest offer being that of the Compagnie Française des Métaux, of Paris. The lowest bid for the contract for the supply of the electric rail connections during the same period was that of Messrs. Felten & Guilleaume.

No fewer than 13 concerns—eight German, two British (Henley's Telegraph Works and the British Insulated and Helsby Cables, Ltd.), and one each Belgian, French and Austrian—tendered for the supply of a quantity of cable to the Belgian Post and Telegraph authorities in Brussels, the lowest being that of the Ateliers de Constructions Electriques de Charleroi.

Burnley.—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for a supply of cables.

Eccles.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., at £709, for a H.T. single-phase A.C. switchboard for the electricity works.

Gloucester.—The Governors of the Royal Infirmary have placed an order with Messrs. Parsons Bros., of Gloucester, for a 20-line intercommunication telephone installation on the Parsons-Sloper system. The wires are to be run in conduit throughout.

Haslingden.—In connection with the electricity scheme the following tenders have been accepted :—

Ferranti, Ltd.—Switchboard and accessories.
British Westinghouse Co., Ltd.—Static transformers.

London.—POPLAR.—The B.C. Electricity Committee has received the following tenders for the supply of one 3,000-KW. turbine alternator and condenser :—

Richardsons, Westgarth.—Alternator by General Electric Co., £7,532 ; ditto, British Westinghouse Co., £7,692 ; ditto, Bruce Peebles & Co., £7,832 ; ditto, Siemens Bros., £7,893, alternative £9,735 ; ditto, Vickers, Ltd., £8,072.

Willans & Robinson.—Alternator by General Electric Co., £7,581, alternative £7,543 ; ditto, Bruce Peebles & Co., £7,797, alternative £7,759 ; ditto, Dick, Kerr & Co., £7,842, alternative £7,804 ; ditto, Siemens Bros., £7,970, first alternative £7,936, second alternative £8,391, third alternative £8,348 ; ditto, Vickers, Ltd., £8,063, alternative £8,025 ; ditto, Electric Construction Co., £8,364, alternative £8,326.

Dick, Kerr & Co.—Condenser by Mirrlees, Watson & Co., £7,617, alternative £7,967 ; ditto, W. H. Allen, Sons & Co., £7,652.

C. A. Parsons & Co.—Alternator by British Westinghouse, £8,306, first alternative £8,402, second alternative £8,012 ; ditto, Bruce Peebles, £8,357, first alternative £8,453, second alternative £8,063 ; ditto, Siemens Bros., (*a*) £8,457, first alternative £8,553, second alternative £8,163 ; (*b*) £8,567, first alternative £8,663, second alternative £8,273 ; ditto, Dick, Kerr & Co., £8,465, first alternative £8,561, second alternative £8,171 ; ditto, Vickers, Ltd., £8,608, first alternative £8,704 ; second alternative £8,314 ; ditto, Parsons, £8,832, first alternative £8,928, second alternative £8,538.

Belliss & Morcom.—Alternator by General Electric Co., £8,456 ; ditto, Bruce Peebles & Co., £8,860 ; ditto, Siemens Bros., £8,877.

Brush Electrical Engineering Co.—£8,727, alternative £8,460.

British Westinghouse Co.—£8,776, alternative £9,269.

James Howden & Co.—Alternator by British Westinghouse, condenser by Mirrlees, Watson & Co., £8,970, first alternative £8,865, second alternative £9,019 ; alternator by Bruce Peebles, condenser by Mirrlees, Watson & Co., £9,145, first alternative £9,040, second alternative £9,194 ; alternator by Siemens Bros., condenser by Mirrlees, Watson and Co., £9,279, first alternative £9,174, second alternative £9,328 ; alternator by Vickers, Ltd., condenser by Mirrlees, Watson & Co., £9,339, first alternative £9,234, second alternative £9,388.

Musgrave & Sons.—Alternator by General Electric Co., £9,267.

Fraser & Chalmers.—Alternator by General Electric Co., condenser by Mirrlees, Watson & Co., £9,925, first alternative £9,785, second alternative £10,023, (Allen's condenser) third alternative £9,473 ; alternator by Siemens Bros., condenser by Mirrlees, Watson & Co., £10,276, first alternative £10,136, second alternative £10,373, (Allen's condenser) third alternative £9,824 ; alternator by Vickers, Ltd., £10,418, first alternative £10,278, second alternative £10,516, (Allen's condenser) third alternative £9,966 ; alternator by General Electric Co., condenser by Worthington Pump Co., first alternative £10,112, second alternative £9,773 (Allen's condenser) ; alternator by Siemens Bros., condenser by Worthington Pump Co., first alternative £10,463, second alternative £10,124 (Allen's condenser) ; alternator by Vickers, Ltd., condenser by Worthington Pump Co., first alternative £10,605, second alternative £10,266 (Allen's condenser).

British Thomson-Houston.—Condenser by Mirrlees, Watson & Co., £9,854, first alternative £9,728.

J. Musgrave & Sons.—Alternator by Siemens Bros., £9,911, first alternative £10,011.

J. Storey & Son.—Condenser only, £3,195.

Cole, Marchant & Morley.—Condenser only, £2,865, first alternative £2,695.

Mirrlees, Watson & Co.—Condenser only, £3,200.

Worthington Pump Co.—Condenser only, £3,180, first alternative £2,830.

W. H. Allen, Sons & Co.—Condenser only, £3,069, first alternative £2,534.

After carefully considering the various types of plant offered and having regard to the cost, reliability and efficiency, the engineer states that the lowest tender received for the complete plant, comprising turbo-alternator and condenser, is that of Messrs. Richardsons, Westgarth & Co., viz., £7,532. The turbine is of the combined impulse and reaction type, coupled to a General Electric alternator, with Contraflo condenser of 7,100 sq. ft. cooling surface, fitted with kinetic air pump. The cooling surface of the condenser was smaller than he would recommend, and the kinetic air pump was of a type of which little experience has been gained in this country, and one which he was not prepared to recommend. The second tender, in order of price, was that of Messrs. Willans and Robinson, viz., £7,581, with Edwards pump and a Willans condenser, with a cooling surface of 10,000 sq. ft. The turbine was of the combined impulse and reaction type, coupled to a General Electric alternator. The condenser was of a size that recommended itself, being nearly 50 per cent. larger than that of Messrs. Richardsons & Westgarth. He was thoroughly satisfied with the work of Messrs. Willans & Robinson, and, next to Messrs. C. A.

Parsons & Co., they had probably had more experience in turbine building than any other makers in this country. The most effective turbine put forward was the two-cylinder pure reaction type of Messrs. C. A. Parsons & Co., which had a guaranteed average steam consumption at ¾, full, and overload of 13·17 lb. Coupled to a British Westinghouse alternator, and with Parsons condenser and Edwards air pump, the amount of this tender was £8,902. The condenser had a cooling area of 5,340 sq. ft. only. This type of turbine occupied the largest floor space, and was necessarily most costly in regard to foundations. If installed at the Council's works, both of the existing converters would have to be dismantled, and re-erected in another position. The engineer was satisfied that this type was a great improvement upon those now installed, but he was not convinced that the guaranteed steam consumption would be steadily maintained. If trouble were experienced, as in the past, the value of the initial low consumption would be materially discounted. The cooling surface of the condenser put forward was very small for the special conditions of the circulating water, and if the turbine should be considered the most satisfactory, he would recommend the substitution of an Allen's condenser of 10,600 sq. ft. capacity, at an additional cost of £663. Compared with the tender of Willans & Robinson, the following result was obtained :—

Willans net tender, £7,581 ; add estimated capital value of difference in guaranteed consumption, £2,058 ; total, £9,639.
Parsons net tender, £8,902 ; add for substitution of condenser £663, estimated extra cost of foundations and removal of converters, say, £300 ; total, £9,865.

Therefore, the ultimate cost of Parsons's plant would be greater, and would, moreover, involve an immediate expenditure of £2,284 more than that of Willans, whilst the gain from improved efficiency was entirely dependent upon the reliability of the plant. Having regard to the foregoing report of the engineer upon the tenders received, the Committee has decided to accept the tender of Willans & Robinson, for the supply, delivery and erection of a 3,000-KW. steam turbine, coupled to a three-phase alternator, with the necessary condensing plant, at £7,581. The following tenders have been received for the provision of one overhead bunker, and one combined coal elevator and conveyor :—

Tickle Bros.—(*a*) Bunker, £1,076 ; (*b*) new conveyor, £490.
New Conveyor Co.—(*a*) £1,188 ; (*b*) £609.
Bennis & Co.—(*a*) £1,270 ; (*b*) £610.
Spencer.—(*a*) £1,212 ; (*b*) £865.
Edgar Allen & Co.—(*a*) £1,730 ; (*b*) £818.
Barry, Hendry & Co.—(*a*) £2,050 ; (*b*) £475.
Babcock & Wilcox.—(*a*) £2,100 ; (*b*) £760.
Dempster & Sons.—(*a*) £1,654 ; (*b*) £1,015.

The specification in the case of the lowest tender, the committee reports, was incomplete, and no drawings were submitted. It was accordingly decided to accept the next lowest tender that of the New Conveyor Co., for supply, delivery and erection of one overhead bunker and one combined coal elevator and conveyor, at £1,797.

FULHAM.—The Electricity Committee has divided the contracts for 5,000 tons of coal as follows, the total cost being £2,583 :—

Hinchliffe & Co.—1,000 tons at 8s. 6d., 500 tons at 11s. 5d.
Harrison & Tidswell.—1,500 tons at 9s. 11½d.
Gilman & Co.—2,000 tons at 11s. 5d.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co. for coal for the electricity works for a year, at £1 0s. 4d. per ton, for the best large Crynant.

Manchester.—The orders for the complete installation of electric light, and experimental work, including all switch-boards, plug-boards, &c., at the new Physical Laboratories, and for the complete installation of electric light for the new Botanical Laboratories, have been placed with Messrs. Sewell & Varley, of Manchester.

Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for three transformers.

Settle.—On the Hospital Lighting Committee's recommendation, the B. of G. has accepted the tender of Messrs. Garsden and Co., of Manchester, at £213, for an electric lighting installation.

Teesside.—Messrs. Stothert & Pitt, Ltd., of Bath, have obtained a contract for the supply of five 5-ton electric cranes for use on extensive quays on the Teesside.

Wakefield.—The tender of Newhall's Insulation Co., Manchester, at £105, for lagging steam-pipes at the electricity works, has been accepted.

Warrington.—The T.C. has accepted the tender of Mr. George Wallington for the construction of the foundations for an induced-draught plant at the electricity works. The Council has recommended the Education Committee to obtain fresh tenders for the work of installing electric light at the Evelyn Street School.

Worthing.—The T.C. has ordered 750 tons of Dynevor Duffryn smokeless steam coal, at 19s. 8d. per ton, from the Main Colliery Co., Ltd.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, October 7th. Visit to the Mar Wireless Telegraph Co.'s Works, Chelmsford. Train from Liverpool St 1.55 p.m.
Wednesday, October 11th. At 8 p.m. At St. Bride's Institute. Presidential address by Mr. W. H. Maw.

Institution of Mechanical Engineers (Graduates' Association). Monday, Oct 9th. At 8 p.m. Paper on "The Advantages of the Steam Turbine Compared with the Reciprocating Engine," by Mr. W. A. Hatch.

Leeds University Engineering Society. Monday, October 9th. Paper on "Rad and Energy," by Prof. W. H. Bragg.

British Electrical and Allied Manufacturers' Association (Inc.).—Thursday, Oct 12th. At 2.30 p.m. Council meeting in the Board Room, Olyn Kensington, W.

Junior Institution of Engineers.—Friday, October 13th. At 6.30 p.m. Vis "The Model Engineer" Exhibition at the Royal Horticultural Westminster.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

THE following orders are issued :—

Drills for efficiency (1911-1912) will commence at Headquarters on Thur November 2nd, 1911, and Headquarters will be open as stated below that date :—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant
O.C. London Electrical Engineers.

NOTES.

To Exhibition Visitors.—Central station engine electrical committees, deputations and others intending to visi Exhibition are asked to advise the management at Olympia the dates of their proposed visits.

The Electrical Contractors' Association and Sh field Corporation.—According to the *Standard*, the long-an pated action by the above Association against the Shef Corporation, in respect of the municipal electric wiring busine Sheffield, will come on for hearing before Mr. Justice Eve earl the next sittings of the Law Courts, which begin on October 1 The action will be by the Attorney-General, at the instance Sheffield ratepayer, for whom Mr. P. O. Lawrence, K.C., and Maurice Drucquer will appear, while Mr. Danckwerts, K.C., Mr. J. Serjeant will appear for the Sheffield Corporation. improbable that there will be much evidence, as the existence municipal wiring department at Sheffield is an admitted fact. sequently, the action will take the form of arguments, whic effect will be an appeal against the judgment of Mr. Justice Ne in the Leicester case. This held that it was illegal for a municip to carry out wiring work except under special Parliamen powers. The Leicester Corporation accepted this judgment as and closed down its wiring department. The position at She is interesting, however, from the fact that the Corporation in acquired the undertaking of the Sheffield Electric Light and Po Co., and £6,000 of the purchase-money was paid specifically respect of the house wiring department. When the underta was taken over by the Corporation the local contractors asked this department be discontinued, but the Corporation resisted t demand, and has continued the wiring of consumers' premises since. It is said to be the intention of the Sheffield Corpora in the event of its losing the action, to continue the case to Appeal Court, and, if necessary, to the House of Lords.

Local Government Board and Fair Wages Cla —The Local Government Board has issued a circular letter to authorities embodying the resolution passed by the Hous Commons on the subject of fair wages clauses in contracts, and recommendations made by the Advisory Committee of repres tives of Government Departments, which has been establis The letter points out that the Advisory Committee recommends clauses such as those inserted in Government contracts should be introduced into contracts which are not entered into by Gov ment Departments, but which involve the expenditure of pu money, or other consideration granted by a Government Dep ment, or which require the approval of the department. It appe to the Board that the policy adopted in the case of Governm contracts should be followed in the cases of all contracts for execution of works, or the supply of materials, which are ent into by local authorities, or by, or on behalf of, any Commi wholly or in part appointed by a local authority. Whilst were aware that many local authorities specified in their contr conditions to be observed by the contractor as to the rate of w and other matters affecting persons employed by him, the B thought that in every case the authority should give the ma careful consideration with the view to the introduction in all tracts of clauses on the lines of those inserted in Governm contracts.

(*Continued on page 573*)



SUPPLEMENT.

Olympia and After.

That the present Exhibition will be of great educative value to those who attend it, is unquestionable, but its actual influence on the electrical industry in the immediate future must depend to a great extent upon the manner in which its message to the public is followed up by the contractor, using the term in its widest sense, to cover all those who in private business or municipal employ are engaged in providing the public with the means of applying electrical energy to its needs. It is a characteristic of our profession that few engaged in it escape the fascination of its rapid growth and constant change. Fed by a vigorous science, and trained by keen competition, it offers scope for energy and satisfies the needs of the imagination; in the confidence and almost partisan enthusiasm of its followers, lies much of its strength and some weakness. The man who is daily absorbed in electrical work often fails to realise that to the public electricity supply is one of the many conveniences offered by modern life, and one for which there are often several substitutes; its importance to the individual may be quite secondary, its extensive use only representing a small portion of his cost of living, and consequently its economics offering but little scope for overall gain, whilst entailing immediate outlay, and, perhaps, changes in business, or in the even more conservative methods of domestic life, which have served, if not perfectly at least unquestioned, for a long time. These reflections need not discourage, but should rather help by suggesting the need for study of the mental attitude of potential buyers, and perhaps also that price cutting is not the only, or even the best, way of obtaining business in a commodity of permanent utility. Patient and very persistent educative work, not of a strident or wholesale character, but informed by technical ability and directed to individual needs, will prove the most efficacious, and provide examples of successful use, than which there is no more powerful form of advertisement.

Satisfactory Progress.

While, no doubt, it must be admitted that the Executive Committee is not omniscient or omnipotent, and that some things might have been done better, we cannot agree with one of our electrical contemporaries that it has "completely failed" in its endeavours to bring the public to the show, or that "there have been no lay Press advertisements." Agreeing, with regret, that the lay Press usually cares nothing about engineering in comparison with the superior attractions of sensational law cases, hobble skirts and such like futilities, unless its attention is enchained by substantial "compensations," we must point out that the Exhibition has been advertised every day in 25 newspapers, and that the lay Press has been remarkably generous in publishing special articles on the exhibits at Olympia. As a matter of fact, the receipts at the paying gates have been quite up to the anticipations of the Executive, which proves that the latter has not failed in its duty. The admissions at the ticket gate have been less satisfactory, mainly because the tickets have not been distributed as early as they should have been; but enormous numbers of tickets have been purchased by the exhibitors (though not by the supply authorities), and these are bound to produce their effect during the rest of the run of the Exhibition. The proposal which was mooted, that the technical Press should prepare articles of a popular nature for insertion in the daily papers, fortunately died of inanition before it matured to the stage at which it would have been contemptuously rejected by the editors of those papers, to whom the technical Press is nothing but a name, and over whose judgment the technical Press can exercise not a jot of influence. The fact that the idea for a moment found supporters merely indicates a total lack of comprehension of the relations existing between the lay and the technical Press.

The only way in which publicity in the columns of the daily papers can be ensured is the sordid method upon which we have already commented in another connection. It appears to be impossible for the Executive to embark upon a costly scheme of advertisement on a lavish scale, but much can be effected by the collective efforts of exhibitors, and it is to them that we must look to take the necessary steps.

The impression under which some exhibitors, or those who pose as voicing their views, are labouring—that the Exhibition cannot be a success unless its floor is crowded with non-technical visitors—is valid only to a limited extent. It is true that we wish to see a great attendance; but some at least of the exhibitors are more concerned that the visitors, though moderate in number, shall be of the right class. Many of the exhibits appeal solely to technical men, and the owners of such care nothing for bands or spectacular effects, or other popular attractions. Their interests are best served by notices of the exhibits published in the technical Press, which meet the eye of the class of reader referred to. We are glad to add that numerous orders have been placed by these visitors, and the amount of business done seems to have given general satisfaction. The daily Press, on the other hand, caters for the consumer and the class from which prospective consumers are drawn, and, therefore, would best contribute to the success of the Exhibition by drawing attention to the unique display of lighting, cooking and heating apparatus which has been concentrated at Olympia. We believe that electric cooking in particular will derive an immense impetus from this Exhibition; demonstrations of the greatest interest are given daily in various parts of the building, and the excellent results obtained cannot fail to carry conviction to the minds of the spectators. As Mr. Mordey truly said at the inaugural dinner, in these matters the ladies are the paramount authorities, and it is to them that the arguments and demonstrations must be addressed. That the object is in some cases, at any rate, attained we have certain knowledge.

Evening Lectures at Olympia.

In the Pavilion of the London Electric Supply Companies lectures of a popular character, and with suitable demonstrations, are being delivered by Mr. R. Borlase Matthews, and by arrangement with the General Electric Co., Ltd. The first of the series took place on September 28th, at 8 p.m., the subject being "Electric Cooking and Power in the Home"; an hour later this was followed by one on the "Comforts of Electric Lighting and Heating." Yesterday, October 5th, the same order was to be followed, and the lectures are to be repeated on October 12th and 19th. The Saturday lectures in the series are arranged for to-morrow, October 7th, and October 14th and 21st, lighting and heating being the subjects of the 8 o'clock lectures, and cooking and power those at 9 p.m.

THE EVOLUTION OF WIRING SYSTEMS.

By J. W. B.

The technique of installation work in this country is at present in a somewhat unstable condition. For many years wood-cased work and steel conduit have been regarded as standard practice, the latter having become highly developed in detail in the attempt of designers to provide fittings for every likely requirement, and to eliminate so far as possible dependence upon the skill of the user. In its most complete form the metal conduit system will possibly remain the most generally satisfactory where the importance of the installation will allow of comparatively high cost and adequate inspection. Wood casing is at the present time much less used than it deserves to be, to some extent because the wireman-carpenter has almost disappeared in consequence of the general use of tube systems. There can be little doubt, however, that for interior work wood casing offers less risk than imperfect and partially earthed tube systems, and poor workmanship is less likely to lead to trouble on cased wiring than on any metal-sheathed system.

It may be urged against either of the above systems that they deprive electric wiring of much of the flexibility and adaptability to changing conditions which it should naturally possess.

During recent years the impetus which electricity supply has received from improvements in lamps and the general fall in tariffs has made possible a great increase in business with the smaller users of light, to whom the first cost of equipment is always an important consideration, and may be the only bar to the adoption of the supply. To meet these changed conditions engineers and manufacturers have brought forward new systems of wiring, and revived old ones with considerable energy. The result is that quite a number of alternative methods are now offered to the wiring contractor. The systems in question are primarily designed to reduce cost. The extent to which they do so in practice is, however, modified by various circumstances to an extent not always realised by their designers. For example, the causes which have led to their inception have also led to the simplification of lighting fittings. To-day a fuller recognition of the principles of scientific illumination, and a tardy escape from the traditions of the gas and oil lamp, have led to the almost entire abandonment of the elaborate metal and glasswork which formed a part of even simple installations, and, incidentally, carried the bulk of the contractor's profit. In consequence it is now necessary for him to secure a higher percentage of profit on the wiring, which deprives the buyer of some of the advantages of the cheaper systems.

Similarly the cost of labour is not found to fall rapidly with the introductions of simpler methods, owing to the fact that a certain familiarity with the new material has to be gained by men who, in most cases, owing to lack of workshop training, are not readily adaptable to changes, and who, furthermore, look with some distrust upon any device having for its object to make the result of their labour cheaper to the consumer of it. It must also be borne in mind that with wiring, as with all work carried out on a consumer's premises, the time lost in preparation and changing jobs is an important item, and becomes more so as the individual jobs become shorter.

There is no doubt, however, that both on technical and commercial grounds new wiring methods are worthy of extended trial by contractors who desire to share the extensive business in fitting small property which may be expected in the near future.

As an example of the influence of different systems on cost, the following figures may be taken as representative for small private house work :—

Installation Complete with Tungsten Lamps and Cord Pendants.

No.	System.	Cost per lamp.
1.	Screwed seamless conduit	22s.
2.	Brazed ditto, with good continuity fittings ...	21s.
3.	Close-joint slip conduit	18s.
4.	Wood casing	17s.
5.	Stannos wiring (concentric)	13s.
6.	Lead-covered twin V.I.R. insulated wire ...	13s.
7.	Rubber and cotton-covered flexible on button insulators	12s.
8.	V.I.R. cable and porcelain cleat insulators (600 meg. non-association wires). ...	10s.
9.	Cotton braided wire and ditto. ditto. ...	9s.
10.	Heavy rubber ("cab tire") covered twin wire run on insulated hooks or metal clips ...	12s.
11.	Enamelled and braided wires	10s.

Nos. 1 and 2.—Not usually used for small installations.

No. 3.—Usual practice; value depends greatly upon accuracy of fit (*i.e.*, quality) of the conduit used and the workmanship; mechanical protection good in dry and non-corrosive situations.

No. 4.—Mechanically weak, but electrically sound in dry situations.

No. 5.—Somewhat weak mechanically, particularly adapted to surface work; electrically very good, owing to whole system being concentric and with sheaths at earth potential neat and easy to fix; very necessary to employ the full line of fittings and accessories provided by the makers. A few of the latter are capable of improvement in mechanical detail. This system has already attained great success, and it appears that its skilful inventors are about to receive flattery of the proverbially sincere order.

No. 6.—An old system which has had less attention in this country than it merits, suitable for any situation, dry or damp; in the latter, at least, the lead sheath should be made continuous and earthed. The softness of the sheath renders it useful for fitting to building outlines, but constitutes some disadvantage with regard to mechanical strength. A considerable amount of house wiring has been carried out with this material, the insulation, however, being of paper, and although more permanent than the rubber, care must be taken to exclude every trace of moisture by sealing all outlets and joints; for this reason its use can only be recommended where conscientious treatment may be relied upon.

Nos. 7, 8 and 9 belong to the group of so-called Continental systems which, unfortunately, have never been given a fair trial in this country, the objections being lack of safety and unsightly appearance; it may be deduced that no great danger is to be feared from their use even with 250 volts, seeing how generally they are found in wooden buildings on the Continent, and also how well our own commercial flexible cord behaves under the treatment which is meted out to it in shops and warehouses.

The security of wiring systems of this class lies in their very insecurity; being fixed upon the surface with the good secondary insulation of the porcelain cleats, and always within sight, they escape rough treatment, because it is obvious that they cannot stand it, even as windows are seldom broken, because it is understood that they must be treated with respect.

The argument against the appearance of this class of work is sound, but certainly exaggerated when applied to small flats, villas and cottages.

To those who would seek an opportunity of using one of these methods, it may be pointed out that No. 7 is less satisfactory than No. 8, the flexible wire offering more difficulty in producing a neat effect and showing an accumulation of dust to a greater extent than the two single wires. The latter are also easier to joint, and, with an ample selection of insulators for corner and special work, may be made to look very workmanlike. On small installations where the section of the copper is not changed, the joints may be neatly and safely made with these surface systems, so saving the extra cost of "looping-in." No. 11 promises to constitute a neat and useful substitute for No. 8. The use of enamel for the insulation of lighting wires is quite new, and the material now being put forward is deserving of careful attention.

No. 10, a comparatively new form of cable, was designed for rough use with hand lamps and portable tools; it offers a ready means of running radiator and cooker circuits, and is also valuable for use in stables and positions where damp and corrosive liquids are found.

Only by actual and fairly extensive trial can a just estimate be formed of the value of these systems for different purposes, and it behoves every electrical contractor to make opportunities for the trial of any material which offers a reasonable chance of reducing installation costs, whilst complying with the requirements of safety.

SOME OF THE EXHIBITS AT OLYMPIA.—III.

(The figures in parentheses are the numbers of the stands.)

Sunderland Forge and Engineering Co., Ltd. (99, 116),
Pallion, Sunderland.

At this stand, which was one of the very first to be completed nd equipped, the Sunderland Forge Co. have a varied exhibit of mparatively heavy machinery, mainly intended for use on board ip. The most prominent feature, perhaps, is one of 17 combined

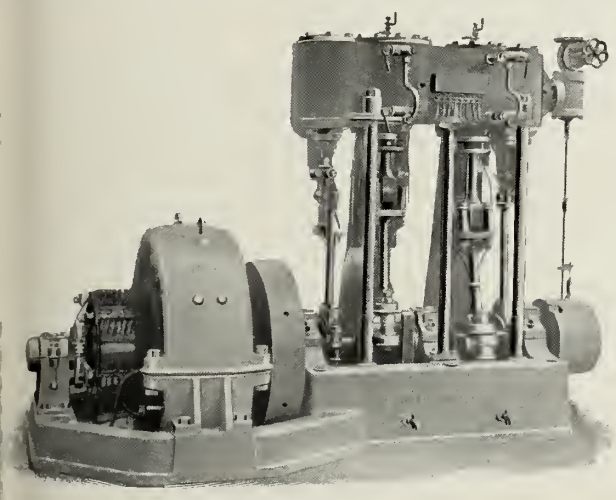


Fig. 102.—Standard Ship Lighting Set.

s built for the Ocean Steamship Co., for their Australian vessels ; is comprises a standard open type vertical compound engine upled direct to a D.C. six-pole compound-wound dynamo, giving KW. at 100 volts, 275 R.P.M. The substantial construction and od finish of the set, ich we illustrate in . 102, are worthy of mmendation.

Two other steam namos, of 15 and KW. respectively, are o shown. Our other ustration, fig. 103, resents a silent- ning electric boat nch to lift 2 tons 70 ft. per minute ; s has two warps, ven through single- luction worm gear- by a D.C. series- und motor, and is vided with a water- ht controller fitted th Blair's patent erlocking gear, a gnetic brake and a t brake. The inter- king gear connects foot brake with controller, so that depressing the ke treadle the con- ller is instantly rown off and the gnetic brake also plied. This allows operator to use h hands in hauling, stopping the winch with his foot when essary. Four of these winches are installed on the *Olympic*, well as four larger ones, and they have also been supplied to *Titanic*, *Adriatic* and other "White r" liners.

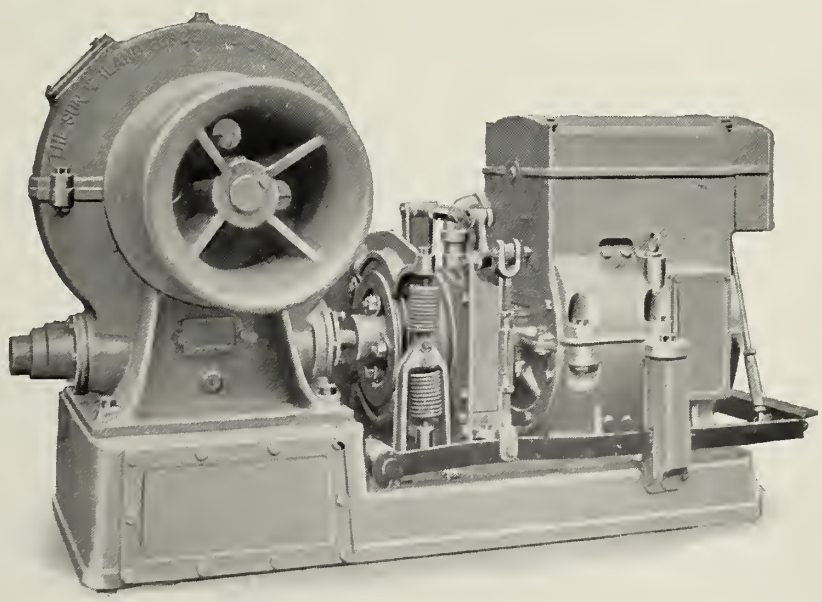


Fig. 103.—Silent Running Electric Boat Winch.

In the centre of the stand there is a ndard 3-ton electric winch for shipyard e, lifting at 60 ft. per minute ; this is ven by a totally-enclosed D.C. series motor ough double-reduction spur gearing, and s two warps and a barrel ; two foot kes and a clutch for disengaging the rel are provided. These winches are wn in operation. Three-phase induction tors and D.C. shunt-wound motors of ions sizes complete an excellent exhibit.

The Eyre Smelting Co., Ltd. (263),
Tonbridge, Kent.

This firm exhibits its "Bamber's" h-encrusting zincs for primary batteries, a number of special registered tapered designs being shown which are claimed to be improvements over the ordinary zincs, the patterns being thicker at the greatest wearing part, which greatly prolongs the life, the wastage of zinc being considerably reduced. Zinc rods for Leclanché cells are shown, the special features being the following : The greatest sectional area is where the heaviest work takes place, and this has been adopted after repeated successful tests. The rods wear evenly to a very fine point, instead of in the middle. The wires, being cast in, do not become loose and drop out as a result of the creeping of the electrolyte ; a constant and even flow of current ; no cleaning beyond an occasional wipe with a damp cloth ; no loss by local action. The company is also sole manufacturer of "Eyre" anti-friction white metal for lining all classes of bearings. The metal is used by railways, electric tramways, and for marine and machinery bearings, and ingots and samples of different brands, as also of lined brass bearings are on exhibition.

Messrs. A. Reyrolle & Co., Ltd. (147),
Hebburn-on-Tyne.

This Tyneside firm is making a special feature of switch-gear embodying the all-armoured principle, particularly such as is required in mining work.

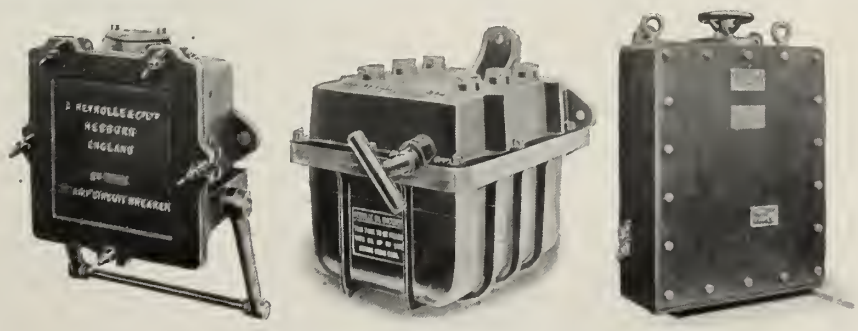
Messrs. Reyrolle's originality in switch design is, of course, very well known ; they claim the maximum of safety with their system, even under such trying conditions as are often found in mining work.

The outstanding exhibit is a 20,000-volt 5,000-KW. sub-station panel, eloquently labelled "No danger," and similar to those shown in our view of a sub-station (fig. 107).

Unskilled labour is employed on the stand to demonstrate the ease with which the panel can be withdrawn for inspection and manipulated. The panel is provided with a carriage (similar to that shown in our view), and a bell-ringing device is fitted to show when the switch operates, either automatically or by hand. A smaller panel of similar type is also on view, as also a variety of ironclad mining switchgear. This includes a draw-out pillar type gear, mounted on a substantial cast-iron pillar with the bus-bars in a chamber at the top, the switch being arranged to plug into suitable contacts, and to slide on rails.

The interlocking gear is on the right-hand skid, and the arrangement is such that the switch handle must be in the "off" position before the switch can be withdrawn from contact with the bus-bars, and a swing door is provided which can be locked in position, in order to cover the contacts when the switch is removed.

The advantages of this gear will be obvious in that, in the event of adjustments being required on the switch itself, it can be readily drawn out and taken to "bank" without disturbing any other part of the gear, or if work is necessary on the cable controlled by one of these panels, it is only necessary that the switch should be drawn out sufficiently far to enable the swing lid to be locked in position, after which there is, of course, no possibility of



Figs. 104, 105, 106.—Reyrolle Explosion-Proof Circuit Breaker, Oil Switch, and Starter.

the cable being made alive. This gear is made in two styles, viz., explosion-proof and dust-proof.

The well-known "Fisher" gate-end box is shown. We illustrate a special explosion-proof drum-type starter, an explosion-proof oil switch, and an ironclad circuit-breaker

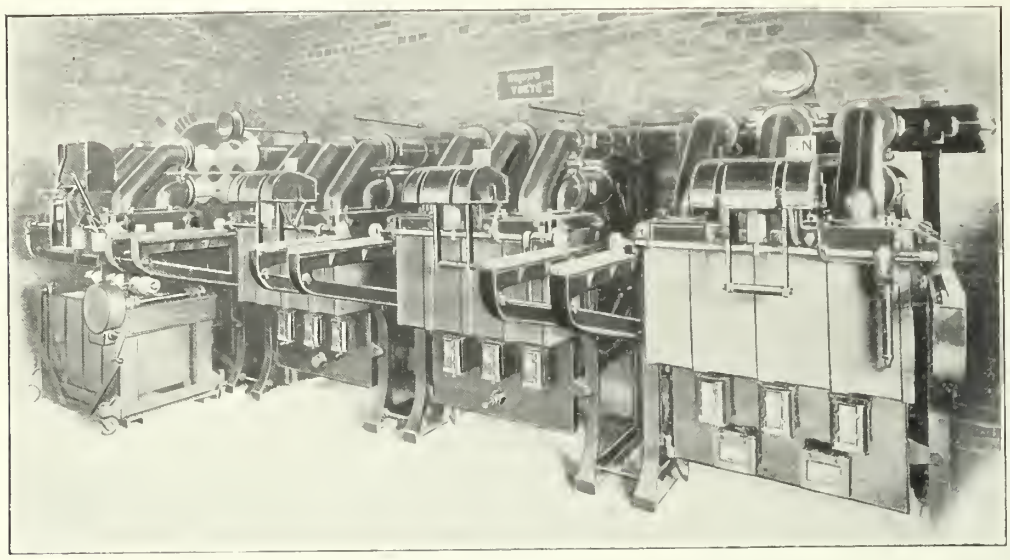


Fig. 107.—Reyrolle 5,000-kw. 20,000-volt Switch Panels.

The now well-known Vernier H.T. cable joint, and a selection of relays and transformers used in the Merz-Price protective gear will appeal especially to mains engineers.

As will be gathered, the exhibit is of great technical interest, and well worth inspection.

The Leskole Co., Ltd. (222),

Palace Works, Enfield.

This company shows a complete range of electrical instruments for the purpose of recording all industrial temperatures from 300° to 3,000° F. in actual use. The exhibits are in two sections, one for electrical resistance thermometers for use particularly in power plants, and for the lower temperatures up to 1,000° F., and the other of thermo-electric pyrometers for high temperatures. Complete temperature control switchboards for central stations, comprising temperatures of cooling air and water, feed water, steam, superheat, flue gases, transformers, &c., are shown, including an entirely new system of push-button switches. Demonstrations are also given of high-temperature instruments, suitable for boiler furnaces, destructors, hardening and annealing furnaces, &c. These thermometers have been successfully adapted to indicate or record the temperature of armature windings. An automatic recording instrument for producing continuous records of the temperature at several points (up to six) simultaneously, is shown working.

The company also shows indicating and recording steam meters; the way in which the disk which is used to determine the speed of the steam is placed in the pipe and connected to the instrument is shown in fig. 108, and fig. 109 is a view of the complete panel fitted with an integrating meter, voltmeter and regulator. The quantity actually measured is the difference of pressure between the two orifices 2 and 3 on opposite sides of disk 1; the mercury gauge 4 is actuated correspondingly by way of pipes 5 and 6, which are fitted with loops 7 and 8 to prevent errors due to unequal condensation of steam on the two sides of the gauge, and sediment collectors 9 and 10. The mercury in the gauge, touching more or fewer of the platinum contacts fused into the glass tube, varies the rate of the integrating meter. It will be noticed that the indicating or recording instruments are of well-known electrical types. Various patterns are made, either indicating, integrating, or graphically recording the steam used.

Draft and pressure gauges are shown in various patterns, as well as chart recorders for draft, pressure, vacuum and differential measurements. The circular type of chart is employed, and the gauges are chiefly remarkable for their solid and sound construction and beautiful finish. The new vacuum recorder for condensing plants, &c., is the first placed on the market for this purpose, based on the mercury U tube.

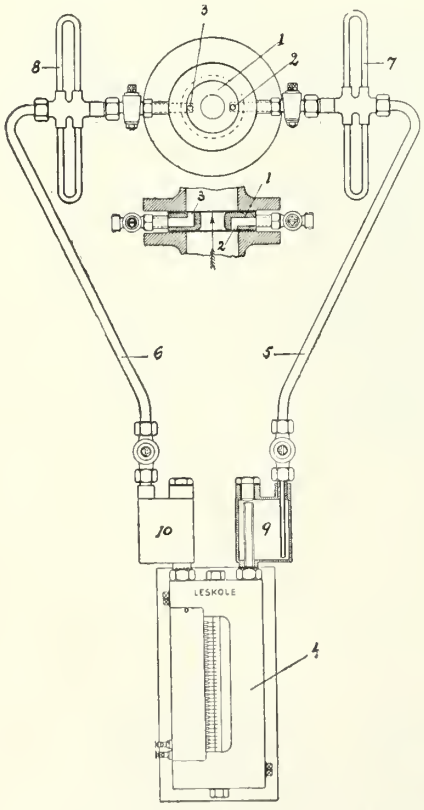


Fig. 108.—Arrangement of Steam Meter.

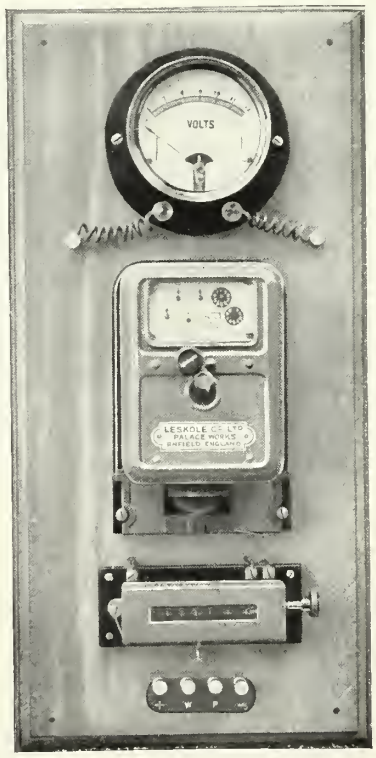


Fig. 109.—Steam Integrating Meter, with Voltmeter and Regulator.



Fig. 110.—Coal Meter.

On this stand can also be found examples of all the various type of mercury thermometers used by central station engineers and others engaged in the electrical industry.

An apparatus which will attract considerable attention is the Leskole coal meter, fig. 110, a new device for automatically recording the weight of coal passing through chutes feeding mechanical stokers, &c. The construction of this meter is exceedingly simple, and i

rice very moderate : engineers are invited to install these instruments on trial in order to test out the accuracy for themselves.

The Leskole leak detector, too, is an interesting little device for the purpose of telling at a glance whether a steam trap is out of order or leaking.

Pope's Electric Lamp Co. (207, 208),

Hythe Road, Willesden.

The arrangement adopted for this stand is intended to convey to the visitor, by means of a brilliant display of Pope lamps in the neighbourhood of a lighthouse, that the right way to a light-house can be found by using these lamps which are manufactured at Willesden. Little need be said concerning the merits of the lamps,



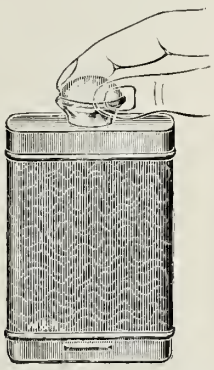


Fig. 112.—Pocket Lamp by Messrs. Jacobs.

G. 111.—Pope Tungsten Lamp for Train Lighting.

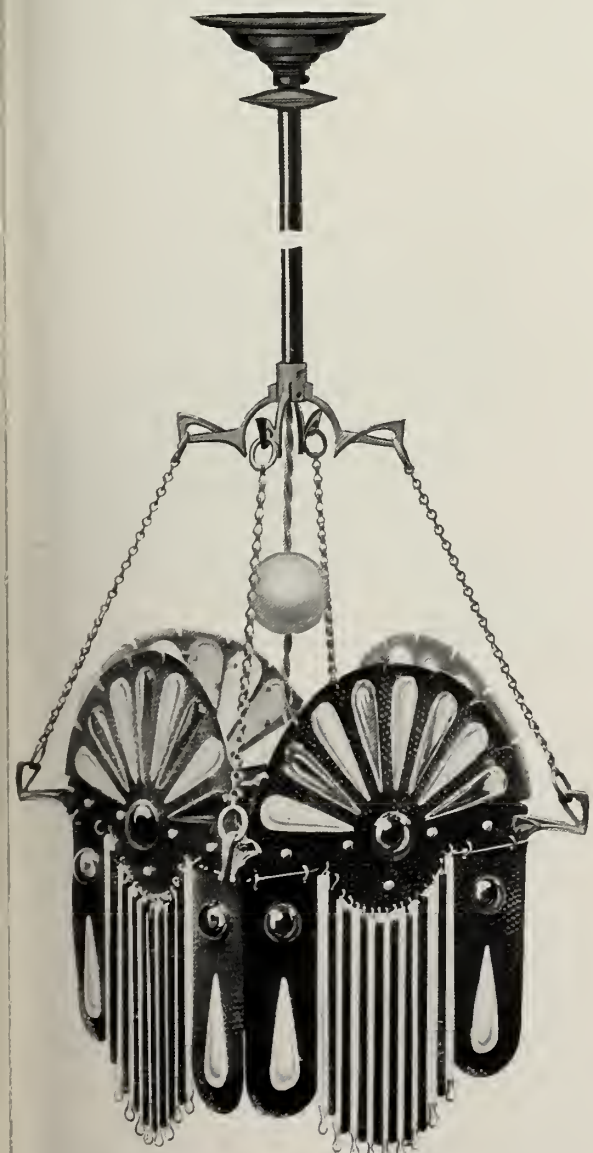


Fig. 113.—Hall Fitting by Messrs. Jacobs.

as they are familiar to our readers. In addition to the standard lamp for high and low voltages there will be seen twisted flame candle lamps, with either clear or frosted bulbs, ranging up to 125 volts and in 13 to 16 c.p. ; olive or plain flame lamps and tubular lamps are shown, ranging from 25 to 125 volts, in 5, 12 and 16 c.p. sizes. Attention may be directed to a new metal lamp for shop window lighting, the filaments being so suspended that notwithstanding the great length of the bulb they will stand reasonable vibration and rough usage. These lamps are made to any standard voltage, and the c.p. range is from 25 to 50 ; they have three-pin caps and reflectors. The three-pin cap assures rigidity and obviates the necessity for placing a cap at the other end of the bulb. This lamp is also serviceable for picture lighting. Other exhibits comprise lamps for motor-car lighting ; the "Pope" Focus lamp, which is suitable for head or side lighting ; and a handy festoon lamp for automobile interiors. For train lighting the firm makes the lamp shown in fig. 111. It is supplied for 16 to 24 volts and for 8 to 16 c.p. A feature that should also be mentioned is a special type of radiator lamp, made in all voltages for fitting to any standard form.

Messrs. W. & R. Jacobs (296),

39c, *King William Street, E.C.*

Glass shades and fittings of every description for electric lighting are in evidence here ; there are nearly 150 designs ranging in value from the cheapest to the most costly. It is never easy to find much to say about exhibits of this kind, and indeed they generally speak



Fig. 114.—Stokvis Dutch Fitting shown by Messrs. Sparkes.

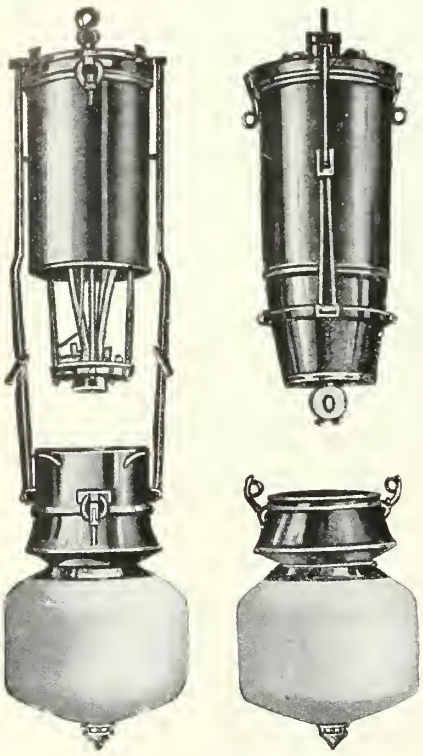
far more effectively for themselves, so we will let them do so on this occasion. To that end we select a design which seems to us to be a departure from the ordinary run of such goods, fig. 113 representing a hall fitting in copper finished metal, jewelled, and with glass drops. The firm's catalogue contains many other choice examples of fittings of the same class, also standard lamps, and innumerable shades. A popular line on the stand is a large selection of electric pocket flash lamps and torches—in all over 50 patterns, one of which is lighted by turning the lens instead of having a switch at the side—and many other electrical novelties.

Messrs. E. C. Sparkes & Co. (235, 235a),

118 *and* 120, *Wardour Street, London, W.*

This firm being agents for Messrs. Peyton & Peyton, Ltd., of Birmingham, and for Mr. W. J Stokvis, of Arnhem, Holland, they show the electric-light fittings manufactured by both. Messrs. Peyton have a long record in brass and iron work—some 70 years—

and their designs of electric light fittings shown, are prepared by their own draughtsmen in all styles, and to suit most pockets. Representative examples of their fittings for private and public buildings, theatres, churches, &c., can be seen at the stand or at the showrooms in Wardour Street. The firm of W. J. Stokvis are likewise of long-standing. They have made a special study of the reproductions of the genuine old Dutch lighting fittings of the sixteenth and seventeenth centuries, as revealed by the examples in



Figs. 115 and 116.—Angold Magazine Flame Arc, G.E. Co.



Fig. 117.—Photo Arc Lamp, G.E. Co

the Amsterdam and Haarlem Museums. We understand that they are the only firm which have received permission to make plaster casts from antique models at these museums. They also reproduce the fittings from the paintings of the old Dutch masters, such as Gerard Don, D. Teniers, jun., G. Metsu, N. Maes, &c., and on the walls of the stand will be observed some engravings showing how these have been copied. It is interesting to recall that a great many of these old painters included in their interior paintings a candelabra, a lantern or a candle-stick, and it is after these that Messrs. Stokvis have prepared many of their fittings. The firm also make a speciality of fittings in French styles, and several fine specimens of these are shown. The fitting which we illustrate in fig. 114, is from a painting ("Amateurs of Music," by Gabriël Metsu) in the Royal Art Gallery at the Hague.

General Electric Co., Ltd. (103, 112, 125, 134), 67, *Queen Victoria Street, E.C.*

It is almost unnecessary to say that everything electrical which the public may be expected to take an interest in, can be found on the several stands of the General Electric Co., as well as many other things which appeal particularly to the engineer.



Fig. 118.—Convertible Ironing, Cooking and Boiling Apparatus.

A casual inspection, such as that which the company kindly arranged on behalf of the Press during the opening week, revealed many interesting novelties, amongst which the most important is undoubtedly the new 16-c.p. 20-watt metal lamp for 200-240-volt circuit. The filament is jointless, and occupies a small bulb; moreover, it will stand severe handling, and for those who wil have a small lighting unit, it appears to be ideal. Naturally th Osram lamp is a great feature of the firm's stand, and in its variou sizes up to 1,000 c.p.—a unit which has been adopted for stree lighting at Torquay and Sutton Coldfield with satisfactory results— provides an attractive display. A case of veteran Osrams, with u to 10,000 hours' burning to their credit, is worth noting, as alsc the interesting devices which demonstrate the strength of th Osram filament as now manufactured.

From lamps to fittings is a comparatively short step; needless t say, the fittings' display is a comprehensive one—a novelty being the "basket work" pendants, standards, &c. The lighting exhibit

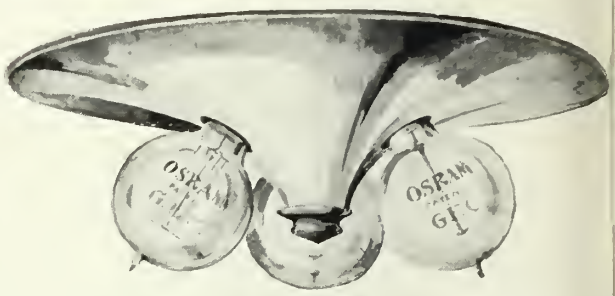


Fig. 119.—G.E.C. Street Lighting Fitting.

also include arc lamps, large and small, for all purposes, and th well-known "Robertson" carbon lamps are shown in course o manufacture.

A variety of cooking and heating apparatus, made under th "Archer" patents is shown; the various articles in this sectio should be carefully inspected. Demonstrations of the simplicit and utility of the cooking appliances have been arranged.

Among the many exhibits to which we can give only passin notice may be mentioned the "Freezor" fans and punkahs; electr medical vibrators and ozone apparatus; miscellaneous accumulato lamp and bell supplies; a wide range of central battery, magnet and battery-call telephone switchboards and wall, desk and fie instruments; and an imposing miscellany of electrically operat devices of every description.

The measuring instruments exhibited range from the cheap roun switchboard types to such laboratory instruments as the Sumpn wattmeter. The meter exhibit (by the Aron Electricity Meter Co Ltd.) is exceptionally complete, and includes the standard eloc type Aron meter, for house or switchboard service, shunted in th heavy current patterns; polyphase clock meters for three or fou wire circuits, and various motor type meters, among which may l mentioned the induction type for single and polyphase measur ment, and the ampere and watt-hour types for continuous current Recent improvements in Aron meters include the introduction silent winding gear, help springs and the springing counter.

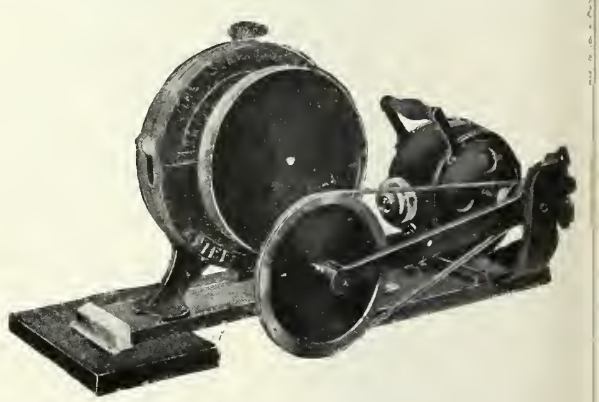


Fig. 120.—Electric "Mary Ann" and Knife Cleaner.

understand that the Aron prepayment meter for alternatin current is the only one approved by the Board of Trad Among the special meters exhibited may be noted the cor bined meter and maximum demand indicator; the two-ra supply meter; the double dial battery meter—integrating on one di the charge input and on the other the discharge output (in ampe or watt-hours)—and the single dial pattern—recording dischar in a clockwise and charge in an anti-clockwise direction. In th latter instrument an automatic relay slows up the charge regi tration by a percentage equal to the desired percentage excess charge over discharge; the dial pointer thus indicates the sta of the battery. Other integrating and indicating instrumen shown by this firm include various combinations of mot meters, portable standard meters and accessories, time meters a switches, high-tension transformer instruments, speed indicato taximeters, electric clocks and so on, almost, the visitor mig think, *ad infinitum*.

In the plant section we noted the "Witton" semi-enclosed, shun wound continuous-current motors varying in size from $\frac{1}{10}$ 110 b.h.p. and wound for any standard voltage. According requirements, these machines are supplied in various designs of t open, protected, semi-enclosed, totally enclosed and waterpro

atterns. Standard alternating-current motors for ¾—50 B.H.P. at 450 R.P.M., 50 cycles, and for one, two or three-phase circuits, are xhibited, in addition to a variable-speed three-phase motor controlled by regulating resistances. D.C. and A.C. small-power Witton iotors are shown coupled to various domestic appliances, and the lectrical "Mary Ann" and portable "Kleenall" and larger size acuum cleaners will doubtless be of general interest.

A novelty somewhat resembling the "Kleenall" is a motor-driven oor polisher, the motor, which operates a circular polishing brush, eing mounted on a broom handle.

A vertical oil engine direct-coupled to a 2-KW., 50-75-volt shunt enerator is typical of the plants recommended by the G.E. Co. for ouse lighting or isolated power supply in general.

A large variety of switches and controllers of every description is ffectively displayed, and is supplemented by a number of high and ow-tension accessories; the "Hoadley" current limiter and the Record" circuit-breakers and automatic battery cut-in and -out ear are worthy of special notice Various types of lighting, power nd telephone cables are shown, together with a new range of "Flame esisting" wires and cables; the conduits exhibited include namelled and sherardised types, the "Geekoduct" insulated conduit nd a complete range of accessory fittings.

Messrs. Wright & Wood, Ltd. (129, 130),

Halifax.

This firm has a representative display of its standard lines in iotors, generators, &c., and combined sets on view. These include ball-bearing rotary converter, typical of some 16 standard sizes;

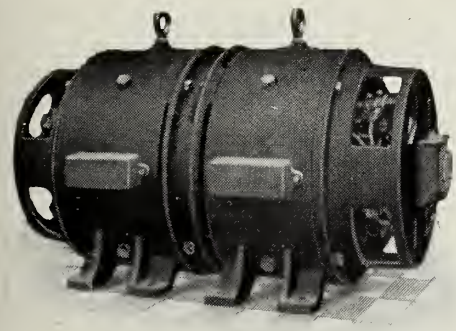


Fig. 121.—Duplex Motor-Generator

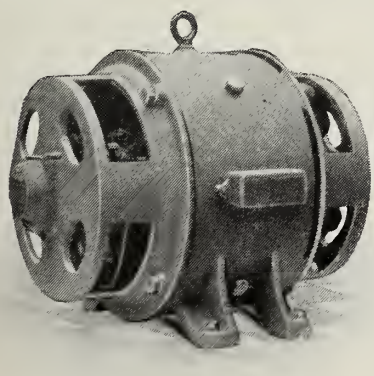


Fig. 122.—Single-Field Rotary Transformer.

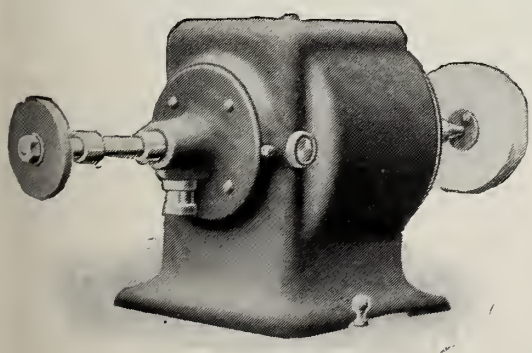


Fig. 123.—Electrically-Driven Polisher.

rotary transformer for cell charging, and a new duplex type nematograph motor-generator for 460/65 volts, and 1,100 R.P.M. This is a very compact and rigid machine, as may be seen in our view, fig. 121; it needs no bedplate, and cost, space and weight are much reduced; it is made in 14 standard sizes.

We illustrate in fig. 122 another of the firm's specialities for cinematograph work—a rotary transformer of the single-field type, for 460/65 volts and 1,100 R.P.M., which again is built in 14 standard sizes, as also are the ordinary type motor-generators exhibited both on this stand, and on that of Messrs. Ozonair, Ltd.

A range of ball bearing and other motors, of from ⅛ H.P. to 3 H.P. (230 volts), is on view, including a variable-speed interpole motor.

Fig. 123 shows one of the firm's electrically-driven polishers, examples of which can be seen on the stand

Union Electric Co., Ltd. (101, 114),

Park Street, Southwark, S.E.

Naturally, this stand is well equipped with arc lamps; the Union Kohinoor semi-enclosed type, in various patterns for D.C. circuits, and the Union Excello flame arcs, which have attained so great popularity, are freely disposed about the area, with a variety

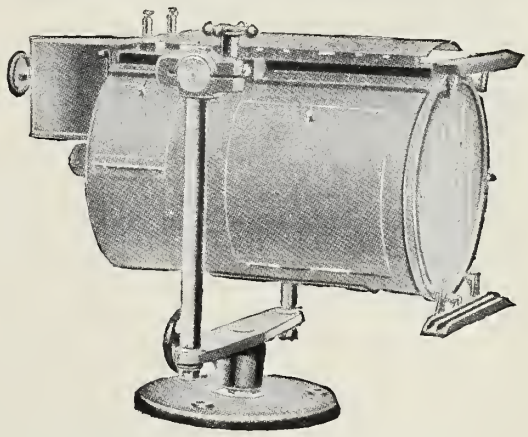


Fig. 124.—Searchlight Projector.

of accessories. The Union Triplex Kohinoor, which can be run three in series on 220-250 volts D.C., and various other arc lamps are also shown, including a number of photo-printing lamps. Searchlight projectors are represented by several examples, one of which is shown in fig. 124; this is specially designed for indoor use, or outdoors under cover, and is provided with an automatic arc and solid metal mirror. Larger projectors for ships' use and other purposes, and cinematograph projectors, are included.

The heavier branches of the company's work are also well represented. The largest item is a 100-KW. dynamo, with commutating poles, and a motor-generator supplies current to the stand for

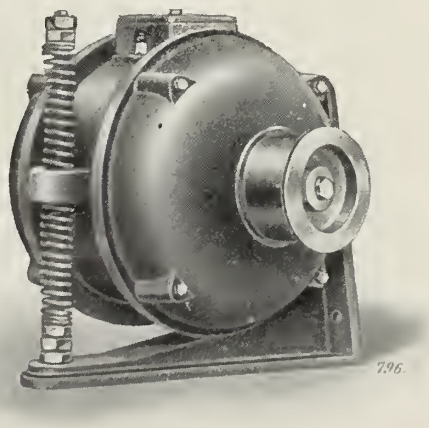


Fig. 125.—1-H.P. Loom Motor

lighting and power An interesting exhibit is a submerged motor and pump, the water being in actual contact with the insulated windings.

We illustrate in fig. 125 a 1-H.P., A.C. loom motor with flexible cradle suspension; similar motors are made of smaller and larger sizes, with high efficiency and power factor, and large starting torque. Various examples of the Union standard V-pattern dynamos and motors are also shown, embodying such features as forced ventilation, wide speed variation, &c., and A.C. induction motors.

Another item is a petrol-electric generating set for country houses, bioscope shows, &c., the engine being specially designed for continuous running at full load; this can also be adjusted to run on paraffin. An electrically-driven friction hoist designed for the use of builders, warehouses, &c., is included in the exhibit.

One of the company's strong lines is switchgear, of which a variety of patterns are shown. The "Fortiter" automatic field regulator, which cuts out resistance by means of a mercury trough

actuated by a solenoid with movable core, is a noteworthy item, its simplicity being a valuable feature. An automatic apparatus for paralleling alternators is also worthy of mention, being equipped with relays depending upon phase and voltage, which interact so that unless all the necessary conditions are simultaneously satisfied the paralleling switch cannot act. When, however, the proper values are attained, a circuit is closed which operates a pull magnet on the switch of the incoming generator: the latter is provided with

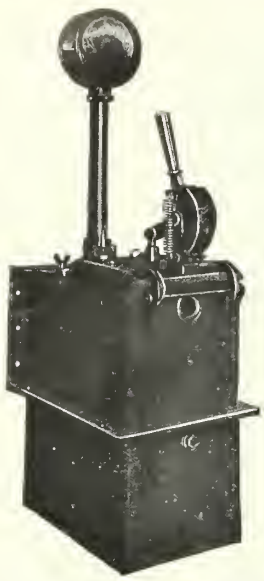


Fig. 126.—Union Mining Switch-Fuse.

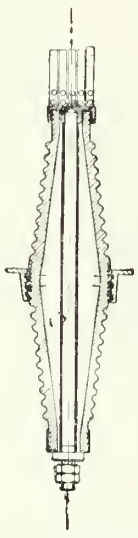


Fig. 127.—Section of Porcelain Insulator.

a time-element device, which ensures that the switch shall not be closed unless synchronism is actually maintained for an adequate interval. One such apparatus serves for paralleling any number of generators, if the pressure transformers and automatic switching-in apparatus of each machine are suitable for connection to the device.

Mining switchgear is, of course, to the fore; the company show a number of panels suitable for use above and below ground, one of which we illustrate in fig. 126. This is a switch fuse with ammeter for motor control, the switch breaking under oil; many hundreds of such switches, we understand, have been supplied by the Union Electric Co. to collieries in this country. An automatic starting

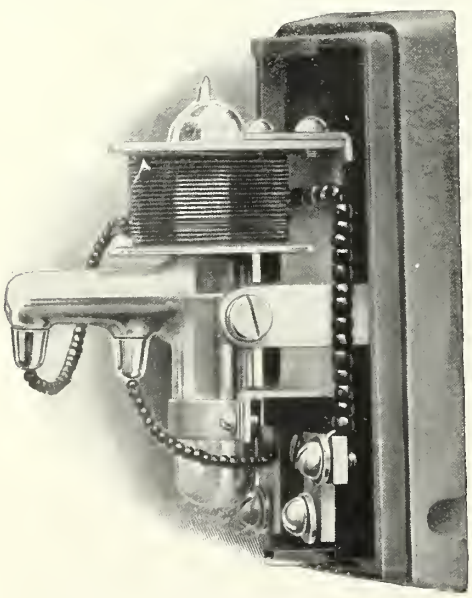


Fig. 128.—Union Current Limiter.

rheostat, without dash pots, in which the rate of switching on is controlled by a pendulum movement and relay, is a novel feature, and mention must not be omitted of the oil-break switches for pressures as high as 20,000 volts. The porcelain insulators used in these are made as shown in the accompanying section, fig. 127, this type being adopted for all pressures above 6,000 volts. The porcelain insulator is hollow, with walls of uniform thickness, and the copper conductor passing through it is further insulated with a tube of non-hygroscopic material; the insulators are fitted into cast-iron flanges screwed into the top of the switch, and can be removed bodily with the conductors. Switches thus designed for 10,000 volts have a breakdown pressure as high as 47,000 volts.

Space is wanting to deal with the extensive display of instruments exhibited, of the Hartmann & Braun type, stationary and portable; we can only, in conclusion, mention a current limiter (fig. 128), consisting of an exhausted glass tube with a horizontal leg, into which two series platinum contacts project; in the tube is mercury and an iron float, and round the upper part of it is a solenoid in series with the main circuit. When the predetermined current is exceeded, the float is drawn up, the level of the mercury falls, and the connection between the platinum contacts is thus broken. The design is obviously simple, the adjustment easy, and there are no wearing parts.

Messrs. W. Lucy & Co., Ltd. (96),

Oxford.

Messrs. Lucy's stand is something of a Mecca for the mains engineer; certainly the selection of disconnecting and joint boxes, feeder pillars, fuse boxes, and street lighting fittings, shown by this firm, bears out their contention that they supply "everything for outside work, except cable." Street lighting fittings for metal-filament lamps are quite a feature of Messrs. Lucy's business, and it is to be hoped that members of street lighting committees

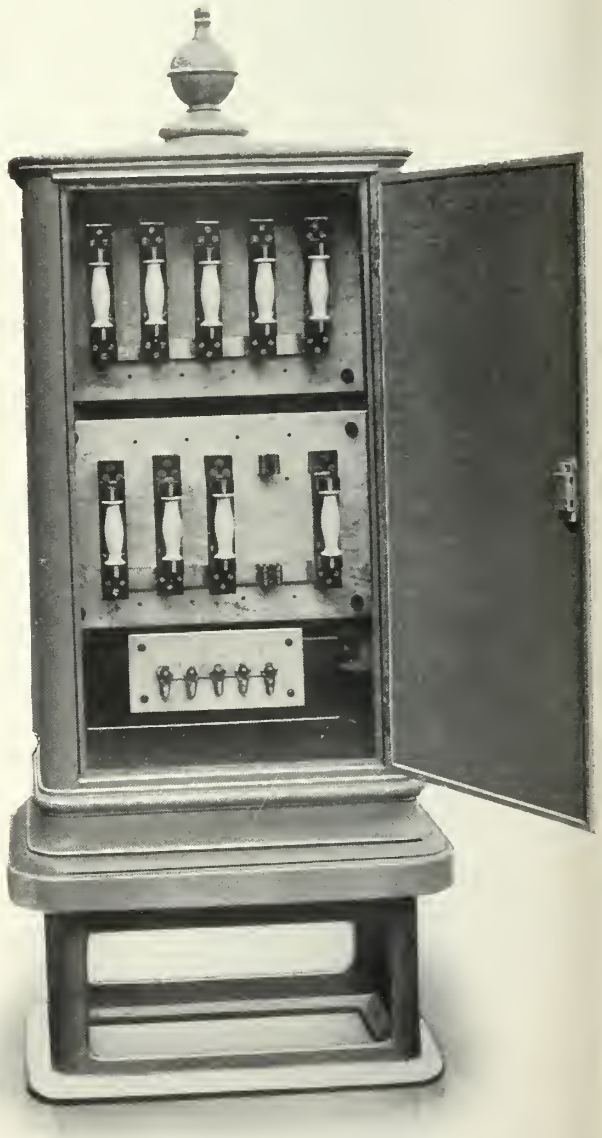


Fig. 129.—Lucy Standard Feeder Pillar.

on tour will inspect some of the various patterns of lamp shown o this stand.

Messrs. Brunner, Mond & Co. (260),

Northwich.

A simple but very effective pedestal showcase contains sampl of the various chemical products of this firm, directly interesting electrical engineers. Blocks of zinc and cadmium (of guarante purity 99·95 per cent. and 99·5 per cent. respectively), are plac between bottles containing powdered muriate of ammonia (98·5 p cent. AmCl), and the well-known "Voltoids" (compress ammonium muriate). Where the latter material is requir for use in considerable quantities (in tinning, jointing and so or the rectangular 18-oz. bars of "Salamac" offer a convenient for

The "Trident" Co. (281).

60, Water Lane, S.W.

Among a number of useful workshop tools and devices, we notice especially the "Grip" belt fastener. The construction and application of this fastener will be obvious from fig. 130. A number of A-shaped pointed staples are fitted with a slotted-strip holder as shown. Being thus held at the correct pitch, one set of staples is fixed to each end of the belt to be joined by hammering on a shaped anvil (as illustrated) or by the use of a special lever press. The two rows of staples are then intermeshed (or "sandwiched") and pinned, and the joint is complete. It is smooth and strong, and instantaneously uncoupled should occasion arise. A metal pin is sometimes employed, but hemp, cane or raw hide is amply strong (owing to the large number of shear sections conferned), and needs no special securing. It is difficult, with the hands alone, to break a single strand of cotton threaded through the meshed staples. The cost of this coupling is trifling, and the device can be fitted and manipulated by any person.

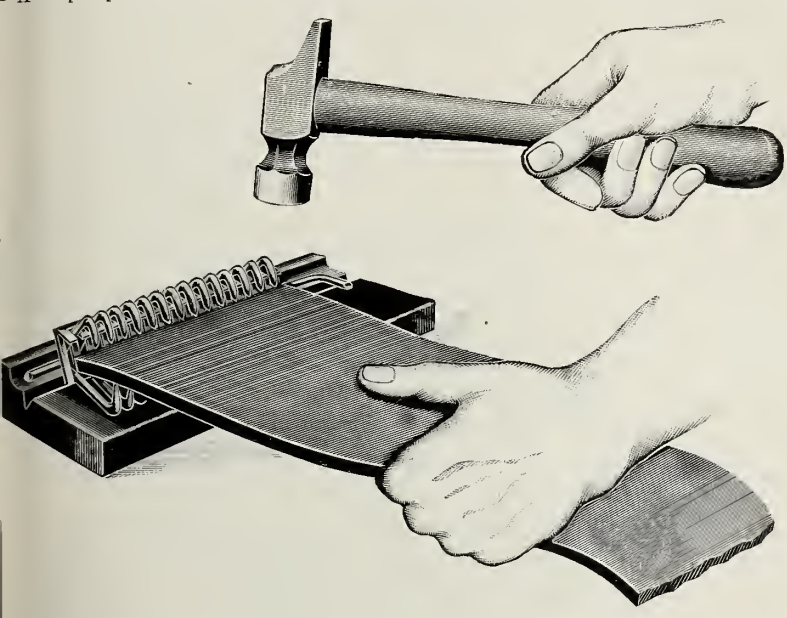


Fig. 130.—The "Grip" Belt Fastener.

The Lancashire Dynamo and Motor Co., Ltd. (122, 137),

Trafford Park, Manchester.

The company's most interesting exhibit is a 4 ft. × 4 ft. × 10 ft. Buckton planer fitted with the "Lancashire" patent reversing motor drive. This drive has been so successful that upwards of 150 equipments have been supplied during the last 18 months. Some particulars of the machine were given in our reference to Messrs. Buckton's exhibit (September 22nd, p. 467). Special attention is called to the accelerating device in the form of a small switch which is worked by adjustable stops on the planer table. It has two functions:—(*a*) Speeding up between cuts when two or more surfaces some distance apart are being planed; (*b*) speeding up when the tool has entered the work so that higher cutting speeds can be used without extra wear on the cutting edge of the tool. If necessary, the table can be retarded before the tool leaves the work, so that the end of the work is not broken. This has never before been done on any system.

The "Lancashire" method of driving a planer or other tool by a reversing motor includes a motor-generator supplied with either alternating or direct current. The generator is connected electrically to the planer motor, which is direct coupled or geared to the planer driving shaft. This generator and motor are direct-current machines, and may be wound for any convenient voltage.

A reversing switch is actuated by one light tappet rod from the reversing gear of the planer. When this is thrown over, it reverses the direction of the current in the field winding of the generator, thus reversing the direction of rotation of the planer motor. At the same time it so regulates the voltage of the generator as to cause the planer motor to run at the speed required, according to whether it is on the cutting or return stroke.

The cutting speed may be varied by hand to suit the work being done by means of a regulating resistance in the generator field. This gives a constant return speed, but if desired the return speed can be varied also.

A very interesting display of motors is given, in the design of which many new improvements are embodied. Various standard types of enclosure are shown, and from these a motor may be chosen suitable for practically any industrial drive. It is the firm's standard practice to fit endplate type induction motors with ball bearings.

Amongst the above we may particularise a protected type squirrel-cage motor of 20 B.H.P. at 2,900 R.P.M. (three-phase 50 periods), operating a Hodges blower delivering 3,000 cb. ft. of air per minute: a semi-enclosed shunt-wound D.C. motor of 5 B.H.P. at 1,000 R.P.M., driving a Davidson fan, and a totally enclosed vertical-spindle squirrel-cage induction motor of 7½ B.H.P., direct coupled to a Watson Laidlaw hydro-extractor. The motor drives the extractor through an automatic slipping clutch, enabling the motor to start up light, and the load gradually comes on when about two-thirds speed has been attained. The motor is switched straight on to the mains, no special switchgear being, therefore, necessary.

A chimney-ventilated wound-rotor induction motor of 15 B.H.P. for colliery work, together with other examples of the firm's A.C. and D.C. work, complete a very valuable exhibit from the power user's point of view. Practically all the machines are fitted with suitable switchgear by well-known makers, and can be shown in operation.

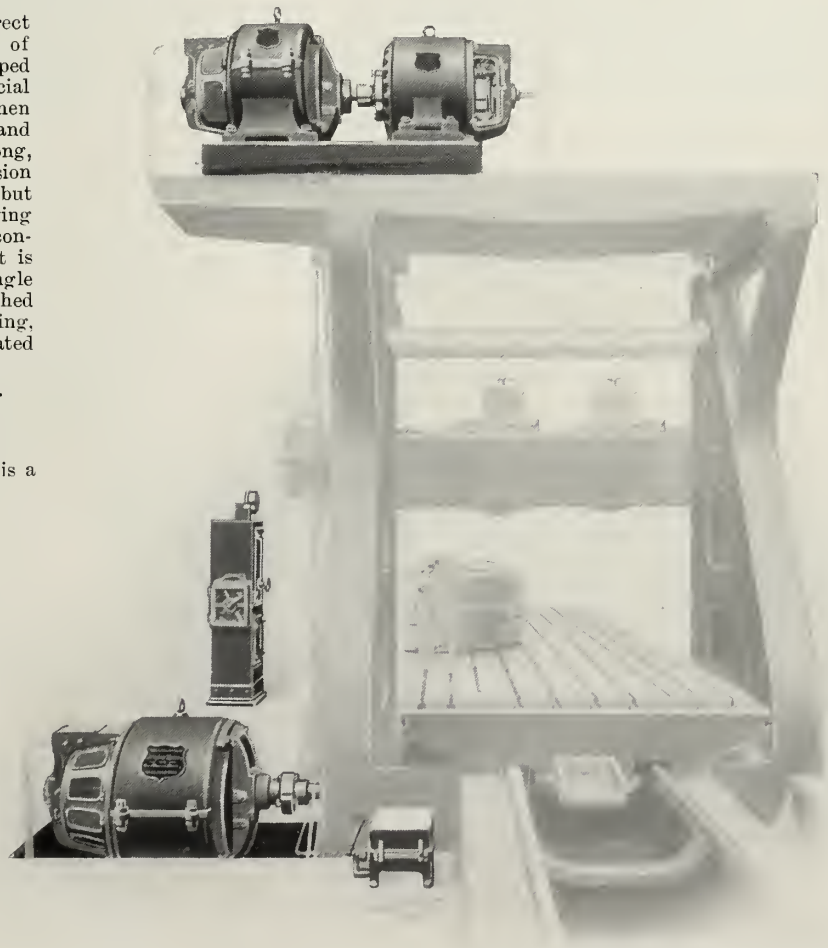


Fig. 131.—Planing Machine fitted with "Lancashire" Reversing Motor Drive.

C. W. Armitage (261).

Here those who are engaged in engineering works will find grease and oil-removing material, such as "Quixol" (for cloth, leather, &c.), and "Motol" (for the skin).

Bell Washer Co. (276).

To this stand there is a continual stream of interested visitors. The action of the machine exhibited is very easy, smooth and vigorous; the only improvement we can suggest is the addition of an electric motor.

Messrs. Berry, Skinner & Co. (129, 130).

78, Upper Thames Street, E.C.

No introduction is needed by our readers to the Berry switch specialities; suffice it to mention that a complete series of the Berry fool-proof gear is shown, including several recent patterns which are of more than passing interest.

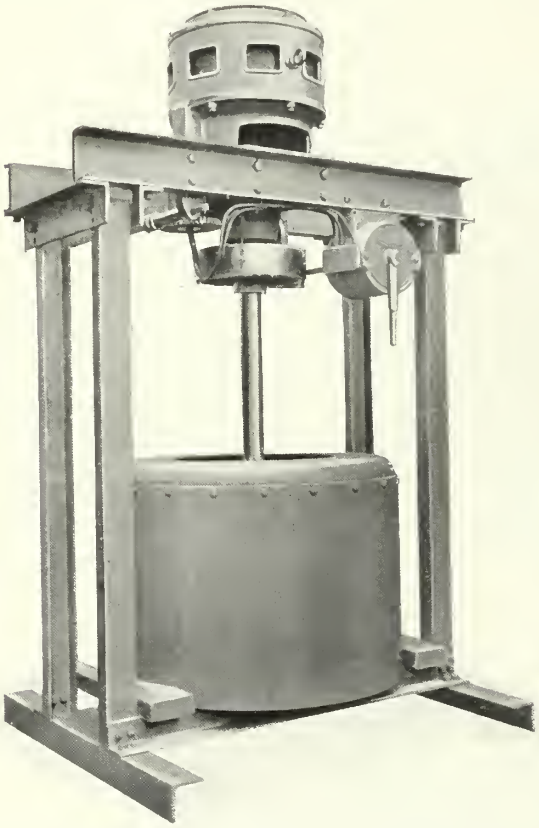


Fig. 132.—Electrically-Driven Hydro-Extractor.

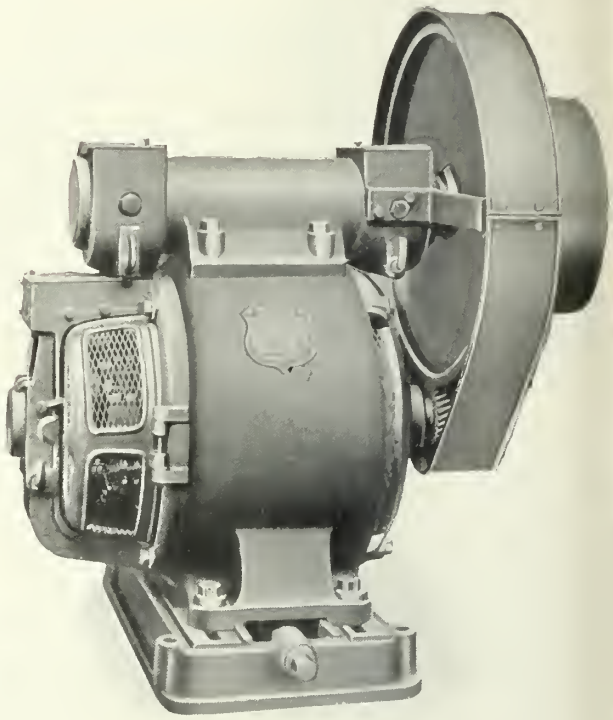


Fig. 133.—Back-Geared Motor.

Lancashire Dynamo Co.'s Exhibit (see p. 561).

One of these is the Firemine three-pole fused switch, which we illustrate in figs. 135 and 136. This is a very compact gear, with a heavy iron fool-proof and automatically interlocked case; it is provided with machine-faced flanges and well fitted cable glands. Only mica and metal are employed in its construction.

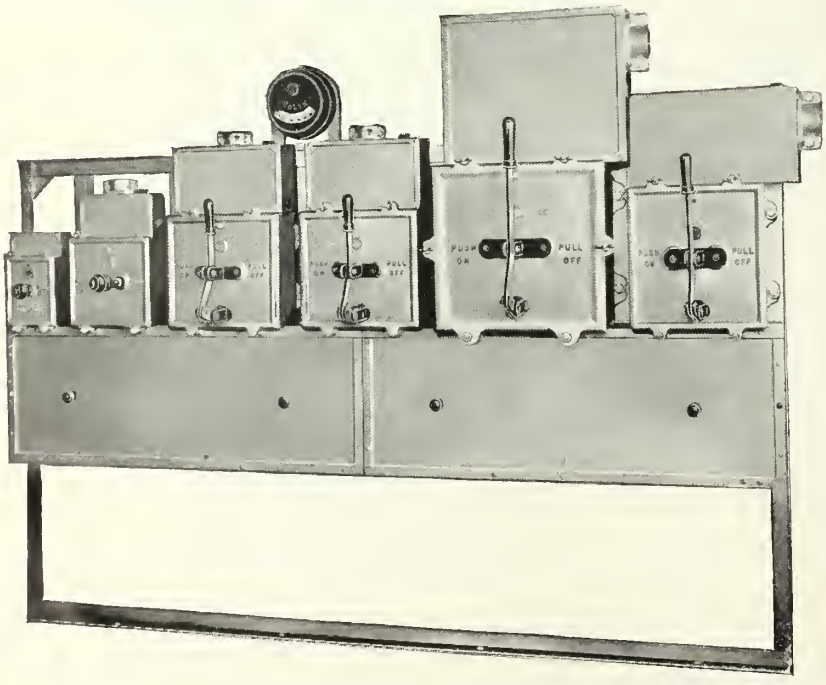


Fig. 134.—Berry, Skinner Mining Switchboard.

The switch contacts are controlled by carriage springs, and the mechanism and fuses are contained in the cover, which can only be opened when the switch handle is in the "off" position. Moreover, it is impossible to make circuit again without first fastening the cover on. Messrs. Berry, Skinner justifiably congratulate themselves on this apparatus, which has been tested as regards colliery application by Dr. Thornton, the well-known Tyneside expert, and appears to conform in every way to Home Office requirements.

Another speciality of this firm is built-up boards, for which their apparatus is very suitable. We illustrate in fig. 134 such a board for mining work, similar in type to one shown on the stand, for controlling five lighting and five power circuits. It is equipped with watertight Masta patent fused switches, trifurcating chambers, and armour clamps for cables; the bus-bars are enclosed in an ironclad chamber.

These boards are very compact, and as everything is get-at-able from the front, no back gangway is required, and none in front; in fact, we are informed that the estimated saving in freehold with board of this kind is sufficient to pay for the latter in the course of two years or so.

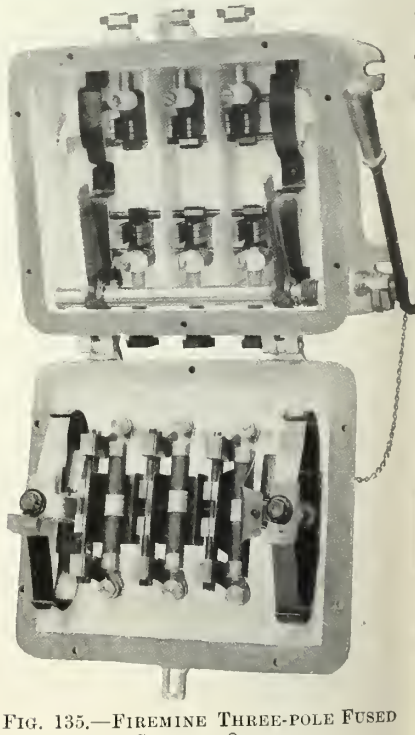


Fig. 135.—Firemine Three-pole Fused Switch, Open.

In passing we may mention the Dreadnought patent switch fus designed for, and approved by, the Admiralty, and capable of sul mersion in 14 ft. of water if required. This switch is simply an strongly made, dust and flameproof, and possesses the fool-proo features of the Firemine type, to which it is constructively some what akin.

The Rockfeller oil-break fused switch, shown in fig. 137, is a ne thing. This also is foolproof. Its peculiarity is that instead removing the oil tank in order to get at the switch mechanis

ne switch and fuse parts are lifted out of the oil by the opening f the lid, leaving the live contacts submerged. This enables the

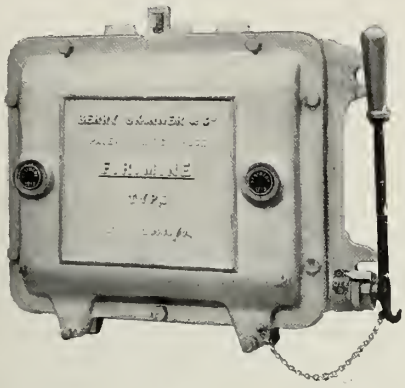


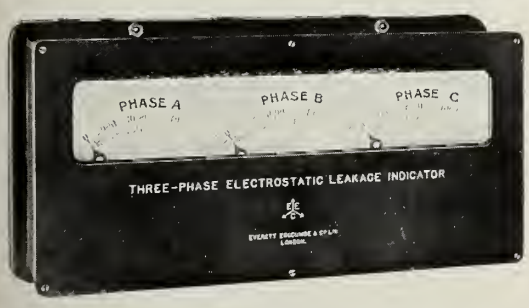
Fig. 136.—"Firemine" Switch, Closed.

ises to be replaced without the slightest risk. It is also worth oting that the firm are now arranging their standard apparatus ith single-cable inlets.

Messrs. Everett, Edgcumbe & Co., Ltd. (66),

Collindale Works, Hendon.

A wide range of instruments is shown at this stand, from which e have selected a few for special notice. Of these, fig. 139 shows a watertight" pattern of instrument., which is particularly intended r installation on board ship, in dockyards, collieries and other laces where it is likely to be exposed to severe climatic conditions. istruments of this class, manufactured by Messrs. Everett, dgcumbe & Co., are in use in very large numbers on practically l H.M.'s warships launched in recent years, to say nothing of ose belonging to foreign navies ; they are all thoroughly water-ght, and are subjected to a rigorous test under water at a pressure



IG. 137.—Three-phase Electrostatic Leakage Indicator.

f several pounds to the square inch. The water-tightness is as ecure after the glass front of the instrument has been broken as efore.

Besides Messrs. Everett, Edgcumbe & Co.'s well-known portable ngle and multi-range dynamometer wattmeters, they exhibit a



Fig. 138.—Induction Ammeter.

omplete new line of similar ammeters and voltmeters, which can e used quite indiscriminately on A.C. and D.C. circuits. A number f induction ammeters, voltmeters and wattmeters are shown, suit-ble for both high and low-pressure circuits. The great advantage possessed by them lies in the extremely long and open scale available (covering some 300° of arc), so that for switchboard work where visibility at a distance is a *sine quâ non*, they find much favour. They have recently been supplied in considerable numbers to the L.C.C. tramways and other large undertakings. Special care has been devoted to the elimination of errors, and the clearness of the scale is well shown in the accompanying illustration (fig. 138).

Leakage indicators for use in mining installations have long been a speciality of this company, and their instruments have been widely adopted. Fig. 137 shows a set of three-phase high-pressure

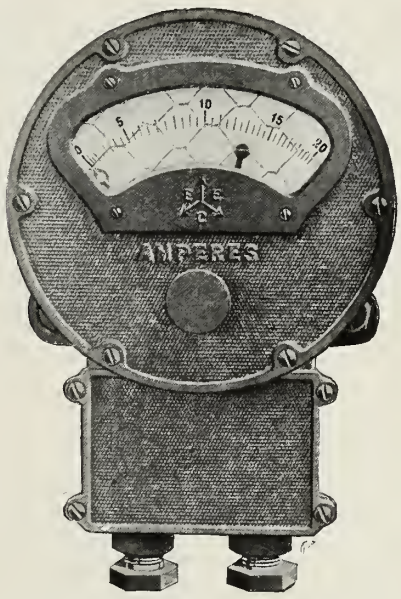


Fig. 139.—Everett, Edgcumbe Watertight Ammeter.

electrostatic indicators combined in an earthed metal case, which is suitable for use not only in mines, but in any high-pressure installation. Another useful instrument is a "potential indicator," fig. 140, designed to show whether the mains or bus-bars with which it is connected are alive or not. Half the dial is coloured red and the other half is white, so that the indication of danger is easily visible at a distance. The instrument itself is entirely cut off from the high-pressure circuit by two special condensers, shown beneath it in the illustration.

Tramcar speed indicators of an electrical type and trolley standard earth detectors are other exhibits ; A.C. relays are made a special feature of the stand, much attention having been given to these instruments by the firm, both for overloads and for reverse currents,



Fig. 140.—Potential Indicator for Bus-bars.

The new "Graphic" recording instruments, which we recently described, the well-known rotary synchroniser in its latest form (with stationary windings), electrically operated ships' telegraphs, and various photometers, tachometers, fault localisers, &c., are included in the exhibit, which, it will be seen, contains features of interest to almost every electrical engineer.

Messrs. Galsworthy, Ltd. (244),

15 *and* 16. *Newman Street, London, W.*

Messrs. Galsworthy, whose exhibit is just a few stands to the right on passing through the main entrance, have a display of various electric light fittings and accessories. A part of the stand is devoted to a feature which, as we observed, was attracting considerable attention, namely, the "Otovacuum" patent vertical direct-driven turbine vacuum cleaner. This is made in sizes for

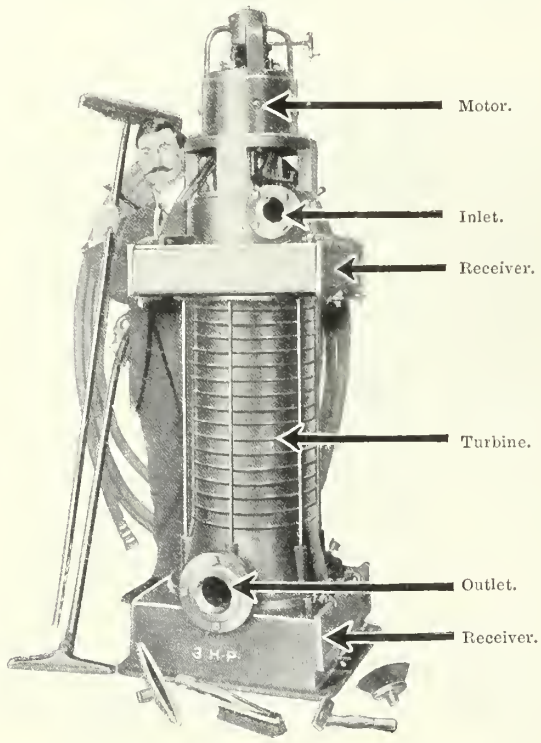


Fig. 141.—"Otovacum" 3-h.p. Vacuum Cleaner

from 1 to 120 h.p.; the smallest, 1 and 3 h.p., operate with one sweeper outfit, ranging up to 15 h.p. for the six-sweeper outfit, 30 h.p. for the 12-sweeper and 120 h.p. for the 50-sweeper outfit. A one-sweeper outfit will operate one renovator only, while a 12-sweeper outfit will operate 12 renovators simultaneously. The machines are vertical air turbines acting as powerful air pumps, and the shaft of the turbine is in each case coupled to the shaft of a vertical electric motor. There are no auxiliary wet dust

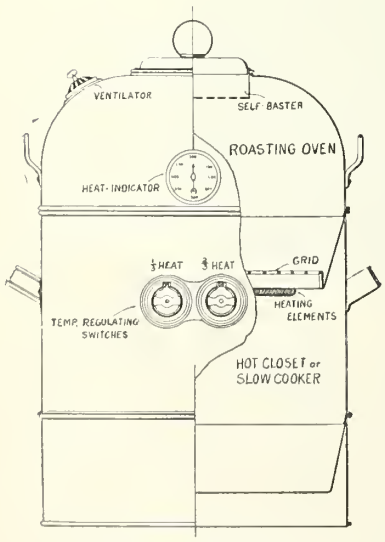


Fig. 142.—"Electroyl" Oven, Part Section.

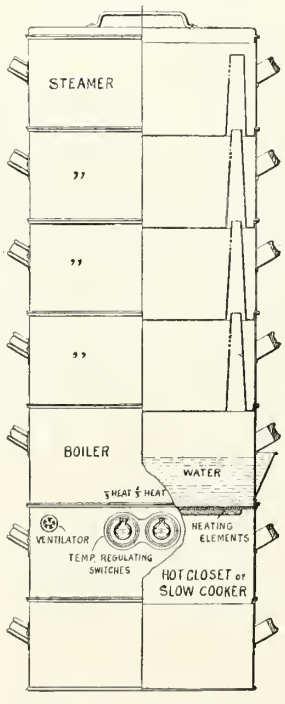


Fig. 143.—"Electroyl" Steam Cooker, Part Section.

separating tanks or pistons and valves to cause trouble. The machine is self-contained, and is designed to be installed in the basement, with one or more riser pipes running up through a building, through which all dirt and dust is sucked down and deposited in the dirt-receiving pans of the cleaner. The foul air which results from any cleaning by suction is conveyed by a pipe from the exhaust end of the machine to a chimney or sewer. For the cleaning of hotels, residences, public buildings and many kinds of factories the cleaner is recommended. The 3-h.p. sweeper outfit comprises two 25-ft. sections of suction hose, floor handle, wall handle in two sections, hand tool for upholstery, carpet renovator, bare floor tool and three brushes.

Messrs. Purcell & Nobbs (159),

87-89, *Cleveland Street, W.*

The most interesting novelty shown by this firm is the "Electroyl" patent oven; the "Electroyl" system of radiators—or rather, convectors—is well known, but this is quite a different thing. The essential feature of it is the arrangement of the heating element horizontally in the centre of the oven, closely applied to the underside of a pan, as shown in the accompanying section, fig. 142. The oven is made in three parts, forming two compartments: the upper is the roasting oven, and the lower, heated by radiation downwards from the heater, is a hot closet or slow baking oven. Access is gained to the upper compartment by lifting off the top section, and to the lower one by lifting off two sections. The top section or cover is curved so as to assist the circulation of the hot air, and is provided with a self-baster—a perforated vessel in the top in which fat can be placed, which melting drips upon the joint below. A direct-reading temperature indicator is fixed on the top



Fig. 144.—"Electroyl" Convector in the Adams Style.

section, and by means of two switches three rates of heating are provided. It will be seen that the heating element is perfectly protected from falling moisture or fat, and from its position and shape it exposes the minimum surface to radiation sideways, while it is most effectively situated for radiation into the lower oven, and for radiation and convection into the upper one. The oven is made of tinned steel, light to handle and presenting bright external and internal surfaces, so that radiation losses are reduced to a minimum. It is made in three sizes, taking 800, 1,000 and 1,200 watts at full-load respectively, and the price is very low.

A similar arrangement is employed in the "Electroyl" patent steam cooker, based on a well-known system. This consists of a pair of sections like the lower pair in the oven, upon which are piled a series of steamers to almost any number, as shown. Directly the water in the boiler reaches boiling point, all the steamers are ready for use; on removing the boiling pan, the top of the section containing the heating element can be used for frying, grilling, &c., with ordinary utensils. The steam cooker is also made in three sizes, from 800 to 1,500 watts.

Turning to the heating apparatus, a complete set of "Electroyl" towel rails is shown; these are hollow, of solid drawn oval tube and contain oil which is heated by a heating element in one of the vertical members, thus ensuring a good circulation of the fluid. There is also a great variety of "Electroyl" cooking apparatus, irons, convectors, &c., including a novel foot warmer and a fine example of a real Oriental brazier converted into an electric convector. In many of these apparatus the resistance heater for which

essrs. Purcell & Nobbs hold the patents—wire interwoven with pestos—is employed.

Some beautiful examples of art metal work are included in the hibit, and in fig. 144 we illustrate one of these—an upright nvector in the double ribbon Adams style.

Messrs. Gambrell Bros. (290),

Durham House, Clapham Common, S.W.

The exhibits on this stand include working models of various ctrical instruments, specially arranged for lantern demonstrations; standard cells, resistances and condensers; "fool-proof" gh sensitivity galvanometers of various types; galvanometer

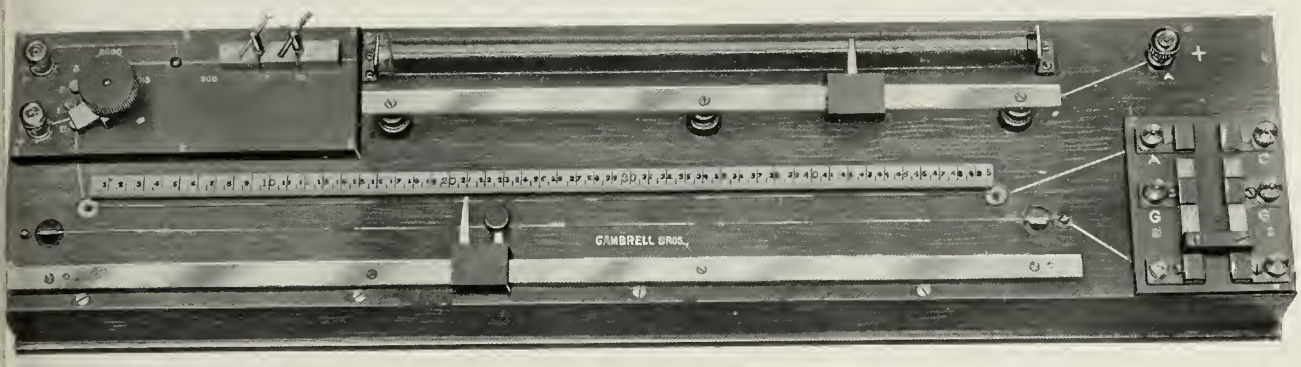


Fig. 145.—Gambrell Bros.' Thermo-electric Potentiometer.

les and other accessories, and the following entirely new paratus:—The high insulation testing key, illustrated in fig. 146, s a three-hole side spring as shown. This compels smart movent to the "charge" or "discharge" position, as the case may and then locks the key in this position with a firm contact ssure till the discharge or charge knob, respectively, is pressed until, by the "Insulate" key, a flat plate is pressed down across e central portion of the switch arm, thus bringing this into the position, where it is held by the central hole in the side spring. e thermo-electric potentiometer (Dr. L. Lownds), has only lately en perfected, and is now suitable for the measurement of any



Fig. 146.—High-insulation Testing Key.

all E.M.F., such as occur with thermo-elements. One mm. on the ided manganin slide wire corresponds to two microvolts. The ole of the connections of the instrument are lined out on the top ate, and the terminals are lettered, so that no connecting diagram required (see fig. 145). The working of the instrument is sensitive, curate and very convenient. A moving-coil galvanometer hibited presents no special features beyond its high sensibility, t this is extraordinary. The magnet pole-pieces are shaped to eld a uniform galvanometer scale.

Messrs. Gambrell Bros. are well-known manufacturers of every ass of testing-room apparatus and accessories, and it is probable at before the close of the Exhibition, they will be showing a new pe of wattmeter taking up to 1,000 amperes direct.

Globe Electric Co., Ltd. (120, 121),

11, *Farringdon Avenue, E.C.*

Lamps and instruments predominate at this stand; the well-own "Multax" flame arc lamps, in various patterns, the "Perl" closed arcs, and a variety of photographic arc lamps, &c., are own, and we illustrate one of them (fig. 149), the "Perl" inverted

type, with a translucent reflector, which while throwing most of the light on the ceiling, allows sufficient light to pass directly downwards to prevent that too perfect shadowless diffusion which renders the outlines of objects indistinct, and gives an unnatural and flat effect. The instruments are of recent introduction under the name "Globe-Nadir," and the company claim that they combine low cost with an unusually high degree of accuracy. Fig. 148 shows the "Globe-Nadir" universal testing set, which possesses an extraordinarily wide range of utility; it is a voltmeter, ammeter, resistance bridge, insulation tester, fault localiser, and battery testing set, all in one.

Space does not allow of our explaining how the various combinations required to effect the above-mentioned measurements are carried out, but the switches and terminals are arranged so as to facilitate the operations; shunts are provided in the case for currents from ·05 to 60 amperes, and resistances for voltages from ·005 to 480, and with the battery contained in the instrument resistances can be measured up to 1 megohm. A slide-wire bridge is contained in the lid. With additional shunts and resistances, and a hand magneto or other external source of pressure, the above-mentioned ranges can be very greatly increased. An ingenious device embodied in the instrument is a small mirror mounted on a long arm, by which it can be brought under the pointer at any position on the scale when special accuracy is desired; the mirror also carries an index by which the divisions of the scale can be further sub-divided, and the accuracy attained is guaranteed to within ± ·2 per cent.

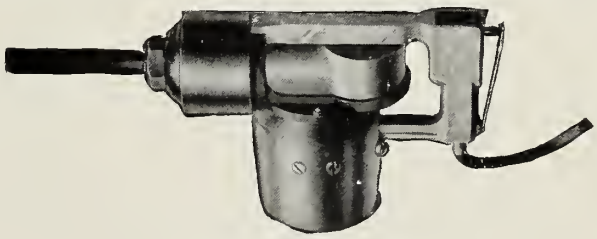


Fig. 147.—Globe Electromagnetic Hammer.



Fig. 148.—Globe-Nadir Universal Testing Set.

Galvanometers of various types, pyrometers and moving-coil instruments for switchboards and of portable types are also shown.

One of the most interesting exhibits is the Globe electromagnetic hammer, an excellent substitute for the pneumatic hammer, which

we illustrate in fig. 147. This can be used for percussion drilling, caulking, chipping, riveting, &c., and is claimed to afford the solution to a problem of long standing. A little series motor



Fig. 149.—"Perl" Inverted Arc Lamp.

drives the reciprocating mechanism, between which and the hammer element a magnetic cushion is interposed, eliminating shock and reducing vibration. The hammer element floats in a magnetic field inside a reciprocating sleeve, which is magnetised by a solenoid, and strikes 1,800 blows per minute; the whole thing weighs 25 lb., and is of handy shape, with a switch in the handle. The power consumed at full load is 220 watts, and the apparatus may be connected to an ordinary lampholder or socket. Ball bearings are used throughout, and the mechanism is enclosed in a strong metal casing. Other exhibits are the "Supra" brush-holder and brushes, and the "Glob-o-lite" illuminated sign, consisting of small glass balls held between metal plates, which are effective both by day and by night.

The special novelty about the Glob-o-lite sign is the method of holding the glass balls in position; they are cast with a flange or girdle round them, and are placed between two metal plates, perforated in accordance with the letter or device to be represented. The balls project through the apertures, but the girdle prevents them from falling out, and thus they are most securely fixed. The effect is excellent, and these signs require only a fraction of the illumination generally necessary.

Messrs. W. T. Henley's Telegraph Works Co., Ltd.

(178, 185),

Blomfield Street, London Wall, E.C.

An admirable and comprehensive exhibit has been arranged by this well-known firm. It includes insulated wires and cables in great variety, from the smallest silk-covered wires to specimens of the

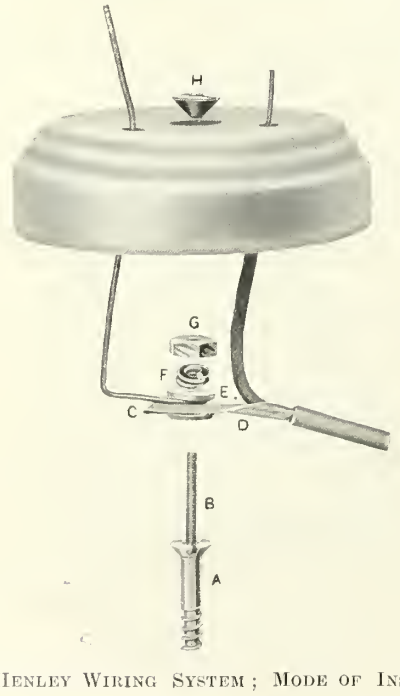


Fig. 150.—Henley Wiring System; Mode of Installation.

largest cable used in a British battleship (3 in. in diameter over the armour, 2 sq. in. of copper, weighing in all 92,000 lb. per mile), and the largest ever supplied to a colliery (·8 sq. in., three-core, 3,000 volts, 4¼ in. in diameter and weighing 145,600 lb. per mile). In addition to these monsters there is a portion of the cable supplied to the Marconi Co. for the Clifden and Glace Bay stations—a two-core armoured cable of 0·02 sq. in., made for 40,000 volts, but tested to 130,000 volts for 10 minutes; this cable was paper-insu-

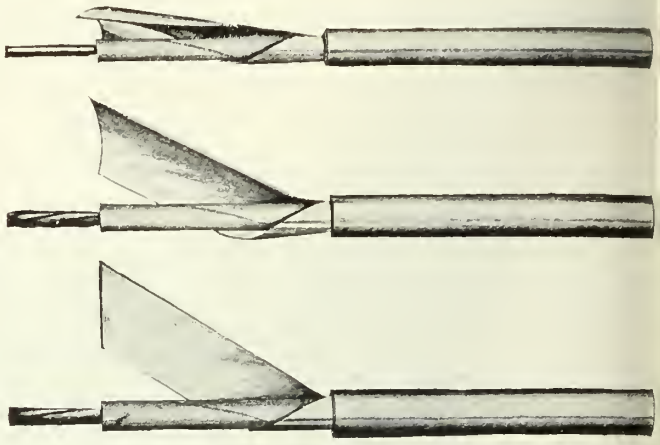


Fig. 151.—Henley Wiring System: Concentric Cables.

lated and lead-sheathed, and is used to carry direct current generated by Thury dynamos in series. Another interesting item is a three-phase loop-in feeder pillar, one of 150 supplied to the

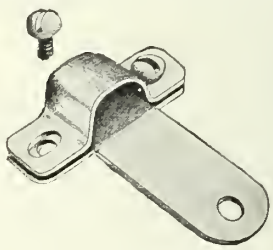


Fig. 152.—Normal Pattern.



Fig. 153.—For Back Entry.

Bonding Clamps for Twin-Wire System.

Buenos Ayres and Pacific Railway; this is provided with a socket for an arc lamp-post on the top, and is made with a separate chamber for each phase, as shown in the section, fig. 154, each set of

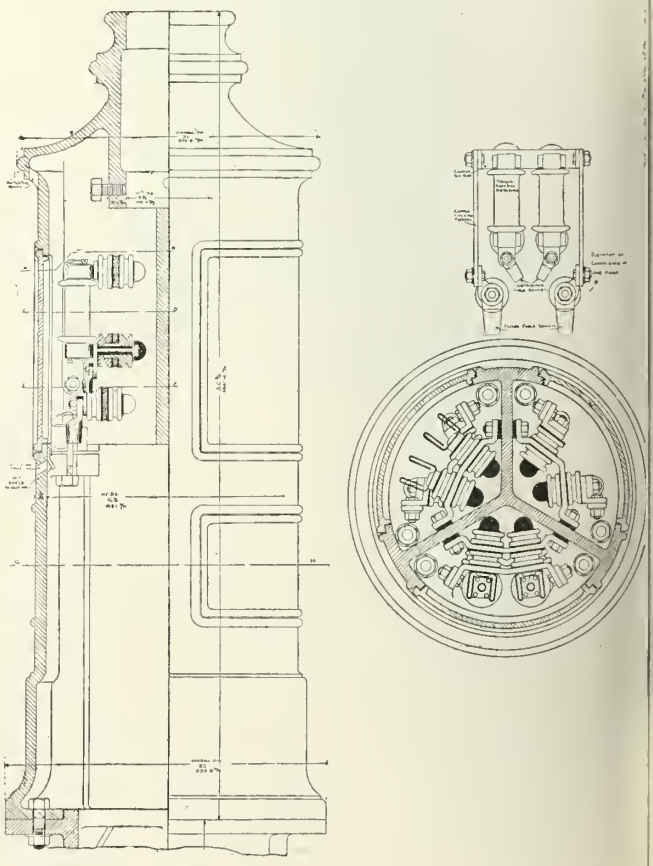


Fig. 154.—Loop-in Feeder Pillar, Sections.

terminals providing for two distributors with fuses. Space for the arc lamp circuits is found below the high-pressure portion of the pillar.

Rubber driving belts and gloves, and a variety of trailing cables
coal-cutters, protected with hard-cord braid, leather, tarred
rline, &c., as well as three-core flexible with hard-cord braiding
hand-lamps and portable tools, and diver's flexible four-core
ble, with a tension centre, form note-
rthy features of the exhibit, and
monstrations are given of the extra-
linarily rapid action of ozone upon
lcanised rubber, which is, however,
evented by a special covering devised
Messrs. Henley's, and shown at the
nd.

The Henley wiring system, which has
t been brought out with a view to
eting the urgent demand for a simple,
eap and efficient method of wiring
all installations, presents novel and
enious features, which are illus-
ted herewith. The special wire used
of the concentric type with un-
ulated outer; the inner conductor
sists of 1/18, 3/22 or 3/20 wire,
ulated with vulcanised rubber, and
outer of a tinned copper tape
und upon the core in a spiral with
ong lay, the whole being sheathed
th a solid-drawn tube of special
oy, which possesses a high degree
ductility, so that the cable can be
t sharply and straightened out
in without injury. The three sizes
de are shown in the accompanying
. 151, and the method of wiring in
. 150. The screw A, which is screwed
o the wall or ceiling, is drilled and
ped, and the stud B is screwed into
head; the washer C is then slipped
and is followed by the outer con-
tor D, in which a hole is punched for
purpose with a plier punch. A
ss washer E and a spring washer F
then put on, and the nut G is screwed home. Lastly, the
od block is put in place and secured to the stud by the cone-
ped nut H.

Connection is made with the fitting by means of a short wire put
with the outer conductor, and a length of the inner conductor
shown. The whole thing is extremely simple, and the system
be used wherever an earthed outer is permissible. The cables
cleated to the walls with brass or lead saddles. Ordinary
ndard accessories are used with the system.

For use where the concentric system is barred, the company
pply cables of the flat twin type, the insulation being of
canised rubber, sheathed with the special alloy above mentioned.
ese are used in the customary way, the only special fittings being



Fig. 155.—Candle-Bracket Fitting.

Albert C. Hands (2),
30, *Snow Hill, London, E.C.*

A useful collection of electric light pendants, brackets, candle fittings, and so forth, in various designs, styles and finishes, with glass and silk shades, are to be found on this stand, also electric radiators, Mr. Hands being a specialist in this department of the electrical trade. An artistic example of his candle-bracket fittings, and a luminous radiator, are shown in figs. 155 and 156 as representing the display.

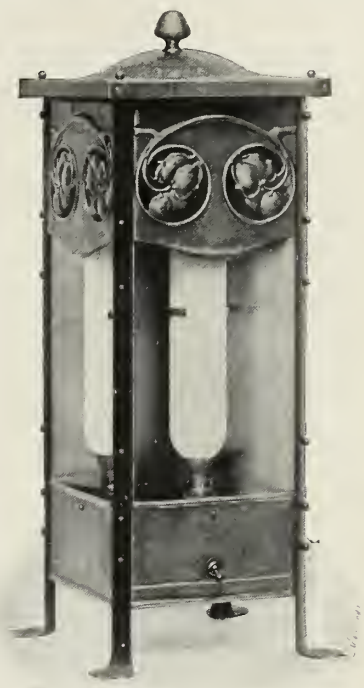


Fig. 156.—Hands Luminous Radiator.

Messrs. Evershed & Vignoles, Ltd. (168),
Acton Lane Works, Chiswick, W.

The beautiful instruments shown on this stand comprise examples of most of the company's well-known standard lines; they include meters of both moving-coil and moving-iron types, stationary and portable. One of our illustrations (fig. 158) shows a new three-range portable moving-iron ammeter for both A.C. and D.C., which needs no transformer, the change of range (to measure accurately from 1 to 100 amperes) being effected by means of a floating terminal of special design. The cell-testing voltmeter, which can be dropped without fear of damaging the pivots, has recently been described in our pages. Fig. 157 shows a recording voltmeter fitted with Murday's patent pen, which is carried on knife edges in a stirrup at the extremity of the hand, moving at right-angles to the motion of the paper. This ingenious device enables

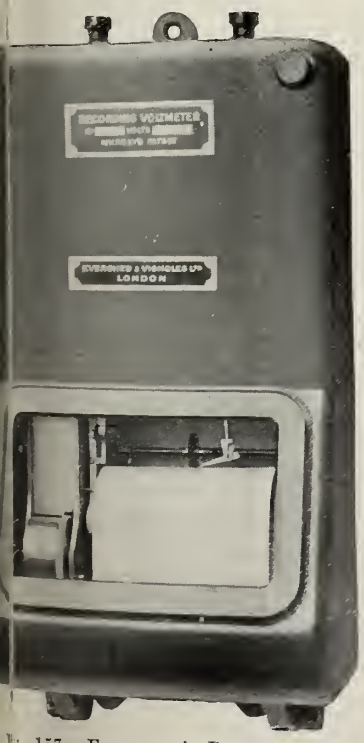


Fig. 157.—Evershed's Recording Voltmeter.

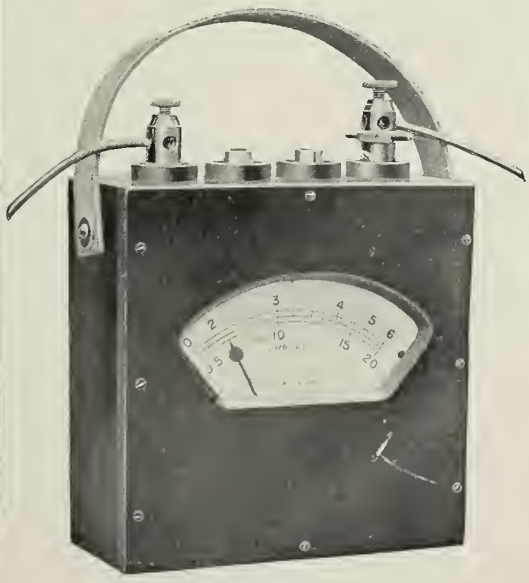


Fig. 158.—Three-range Portable Ammeter.

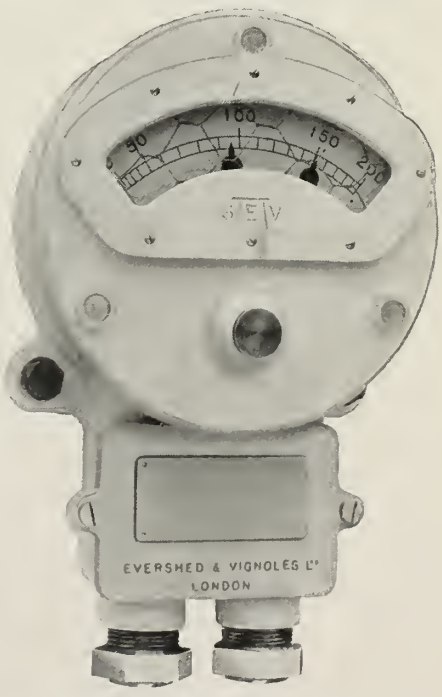


Fig. 159.—Admiralty Ampere Gauge.

the bonding clamp, fig. 152, which is nicked so that it can also be used for back entry, fig 153. Where the conditions necessitate further protection for the wiring, a light steel covering is fixed over the cables; this may also be used for appearances' sake where necessary. The chief points claimed for the systems described are their low initial cost, low cost of installation, and extreme simplicity; and certainly all these claims appear to be fulfilled.

rectangular co-ordinates to be used on the chart instead of the usual curved ones, making the record easier to read.

Electrical speed indicators which indicate on a voltmeter are exhibited, as well as a patent electric soldering iron called the "Thermobit," which is readily connected to an ordinary lamp-holder.

The Admiralty pattern ampere gauge, illustrated in fig. 159, is of the moving-iron type, in a gun-metal case, and is water-tight and shock-proof; many other electrical instruments are made by the company for use on board ship, such as helm indicators, stoking indicators and telegraphs. The "Megger" and its associated instruments, such as the "Ducter" and the "Dionic" water tester are, of course, exhibited.

The Lazilite Co. (316),

Southampton House, High Holborn.

The accompanying illustrations show the "Lazilite" adjustable fitting at its full extension of 5 ft., and also totally closed; it is constructed of No. 14 gauge steel strip, and is strongly assembled. The great advantage gained over fittings of a movable kind is that any horizontal point can be reached within a circle of 10 ft. diameter, by simply moving the lamp by hand to the desired position, as the arm rotates through 360° about its point of suspension. Further, the light may be adjusted to any desired vertical

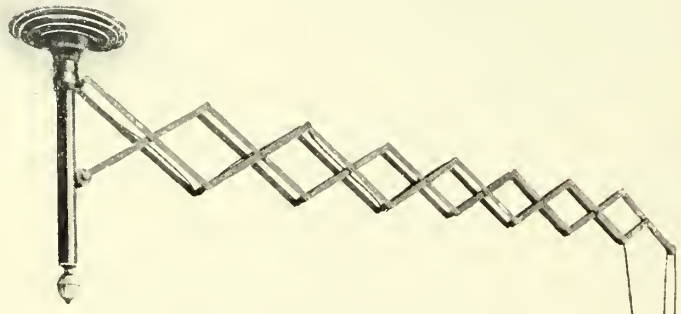


Fig. 160.—Lazilite Fitting Extended

position by means of a rise and fall pendant attached to the end of the arm. It is supplied in a standard finish of dull nickel; other finishes such as brass, oxidised silver, &c., can be supplied as desired. The fitting is manufactured by the Lazilite Co., who will be pleased to demonstrate its numerous advantages to our readers at their stand.

The Hoffmann Manufacturing Co., Ltd. (149, 162),

Chelmsford.

This company has a very interesting exhibit of steel balls and ball bearings—the specialities for which it is famous.

To electrical engineers the Hoffmann bearing is more than a name; it has been widely adopted in all classes of generator and motor work, as may be gathered from the fine series of photographs of machines on which these bearings are being successfully used. Many of the leading makers have now standardised complete ranges of machines with these bearings, and visitors to the stand will do well to inspect the latter, as well as the firm's patent ball-bearing hanger in use on a line of shafting, for which purpose it has been signally successful.

Bi-Metals, Ltd. (324),

80A, *Southwark Street, S.E.*

The skilled workman, no less than the despairing amateur, will find a solution to all soldering difficulties in the well-known "Tinol" *paste-solder*. It is necessary to italicise these words since few persons can be brought to realise that "Tinol"—composed of practically pure tin and lead in conjunction with a certain oily flux—is in itself a complete soldering material and not merely a soldering paste. Visitors are being shown the efficacy of the composition by demonstrations on most unpromising materials, and by most unlikely methods. Dirty copper wires up to No. 18 S.W.G. are easily soldered by the smoky flame of a wooden match; hacksaws and malleable castings are thoroughly tinned by the mere application of "Tinol" and heat. Six compositions of the paste are available, and for certain purposes a core of "Tinol" is enclosed by a sheath of high grade solder. Besides the material itself, the exhibit includes a number of useful Tinol accessories and equipments.

"Rapid" Magnetting Co., Ltd. (10),

18, *The Crescent, Birmingham.*

This firm is exhibiting three types of electromagnetic separators excited by independent dynamos or the ordinary electric supply, as may be most convenient. The "Standard" machine is of the radial magnet drum type, and has an output (based on brass turnings), of 2 cwt. to 2 tons per day, according to size; this separator is especially suitable for materials containing a high percentage of iron, and repeat orders have been received from Government departments. Type "A" separator is a similar machine, except that the drum is now built up of alternate rings of iron and brass; it is designed for the removal of iron and steel from all kinds of large scrap and refuse. This type is now in use by the Birmingham and Glasgow Corporations, among others. Where material containing very little iron (whether in large pieces or minute particles) is to be treated, the type "BB" separator is most suitable. This is an inclined-tray machine, having a series of powerful electromagnetic bars of alternate polarity, extending the width of the shoot, and magnetised over their whole length: the separator is largely used for treating raw, ground or calcined bones, ground rubber, cotton seed, &c.

Messrs. H. Wiggin & Co., Ltd. (247),

55, *George Street, Birmingham.*

This firm shows an interesting selection of its various electrical resistance materials. Besides the more ordinary German silver and copper-nickel materials, visitors should pay special attention to the "Tarnac" (copper-nickel-manganese), "Ferry" (copper-nickel), "Ferrozoid" (nickel-steel), and "nickel-chrome" grades of resistors. All these alloys are characterised by high strength, high specific resistance and low temperature coefficient of resistance. "Ferrozoid" has a tensile strength of 42·4 tons/sq. in., a temperature

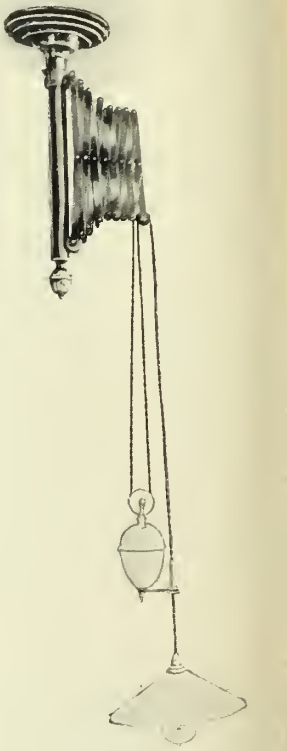


Fig. 161.—Lazilite Fitting Closed.

coefficient of resistance (per 1° C.) of 0·00076 and a specific resistance of 84 microhms/cm³. The corresponding figures for "nickel-chrome" are 47·1 tons/sq. in.; 0·00024 per 1° C.; 93 microhms/cm³. "Ferrozoid" has an extraordinarily low coefficient of expansion, viz., 0·00000706 per 1° C., but is subject to slight surface oxidation. Nickel-chrome, however, can be run at white heat for some time without damage.

The various resistance materials are shown as bare and covered wires, strips and stamped flexible grids; cotton, silk or asbestos covering is available. Attention may be called to the reels of No. 47 S.W.G. pure nickel wire and to the "Ferry" 6/14 strand resistance cables as used by the Admiralty for searchlight work.

"Chicago Rawhide" Co., Ltd. (272),

Hythe Road, Willesden, N.W.

This firm makes an artistic exhibition of its various grades and sizes of heavy and light belts, laces, rope and twist. Rawhide blanks for gearing and "stripping," as used for protecting various underground cables, are shown, in addition to oak-tanned leather, hair, balata and cotton belts. Rawhide belting is specially supple yet dense, owing to the avoidance of lime and acid processes in manufacture; it is 40-60 per cent. lighter than the equivalent tanned belting, and can be built to four or more ply without serious loss of pliability.

Messrs. Braun & Co. (259),

King's Cross, London, N.

This exhibit includes a most interesting series of models ranging from a vacuum pump for cow milking to the model engines of the famous Rolls-Royce "Silver Ghost" and a tiny Helicopter aeroplane. All interested in the difficulties and accomplishments of model engineering should certainly visit this stand. We understand that nearly 3,000 inventions and models now pass annually through the King's Cross Works.

Messrs. W. H. Wilcox & Co., Ltd. (177, 186).

23, Southwark Street, London, S.E.

This firm is present with a representative and effective exhibit of the very wide variety of engineers' stores and engineering manufactures for which it is so well known. Among them will be observed lubricating oils, cylinder oils for high-speed engines for electrical installations, steam turbine and dynamo oils, all kinds of electrical installation stores; also engine and other packings, Penberthy patent injectors of several patterns for boiler feeding, Wilcox semi-rotary pumps, Wilcox-Turner triple-acting pumps, lubricators, beltings and driving bands, stocks and dies for electric conduits, electric drills and grinders, steam engine and boiler fittings, and so forth.

Messrs. C. W. Burton Griffiths & Co. (205, 210),

Ludgate Square, London, E.C.

A number of new machines are on view here. First there is a portable radial drilling machine, by Collet & Engelhard, with self-contained electric motor, suitable for drilling holes at almost any angle and in every position within reach of the radial arm. The machine is mounted on runner wheels, so as to be easily transported. An "M. C." gear-cutting machine is shown for working by the hobbing process, and especially intended for small gears of fine pitches, such as are found in the mechanism of electric meters, recorders, &c. The machine has a big output, and works at a high speed. Several sizes are made, and each can be arranged for spur gears only or for spur, worm and spiral gears. Other exhibits include a radial head automatic slot drilling machine for cutting slots or mortises in metal; a "Rice" patent high-speed ball-bearing sensitive drill, with three spindles and slow motion for tapping; a collection of small sensitive drilling and tapping machines for clock and instrument work; a "National" counting machine, a 6-in. "Acme" sawing machine, a Brown electric furnace and Brown pyrometer, grinding and milling machines, and various small tools.

Messrs. James Proctor, Ltd. (23, 38),

Burnley.

This exhibit consists of one of the firm's patent shovel stokers with moving firebars, which, as far as possible, mechanically imitates hand firing, also their patent coking stoker with self-cleaning firebars, which operates with a "ram" action, laying the coal well inside the furnace.

The rams are protected from burning by the charge of coal, and they are made with loose ends, which can be easily renewed.

A Proctor coal elevating and conveying plant is also shown, and attention may be directed to the "ram" feed fitted on the elevator boot, by means of which fuel is fed without friction or jamming into the moving elevator buckets, the usual plan being, of course, to feed the fuel direct into the boot through which the buckets are dragged.

The Unbreakable Pulley and Mill Gearing Co., Ltd. (25, 36),

West Gorton.

A complete range of the firm's specialities is exhibited, including bearings, couplings, pulleys, clutches, wall brackets, hangers, &c.

Among the bearings are the ingenious Skefko swivel type, also Cooper roller bearings, and Vickers patent type in which forced lubrication is obtained by a self-contained pump. The Reny patent flexible coupling may be mentioned as suitable for electrical uses, also the well-known Benn friction clutch, of which three types are shown, and which has met with very wide adoption in mill driving, &c., in sizes up to 1,000 H.P. The diminution of starting effort with modern frictionless bearings is impressed on the visitor by means of a testing machine on the stand.

Post Office Telegraphs and Telephones (283, 29, 32).

The Post Office Telegraphic exhibit at Olympia is in working order, and demonstrations are being given. Among the modern apparatus which is intended to illustrate the appliances at present in general use in the Post Office are the following:—The Wheatstone A.B.C. Apparatus, which is used chiefly at small country post offices where the assistants are unable to use the ordinary Morse instruments. This instrument will gradually be displaced by telephone apparatus. The double plate sounder shown is in reality an improved single needle instrument, but this apparatus has been abandoned by the Post Office, and is gradually being dispensed with generally, the sounder and telephone being looked upon as the standard instruments for the future. Double plate sounders are now chiefly to be found in railway telegraph offices. The single current sounder circuit is the simplest form of Morse circuit; it is useful for short circuits with a fair amount of traffic, and where the operators engaged are trained telegraphists. The double current duplex circuits system enables much longer distances to be worked over, owing to the rapid reversal of the currents in the line, and when a larger capacity is required from a circuit, the first step is to duplex the set. The Wheatstone automatic system is used when it is necessary to get a large quantity of work over a limited number of wires in a short space of time. The speed of this system may be anything up to 400 words a minute. The Wheatstone automatic system is that usually used for Press work, as the perforated slip can be used several times.

The Hughes type-printing apparatus and the fast repeater apparatus used in connection with the Wheatstone automatic system are shown. Specimens of modern telegraph and telephone cables, and a specimen in miniature (one-third actual size) of a telegraph line illustrating the method of construction and twisting wires to prevent inductance, are also exhibited.

Classified as ancient apparatus, the following are on view:—Wheatstone's four-needle instrument, which was used in 1838 Highton's single-needle instrument, 1848; double-needle instrument used at Buckingham Palace, 1851; Bright's bell, 1854; sounder and galvanometer combined, 1870; specimens of early forms of relays, electrometer, thermopile and the early Hughes type-printing telegraph; insulators used by Sir W. F. Cook, 1838-1847; Cooke and Wheatstone (Fossil) telegraph, 1837; early form of lead-covered cable laid at Chalk Farm, 1840; specimens of submarine cable, 1846; specimens of old pneumatic tube with carrier, 1854-1870; samples of incrustation of submarine cables and aerial wire; specimen of telegraph pole damaged by woodpeckers.

It was one of the first-mentioned of these "ancient" type instruments that was instrumental in securing the capture of the notorious Tawell, the Quaker murderer. The feat was not accomplished without difficulty; the instrument could not make the letter Q, and but for the ingenuity of the telegraphist, who spelt Quaker "Kwaker," the murderer would have escaped.

The Post Office has, in addition to the above, a separate telephone exhibit. This takes the form of a working telephone exchange, which will be known as the "Olympia" Exchange. It includes a switchboard of three working positions. The circuits of exhibitors at the Electrical Exhibition are connected with the switchboard, and subscribers obtain the same telephonic facilities from their stands as are afforded to subscribers to an ordinary telephone exchange. The equipment is of the latest common-battery type. The signalling between telephones in the stands and the switchboard is by means of miniature incandescent lamps fitted in the panels above the operator's keyboard. Connections are made by means of pairs of plugs and cords provided with lamp supervision. The accumulator battery at the rear of the stand provides energy for speech transmission and signalling; it is charged from the 220-volt direct-current supply through a voltage-regulating resistance comprised of 32-C.P. carbon-filament lamps fitted upon a power panel. The exhibit includes two strips of heat coils and lightning protectors (two heat coils and two protectors for each telephone circuit), two strips of line fuses (one pair to each telephone circuit), one bay of lamp-controlling relays, one bay of meters for recording calls made by subscribers, and other miscellaneous apparatus. Two demonstration telephones are also provided in order to show visitors more clearly the various steps taken in dealing with a telephone call.

Messrs. Marryat & Place (150),

28, Hatton Garden, E.C.

This firm have a stand in the centre of the Main Hall, where they have erected one of their latest pattern automatic electric lifts on a steel structure reaching to a height of 50 ft. They claim to have developed the automatic electric lift from the electrical side to the highest pitch, whilst profiting by the experience of others in mechanical details. The difficulty with push button lifts has been that with a brake of constant strength, the floor levelling varies according to the load; that is to say, when travelling with light load the car will stop a little above floor level, and when travelling with heavy load it will stop somewhat below floor level. This floor levelling error increases with the speed of the lift. To get over this difficulty, manufacturers have contrived various floor-finding switches fitted in the well.

Messrs. Marryat & Place's arrangement gets over the difficulty without the aid of any well switches, the whole apparatus being self-contained and fitted either at the top or bottom of the well, and they can run their lifts at three to four times the speeds previously possible with automatic control. The wiring and erecting costs are greatly reduced, and the whole apparatus is rendered extremely simple and reliable.

The lift exhibited is equipped with both push-button and car-switch control, together with a two-speed apparatus, the latter being a great convenience in places where it is sometimes required to operate the lift slowly for convenience of nervous or invalid people and at other times rapidly for general business.

Patent Castings Syndicate, Ltd. (273),

Balfour House, Finsbury Pavement, E.C.

This firm undertake every class of die casting; their success depends on the use of hard steel dies, and a wide range of patent alloys varying from soft Babbitt metals to specially hard, tough and non-corrodible materials. Wherever repetition work is concerned, parts can be turned out much cheaper than by machining. The cost of special machine tools is avoided, and absolute accuracy and interchangeability is guaranteed. The parts are suitable for use without machining or fitting, and the greater their complexity, the greater the saving over other methods of production. A large number of samples are exhibited, having various mechanical and electrical applications, and they deserve the careful attention of designers, works managers, and others.

Wandsworth Electrical Manufacturing Co., Ltd. (244A),

London and Birmingham.

This firm specialises in the smaller branches of house fittings such as tumbler switches, plugs, ceiling roses, fuse-boxes, &c.

As regards tumbler switches, the hundreds of decorative and plain patterns on view meet every requirement; we noticed a two-way tumbler switch with the base recessed, lead-covered cable, also a tumbler switch with a special master key handle, for use in corridors of large institutions, asylums, &c.; the attendant carries the key with him for switching on the lamps, and it cannot be withdrawn unless the switch is off and the lamps are out, thus preventing waste. We also noted a plug-box screwed for conduit wiring and a special two-way tumbler switch with an "off" position.

The small switches can be had with either circular or rectangular covers, and finished in either silver, bronze or copper, of Empire, Georgian or Adams styles as required. The firm have specialised in and largely developed the "flat" type of tumbler switch, which is very compact, and one of their manufacturers which has found considerable favour in the Far East is a tumbler switch with china cover and ebonite nob, and mounted on three feet, for use in damp situations.

Messrs. Siemens Bros. Dynamo Works, Ltd.

(179, 184, 206, 209),

Tyssen Street, Dalston, London, N.E.

Next week we shall allude to the variety of exhibits shown by this firm. We may now, however, call attention to their collection of electric light fittings in all types of finish and many-period designs. Fittings of the Adams, Jacobean, Elizabethan, Old Dutch and Georgian periods can be seen, with suitable glassware and tantalum and "Onewatt" lamps installed. Wall brackets, table lamps, electroliers and outside lanterns figure in large variety. There is also a fine selection of electric radiators, economic stoves and heaters, together with necessary accessories for use in conjunction with same. Naturally, the tantalum and "Onewatt" lamps figure conspicuously. There is a special range of low-voltage lamps (20-50-volt) made in 10 and 16-C.P. sizes, suitable for use with house transformers for economical private-house lighting: also a range of 50-C.P. lamps suitable for use on 100-130 and 200-250-volt circuits. These lamps can be obtained in either bell-shaped or spherical bulbs. A range of lamps from 100-600 C.P. have now been placed on the market, and it is hoped, before long, lamps up to 1,000 C.P. will be forthcoming. The tantalum lamp is made in a range of from 20-250 volts for candle-powers from 16-50. A mechanical device demonstrating the strength of the lamps is seen on Stand No. 209. It consists of two rotary arms, at each end of which are mounted tantalum and "Onewatt" lamps respectively. These are set in motion and rotated by means of an electric motor, which accounts for a certain amount of vibration, and owing to the speed at which they revolve, the centrifugal force, acting upon the hot filament, is sufficient to break the more fragile type of lamps. As our readers are aware, a practical demonstration of the great strength of these lamps can be seen on some of the underground tube railways, such as the Great Northern and City, where they are installed in the trains. We understand that groups of tantalum lamps have given a life of over 5,000 hours when subjected to tube railway car vibration.

"Onewatt" battery lamps for motor-car headlights are also being exhibited, and sample showcards are displayed which contain one of each type of "Onewatt" battery lamp at present supplied by Messrs. Siemens Bros. Dynamo Works, Ltd. A variety of carbon-filament lamps are exhibited in a show-case, which has a revolving wheel mounted at the back driven by an electric motor. On each spoke of the wheel is a different type of lamp (all under current), and this is revolved at a rapid speed. These lamps are the carbon-filament traction type with anchored filaments. Carbon-filament lamps for collieries, photographic purposes, private house and general purposes, are also present. With regard to glassware, a wide selection of fancy glass shades in satin etched and opalescent finish, and a number of cut-glass shades, are exhibited. Holophane glassware suitable for use in conjunction with tantalum and "Onewatt" lamps can be seen, and demonstrations will be given to anybody interested. The new "Household" type of Holophane reflectors, which are designed primarily to combine an efficient distribution of light with artistic effect, may also be seen, and are in actual use on some of the fittings on the stand.

August Reichwald (256),

Exchange Buildings, Newcastle-on-Tyne.

"Festonit" and "Festo-Bakelite" insulating material for the electrical trade is here shown in various shapes and forms. It is supplied in sheets and plates for cutting up into any required sizes, and also for switchboards, distributing boards, electricity meter boards and baseboards. Motor terminal boxes, hand lamps, switch handles, bushes, arc shields for controllers, are all made of "Festonit," and "Festonit"-covered bolts, &c., for overhead tramway work form one of the firm's specialities. "Festonit" can be moulded and machined.

"Festonit" and "Festo-Bakelite" are claimed to be of high insulating value, great dielectric and mechanical strength, to resist heat and cold. "Festonit" plates of 8 mm. to 10 mm. thickness compare favourably in price with slate or marble of 25 mm. thickness.

Besides the plain plates for switchboards and distributing boards, &c., there are made special plates for these purposes with thickened rims, which, although having the appearance and strength of thick marble or slate, are reduced in weight and price to meet the competition of slate or marble, irrespective of the other advantages which are derived from using "Festonit" and "Festo-Bakelite."

Metalite, Ltd. (176, 187).

London and Derby.

The woman in white who first catches your fancy on this stand bears upwards a number of "Metalite" metal-filament lamps, one of 100 C.P., and four of 200 C.P., being placed either vertically or at angles, which are regarded as testing their ability to burn in any position. Along the sides for the lighting of the stand there are a number of 50 and 32-C.P. "Metalites."

The Electric Home.

In the Model Electric Home Messrs. John Barker & Co., Ltd., of Kensington, S.W., have prepared an exhibit which both does them credit and forms a great attraction to the public, whether they are interested in the more technical exhibits or not. The "Home" is to be found in the gallery just over the ELECTRICAL REVIEW's stand at the farther end of the building. The building is in French Renaissance style, and of the decorative work and furnishing we need say little here. Of course, the visitor can observe how electricity can be employed for everything, lighting, cooking, heating, pumping, and so forth. In the words of the official description, the lighting of the drawing room is "by means of electric lamps coyly hidden in the coves," and everywhere the electrical details make a very attractive appeal to the visitor and impress him or her more than any other exhibit in the building with the easy adaptability of electricity to every class of operation to which the housewife and the domestic are accustomed in the twentieth century home. While it is, no doubt, true that many of those who have passed, or will pass, through these rooms cannot afford to change their ways over to the completely electrical in their existing or even new homes, there have been or will be others who can, and doubtless will, do so as the result of what is to be seen here. And those who cannot adopt electricity throughout will no doubt be so impressed that they will go as far as they can and use it to a limited extent at first. The Home has its own generating plant, consisting of a 4-B.H.P. paraffin engine (2·5-KW.) coupled to a 50/75-volt dynamo. There is also a 50-volt 27-cell battery capable of maintaining 125 16-C.P. metallic-filament lamps for seven hours on one charge. This "power house" supplies the necessary energy for the electric heating irons in the laundry, the cooking stoves in the kitchen, the electric light bath, massage instruments, electric fans, radiators, electric irons, and the lighting throughout the dining, drawing and bedroom and hall, also for working the small pump used in the garden, and for rendering necessary services in the garage. From the general public point of view we regard this exhibit as being one of the utmost interest, as experience has proved such features to be at other electrical exhibitions.

Messrs. John Barker & Co., Ltd. (280),

Kensington, W.

The well-known Kennedy bending machine and specimens of its work are on view. This machine will, in its various sizes, bend tubes from $\frac{1}{8}$ in. diameter up to 2 in. diameter to radii from $1\frac{1}{8}$ in. to 8 in. Moreover, the tubes are bent cold and unloaded, even though they be of the open joint type. Various patterns of the machine are arranged for power drive or hand operation by various means. Top and bottom and side blocks completely prevent distortion of the work during bending, various sizes and shapes of the central former being used according to the nature of the work handled. Visitors can see and test the machine in actual working, and the many edge-bent strips, S-bent angle irons, and so on, are striking examples of the excellent results obtainable. A special machine has been introduced for cold-bending round or square bars—from $\frac{5}{8}$ in. rod on $\frac{1}{2}$ in. radius up to $1\frac{1}{2}$ in. rod on 1 in. radius—for reinforced concrete work.

The Stern-Sonneborn Oil Co., Ltd. (28, 33),

Royal London House, Finsbury Square, E.C.

This company has, as the central feature of its stand, and one which will undoubtedly interest power station engineers, an exhibit of an oil-testing machine, of which we may be able to publish descriptive particulars later. The company's "Sternol" transformer, turbine, high-tension, switch and brake, and other electrical and engineering oils, also "Sternoline" motor grease for electrical machinery, bearing grease, commutator paste, and other similar specialities are, of course, well in evidence.

Various Exhibits.

MESSRS. WINSTON & CO. (294) are exhibiting a selection of general optical goods, including small microscopes, combination achromatic lenses and ophthalmometers, besides a useful range of clinical and dairy thermometers and various types of spirit levels.

THE ACME LADDER CO. (301) exhibit a number of extension ladders and similar appliances for use in trimming and cleaning electric lamps, replacing fuses, and, in fact, performing any "overground" work.

TAYLOR'S "quick-grip" spanners (Gallery stand 302) are exhibited, and are applicable to any nut or fastening over a wide range of sizes. A special cone spanner acts also as a wire-cutter and wire grip, and has specially shallow jaws.

Combination knife and tool sharpeners, files and magnetic screw drivers are being shown, together with other engineering tools, by the DIAMOND STEEL CO. (258), E. KRONEY & CO. (285), and the EXCELSIOR TRADING CO. (305).

Lacquers.—THE FREDERICK CRANE CHEMICAL CO., of 22 and 23, Newhall Hill, Birmingham, make a speciality of suitable lacquers for tools. The lacquers may be applied by dipping, brushing or spraying. Spraying machines may be seen in operation at the company's works.

NOTES.

(*Continued from page* 554.)

Fatal Tramway Accident.—On Monday morning a ing man named Wm. Knight died at Birmingham General spital as the result of a tramway accident which took place late Sunday night at Smethwick, by which 12 persons were injured. ar from the city was proceeding up Cape Hill, Smethwick, when ething went wrong. The car began to run back, and the driver being able to check it, it dashed into another one which following about 50 yd. behind. The force of the impact was reat that both cars were driven down the steep decline and e into collision with a third standing at the bottom. Knight a passenger in the second car, and the chief injuries were ained by passengers in this car. With the exception of Knight a Mrs. Davis, who was also seriously injured, all the other engers were able to proceed home. The driver of the second escaped death by jumping off.

Associated Municipal Electrical Engineers (eater London).—At the last meeting, the Association elected following officers :—

President : W. C. P. Tapper, Stepney.
Vice-Presidents : F. A. Bond, Battersea ; L. L. Robinson, Hackney ; A. H. Shaw, Ilford.
Hon. Treasurer : G. G. Bell, Hammersmith.
Hon. Auditors : J. G. Bruce, Willesden ; E. Calvert, Finchley.
Hon. Secretary : Norman Staniland, Hornsey.
Council : S. W. Baynes, St. Pancras ; J. H. Bowden, Poplar ; H. H. Couzens, West Ham ; C. S. Davidson, Barnes ; A. J. Fuller, Fulham ; F. Hill, Hammersmith ; W. Innes, Poplar ; C. Newton Russell, Shoreditch ; P. E. Rycroft, Heston ; E. Sayer, Hampstead ; A. H. Seabrook, St. Marylebone ; W. C. Ullmann, East Ham.

wing to the kind permission of the Institution of Electrical ineers, the Association meetings are now held at the new itution buildings, and the dates of the meetings will be fixed advance. The Association had under consideration at its ting various matters of interest, including the question of a ensive combination between the power and light authorities luding gas companies) in times of general strikes. The ociation visited the Electrical Exhibition at Olympia on ober 4th.

Educational Notes.—Borough Polytechnic Insti-E.—We have received the prospectus for the new session, which s particulars of the various courses, including evening classes lectrical and mechanical engineering, motor-car engineering, Dr. J. Henderson is head of the Electrotechnics Department. session began on September 25th.

Institution Notes.—Institution of Electrical Engi-rs (Students' Section).—The hon. sec., Mr. D. Batts, 3, lwych Road, London, N.W., wishes to call the attention of those bers of the Students' Section who desire to read papers to the that it is necessary that notice of such intention be sent to him ediately, in order that the announcement of such intention be embodied in the programme of the session, which is now g drawn up.

The G.E.C. Athletic Club.—The G.E.C. Athletic Club ed their football season on Saturday last on their new ground Villesden with a stirring game between Head Office (Osram .) and Queenhithe Branch (Magnet F.C.). The game was very on account of the boisterous wind which was blowing from end d, the ball being very hard to control. A hard fought game lted in a win for the "Osram" team by 3 goals to 2. The tary will be pleased to hear from any club connected with the stry with a view to fixing up matches for the coming season.

Appointments Vacant.—Day lecturer in engineering nematics at the Northampton Polytechnic Institute (£120 per on). Second engineer-in-charge for the Ilford U.D.C. Electty Works (£120). See our advertisement pages to-day.

The Evolution of Wiring Systems.—In the article on 56, which went to press early in the week, the cost of installation amp in No. 10 should read 13s., not 12s.

Smoke Abatement Exhibition.—The Manchester and ord Smoke Abatement Exhibition will be held in the City Hall, rpool Road, Manchester, from November 10th to 25th. We erstand that everything points to the event being a success.

Enquiry.—Makers of the "Eclipse" arc lamp are asked

Institute of Metals.—The autumn meeting was held wcastle-on-Tyne last week. A report will appear in our next

At the Church Congress.—Sir R. Hardy, speaking at ley, on Tuesday, on the peace question, said, "The machinery at Hague was a splendid engine, provided there was a dynamo to it." (*As reported in the Westminster Gazette.*)

Electrolytic Zinc.—It is stated in the *Board of Trade Journal* that a method for the electrolytic refining of zinc has been invented by Mr. Chitaru Yoshida, proprietor of the Kano Copper Mine, Iwashiro Province, Japan. This new process will, it is stated, enable zinc to be refined in Japan, which hitherto has not been commercially possible. Up to the present zinc ore has been exported, and the refined metal imported. The process is being patented, and the right of working it in Japan has been leased to the Mitsui Bussan Kaisha.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Brighton T.C. on September 28th rejected, by 37 votes to 11, a motion to increase the salary of Mr. C. C. Fowler, assistant manager of the electricity works, from £350 to £375 per annum, rising to £400 a year hence. By 27 votes to 13 it was also decided not to adopt a proposal that the salary of Mr. G. T. Joyce, chief clerk, be increased from £250 to £300 per annum, but the salary of Mr. T. Henwood, mains superintendent, was increased from £3 10s. to £3 15s. per week, and that of Mr. W. Charman, meter inspector, from £2 2s. to £2 5s. per week.

At the Electricity Works, Factory Lane, Croydon, last Saturday afternoon, Mr. A. C. Cramb, the borough electrical engineer, was, on the occasion of his approaching marriage, made the recipient of a present from the staff and employés of the Corporation Electricity Department. The present took the form of a large silver salver suitably inscribed. Mr. W. Burr, deputy borough electrical engineer, made the presentation, wishing Mr. Cramb, on behalf of the staff and employés, the best of health and happiness. Mr. Cramb suitably responded, acknowledging the good feeling which prompted the gift, and expressing his appreciation.

On Friday, September 29th, the staff and workmen of the Pontypridd Urban District Council's Electricity Department presented Mr. E. C. Gaccon, charge engineer, with a marble timepiece to celebrate the occasion of his marriage. The presentation was made by Mr. J. E. Teasdel, engineer and manager.

Tramway Officials.—Mr. Arthur J. Hardy has resigned his position with the Engineer-in-Chief's Department of the General Post Office, London, to take up an appointment as secretary of the Malta Electrical Tramways.

General.—Amongst those who have been awarded the Edward Medal, Second Class, for bravery in rescue work at the Pretoria Pit, Hulton disaster last December, is Mr. James H. Polley, electrician at the Hulton Collieries.

Mr. W. C. Field, who was formerly with Messrs. Harry Cox and Co., has joined the Bryant Trading Syndicate, Ltd.

The marriage has taken place at Los Angeles, California, of Mr. F. G. Garstang, electrician, formerly of Blackburn, to Miss Margaret A. Kenna, also of Blackburn.

Mr. Fred Farrar, until recently in the Electrical Engineering Department of Blackburn Technical School, has been appointed demonstrator and lecturer in Electric Wiring at Fleetwood Technical School.

On leaving the British Thomson-Houston Co., Ltd., of Rugby, to take up an appointment with the British Westinghouse Co., at Manchester, Mr. W. H. Wood was presented by the staff with a marble clock.

Obituary.—We regret to learn that Mr. Wm. Shuter, late chairman of the Telegraph Construction and Maintenance Co., Ltd., passed away on Tuesday, October 3rd, at Hampstead, N.W., at the age of 82 years.

NEW COMPANIES REGISTERED.

Ormskirk Electric Supply Co., Ltd. (117,854).—This company was registered on September 29th with a capital of £3,000 in £1 shares, to acquire and take a transfer of, and all benefit and rights under the Ormskirk Electric Lighting Order, 1900, to adopt an agreement with the Ormskirk Urban District Council, and to carry on business of suppliers of electricity for light, heat, motive power or force, &c. The subscribers (with 1,000 shares each) are :—Rhodes Motors, Ltd. (A. L. Rhodes and R. Salem, directors), 90, Charing Cross Road, W.C. ; A. L. Rhodes, Armthorpe, Doncaster, electrical engineer ; J. W. Speight, The Elms, St. Annes-on-the-Sea, electrical engineer. Private company. The provisional directors are A. L. Rhodes, R. Salem and J. W. Speight. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

London Electric Treatment Co. (1911), Ltd. (117,852).—This company was registered on September 29th, with a capital of £100 in £1 shares, to take over the business of an electric light cure and electro-therapeutic institute carried on by the London Electric Treatment Institute, Ltd., at 43 and 44, New Bond Street, W., and to adopt agreements with E. E. Greville and E. W. B. Wright. The subscribers (with one share each) are :—L. Dick, 16, Dover Street, W., motor hiring agent ; P. C. Brocas-Parsons, 28, Sackville Street, W., engineer. Private company. E. W. B. Wright is the first managing director. Registered office, 43 and 44, New Bond Street, W.

Clevedon and District Electric Supply Co., Ltd. (117,847).—This company was registered on September 29th, with a capital of £12,000 in £1 shares, to carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in cables, wires, lines, accumulators, lamps, &c., and to adopt an agreement with Christy Bros. & Co., Ltd. The subscribers are:—F. W. Taylor, Highfield, Chelmsford, auctioneer, 100 shares; G. Wilks, 17, Duke Street, Chelmsford, auctioneer, 1 share; F. Ward, 40, Broomfield Road, Chelmsford, solicitor, 1 share; L. F. Christy, 51, Broomfield Road, Chelmsford, electrical engineer, 100 shares; C. E. Smith, 7, Park Road, Chelmsford, electrical engineer, 1 share; A. A. Gates, 20, Glebe Road, Chelmsford, clerk, 1 share; F. Christy, 53, Broomfield Road, Chelmsford, electrical engineer, 100 shares. Minimum cash subscription, 6,000 shares. The number of directors is not to be less than three or more than seven; the first are F. W. Taylor, L. F. Christy and F. Christy; qualification, 100 shares; remuneration as fixed by the company. Registered by Duffield and Son, Chelmsford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hydraulic Power and Smelting Co., Ltd. (117,141).—Particulars of £1,000,000 debentures, created August 29th, and secured by trust deed dated September 4th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £875,000. Property charged: 5,000 "Bearer" shares of the Aktieselskabet Tysssefaldene of 500 kroner each; 5,000 "Bearer" shares of £100 each in the Norsk Elektrisk Metalinsurtri Aktieselskab and 6,000 registered shares of 100 kroner each in the Trollbattans Elektrollhaus Electrotbermiska, Aktiebolag, and the company's undertaking and property, present and future, including uncalled capital, but excluding specifically mortgaged premises. Trustees: Rt. Hon. Earl of Kintore, P.C., G.C.M.G., Keitb Hall, Inverie, N.B.; and Sir Walter F. Hely-Hutchinson, G.C.M.G., 147, St. James Court, S.W.

Aron Electricity Meter, Ltd. (58,650).—Return dated July 4tb, filed July 27tb, 1911; capital, £350,000 in £1 shares (125,000 preference); 125,000 ordinary and 124,896 preference sbares taken up; £1 per sbare called up on 124,896 preference; £124,948 10s. paid, including £52 10s. on 104 preference shares forfeited; £125,000 considered as paid on 125,000 ordinary shares. Mortgages and cbarges: £104,900

Beck Flame Lamp, Ltd. (92,387).—Particulars of £2,000 second mortgage debenture stock, created September 4th, 1911, and secured by trust deed dated September 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount heing now issued. Property charged: Leasehold premises at Hayes, Middlesex, subject to prior cbarge, certain British and Colonial patents, and tbe company's undertaking and property, including uncalled capital. Trustees: C. de Broe, Walden Lodge, Carlisle Road, Eastbourne; and F. W. Biddle, 22, Aldermanbury, E.C.

Corona Lamp Works, Ltd. (116,527).—Issue on September 13tb, 1911, of £200 debentures, part of a series of which particulars have already been filed.

Sloan Electrical Co., Ltd. (61,528).—Return dated July 29tb, filed August 3rd, 1911. Capital, £15,000 in £1 shares (5,000 "A" preference and 10,000 ordinary). 5,000 "A" preference and 2,754 ordinary shares taken up. £1 per share called up on 1,254 ordinary. £1,254 paid. £6,500 considered as paid on 5,000 "A" preference and 1,500 ordinary. Mortgages and charges: Nil.

Stearn Electric Lamp Co., Ltd. (95,340).—Return dated August 8th, filed August 9th, 1911. Capital, £4,070 in £10 sbares. 407 shares taken up. £10 per share called up on 7. £70 paid. £4,000 considered as paid on 400 shares. Mortgages and cbarges: Nil.

St. Austell and District Electric Lighting and Power Co., Ltd. (66,382).—Return dated August 21st, filed September 7tb, 1911. Capital, £10,000 in £1 shares (3,000 preference). 3,000 preference and 4,887 ordinary taken up. £1 per sbare called up. £7,887 paid. Mortgages and cbarges: £4,000.

Trowbridge Electric Supply Co., Ltd. (114,745).—Mortgage dated September 21st, 1911, to secure £250, charged on land in Duke Street, Trowbridge, with the buildings erected tbereon. Holder: J. H. Blake, Beechfield, Melksham.

Electrical Power Storage Co., Ltd. (30,313C).—Return dated August 3rd, filed August 12tb, 1911. Capital, £100,500 in £5 shares (100 founders'). 66 founders' and 18,392 ordinary shares taken up. £5 per sbare called up on 66 founders', and £4 per sbare on 3,132 ordinary. £13,332 5s. 1d. paid. £77,300 considered as paid on 15,460 shares. £474 5s. 1d. on 5 founders' and 405 ordinary shares forfeited. Mortgages and cbarges: £10,000.

CITY NOTES.

Anglo-American Telegraph Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Friday last week at Winchester House, Old Broad Street, E.C., for the purpose of considering resolutions for the transfer of the company to the Western Union Telegraph Co.

Mr. F. A. Bevan, the chairman who presided, proposed resolutions authorising the directors to carry into effect the provisional agreement already entered into with the Western Union Co. He said the agreement had been so fully discussed in the Press that even before reading the circular, which all the shareholders had received informing them of its principal points, they were probably pretty well aware of its nature, and therefore he did not propose to occupy much of their time. He would first like to allude to the reasons which led the directors to enter into the agreement. He need hardly say that the proposals for the agreement came from the other side. They would have been quite satisfied to continue to work under the pool agreement between the three companies—themselves, the Direct United States Co., and the Western Union, but the gentlemen who had the management of the Western Union were of opinion that if the three companies could be brought under one management, instead of being, as hitherto, under three separate managements, it would be easier to effect improvements which they had in contemplation in working the telegraphs, and that it would also save expense. With that object the negotiations for the agreement were commenced, and when they had made considerable progress the Western Union made the discovery that the pooling agreement under which they had been working so satisfactorily as far as the Anglo-American Co. was concerned for many years, was in contravention of the Sherman Trust Act. Shortly speaking, that Act aimed at preventing combinations of companies entering into monopolies, which would have a detrimental effect upon the general public in America. Of course they over here were no judges of what the Sherman Act really was and therefore they thought it right to consult the best legal opinion they could get from the other side, and they invited over one of the most eminent lawyers in the United States, and he (the chairman) was bound to say that he was a gentleman of remarkable acumen and experience, and they had every reason to believe that the advice which he gave them was thoroughly sound. He told them that the matter could not be absolutely settled without going to a court of law, but that he had no doubt in his mind that if it was brought before the Courts they would declare the pooling agreement illegal. He thought the shareholders would agree that the directors were bound to act upon the advice which they had received. Whether they would have done better to have gone into a legal fight he could not say. The case would have taken a very long time and cost a lot of money, during which time, no doubt, the shareholders would have received considerably less in the way of dividend. The directors thought that the better way, instead of contesting the matter, was to assume that the advice they had received was correct. The Western Union Co. at once stated that believing the advice to be correct, they would terminate the pooling agreement as from March 1st last, which meant that instead of the earnings being divided as they had been up to that time in certain proportions between the three companies, each company would do its best to get traffic and would only be entitled to the earnings which it could make. Therefore they would have had to depend more or less upon their own unaided work, which was a totally different thing from having the traffic pooled as hitherto. It must be borne in mind that there was a slight advantage to the Americans compared with themselves—the traffic from America was far larger than the traffic to America; but in addition to that the Western Union Co. had an enormous inland business on the other side, and, therefore, it was only natural that they would be able to get hold of the traffic on that side in a way that they on this side could not possibly do. That, therefore, in the directors' opinion was a strong additional reason why they should enter into the agreement which they proposed to the shareholders. What might have been the issue if they had gone into a fight, he could not say, but he, personally, and his colleagues agreed with him, was of opinion that under the agreement they were safer than they would have been if they had gone into a regular stand-up fight with their former colleagues and friends, which they did not want to do. Those were the principal reasons why the directors had thought fit to submit the agreement, and why they strongly advised them to approve it. The lease was one for 99 years, and guaranteed 3¾ per cent. on their ordinary stock, which meant 6 per cent. on the preferred and 1½ per cent. on the deferred, an amount which they had only once exceeded since 1884—that was since they had had the present tariff. If they took that 3¾ per cent. on 7 millions, it seemed to him that it was a very good return. because if they looked at the market price of their stock, it was somewhere about 4½ millions, and, therefore, 3¾ per cent. on 7 millions represented a much higher rate of interest than 3¾ per cent. on the market price of the stock. In addition, the Western Union Co. had to maintain their cables and all their plant; they had also to keep up their renewal fund till it reached a million, just as it was under the previous arrangement. They took over all their liabilities and they relieved them of the management of the cable, but on the other hand, they had purchased from them the cable which they had laid down a few months ago. The cost of that would come out of their renewal fund, which would therefore be diminished by a very large amount, and the Western Union Co. would have to contribute for many years a considerable sum if they were going to make it up to a million, as they were bound to do. As to the number of cables, the Western Union, under the agreement, were bound to maintain five, except in the case of the failure of one of their old cables. If they then substituted for two of their cables a new cable equal in power to the two, then they were to maintain four cables, including the one they, the Anglo-American Co., had just purchased from them. Therefore there would never be less than four cables. Their plant was to be maintained, and the dividend guaranteed whatever happened, and they had only to sit down and receive their dividends. There were certain contingencies under which the lease might be determined. On their side if the Western Union were to fail to pay this guaranteed dividend, they could give them notice to terminate the contract. On the other hand, if by the action of either the British Government or the United States Government, it was found practically impossible to carry on the traffic, then the Western Union Co. would be released from their obligations. It appeared to him that those contingencies were most unlikely when they thought of the magnitude of the Western Union Co. after paying its debentures it had an earning power of something like one million of money, and over and above the dividend which it paid to its shareholders there remained a very large surplus. Taking these facts into consideration, and the further point that the traffic itself was from natural causes likely to increase, he should say that the 3¾ per cent. was about as safe as possibly could be, and the deferred shareholders, instead of having what he might term a speculative stock, would have really a gilt-edged stock which would not be subject to fluctuations, and they would know exactly where they were. It had been hinted in the papers that some difficulties might arise. It had been suggested that the new agreement was a violation of the Sherman Trust Act. He need not tell them that they had taken counsel's opinion

iat point, and they were assured, as far as they could tell, that the greement was not in violation of the Trust Act. It seemed to him he chairman) that there was this difference—that instead of there eing, as there was now, a combination of the three companies to iaintain certain rates, none of which could be altered without ie consent of all the companies, it would now be in the ower of the Western Union to vary the rate as and when ley pleased. They could put the rates up or down as they pleased. it they would have to pay them their 3¾ per cent. He knew it as dangerous to prophesy, but as far as he knew, he saw no reason hy the agreement should not last the 99 years. If, from any nforeseen contingency, it came to an end, the position of the Anglo-merican Co. would be that they would resume with their four or ve cables maintained; they would have all their plant that was ot perishable handed back to them; they would have their renewal nd at whatever point it might have reached, and they had the surance that the Western Union Co. would do their utmost to store them, as far as traffic was concerned, to the position which ley occupied before making the agreement. He thought they would gree that the directors had, in every way that was possible, safe-iarded the interests of the shareholders, and in recommending em to approve the agreement, he believed they were doing that hich was safest for the interests of the shareholders.

Sir Gerald Fitzgerald seconded the resolution.

In reply to Mr. Chester, a shareholder, Mr. Carson, the general anager, said that the traffic was pretty equally divided between st and west; the greater proportion—about 52 per cent.—came om America and about 48 per cent. came from this side.

The Chairman, in reply to questions, said it was the intention the directors to pay dividends quarterly in the future. In expend-g their money on a new cable, they were in no way damaging emselves. They were getting a very fine new cable, and in any se, sooner or later, they would have had to lay a new cable. The sition would be, that they would have five cables in addition to e Western Union two, and they would be their property, although ey would be leased to the Western Union. Therefore, in the ent of the agreement breaking down, they would be in a very uch better position, having this new cable already laid, than if ey had the money.

Mr. Carslake, the solicitor, replying to further questions, said at as to the power of the company to enforce its rights under the ntract, the contract was an English one, and they could sue the estern Union Co. here as well as in America. They could get dgment against them here and put in a Receiver of all their ceipts on this side. Then, again, if the Western Union broke the se, they could determine it and retake possession of their pro-rty. In the event of the Sherman Act being put into force, and e lease being declared invalid, there again they would have all eir property back, and the lease contained a proviso that the estern Union Co. were, in that event, to give the company the me facilities in the United States for the transmission of their affic on the overland lines that they enjoyed at the end of 1910.

The resolutions were then carried unanimously, and the pro-edings terminated with a vote of thanks to the chairman and rectors.

Direct United States Cable Co., Ltd.

ie sixty-eighth ordinary general meeting of the shareholders of e above company was held on Friday last week at Winchester ouse, Old Broad Street, E.C., Mr. E. M. Underdown, K.C., in the air.

The Chairman, in moving the adoption of the report (see Elec-ical Review, p. 479), and the confirmation of the dividend already id, said that the outstanding feature of the accounts was the crease of £13,326 in the half-year's receipts, which, as explained the report, was due to the Western Union Co. having ceased since arch 1st last, to hand over to them or to the Anglo-American Co., e proportion of the eastward traffic, which up to that time since e year 1882 had always been dealt with by them. The increase £2,471 in the working expenses was entirely due to the establish-ent of the Harbor Grace station consequent on the diversion of e cable to Newfoundland, which had resulted in an acceleration the speed at which messages were transmitted from the cables, ual to some 70 per cent. upon its previous record. The reason r the delay in holding the meeting, was that in the middle of ly when the accounts were usually circulated, they were tering upon the final stage of the protracted negotiations which id resulted in the agreement with the Western Union Co., and it as, therefore, deemed inadvisable to publish the accounts at that me. Those negotiations had now been brought to a nclusion, and if the agreement was approved by the share-olders, the Western Union would have to hand over to them ie sum of £10,800 in respect of the traffic withheld since arch 1st, so that the diminution in their income would be practi-lly covered. From a diplomatic point of view, it was thought esirable to continue the dividend as usual up to June last, and aving regard to their reserve fund having been increased by 18,000 in the half-year, the directors felt themselves justified in sing some £7,000 of that increase for the purpose of the dividend. he directors were fully alive to the strength of the position of the ompany, and they were confident that the Western Union Co. ould concede terms that would be regarded as satisfactory by the hareholders.

Sir J. Pender, Bt., seconded the motion, and the report was dopted.

An extraordinary general meeting was then held for the pur-ose of considering an agreement to lease the cables of the com-any to the Western Union Telegraph Co.

The Chairman, in proposing a resolution approving of the agreement, said that the shareholders were probably all aware that since 1882 the company had been working with the Anglo-American Telegraph Co. and the Western Union Co. under agreements entered into with a view not only to secure and maintain the successful carrying on of their cable business, but also to give to the public an efficient cable service between this country and the United States and Canada, founded upon the mutual support and facilities between the cables for all purposes, it being conceded that there was a necessity for a fair number of lines across the Atlantic if steady communication was to be secured. Under that arrangement the bulk of the cable business was, up to 1882, conducted over the cables of the Anglo and Direct Companies; the Anglo possessing four cables to their one, it would be obvious that the proportion of traffic dealt with by them was small as compared with that dealt with by the Anglo Co. In 1882 the Western Union Co. joined the combination with two cables, while the land-lines and communications on the other side were conducted by the Western Union. In order that they might properly appreciate the position of the Western Union Co. in America he must explain that it was a company possessing, in addition to cables across the Atlantic, an independent telegraph system in many respects comparable with that of the telegraph system in this country, which was in the hands of the Government. The Western Union Co. did not have a monopoly of the telegraph system in America, but its only serious competitor was the Postal Telegraph Co., an ally of the Commercial Cable Co. In the year 1910 the Western Union Co. had 24,825 offices in the United States, operating 1,429,049 miles of wire and 214,360 miles of poles and cables. The total receipts for 1910 amounted to the huge sum of $33,889,202, equal to nearly 7 million pounds sterling, and after paying all expenses, interest and dividends for the year a balance of revenue remained of $2,597,373, or over £500,000. Those figures would give them some idea of the magnitude of the Western Union Co.'s operations, and he had no doubt would satisfy them that the payment of the rental for their cables was well secured. Although the Anglo-American and their company had hitherto maintained separate offices in New York and other centres, under the working arrangement that existed between the three companies, the Western Union Co. acted in America, to all intents and purposes, as collectors of cable messages passing over the cables of the three companies, and these messages were distributed and dealt with in agreed proportions. In the early part of 1910 a controlling interest in the Western Union Co. was obtained by the American Telegraph and Telephone Co., and a change in the management of the former company followed. About the same time, the United States Government proceeded to put in force the Sherman Anti-Trust Act, which prohibited combinations characterised as being in restraint of trade, and in view of this, the Western Union Co. was advised that the agreement then existing between the three companies involved a contravention of the Sherman Act, and that the only method of avoiding it was to enter into some fresh agreement which would do away with the objectionable features of the combination. In May, 1910, negotiations were commenced with the Anglo and the Direct Companies to this end, and certain proposals were submitted to them which they, in the interests of the shareholders, were reluctantly compelled to decline. That was the position of affairs when, in February last, the Western Union gave notice that, in view of the agreement being considered as a violation of the provisions of the Sherman Act, the agreement that had been in existence between the three companies since 1882 would no longer be recognised. In the meantime they had obtained the highest legal advice in America and on this side, and they at once intimated to the Western Union Co. that they could not accept that notice, but that they would hold them to the 1882 agreement. The Western Union Co., therefore, gave notice cancelling the convention. The advisers of the Western Union Co. were satisfied that the proposed lease was not a contravention of the Act. It must be admitted that their advisers were not so confident, while an American counsel consulted by the Anglo Co., had expressed the view that whilst it was not possible to pronounce with certainty upon the validity of the agreement, in his opinion the proposed lease was good under American common law, and would not be held to be in violation of the Anti-Trust Act. That aspect of the question had been most closely and carefully studied by the directors, and while they appreciated that there was a risk, it was believed to be a distant one. With full knowledge of the position, they had taken every step to effectually safeguard the interests of the shareholders, and ensure that should the lease be broken or even modified with their consent, they would be certainly in no worse position than they were when the Western Union repudiated the 1882 agreement. On March 1st last the Western Union ceased to hand over either to them or to the Anglo Co. any portion of the eastward traffic collected by them on the other side. That represented nearly 50 per cent. of the messages transmitted over the cables, which would show them the enormous loss that resulted to the English companies. That had brought about a reduction in their revenue for the four months to June 30th last from £42,500 to £28,290, as compared with the corresponding four months in 1910, or a decrease of £14,210, and that on the assumption that their original agreement with the Anglo Co. entered into in 1877 prior to the admission of the Western Union Co. would still have held good, and that they would receive their full proportion of the traffic of the two companies as provided under that agreement. In the intervening months they were from time to time informed that negotiations were proceeding between the Anglo and the Western Union Companies, and it was intimated to them that when those were completed the Western Union Co. would approach them with a view to entering into a similar arrangement. In the early part of July they were informed

that those two companies had come to an agreement, and the Western Union Co. then approached them. They might doubtless be disposed to ask him whether the arrangement might be broken by one of the parties, or whether it was not capable of being held invalid for the reasons he had already referred to. He thought they might look upon that in the light of the attitude and intention of the parties, and especially of the Western Union Co. He was convinced that the latter company would loyally endeavour to substantially uphold the agreement. Their negotiations with the Western Union Co. had resulted in the arrangement which had been communicated to them, and which the directors recommended them to accept. They carefully studied the possible alternatives—(1), to revert to the original agreement with the Anglo Co.; and, (2), to endeavour to work alone. The latter alternative seemed an impossible one, seeing that they had only one cable across the Atlantic, and that interruption thereto would result in complete loss of revenue; while, as regarded the other alternative, they had had four months' working with the Anglo Co. without the Eastern traffic coming from the Western Union Co.'s system, and the result had conclusively demonstrated that their receipts under the 1887 agreement would have been little more than sufficient to meet their working expenses. The question might be asked whether the two English companies could not have combined and established their own landline connections in America. He could only say that the institution of any such system by the English companies would have been a most costly undertaking, beset with such difficulties, including the strenuous opposition of existing telegraph companies in America, as to make it practically impossible of accomplishment, at any rate with the capital at the disposal of the English companies. He was bound to state that the Anglo Co. proceeded with their negotiations and came to their agreement without consulting them in any way, so it was obvious they could not count upon the co-operation of that company in attempting to provide their own means of communication between the cable ends and the interior of America. The only course, therefore, open to them was to come to the best arrangement possible with the Western Union Co., and he had no hesitation in saying that they had, after many months of anxious negotiation, succeeded in doing this, and had secured terms which they could honestly recommend for their acceptance. Under the arrangement proposed, the two most important points to be considered, in their judgment were, first, that the proposed lease was for the long period of 99 years, whereas the 1882 agreement would have expired in a little over nine years from now, when the company would be forced to deal with many complications; and, second, that they retained absolute control of their reserve fund, and in case of breach of the agreement, voluntary or otherwise, the cable and property connected therewith. Their cable was laid many years ago, and as he had often stated, the life of a cable not yet having been demonstrated, they could not say when it might be necessary to renew it. At the present time their cables were working as well as, if not better than, they had ever done, the diversion to Newfoundland having brought about, through the shortening of the main cable, and in other ways, a great increase in the speed in the transmission of messages. They had no reason, therefore, to assume that there would be any reason to lay another cable in the near future, or for a great many years to come, nor did they believe that the cost of repairs and maintenance would in future exceed that of recent years. The rental of £58,568 that they were to receive, ensured the shareholders for 99 years a dividend of 4 per cent., which would absorb £48,568, while the additional £10,000 a year, with a small sum to be taken when circumstanees permitted, from the interest on the reserve fund investments, they had every reason to believe would enable them in ordinary circumstances to give a bonus equal to another 1 per cent., making 5 per cent. in all, the highest rate of dividend that the shareholders had ever received. They had also agreed with the Western Union that this 5 per cent. should not be exceeded except with their consent. That latter condition they regarded as being as much in their interests as in that of the Western Union Co. Their lessees desired to restrict the payment of dividends and bonus approximately to the rental that they were to pay, and to ensure that any balance remaining out of the interest on the reserve fund investments, after paying for the repair and renewal of the cable, should be added to the reserve fund so that the company might be prepared at any time, should the cable be beyond repair, to replace it. Inasmuch as the rental itself would cease, and the lease come to an end if there were no cable to work, it was entirely in the interests of the shareholders that the policy followed by the board in the past should be continued, viz., that the capital of the reserve fund should be maintained; and if they were fortunate enough to escape heavy expenditure for repairs to the cable, any balance of interest on the reserve fund, after making up the 5 per cent. dividend and bonus, should be added to the reserve fund. The policy of the board in future would be to pay a quarterly dividend at the rate of 4 per cent., and at the end of each half-year to take into account the expenditure upon repairs and renewals of the cable, and to declare. or not to declare. a bonus as the circumstances warranted. They had no valid reason to anticipate that the bonus they had hitherto received would not be continued, but should fortune desert them and the cost of repairs to the cable—say, about £12,600, as in the last six years—exceed the sum that they had to provide for it, viz., the interest on the reserve fund plus the £10,000 a year, then they felt that in the interests of the shareholders, it was desirable that they should in such a case distribute only the dividend of 4 per cent., keeping up the reserve fund for the purpose of laying another cable, which was after all the only security that they had for the payment of the rental under the lease. A provision was contained in the agreement that should the cable be interrupted for a period exceeding 12 months, the rental payable by the Western Union Co. was reducible by 50 per cent., and if it should be interrupted for a further six months, or 1[illegible] months in all, such rental ceased altogether. Under the so-called pool contract their participation, in case of interruption for [illegible] months, continued; if the default lasted for another year, the share was reduced, and came to an end after three years. When he told them that the longest period which their cable had been interrupted in the past had been five months, he thought they would agree that the period of 18 months might be considered as a sufficient safeguard. They had stipulated that the whole of the staff, with the exception of the secretary and his assistants, who naturally remained with them, were to enter the employment of the Western Union Co. at the salaries and on the terms and conditions of their existing contracts, and the Western Union Co undertook to contribute an annual sum sufficient to maintain the pension scheme for the entire staff. They were, moreover informed that the Postmaster-General had stipulated that the stations of the English companies should be staffed by British subjects. They had therefore satisfactorily ensured the future of their employés, and as they would shortly be passing into the service of the Western Union Co., he would like to express on behalf of the board, and he was sure the shareholders also, their warm appreciation of the loyalty and devotion to duty that has been characteristic of every grade of the service since the incorporation of the company. The existing articles of association provided that the minimum number of directors should be five and the proposal to reduce that number to three was a domestic matter arising out of the agreement, and that reduction would doubtless meet with the approval of the shareholders.

Sir J. Pender, Bart., seconded the resolution.

The Chairman, in reply to questions, said that they had made this agreement for themselves, and it was quite independent of the Anglo agreement. As he had said, it was possible that there might be difficulties in America in continuing the agreement, and that point they had been studying for months. If anything of that sort should happen, their position would be no worse than it was now. The only thing they gave up were their rights under the 1877 agreement.

The resolution was carried unanimously.

Drake & Gorham, Ltd.—The directors' report for the year ended June 30th, 1911, states that after payment of all charges including bonuses due to staff, there remains a net profit of £7,18[illegible] which, with the sum of £1,242 brought forward from the previous year, makes a total of £8,427, which it is proposed to appropriate as follows:—Dividend at the rate of 4½ per cent. per annum £5,625; by writing off part of the underwriting commission £1,500; carrying forward, £1,302. The improved results are mainly due to the increasing popularity of the electric light especially in view of the large reduction in first cost and running expenses. The wholesale department has been further extended and an additional warehouse will shortly be ready for occupation.

Eastern Telegraph Co., Ltd.—A second quarterly interim dividend of 1¼ per cent. on the ordinary stock is announced.

Lisbon Electric Tramways, Ltd.—An interim dividend of 3 per cent. on account of earnings of the current year, is payable on November 1st.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ending September 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on November 1st.

County of Durham Electrical Power Co., Ltd.—The secretary has issued a circular to the shareholders as follows: "While the profits for the first six months of the current year, as shown by the cost sheets, are slightly better than those for the same period of last year, the directors, in view of the disturbed position of the labour world and the possible dislocation of local trade which may follow therefrom, do not think it advisable that an interim dividend on the preference shares should be paid."

Howard & Bullough, Ltd.—The directors have declared an interim dividend at the rate of 10 per cent. per annum (6d. per share), on the ordinary shares for the quarter ended September 30th.

Folkestone Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock, payable on the 1st inst. for the six months ending that date, have been posted.

Edgar Allen & Co., Ltd.—The directors have declared an interim dividend on the 5 per cent. cumulative preference shares for the half-year to September 30th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have announced an interim dividend for the quarter ended June 30th of 2s. 6d. per share.

Calcutta Tramways Co., Ltd.—An interim dividend of 2½ per cent. is announced.

Dick, Kerr & Co., Ltd.

Mr. John Kerr (chairman) presided on September 28th at the Cannon Street Hotel, E.C., over the ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 478), said that in dealing with the year's trading, he should like to remark that keen competition for orders had continued in all departments. It was all a question of supply and demand. The development of electrical power in ironworks, and the textile trades, and in many other industries, showed some progress. If this country did once lag behind Germany and America in the adoption of electricity it might fairly now be said that the greatest interest had been awakened. A considerable amount of plant had been ordered, and quite a number of important installations were under consideration. At their Preston works the very highest grade of machinery could be turned out in an economical manner by reason of good labour and the best modern equipment. Competition for business was acute enough between the home manufacturers, but it was increased by their market being an open one to Continental and American works. These happy manufacturers were secure in their home market, and had the British as a dumping ground. They had every opportunity of maintaining their output; to anyone who knew anything of manufacturing, the question of cost was largely one of output. To the working man, steady employment was better than intermittent work, even if the nominal wages were slightly higher per week. Work and plenty of it was equally essential to employer and employé. At the last general meeting they were told of the board's intention to manufacture steam turbines. The directors were pleased to state that their efforts in this direction were meeting with satisfactory results. There could be no question that this development was on the right lines. In view of the enormous demand for metallic-filament lamps, and the fact that the bulk of the lamps used of this class were of foreign manufacture, the directors, after careful investigation, decided to add a lamp factory. To avoid the danger of experimental work they had availed themselves of the experience of a Continental company. Their factory was now rapidly approaching completion, and would very soon be in a position to turn out lamps second to none in the market. The selling of the lamps would find employment for their various offices and agencies without material addition to the staff. It was the intention of the board to push this business with vigour. As regarded prospects for the coming year, they were encouraging. As soon as international difficulties, which had been causing considerable European anxiety, were settled, an amount of foreign work that was held in suspense should be proceeded with. Although they had been practically free from labour difficulties, there could be no doubt that strikes and threatened strikes all militate against business by delaying work or causing postponement of orders. It was to be hoped the Government would deal in no uncertain manner with "peaceful picketing," as the scenes that had recently taken place were a disgrace to the country and a source of public danger. Means could surely be found to deal with this clamant evil without in the slightest inflicting any injury to the just rights of trade unions. One serious and disastrous effect produced by the reckless policy of a certain section of labour leaders in inciting strikes of the nature and magnitude of those they had just experienced regardless of the loss and suffering they had produced, was to discourage and frighten the employers of the country and to restrain them from developing their resources for the general benefit of trade and consequently of labour itself. The balance-sheet represented a rather uneventful year, although the result showed an improvement on the two previous years. They would observe on the assets side an increase of £32,753 on capital expenditure; this was represented by the expenditure on the turbine business, the lamp factory, and some additional plant at the Kilmarnock works. Turning to the liabilities, they would notice that the debenture stock had been redeemed to the extent of £9,000. Altogether, since the issue of this debenture stock, £46,570 had been paid off and a reserve fund of £150,000 had been created under Clause 31 of the trust deed securing the debentures. It had always been the policy of the directors to strengthen the position of the debenture and preference shareholders. The contingent liability referred to in the balance-sheet as co-obligants with the Edinburgh and District Tramways Co., Ltd., in their liability to the Corporation of Edinburgh, under the lease of the tramways, would continue for about nine years. There need be no anxiety under this head, as the tramways were a remunerative undertaking of a first-class character. As they would see by the auditors' certificate, the plant and machinery had been amply depreciated. Regarding the investments, they had experienced, like many other concerns, the greatest depreciation in the securities recognised as gilt-edged, but this had been fully allowed for in adjusting the total valuation. The rearrangement of the staff necessitated by the lamentable death of Mr. George Flett last year had been carried out. Mr. Schultz, who has long been actively associated with the business, had been appointed assistant managing director. There was a desire by the staff and directors to commemorate the late Mr. George Flett's memory in a suitable manner; the money subscribed by them, in conjunction with a handsome donation by his daughter and one hundred guineas by the company, had been the means of endowing a bed in that noble institution, the London Hospital. The directors would like to record their high appreciation of the management and staff for the untiring energy they had displayed throughout the year, and their whole-hearted efforts to maintain the reputation of the company.

Mr. C. T. Cayley seconded the motion.

Mr. T Hacking pointed out that there were two items on the liability side of the balance-sheet about which he would like to ask. The first was "Special reserve, balance from last year £16,000," and the second, "Special reserve for extensions of the manufactories or replacements of machinery, &c., £50,000." He wished to know for what those two items were specially reserved.

The Chairman said the first one was made many years ago against possible liability under the Edinburgh tramways contract, and it had been allowed to remain, although they would never be called upon for any liability. The other was for the purpose for which it was stated.

Mr. Hacking asked why it was then that the £32,000 odd expenditure on new works had not been taken from this £50,000.

The Chairman said the board thoroughly discussed that matter, and decided to do what they had done, and leave the £50,000 intact to strengthen the company.

Mr. Hacking further asked if it would not be possible for the board to give the amount set down for goodwill and patents, instead of lumping it altogether with capital expenditure on work.

The Chairman said he would be glad to furnish any shareholder with any information he required, if he called at the office, but in a manufacturing concern, it was not always wise to disclose all their affairs publicly. They had, however, nothing to hide from the shareholders.

Mr. J. Russell Gubbins said he had always tried to insist on the amount set aside for goodwill being disclosed, and there were industrial companies who did so. He saw no reason why such a fact should not be stated, and he believed that eventually he would be able to bring such pressure to bear that every company in England would be compelled to disclose its goodwill.

The Chairman said that the board would consider the point raised, but if all companies were as careful as they were there would probably be less trouble in the City of London.

The report was then adopted, and on the motion of Mr. Barber Glen, a hearty vote of thanks was passed to the directors and staff.

Willans & Robinson, Ltd.—The directors' report for the half-year ended June 30th, 1911, to be submitted to the half-yearly meeting on Tuesday next, October 10th, states that after writing off £4,429 as depreciation, paying £4,174 interest on debenture stock, and £348, the cost of the upkeep of the Queen's Ferry Works, the result of the half-year's trading shows a loss of £7,693, as compared with £10,811 for the previous six months. Added to the balance £26,080 brought forward from the previous half-year, this brings up the total of the debit standing against the profit and loss account to £33,773. Although the company is securing its fair share of orders, the prices obtainable, due to the continued excessive competition, render these largely unremunerative. The company's area of operations is being judiciously extended. The economies referred to at the last half-yearly meeting, and which are only partially operative in the current balance-sheet, should materially assist the company in meeting the severe conditions at present existing. The regrettable lawsuit, referred to at previous meetings, involving a claim for £10,000 damages, has now been concluded, a verdict of £3,411 damages, with costs, being given against the company. The total cost to the company of this action amounts to £23,519. Provision against this liability to the extent of £3,863 has already been made, leaving a balance of £19,656 still to be dealt with. This matter concludes the liabilities arising out of the company's Queen's Ferry Works, prior to their being closed in 1908, and is in no way attributable to the company's business as carried on at Rugby.

Kalgoorlie Electric Power and Lighting Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per annum for the six months ending September 30th.

Stothert & Pitt.—A financial daily states that after transferring £1,000 to reserve, the directors recommend a dividend of 3 per cent. on the ordinary shares, for the year ended June 30th, carrying forward £3,313.

STOCKS AND SHARES.

Tuesday Evening.

It would appear as though the Stock Exchange were getting accustomed to shocks of various kinds, political, financial and otherwise, and that they are beginning to lose their power of affecting the markets to any violent extent. Consequently, the outbreak of war between Italy and Turkey, while it produced a weakening of prices and imposed a further check upon business, quite failed to produce any sort of panic or even demoralisation. With the later telegrams suggesting an early termination to the dispute, the Stock Exchange was disposed to view the matter in a light not particularly serious, and the falls of Saturday were largely wiped out by a general recovery throughout the markets on Monday and Tuesday.

This week there has been rather more doing in the shares of the English Electricity Supply companies, but it has not been of the sort that kindles any particular pleasure in the minds of shareholders. Which is a round-about way of saying that prices are easier where they have moved at all. Charing Cross Ordinary are ⅛ down, and the Preference eased off to 4. Metropolitan Ordinary and St. James's shed ¼ each, reducing the price of the latter to 8¾. In the Provincial list there is an improvement of 2s. 6d. in Bourne-

mouth and Poole Second Preference, while Folkestone Preference were reduced by the amount of their dividend, the Ordinary shares practically regaining theirs. Amongst the Debentures, the only changes are those produced by the marking *ex* dividend of South Metropolitan 4½ per cent. and Urban First Mortgage stocks.

In the Colonial and Foreign list, there is a much better tendency amongst the Mexican issues. This is due chiefly to the indirect influence of an excellent dividend on Mexican Railway stock, combined with evidences afforded by that company of the way in which affairs are settling down after the little revolution. Mexican Light and Power Preferred and Common moved up ½ each, the bonds rose 1, and Monterey Debenture improved to the same extent. Northern Light and Power bonds recovered 1, which brought the price to 37, and Montreal shares retained their good rise of last week. West Kootenay Sixes came into some request, and Electrical Development of Ontario bonds hardened up in sympathy. Canadian General Electric Common and Preferred recovered most of their dividend deductions. On Monday, Shawinigan Water capital stock was marked *ex* rights, and the value of the new stock was officially fixed for the time being at 4 premium.

In the Home Railway market, prices suffered a fairly severe decline at the end of last week on the Italian-Turkish *affaire*, added to which there were rumours that Germany had reopened the Morocco business, while hints circulated as to the possibility of a big miners' strike throughout the country to be declared within a day or two. The falls, however, were in most cases recovered, and the market has again swung on to a better level. There can be no doubt as to the shortage of stock which exists in this department, and it is this, rather than fresh buying on the part of investors, which sustains prices at the present time, when there is the cloud of the Railway Commission findings hanging over the situation. With regard to this latter, it is already taken for granted that the Commission will find that recognition of the Trade Unions by the companies ought to be advocated; but, on the other hand, it is hoped that, besides permission being given to raise freights, the Commission will have something to say on the point of making sudden strikes illegal.

So far as the Electric Railways are concerned, Metropolitan Ordinary is down half a point, and the Central London Preferred lost 1. Districts, however, are 1 up, this following upon an advance last week, and the company's 4 per cent. Debenture stock at 98 is also 1 higher. The progress which the District Company is making, and the ever-increasing density of the traffic which it is attracting are points which supporters of the company keep in mind. A good many small buyers of speculative stocks are putting away Districts, as they say, for their children, just as we in our younger days used to buy Chartered for posterity, although it is to be devoutly hoped that the subsequent result will not be the same in both cases. Underground Electric Railways Income bonds eased off to 58. Hastings Trams Preference shares remain at ¾, *ex* the dividend at 7½d. There are no changes in the London United descriptions.

The Telegraph market professed satisfaction at the meeting of the Anglo-American Telegraph Company last Friday, at which the chairman, Mr. F. A. Bevan, made a striking speech in favour of the agreement with the Western Union. The proposals were carried, but there is no change in prices, because some little uncertainty is still felt as to whether the arrangement will be allowed to stand under the Sherman Anti-Trust Acts of the United States, under which it is conceivable that the scheme might be construed as a monopoly in restraint of trade. Other American shares are unchanged, and the Eastern group keeps exceedingly steady. Amazon Telegraphs are ⅛ easier at 7½. Direct Spanish Ordinary and Preference, *ex* their dividends, were left unaltered at their previous quotations. Reuters, also *ex* dividend, show no nominal movement at 9¼ middle. Globe Telegraph and Trust Preference went back ⅛ to 13⅛, but they are not at all a bad market, and the Ordinary rose ⅛ to 10⅞.

Fresh animation has arisen in the National Telephone market, and, following upon a rise of 3 points last week, another gain of a point is shown now. The market has been depressed of late by forced selling, but this being practically completed, buying was resumed by those who are looking for the stock to be paid off at a handsome price when the company is taken over by the Government at the end of this year. The Third Preference hardened to 5½. Other Telephone shares are mostly firm. Monte Video Preference gained 3/32. Oriental Ordinary rose 1/16. New York bonds are ½ higher, and the only decline in this section is one of 1/16 in United River Plate Ordinary

Foreign Tramway bonds are also harder, substantial rises being secured by Mexico Trams, Rios and Sao Paulos, the latter putting on 2 points, and so recovering the dividend deducted a fortnight ago. Winnipeg Electric Railway 4½ per cent. Debenture is a little harder, and the demand for good bonds of this class has once more become perceptible. British Columbia Electric issues have firmed up.

The manufacturing group is very quiet. Castner-Kellners continue to droop, and Crompton Debenture at 60 shows a loss of 2½ points. Edison & Swan Second Debenture recovered 1½ of its interest, and Electric Construction Preference at 1⅛ are ⅛ higher. The Electric Supply Corporation's recent issue of Debenture stock —with which the underwriters got left to the tune of about 95 per cent.—has not yet received the dignity of a market quotation, although it is understood that transactions do take place occasionally. The first interest payment was made this week. Willans & Robinson Ordinary were marked back a trifle on the issue of another report which can only be described as lamentable, a further big deficit being added to the existing burden. At the same time, the directors strike a note of subdued hope in respect of the orders which are coming in, although they complain of excessive competition.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 27	3,087	+ 124	17	27,988	+ 1,725	..	..
Ayr	„ 30	940	+ 354	20	8,486	+ 59	8	..
Bath	„ 27	1,765	— 81	39	33,685	+ 1,065	..	..
Birkenhead	Oct. 1	2,388	+ 117	26	30,821	+ 1,155	13·7	..
Birmingham Corp.	Sept. 23	18,118	+4,309	25	204,622	+31,657	56·8	..
Blackburn	„ 27	2,252	+ 158	26½	32,014	+ 2,862	14·6	..
Blackpool Corp. ..	„ 28	4,813	+ 934	..	50,784	+ 6,963	..	..
Blackpool-Fleetw'd	„ 30	2,119	+ 257	13	21,607	+ 1,897	..	..
Bolton	Oct. 1	4,846	+ 120	27	68,672	+ 4,683	26	..
Bournemouth ..	Sept. 27	4,012	+ 172	26	51,517	1,156	22	..
Bradford	„ 23	10,914	+ 755	25	143,203	+11,534	56	1·2
Brighton	Oct. 1	2,180	+ 42	26½	30,979	..	9·5	..
Bristol	Sept. 29	12,942	+ 385	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 22	472	+ 6	38	8,308	+ 54	3·65	..
Barnsley	„ 22	387	+ 55	„	7,030	+ 495	..	..
Barrow	„ 22	737	+ 188	„	11,815	+ 1,446	5·37	..
Devonport ..	„ 22	1,082	+ 126	„	19,048	+ 2,825	8·85	..
Gateshead	„ 22	2,032	+ 137	„	39,594	+ 2,260	11·25	..
Gravesend	„ 22	473	+ 46	„	8,219	+ 288	6·5	..
Greenock	„ 22	1,582	+ 274	„	27,817	+ 3,679	7·25	..
Hartlepool ..	„ 22	621	+ 87	„	10,559	+ 937	6·72	..
Kidderminster ..	„ 22	258	+ 20	„	4,668	+ 327	..	..
‡Leamington ..	„ 22	435	— 2	„	6,996	+ 484	..	..
Merthyr	„ 22	449	+ 6	„	8,026	+ 128	2·9	..
Metropolitan ..	„ 22	18,628	+2,331	„	337,154	+42,516	22	..
Middleton ..	„ 22	694	+ 32	„	13,802	+ 1,100	8·5	..
Mid. Joint Com'tee	„ 22	8,812	—3,000	„	208,728	—10,256	..	..
Oldham—Ashton	„ 22	1,176	+ 43	„	21,920	+ 820	9·13	..
Peterborough ..	„ 22	275	+ 41	„	4,952	+ 535	5·31	..
Potteries	„ 22	4,069	+ 291	„	73,222	+ 6,971	29	..
Rothesay	„ 22	550	+ 5	„	9,341	+ 82	2·75	..
Southport ..	„ 22	661	+ 19	„	12,041	+ 531	3·17	..
S. Metropolitan ..	„ 22	1,825	+ 68	„	33,734	+ 2,066	..	..
Swansea	„ 22	2,414	+ 149	„	43,909	+ 2,667	12·5	..
Tynemouth ..	„ 22	605	+ 25	„	10,918	+ 481	3·76	..
Weston-s-Mare ..	„ 22	590	+ 129	„	7,572	+ 1,016	3	..
‡Worcester ..	„ 22	712	+ 86	„	11,550	+ 622	5·75	..
Wrexham ..	„ 22	229	+ 23	„	3,889	+ 198	..	..
Yorks. Wool. Dist.	„ 22	2,183	+ 43	„	40,295	+ 2,842	17	..
Miscellaneous ..	„ 22	468	+ 36	„	8,834	+ 517	..	..
Burnley	„ 30	2,709	+ 125	..	..	..	11·7	1
Burton-on-Trent ..	Oct. 1	555	— 137	26	7,875	+ 527	6·6	..
Bury	„ 1	2,513	— 8	26	35,098	+ 3,208	22·5	..
Cardiff	Sept. 23	4,861	+ 240	25	64,554	+ 5,543	..	..
Chatham and Dist.	„ 28	1,863	— 147	39	33,844	+ 319	4·6	..
Cork	„ 28	999	— 4	39	19,845	+ 597	9·9	..
Croydon	„ 23	3,610	+ 167	..	47,565	+ 4,037	..	..
Darlington	„ 30	449	+ 49	27	6,039	+ 623	..	..
Darwen	„ 24	523	+ 57	26	7,195	+ 620	4·4	..
†Dover	„ 23	289	+ 53	25	7,291	+ 1,100	1·75	..
Dublin	„ 29	11,010	— 313	..	88,815	+10,274	54	..
Dundee	„ 27	2,397	— 92	19⅔	23,494	— 397	15	..
East Ham	„ 30	2,181	— 42	26	29,298	+ 1,152	7·85	..
‡Exeter	„ 29	363	+ 17	26	9,722	+ 815	5·5	..
Glasgow	„ 30	41,290	+2,987	..	..	..	98	·75
Hastings	„ 28	2,376	+ 130	..	..	..	..	..
Huddersfield ..	„ 30	4,194	+ 396	26	52,855	+ 6,246	29·5	1
Hull	„ 30	5,631	+ 259	26	74,794	+ 3,711	14·5	..
Ilkeston	„ 28	268	— 11	26	3,542	+ 109	..	..
Ipswich	„ 30	954	+ 27	26	12,924	+ 860	10·5	..
†Kilmarnock ..	„ 23	161	+ 18	19	3,330	+ 329	4·2	..
Lancashire United	„ 27	2,745	+ 60	39	57,132	+ 1,829	39	..
Leeds	„ 30	15,184	+ 820	26	200,924	+14,265	108	..
Leicester	„ 30	5,051	+ 238	..	..	..	..	..
Leith	„ 30	1,295	+ 51	19⅔	13,988	+ 1,151	8·7	..
Liverpool	„ 25	23,266	+1,066	38	434,789	+12,572	118	..
‡L.C.C.	„ 20	87,113	+2,937	..	1,109,091	+65,328	141·6	9·6
London United ..	„ 30	13,312	— 297	..	261,844	+10,547	..	..
Lowestoft	„ 24	589	— 25	51	11,436	+ 1,042	3·5	..
Manchester ..	„ 30	32,531	+1,080	26	429,673	+24,256	189	..
Newcastle	„ 30	8,411	+ 703	..	112,944	+ 8,221	14·5	..
Newport	„ 23	1,867	+ 18	25	18,606	+ 931	14·6	..
Oldham	Oct. 1	3 859	+ 187	27	53,024	+ 2,161	23·7	·5
†Pontypridd ..	Sept. 30	410	— 27	26	11,008	— 29	5 5	..
†Portsmouth ..	„ 23	2,247	+ 76	25	63,332	+ 6,112	15·25	..
Preston	„ 27	1,555	+ 139	26	20,995	+ 1,629	..	..
Rotherham	„ 28	1,356	+ 84	25⅔	17,878	+ 1,562	12	..
Salford	„ 25	9,766	+ 729	25⅔	126,452	+ 6,292	..	..
Sheffield	Oct. 3	12,816	+ 643	27	174,316	+11,567	40	..
Southampton ..	Sept. 27	2,630	+ 372	26	34,059	+ 4,555	22	..
Southend-on-Sea ..	„ 27	1,690	+ 321	26	21,434	+ 3,390	..	..
South Shields ..	„ 30	1,198	+ 64	26	17,192	+ 2,001	..	..
†Swindon	„ 27	180	+ 26	..	4,812	+ 616	..	..
Tyneside	„ 27	949	+ 141	15	7,216	+ 942	..	..
Wallasey	„ 30	2,177	+ 277	26	30,826	+ 4,749	..	..
Walthamstow ..	„ 30	1,415	— 78	26	21,283	+ 1,691	9	..
West Ham	„ 21	5,443	+ 415	25	69,546	+ 6,908	15·25	..
Wolverhampton ..	„ 27	1,938	+ 79	26	26,284	+ 1,720	25	..
Cen. London Rly...	„ 30	9,524	—1,601	13	56,842	—11,888	6·32	..
City & S. Lon. Rly.	Oct. 1	6,321	+ 112	13	89,749	— 356	7·26	..
Dublin-Lucan Rly.	Sept. 29	888	+ 2	13	2,262	— 41	7	..
G.N. and City Rly.	„ 30	2,819	+ 46	13	17,648	+ 289	3·5	..
L'pool Overh'd Rly.	Oct. 1	3,086	+ 270	..	20,138	+ 998	6·8	..
Llandudno-Col. Bay	Sept. 29	805	+ 90	43½	13,936	+ 522	..	..
London Eleo. Ry. Co.	„ 30	25,395	+1,005	13	152,890	+ 2,420	21·25	..
Mersey Railway ..	„ 30	4.183	+ 72	13	23,871	— 1,688	4·5	..
Metropolitan Rly.	Oct. 1	33,089	— 838	13	209,616	— 5,289	24·5	..
Met. District Rly.	Sept. 30	22,157	+ 944	13	137,410	+ 5,761	24	..
Anglo-Argentine ..	„ 30	95,816	+3,650	..	1,899,214	+173,926	..	..
§Auckland	Sept.	15,905	+1,810	8	48,372	+ 3,617	23·8	·6
Bombay (B.E.T.) ..	Sept. 1	5,475	+ 42	35	99,345	+ 5,809	..	..
§Brisbane	August	24,650	+2,700	8	163,520	+18,725	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 30	8,605	+1,108	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	August	8,858	..	8	27,687	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 30	1,462	+ 201	..	26,652	+ 2,331	..	..
§Montevideo ..	Sept.	23,246	+1,886	11	273,519	+16,540	..	..
Perth (W.A.) ..	Sept. 29	8,105	+ 572	..	62,452	+14,137	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
rnemouth & Poole, Ord.	*					
o. 4½ % Pref.	10	5½	5⅝	7⅜ — 8⅜	..	6 5 9
o. Second 6 % Pref.	10	4⅛	4⅛	8¾ — 9⅜	..	4 12 4
o. 4½ % Deb. Stock	10	6	6	10¼ — 10⅝	+ ⅛	5 12 11
mpton & Kensington, Ord.	Stock	4½	4½	101 —103	..	4 7 5
o. 7 % Cum. Pref.	5	10	10	7⅝ — 8⅛	..	6 3 1
tral Electric Supply, 4 % Guar. Deb.	5	7	7	7⅞ — 7⅞	..	4 7 6
aring Cross, West End & City	100	4	4	99 —102	..	3 18 5
o. 4½ % Cum. Pref.	5	5	5	3⅝ — 4⅛	— ⅛	6 1 3
o. "City Undertaking" 4½ % Cum. Pref.	5	4⅓	4½	4⅛ — 5	..	4 10 0
o. Do. 4 % Deb.	100	4½	4½	3¾ — 4¼	— 1/16	5 5 11
elsea, Ord.	5	4	4	94 — 98	..	4 1 8
o. 4½ % Deb.	5	4⅛	5	3⅞ — 4⅜	..	5 14 3
y of London, Ord.	Stock	4½	4½	98 —100	..	4 10 0
o. 6 % Cum. Pref.	10	7	7	12 — 12½	..	5 12 0
o. 5 % Deb.	10	6	6	11¾ — 12¾	..	4 14 1
o. 4½ % Second Deb.	Stock	5	5	119 —123	..	4 1 4
nty of Durham, 5 % First Mort. Deb.	100	4½	4½	100 —103	..	4 7 5
nty of London, Ord.	Stock	5	5	89½ — 91½	..	5 9 3
o. 6 % Pref.	10	5	5	7⅜ — 7¾	..	6 7 0
o. 4½ % Deb.	10	6	6	10¾ — 11¼	..	5 6 8
o. 4½ % Second Deb.	Stock	4½	4½	108 —110	..	4 1 10
mundson's, Ord.	Stock	4½	4½	100½ —103½	..	4 7 0
o. 6 % Cum. Pref.	5	Nil	Nil	3/8 — 7/8	..	Nil
o. 4½ % First Mort. Deb.	5	Nil	Nil	2 — 2½	..	Nil
kestone	100	4½	4½	83 — 86	..	5 4 8
o. 5 % Cum. Pref.	5	5½	6	4⅛ — 5 xd	+ ⅛	6 0 0
o. 4½ % First Deb.	5	5	5	4⅜ — 5⅛ xd	..	4 17 7
ve	100	4½	4½	95 — 98	..	4 11 10
	5	8½	9	6⅞ — 7⅜	..	6 2 0
Kensington & Knightsbridge, Ord	*					
Do. 4 % Deb.	5	8	9	6⅜ — 7½	..	6 0 0
Kent Elec. Power, 4½ % Deb.	Stock	4	4	91 — 93	..	4 6 0
London Electric, Ord.	Stock	4½	4½	80 — 84	..	5 7 2
Do. 6 % Pref.	3	2	2	1⅝ — 2	..	3 0 0
Do. 4 % First Mort. Deb.	5	6	6	4½ — 4⅞	..	6 3 1
Metropolitan	Stock	4	4	89 — 92	..	4 7 0
Do. 4½ % Cum. Pref.	5	5	5	3½ — 4	— ¼	6 5 0
Do. 4½ % First Mort. Deb.	5	4½	4½	4½ — 4¾	..	4 14 9
Do. 3½ % Mort. Deb.	Stock	4¼	4¼	100 —105	..	4 5 9
Midland Electric Corporation 4½ % First Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Newcastle-on-Tyne	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Pref., Non. Cum.	5	4	4	3⅜ — 4	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	5	5	5	3⅜ — 3⅞	..	6 9 0
Notting Hill	100	5	5	101 — 104	..	4 16 2
Oxford	10	7⅛	8	.. .	..	..
St. James' and Pall Mall, Ord.	5	7	7½	6 — 6½	..	5 11 6
Do. 7 % Pref.	5	10	10	8½ — 9	— ¼	5 11 1
Do. 3½ % Deb.	5	7	7	6⅝ — 7¼	..	4 16 7
Smithfield Markets, Ord.	100	3½	3½	85 — 87	..	4 0 6
South London, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
Do. 5 % First Mort. Deb.	4	5	5	2⅜ — 3	..	6 13 4
South Metropolitan, 7 % Pref.	100	5	5	98½ —101½	..	4 18 6
Do. 4½ % First Deb. Stock	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Urban, Ord.	100	4½	4½	95 — 98 xd	..	4 11 10
Do. 5 % Cum. Pref.	5	5	5	½ — 1	..	..
Do. 4½ % First Mort. Deb.	5	5	5	2 — 2½	..	..
Westminster, Ord.	100	4½	4⅓	85⅞ — 87½ xd	..	5 2 10
Do. 4½ % Cum. Pref.	5	10	10	7½ — 8	..	6 5 0
	5	4½	4½	4⅝ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

laide, 6 % Pref.	5	6	6	5⅛ — 5⅝	..	5 6 8
cutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
o. 5 % Pref.	5	5	5	5 — 5½	..	4 10 11
gary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
adian Gen. El. Com.	$100	7	7	104 —108 xd	+2½	6 9 8
o. 7 % Pref.	$100	7	7	118 —122 xd	+ ½	5 14 9
rdoba Lt., Power and T., Ord.	1	2	3	3/8 — 7/8	..	3 8 4
o. 5 % Deb.	100	5	5	92 — 95 xd	..	5 5 3
c. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
c. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
c. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85⅜ — 87½	+ ½	5 14 3
lgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/16	..	Nil
o. 6 % Pref.	1	6	6	1/16 — 3/32	..	8 6 8
ministiquia Power, 5 % G. Bs.	$500	5	5	101¼ —103¾	..	4 16 7
dras, Ord.	5	Nil	..	2⅜ — 2⅝	..	..
lbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
xican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
xican Lt. & Power, Common	$100	4	4	85½ — 87½	+ ½	4 11 5
o. 7 % Cum. Pref.	$100	7	7	107½ —109½	+1½	6 7 10
o. 5 % 1st Mort. Gold Bds.	..	5	5	93½ — 95½	+1	5 4 9
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	+1	5 9 11
Montreal, Lt., H. and Power	$100	6	7	167 —172	..	4 1 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	36 — 38	—1	13 3 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	+1	4 9 1
Shawinigan Water, Capital	$100	4	4	115 —117	..	3 8 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105½ —107½	+ ½	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

azon Telegraph	10	Nil	Nil	7/16 — 7/8	— 1/8	Nil.
o. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
erican Telep. & Teleg., Cap.	$100	8	8	136 —140 xd	..	5 15 11
o. Collat. Trust	$1000	4	4	93 — 95	—1	4 4 3
glo-American Telegraph	Stock	3⅜	3¾	67 — 69	..	5 8 8
o. 6 % Pref.	Do.	6	6	111½ —112½	+ ½	5 6 8
o. Def.	Do.	25/-	30/-	24⅜ — 25⅝	..	5 19 5
glo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
ili Telephone	5	8	7	6 15/16 — 7 3/16	..	4 18 3
mmercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½ xd	+1	4 10 5
ba Telegraph	10	6	6	10¼ — 11	..	5 9 1
o. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
rect Spanish Telegraph, Ord.	5	4	4	3⅜ — 4 xd	+ ⅛	5 0 0
o. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞ xd	+ ⅛	5 14 3
o. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
rect United States Cable	10	4¼	4½	7⅞ — 8¼	..	5 9 1
rect W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	+ ½	4 8 8
stern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
o. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
o. 4 % Mort. Deb.	Do.	4	4	102½ —104½	..	3 16 7
stern Extension	10	7	7	13½ — 14	..	5 0 0
o. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
st and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
obe Telegraph and Trust	10	5⅞	5⅞	10⅝ — 11⅛ xd	+ 3/16	5 5 7
o. 6 % Pref.	10	6	6	12⅛ — 13⅜	— ⅛	4 9 9
eat Northern Telegraph	10	18	18	30½ — 31½	..	5 14 3
do-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
ackay Companies Common	$100	4	5	83 — 85	..	5 17 8
o. 4 % Cum. Pref.	$100	4	4	74 — 76	..	5 5 3
arconi's Wireless Telegraph	1	Nil	Nil	2 3/16 — 2 5/16	..	..
Monte Video Telephone, Ord.	1	6	6	7/8 — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	25/32 — 27/32	+ 1/32	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	118 —121	+1	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	+ 1/16	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	+ ⅜	4 6 7
Oriental Telep. and Elec.	1	8	8	1 1/16 — 1 1/8	+ 1/16	4 14 10
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 1/8	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5	9 — 9½ xd	+ 3/16	4 4 3
Submarine Cables Trust	Cert.	6	6	133 —136	..	4 8 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16 — 7 7/16	— 1/16	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅝ — 2⅞	— ⅛	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13¼ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	107 —110	..	3 12 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Batb Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/4	..	Nil
Do. 5 % Pref.	1	5	5	1/4 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	77 — 81 xd	..	5 11 1
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1 3/8	..	Nil
Do. 6 % Pref.	10	1½	1½	3 3/8 — 3 3/4	..	3 17 5
Do. 5 % Deb.	100	5	5	90 — 93 xd	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	—1	4 13 0
Do. Def.	100	2	2	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	28½ — 29½	..	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1 1/8	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	3/8 — 7/8 xd	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3 — 3½	..	Nil
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Pres Yie p.c
	*					£ s.
Metropolitan Railway Consol.	100	1	1⅛	41¼ — 41¾	— ½	3 5
Do. Surplus Lands	100	2⅜	2⅜	64 — 66	..	4 3
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1
Metropolitan District Ord.	100	Nil	Nil	24½ — 25	+1	Ni
Do. 6 % Deb.	100	6	6	145 —147	..	4 1
Do. 4 % Deb.	100	4	4	97 — 99	+1	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	..	3 14
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13
Metropolitan Elec. Trams, Ord.	1	5	5½	29/32 — 1 1/32	..	5 6
Do. Def.	1	Nil	Nil	3/32 — 5/32	..	Ni
Do. 5 % Pref.	1	5	5	3/4 — 1	..	5 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9
Do. 5 % Deb.	100	5	5	100 —102 xd	..	4 19
Potteries, Ord.	1	2	2	7/32 — 11/32	..	..
Do. 5 % Pref.	1	5	5	3/32 — 3/32	..	7 12
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18
Soutb Metro. Trams, 6 % Pref.	1	3	6	15/32 — 17/32	..	10
Do. 4 % Deb.	100	4	4	72 — 77	—1	5 5
Underground Elec. Railways	10	..	..	1 3/8 — 1 5/8	..	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10
Do. 6 % Income	100	Nil	1	57 — 59	—2	1 13
Do. Power House Debs.	100	..	4	100 —102 xd	+1	3 18
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/4	..	Ni
Do. 6 % Pref.	5	Nil	Nil	2 3/8 — 2 5/8	..	Ni
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 2nd Pref.	5	5	5	4 3/8 — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	93 7/8 — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/8 — 11 1/4	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96 7/8 — 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6 5/8 — 7 1/8	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	139½ — 143½	+1½	5 11 6
Do. Pref. Ord.	100	6	6	120 —124	+1	4 16 9
Do. 5 % Pref.	100	5	5	107½ — 110½	+ ½	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½ — 103½	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5¾ — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/16 — 3/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 5/16 — 5 13/16	..	4 12 6
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½ — 102½	..	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf,	1	6	6	2 3/8 — 1 1/2 xd	..	5 1
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 1
Do. 5 % Deb.	100	5	5	96 —100	—1	5
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	..	5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5
Mexico Trams Com.	$100	7	7	118 —120	+4	5 1
Do. Gen. Con. 5 % Bonds	..	5	5	97 — 99	+ ½	5
Do. 6 % Bonds	100	6	6	97 — 99	..	6
Para Elec. Rlys. & Lt., Ord.	5	..	10	6 3/4 — 7 1/4	..	7
Do. 6 % Pref.	5	6	6	5 3/4 — 5 7/8	..	5
Do. 5 % 1st Deb.	100	5	5	99¼ — 101½	..	4 1
Pertb (W.A.) Elec. Tr., Ord.	1	2½	2½	1 3/8 — 1 5/8	..	2
Do. 5 % 1st. Deb.	100	5	5	101½ — 103½	..	4 1
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 3/8 — 5 5/8	..	5
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4
Rio de Janeiro Trams	$100	1	4½	116½ — 117½	+1½	3 1
Do. 1st Mort. 5 % Bonds	..	5	5	101½ — 102¼	+ ¼	4 1
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½ xd	..	5
Sao Paulo Tram, Lt. and P.	$100	10	10	173 —176	+2	5 1
Do. 5 % 1st Deb.	$500	5	5	102½ — 104½	..	4 1
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	—1	5 1
Soutbern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½ — 107½	+ ½	4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	3/16 — 11/16	— 1/32	Nil
Do. 6 % Pref.	1	12	9	1 1/16 — 1 3/8	..	7 7 8
Babcock & Wilcox	1	24	26	5½ — 5¾ xd	..	4 10 5
Do. Pref.	1	6	6	1 3/8 — 1 1/2 xd	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 3/4 — 7 1/4	..	6 17 11
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
Britisb Westingbouse, Pref.	3	Nil	Nil	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	99 —101 xd	..	5 18 10
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/4 — 1/2	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 17 11
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 7/16 — 3 9/16	— 1/16	4 18 3
Do. Deb.	100	4½	4½	103 —107	..	4 4 1
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	—2½	7 13 10

Dick, Kerr	1	6	5	1 3/8 — 1 5/8	..	5 6
Do. Pref.	1	6	6	1 5/8 — 1 7/8	..	5 12
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	Nil	9/32 — 11/32	..	N
Do. fully paid	5	Nil	Nil	1 1/4 — 2 1/4	..	N
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	77 — 80 xd	+1½	6 5
Electric Construction	2	Nil	2½	1/4 — 3/4	..	6 13
Do. Pref.	2	7	7	1 13/16 — 1 15/16	+ 1/16	7 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	8 1/4 — 9	..	5 11
Do. Deb.	100	4	4	86 — 91 xd	..	4 7
Henley's, Ord.	5	15	15	12 — 12 3/4	..	5 17
Do. Pref.	5	4½	4½	4 15/16 — 5 3/16	..	4 5
Do. Deb.	100	4½	4½	106¾ — 108¼	..	4 2
India-Rubber, G. & T.	10	10	10	13¾ — 15¼	..	6 9
Do. Pref.	10	5	5	9 3/4 — 10 3/4	..	4 16
Telegraph Construction	12	17½	20	34½ — 36½	..	6 11
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	Nil	3/32 — 5/32	— 1/32	N
Do. Pref.	5	1½	Nil	1/2 — 1	..	N
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otberwise stated, all sbares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1911.

Compared with the previous month's returns, those for August show considerable improvement as regards the export section, but, on the other hand, a marked falling off in the value of both imports and re-exports.

The exports from this country totalled some £399,149, a figure which compares with £356,645 in July, and has only once this year been exceeded (in March last). Even neglecting the £50,000 worth of telegraphic material the return is a very satisfactory one.

The import total for August reached £179,375, as compared with £188,360 in the previous month, and the re-export figures for the same months were £9,795 and £19,791 respectively—the former value being the smallest recorded during two years past.

During the month electrical machinery exports amounted to over £168,000, while the exports of telegraphic material, telephonic material, and of wires and cables were in each case in excess of £50,000. The export business in lamps reached £16,800 in value, and is steadily improving, month by month; it may also interest some to notice an export from this country to Belgium of nearly £30,000 of telephonic material—a reversal of the state of things existing a few years back. The individual items of the imports are mostly less in value than in July, but machinery and lamp imports are slightly better; otherwise they call for no comment.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	324	230	159	229	125	3,102	37	...	...	20	166	4,392
Germany	1,823	1,992	34	704	314	2,504	...	46	...	...	37	7,454
Netherlands, Java and Dutch Indies	1,105	675	162	72	43	619	...	62	...	13	15	2,766
Belgium	876	...	78	144	64	2,027	176	...	...	29,164	260	32,789
France	742	...	338	16	27	1,563	1,144	...	160	154	178	4,322
Portugal	22	45	...	...	...	73	801	2	...	...	...	943
Spain and Canary Isles	58	15	206	20	254	3,074	27	...	...	...	5,000	8,654
Switzerland, Italy and Austria-Hungary ...	365	...	15	28	800	2,868	72	9	...	...	19	4,176
Greece, Bulgaria and Turkey	19	108	150	43	...	245	...	92	...	15	127	799
Channel Isles, Gibraltar, Malta and Cyprus ...	46	1,828	14	21	97	341	2	95	...	...	312	2,756
U.S.A., Philippines and Hawaii	168	57	318	1,069	20	317	60	...	23	...	32	2,064
Canada and Newfoundland	996	2,721	979	455	866	9,930	...	1,328	139	25	64	17,503
British West Indies, British Guiana and Falkland Islands	158	...	21	54	4	...	342	33	...	65	64	741
Mexico and Central America	...	1,090	...	...	...	1,205	...	...	...	22	43	2,360
Peru and Uruguay	239	...	543	58	79	181	...	18	...	...	...	1,118
Chile	278	715	705	117	80	3,523	2,173	1,605	21	189	213	9,619
Brazil	603	1,902	531	525	10	3,496	883	429	70	794	12,599	21,842
Argentina	1,649	3,947	997	1,050	741	6,675	...	3,425	12	4,696	2,891	26,083
Colombia, Ecuador and Bolivia	23	...	33	...	...	30	...	...	...	141	...	227
Egypt, Tunis, Persia and Morocco	402	206	187	169	50	1,343	1,622	353	...	234	275	4,841
British West Africa and St. Helena	36	99	95	...	433	210	2	37	...	77	316	1,305
Rhodesia, O.R.C. and Transvaal	2,235	1,145	438	2,705	499	10,344	15	265	108	63	932	18,749
Cape of Good Hope	1,667	1,746	282	1,130	491	20,806	12	181	28	278	807	27,428
Natal	1,244	5,858	638	804	45	7,625	27	204	54	22	100	16,621
British East Africa, Mauritius and Aden ...	29	181	24	177	37	353	2	...	...	283	18,098	19,184
Azores, Madeira and Portuguese Africa ...	522	924	24	...	9	339	...	34	...	57	44	1,953
French African Cols., Madagascar & Indo-China	227	125	128	...	37	54	72	...	...	...	298	941
China and Siam	429	362	120	255	161	4,344	...	8	...	219	167	6,065
Japan and Korea	1,300	98	33	45	245	15,539	1,777	1,214	80	2,871	4,837	28,039
India	2,480	8,380	1,514	3,959	956	11,927	2,817	3,414	139	227	813	36,626
Ceylon	143	193	100	237	10	421	8	66	...	...	24	1,202
Straits Settlements and Fed. Malay States ...	350	3,487	110	98	45	570	866	32	...	271	102	5,931
Hong Kong	32	85	70	33	172	456	107	37	...	114	...	1,106
West Australia	873	156	7	133	9	454	...	10	...	17	126	1,785
South Australia	289	446	218	196	39	1,524	400	5,247	...	309	22	8,690
Victoria	1,041	8,242	389	452	365	5,055	349	79	...	6,974	583	23,529
New South Wales	1,051	8,074	250	1,263	260	6,726	353	1,110	88	1,918	...	21,093
Queensland	135	...	...	155	34	5,507	334	...	69	448	200	6,882
Tasmania	35	...	...	...	...	...	...	...	...	...	24	59
New Zealand and Fiji Islands	1,526	1,010	438	396	558	10,863	100	218	...	795	607	16,511
Total, £	25,541	56,142	10,348	16,812	7,979	146,233	14,580	19,653	991	50,475	50,395	399,149

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	46	...	...	49	7	992	148	674	...	6,635	8,551
Germany	3,820	4,272	2,406	22.973	2,183	64,624	335	1,025	5,060	19,960	126,658
Holland	160	...	...	354	...	112	...	...	71	...	697
Belgium	457	1,142	...	40	11	1,697	60	151	303	5,829	9,690
France	58	...	572	1,599	358	330	...	621	2,835	819	7,192
Switzerland	160	805	156	57	75	2,102	10	...	...	170	3,535
Italy	18	395	...	5	...	262	...	...	...	524	1,204
Austria-Hungary	6	311	...	200	...	8	...	6	493	282	1,306
United States	3,738	1,045	197	1,044	...	9,387	4,252	290	50	268	20,271
Total, £	8,463	7,970	3,331	26,321	2,634	79,514	4,805	2,767	8,812	34,487	179,104

Additional imports: Portugal, batteries, £3; machinery, £40. Spain, carbons, £70. Japan, machinery, £15. Canada, goods, £129; machinery, £14.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	5,147	1,756	...	912	...	1,056	...	256	334	38	296

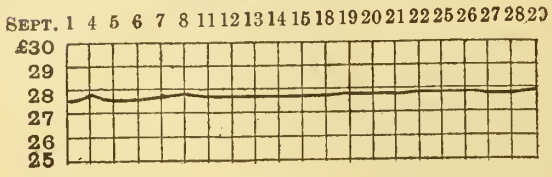
Total Exports: £399,149. Total Re-Exports: £9,795. Total Imports: £179,375.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

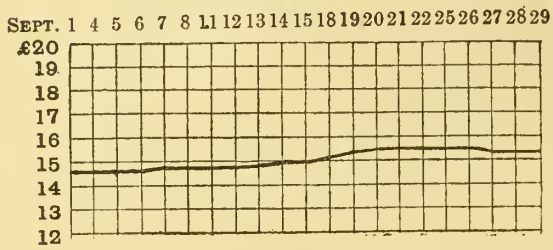
METAL MARKET.

Fluctuations in September.

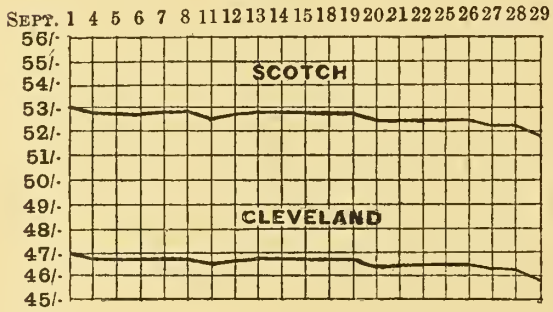
SPELTER (G.O.B's.).



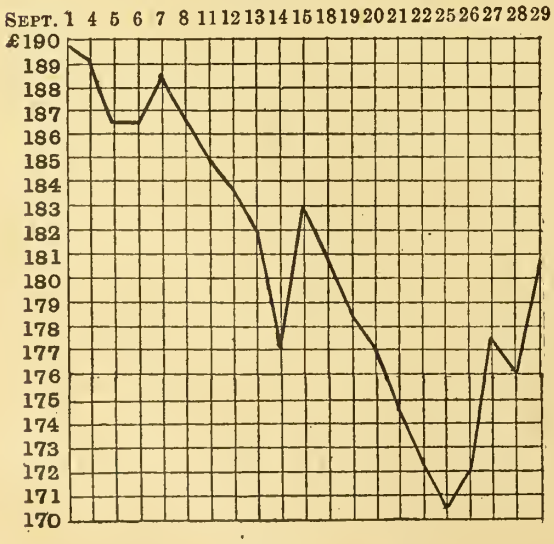
LEAD (ENGLISH).



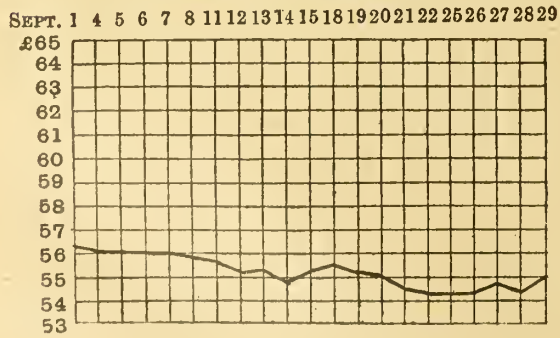
IRON.



TIN.



COPPER (G.M.B's.).



ELECTRIC COOKING: ITS PRESENT POSITION AND COST.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E.

With the evolution of the very much more reliable electric cooking apparatus which is now available, greater and greater interest has been aroused of late as to its applications and costs of operation. Such data are difficult to obtain, and mean much troublesome investigation and experimental work. Still, the matter is of such great importance in connection with the possibilities of the extension of the sale of electrical energy, that it is well worth the time expended in investigating it. For some years past the writer has given considerable attention to the subject on account of its bearing on central station electricity supply, and he has accordingly been asked by the Editors of the Electrical Review to set forth, for the benefit of others, some of the data he has collected; he further hopes that others, who happen to have any useful data, will allow them to be published for the common good.

Before entering into specific details, it will be well to summarise the present position of electric cooking, which is not a case of possibilities, but rather one of actualities. There is now no question at all as to the quality of the cooking carried out by the electrical method, simply because the way of applying the heat is an ideal one which is under perfect control. Electrically cooked food has a specially attractive flavour of its own, and it is always properly cooked through—not half-burnt and dried on one side or the exterior, and half-done elsewhere. A great deal of attention has been drawn of late to the advantages of paper bag cookery—and rightly so, in the opinion of the writer, for if intelligently handled, results can be obtained which nearly equal those attained with the electric oven, without the bags, be it noted. In other words, paper bag cookery has not so many advantages in conjunction with the electric oven, though, of course, it adds to the cleanliness of the operation of cooking, since there are no pots and pans to cleanse if the paper bags are used. Also when several dishes are being cooked together, paper bags prevent an intermingling of flavours and aromas.

While many admit the excellent quality of electric cooking, they still consider it to be a luxury beyond the reach of ordinary mortals. This, however, is not the case, for it is an interesting fact that if coal or gas cost nothing, it would still be cheaper to cook a joint of meat in an electric oven and pay a comparatively high rate per unit for electricity. For the loss due to the process of electric cooking is so slight, as compared with that sustained when gas and coal ovens are employed, that a very considerable saving is effected on the butcher's bill, so much so that, after paying for the electricity, and assuming that nothing was paid for gas or coal, the housekeeper would still have money in hand. The following tables and chart, giving the results of various experiments carried out in private houses, show clearly what an important matter this is, and what a definite saving of money may be brought about by the use of the electric oven.

BEEF.

Weight of joint when cooked.	Weight to be ordered from butcher when cooking is to be done by						Saving of meat and money when electricity is used instead of							
	Elect'ty.		Coal.		Gas.		Coal.				Gas.			
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	s.	d.	lb.	oz.	s.	d.
4	4	8	5	11	5	14	1	3	1	2	1	6	1	4
5	5	11	7	3	7	6	1	8	1	6	1	11	1	8
6	6	13	8	9	8	13	1	12	1	9	2	0	1	11
7	7	15	10	0	10	5	2	1	2	1	2	6	2	4
8	9	2	11	7	11	13	2	5	2	4	2	11	2	8
9	10	4	12	14	13	4	2	10	2	7	3	0	3	0
10	11	6	14	5	14	11	2	15	2	11	3	5	3	4
11	12	8	15	11	16	3	3	3	3	2	3	11	3	8
12	13	10	17	2	17	11	3	8	3	6	4	1	4	1

In the above and also in the succeeding table, the joints were nicely done and thoroughly cooked through. Of course, if they had been underdone, the shrinkage in the case of the coal and gas ovens would not have been quite as much. Mrs.

Beeton's Standard Cookery Book states that in ordinary roasting a loss occurs of anything from one-quarter to one-third of the weight of the joint. This is a further confirmation of the correctness of these tables.

MUTTON.

Weight of joint when cooked.	Weight to be ordered from butcher when cooking is to be done by						Saving of meat and money when electricity is used instead of					
	Elect'ty.		Coal.		Gas.		Coal.				Gas.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	s.	d.	lb.	oz.	s.	d.
4	4	8	5	7	5	8	0	15	0	10	1	0	0	10
5	5	11	6	13	6	15	1	2	1	0	1	4	1	1
6	6	13	8	2	3	5	1	5	1	1	1	8	1	3
7	7	15	9	7	9	11	1	8	1	3	1	12	1	6
8	9	2	10	13	11	2	1	11	1	5	2	0	1	8
9	10	4	12	2	12	8	1	14	1	7	2	4	1	11
10	11	6	13	8	13	15	2	2	1	9	2	9	2	2
11	12	8	14	14	15	5	2	6	2	0	2	13	2	4
12	13	10	16	4	16	11	2	10	2	3	3	1	2	7

The foregoing tables are very interesting; in fact, they almost seem too good to be true. They are, however, based on actual results obtained from a series of experiments; further, they are such simple experiments that anyone can easily substantiate them for himself. An illustration which supports the evidence of the tables just referred to is given below. It gives the actual results of a series of experiments carried out in a private house to check the electric oven makers' statement—that a saving of at least 10 per cent. would be effected if their apparatus was used instead of a gas oven or a coal range—a statement which apparently claimed too much, whereas it will be noted that it erred very considerably on the side of modesty :—

Date, 1911.	Joint.	Weight before cooked.		Weight when cooked.		Type of oven.	Loss of weight.		Loss per cent.
		lb.	oz.	lb.	oz.		lb.	oz.	
Mar. 23	Ribs of beef ...	5	7	3	12	Coal	1	11	31
„ 26	Leg of mutton ...	8	8	5	13	„	2	11	31·7
„ 29	Should'r of mutton	6	13	5	1	„	1	12	25·7
Apr. 2	Leg of mutton ...	8	4	6	0	Gas	2	4	28·1
„ 9	Leg of mutton ...	8	0	7	12	Electric	1	4	13·9
„ 15	Should'r of mutton	4	12	4	2	„	0	10	13·1
„ 16	Ribs of beef ...	9	1	7	6	„	1	11	18·6
„ 23	Leg of mutton ...	9	1	7	10	„	1	7	15·8
„ 30	Should'r of mutton*	5	10	5	0	„	0	10	11·1

* The last item shows the best results, *i.e.*, the least shrinkage. This is explained by the fact that the use of the electric oven was better understood with practice.

The householder who carried out the experiments made comments as follows upon his experiences :—

1. The great convenience and thorough cleanliness of electric cooking.

2. The cost of the electricity consumed compares very favourably with that of gas or coal.

3. That once electrically cooked joints, poultry, &c., have been tasted, no one will want to go back to the gas or coal-cooked article, with its drawn and shrivelled appearance.

It may be of interest to mention that the oven used in the above-mentioned experiments was one of the "Tricity" cookers.

Another actual example, obtained in a private house, is as follows :—

Weight of Joint (Top Side of Beef).

	Coal range.		Electric oven.	
	lb.	oz.	lb.	oz.
Weight uncooked ...	5	4	4	0
Weight cooked ...	3	6	3	8
Loss in cooking ...	1	14		8
	35·7 %		12·5 %	

Therefore, with electric cookers, 4 lb. may be purchased instead of 5¼ lb.

The next question that is sure to occur is, do these savings amount to anything, or are they only a paper calculation? This is again best answered by citing an actual case. The cooker used was of the "Tricity" make.

In a £70 a year house, with six persons resident practically all the year round, the butcher's bills with coal cooking averaged over several years £52 per year. The first year's use of electric ovens reduced the butcher's bill to £38, while the coal consumed was 8 tons instead of 16 tons. Summary :—

	Old style.		Electric.
Butcher's bills ...	£52		£38
Coal bills	18		9
Electricity bills. Lighting only at 5d. per unit, with carbon lamps	13	Lighting at 4½d. per unit with metal lamps & cooking at 1½d. per unit ...	18
	£83		£65

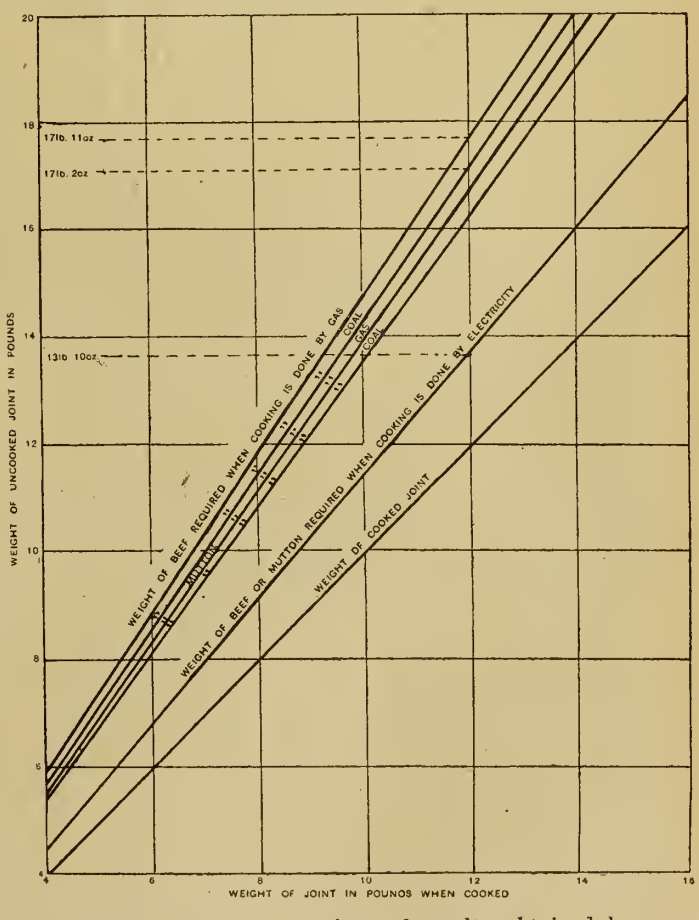
Net cash saving ... £18 per annum.

Another record of a test carried out by a private consumer was as follows :—

Gas Oven.—Joint, leg of mutton; weight before cooking, 12 lb. 4 oz.; after cooking, 9 lb. 3 oz.; loss in weight, 3 lb. 1 oz.; percentage loss, 25 per cent.

Electric Oven.—Joint, leg of mutton; weight before cooking, 11 lb.; after cooking, 9 lb. 1 oz.; loss in weight, 1 lb. 15 oz.; percentage loss, 17·6.

The cost of cooking the joint in the gas oven was 3½d., and in the electric oven 3¼d. The value of the meat saved by the smaller shrinkage in the electric oven than in the gas oven was 1s., and in addition there was the slight saving of ¼d. in the cost of cooking. The electric oven used was of the "Marylebone" type, which is very similar in appearance to the ordinary gas oven.



The following is a comparison of results obtained by an expert in gas cookery :—

Losses in cooking meat when gas, coal or electric ovens are used, respectively. Example: If 12 lb. of cooked beef are required,

13 lb. 10 oz. must be put in the Electric oven, as the loss is 1 lb. 10 oz.
17 lb. 2 oz. „ „ „ Coal „ „ „ 5 lb. 2 oz.
17 lb. 11 oz. „ „ „ Gas „ „ „ 5 lb. 11 oz.

Conversely, if 12 lb. of uncooked beef is put in an

Electric oven, it will weigh 10 lb. 8 oz. when cooked.
Coal „ „ „ 8 lb. 7 oz. „ „
Gas „ „ „ 8 lb. 1 oz. „ „

Gas Oven.—Joint, leg of mutton; weight before cooking, 3 lb. 4 oz.; weight after cooking, 2 lb. 12 oz.; loss, 8 oz.; time taken to cook, 1 hour 10 min.; percentage of loss, 15·4 per cent.; cost of cooking, 1·9d.

Electric Oven.—Joint, leg of mutton; weight before cooking, 3 lb. 7 oz.; weight after cooking, 3 lb. 2 oz.; loss, 5 oz.; time taken to cook, 1 hour 15 min.; percentage of loss, 9 per cent.; cost of cooking, 1·8d.

The value of the meat saved by the less loss in the electric oven, as against the gas oven, was 2¼d., which will be seen to be more than the cost of cooking the joint.

Note.—The loss in a gas stove when in the average cook's hands would be nearer 12 to 16 oz. The cook who

carried out this test is an expert on gas cooking, and the finest regulation obtainable by the gas cooker was used. This was the first occasion on which this cook used an electric oven, and the latter was of the "Marylebone" pattern.

The following is a comparative test of gas and electric cooking (Harold Gray) :—

	Size of oven.	Weight of bread.	Time.	Consumption.	Cost per lb. bread.
Gas ...	6,400 cb. in.	8 lb.	58 min.	31 ft.	0·128d.
Electric ...	6,137 cb. in.	9 lb.	52 min.	0·92 unit	0·102d.

The figure for the cost of electricity per lb. of bread is the average of seven tests taken over a lengthened period. The figure for gas is the average of four tests.

Cooking Meat.—The average consumption of electricity per lb. of meat is just over one-fifth of a unit. This is borne out by the following series of experiments :—

Weight of joint in lb.	Time, h. m.	Units consumed.	Units per lb. of meat.	Cost at 1d. per unit. s. d.
32	5 0	9	0·281	0 9
38	5 0	9	0·237	0 9
40·5	4 0	11	0·271	0 11
41	4 10	8	0·195	0 8
41	5 0	10	0·243	0 10
41	5 30	9	0·219	0 9
41·5	4 0	9	0·216	0 9
43·5	5 30	11	0·252	0 11
48	6 0	13	0·271	1 1
53	6 20	11	0·207	0 11
58·5	7 40	13	0·222	1 1
87	7 30	14	0·161	1 2

Electric Cooking Data.

The following costs of cooking and baking by electricity are important as giving authentic and complete data on this subject, and it should be particularly noted as significant, that the cost per person per meal for cooking by electricity is not only practically the same in the following cases, but agrees very closely with the results obtained in many other instances where the observations cover even longer periods.

The results approximate 300 watt-hours per meal per person (say one-third of a unit).

Costs over Eight Months.—The table below gives the details of the cost, and the energy consumption for doing absolutely all of the cooking and baking by electricity in a private house, covering a period of eight months :—

Dates.	Units.	Cost at 1d. per unit.	No. days 3 meals each.	No. days 2 meals each 1 person.	Equivalent No. persons per day.
			2 persons		
June 23—July 24 ...	71	5/11	31	17	2·55
July 24—August 22 ...	71	5/11	29	18	2·62
August 22—Sept. 24... (House closed 2 wks.)	31	2/7	17	5	2·30
Sept. 24—Oct. 22 ... (House closed 2 wks.)	26	2/2	19	4	2·21
Oct. 22—Nov. 22 ...	63	5/3	32	28	2·51
			3 persons		
Nov. 22—Dec. 22 ...	87½	7/3	29	16	3·55
Dec. 22—Jan. 22 ...	87	7/3	31	25	3·81
Jan. 22—Feb. 22 ...	97½	8/11	31	22	3·71
Eight months' total	533	£2/3/5	219	135	3·69

Total single-person days 674
" " meals... ... ... 1.887
Units per person per meal... ... ... 0·282 total average.
Cost at 1d. per unit 0·282d. per person per meal (just over ¼d.).

Costs over Three Months.—The following is a record of the use of electric cooking utensils by a family of four :—

Total number of days in use 90
Units consumed 400
Average units per day ... ... 4·45
Average cost per day 4·45d. (nearly 4½d.)
Units per person per meal ... ... 0·37

The utensils used and proportion of energy used by each were as follows :—

Oven ... ... 25 per cent.
Water-heater ... ... 30 "
Disk stove ... ... 15 "
Broiler ... ... 15 "
Frying pan ... ... 10 "
Grid and coffee percolater ... ... 5 "

Costs over Three Months.—The following table shows the results of comparative experiments on the cost of electric cooking for three persons. These experiments were carried out in Switzerland during a period of three months (W. R. Cooper) :—

Period. 1901.	Consumption (units). One month.	Per day.	Cost per day with energy at 1d. per unit.
March 22nd—April 22nd	67·04	2·24	2·24d.
May 1st—May 31st ...	63·55	2·19	2·19d.
June 1st—June 30th ...	66·31	2·21	2·21d.

The cost of cooking with paraffin oil in the same case was 3·3d. per day (1½ quarts of oil).

Costs over One Month.—The particulars below give in great detail the results of a careful record taken in a private house during a period of 30 days :—

Total units for 30 days... 137
Units per day for month ... ... 4·5
Number of dishes cooked during 30 days 288
Number of regular meals (three meals per day) served during the month 90
Total number of meals... 116
Average number of persons per meal per month ... 3·9
Number of individual meals served during month ... 351
Units per meal per person per month ... ... 0·39
Units per meal ... ... 1·52
Maximum demand shown by Wright demand meter in KW. ... ... 2·0
Maximum demand shown by recording ammeter charts ... ... 3·2

(This 3·2 KW. peak occurred for 7 minutes about 8 a.m., January 5th. It does not occur at any other time during the month. It was caused by using the oven and several other appliances at the same time.)

Maximum demand during station peak, or between 5.30 and 6 p.m. ... ... 1·3
Load factor with 1·3 KW. as a maximum, 14 per cent.; load factor with 2 KW. as a maximum, 9·5 per cent. Number of times oven was used... 27

(The abnormal conditions are shown by the last figure, as the average family will hardly use an oven on the average nearly once a day for a month. This was caused by the necessity for special cooking. As the oven consumes more energy than any of the rest of the apparatus, its frequent use, of course, makes the total consumption for the month above normal.)

The average of the monthly gas bills for this family, for the eight months before electric cooking was begun, with gas at 3s. 6d. per thousand, was 9s. 6d. For 16 months previously to that when gas was 4s. per thousand, the average bill was 12s. 6d. Several years ago, before gas was piped in the neighbourhood, the anthracite coal range used by this family took a ton of coal a month regularly.

For a time before, oil was used for cooking exclusively and approximately 12s. worth of oil was consumed every month.

The electrical apparatus used was as follows :—One two-quart combination porridge cooker, steamer and water boiler ; one 8-in. three-heat stove with 5-quart saucepan ; one two-heat frying pan ; one coffee percolator ; one broiler ; one oven ; one 7½-lb. flat-iron ; one stove and chafing dish.

Examples of Single Meals.—Below will be found some particulars of electrically cooked meals :—

Meal.	Food cooked.	Time. Min.	Units.	Cost.
Breakfast—4 people	Coffee ; fried potatoes ; bacon.	20	0·7	0·7d.
Breakfast—4 people	Coffee ; porridge ; steak ; fried potatoes.	40	1	1d.
Breakfast—5 people	Coffee ; porridge ; bacon and eggs ; fried potatoes	30	1	1d.
Lunch—3 people	Fish ; potatoes ; pancakes.	20	0·25	¼d.
Lunch—2 people	Chicken fricassee ; peas ; apple fritters.	20	0·5	½d.
Lunch—3 people	Cutlets ; mashed potatoes ; blanc-mange and stewed fruit.	35	1·2	1·2d.
Dinner—4 people	Soup ; pork chops ; boiled potatoes ; jam omelette ; coffee.	50	1·35	1·35d.
Dinner—5 people	Soup ; chicken ; cauliflr ; potatoes ; queen pudd'g.	75	2·5	2·5d.
Dinner—5 people	Soup ; boiled salmon ; veal chops ; boiled potatoes ; stewed apples ; coffee.	55	2	2d.
			10·5	10½d.

Cost per person per meal, at 1d. per unit, a little under ¼d. (0·3d.).

ber of ons.	Food cooked.	Units consumed.	Cost.	Method of cooking.
ve.	4½ lb. corned beef (boiled); potatoes; cabbage; beetroot; cup custards.	2·24	2½d. (2·24d.)	Steamer.
ix.	4½ lb. roast pork; potatoes; turnips; 2 apple pies; 3 loaves bread; coffee.	6·15	6d. (6·15d.)	Oven (chiefly).
ght	4 lb. corned beef; carrots; parsnips; turnips; cabbage and potatoes; 2 fruit puddings; 2 large apple pies; 2 loaves brown bread; 1 doz. small cakes; 1 doz. buns.	6·04	6d. (6·04d.)	Steamer and oven.

Cost per person per meal, ¾d.

Toasting.—Small toasters, toasting four slices of bread at e, cost 1d. to operate for 160 slices.

ull electrical details of a dinner prepared on January 9th, 1, on a Simplex cooker, are given below :—

Soup	1	quart
Cutlets	6	
Sirloin of beef	7	lb.
Potatoes	2	„
Sprouts	12	

e.	Meter.	Switch.	Operation.	Amps.	Remarks.
8	39·35	Maximum	Oven warming up	11	Oven at full
4	39·35	„	12 mince pies	10	—
1	4·60	Min. only oven	—	7¼	Oven heat reduced to min. only
5	40·69	Min. only oven	Mince pies finished	—	do.
6	40·71	Min. only oven	Meat in (7 lb. sirloin)	—	—
7	40·77	Small boiler at full heat	Potatoes in (2 lb.)	8	do.
1	41·15	Max. switch only	—	10	Oven at max. only
9	41·41	Min. only for small	—	—	—
3	41·53	Small boiler off	Potatoes placed in oven for finishing	6½	—
8	42·09	Oven at full	—	10	Oven at full
3	42·29	Large boiler at full	Sprouts put on	13	—
5	43·34	Grill (full)	—	—	—
.6	43·39	Oven max. only	—	16	—
5	43·86	Large boiler max. only	—	15·5	—
8	43·98	Large boiler off	Sprouts finished	14	—
9	44·02	Oven on min. only	—	10	—
5	44·22	Oven off	Heat finished	6	—
5	44·43	Grill off	Grill „	—	—

Cost of Electricity as Compared with that of Coal and s.—The figures given in the foregoing tables show that t: cost of cooking by electricity is exceedingly reasonable. It it is necessary also to compare the price with that of g and coal, and this comparison shows that where gas costs 6d. per 1,000 cb. ft., and electricity is 1d. per unit, the actual costs of cooking are about equal, while even at 1½d. per unit, electricity is cheaper than coal. But the economy in electric cooking lies not so much in the actual amount of money paid out for the energy used, but rather in the economy effected by the satisfactory manner in which the food is cooked, without the usual waste and loss due to shrinkage. Moreover, there must also be taken into account its accompanying advantages of perfect cleanliness, and the entire absence of fumes, smell and smoke—its saving of labour in many directions, and its uniformity of results. When all these points in its favour are brought into consideration, it must be acknowledged that the adoption of electric cooking will be fully justified from an economic point of view.

Average Electricity Bills.—From the experience of the writer, the amount of energy consumed in cooking for a family of from three to five persons works out at an average of one-third of a unit per meal per person. This average is demonstrated by the results already given in tabular form, and is also confirmed by the well-known scientist, Dr. Fleming, F.R.S., in his Cantor Lecture at the Royal Society of Arts, London, "Applications of Electric Heating," when he said that on the lines of the rule for making tea—*i.e.*, "one spoonful for each person and one for the blessed pot," the amount of electricity consumed in an electric oven for cooking purposes might be stated as a unit per day per person and two or three more for the oven. Reckoning the rate for a unit to be 1d. (which is now a usual charge for power and cooking), the monthly bill for electricity used for cooking purposes will come to from 3d. to 5d. per day, or 7s. 6d. to 12s. 6d. per month, for a family of three to five. This compares very advantageously with the price of coal.

One central station made a careful tabulation of the bills of 50 of its consumers who were doing all their cooking by electricity, and found that they averaged 18s. per month, ranging from 12s. to 24s. per month, depending upon the number of persons cooked for, the rate being 2½d. per unit. These figures indicate clearly that the cost of electric cooking is very reasonable, even when its accompanying advantages are not taken into consideration. In many towns the price of electricity used for heating and cooking is much less than 2½d. per unit, the rate upon which these latter figures are based.

There is a wide, unfilled gap between the manufacturer and the user of electric ovens, which very few are taking steps to lessen. The Berry Construction Co. are noteworthy on account of the great trouble they have taken to bridge this gap, by the establishment of a working kitchen that is in regular operation. Firms who do this sort of thing should know a good deal more about the practical requirements of cooking apparatus than those who only occasionally test an oven on actual cooking, with a fitter as an amateur cook.

Among central stations which are aiding in this good work, the Borough of St. Marylebone Electricity Supply Department, and the Brompton and Kensington Electricity Supply Co. are worthy of special mention, as they have passed beyond the stage of playing with electric cooking, which so many do nowadays, and have fully equipped kitchens, which they use.

Electric ovens are still somewhat expensive appliances as compared with the cost of gas stoves. Still, it must be remembered that they are better made and have a greater thickness of heat insulating material. The cost, however,

Some Standard Electric Ovens.

Make.	Dimensions of oven in inches.	Cubic inches.	Cubic feet.	Watts taken by Oven.	Boiling plate, No. 1.	Boiling plate, No. 2.	Hot plate.	Grill or frying pan.	Total watts.
[.-H.	18 × 10½ × 14½	2,744	1·59	1,500	—	—	—	—	1,500
lipse	21 × 13½ × 13½	3,820	2·22	2,000	800	800	—	800	4,400
arylebone	20 × 15½ × 16	4,960	2·87	2,500	1,200	1,000	—	1,200	5,900
œnix	18 × 14 × 14	3,522	2·04	2,000	750	750	500	1,000	5,000
ometheus	20 × 13 × 10½	2,725	1·58	1,875	—	—	—	—	1,875
„	18 × 18 × 22	7,128	4·12	4,000	1,000	750	—	500	6,250
nplex	18½ × 14 × 14	3,624	2·1	2,400	1,000	750	750	1,000	5,900
ierol	16 × 15½ × 14	3,416	1·97	300*	—	—	—	—	300
icity	14 × 16 × 16	3,584	2·08	1,600	800	—	800	—	3,200
„	12 × 12 × 12	1,728	1	800	800	—	—	—	1,600
rity	19½ × 12 × 15	3,505	2·03	2,000	—	—	—	—	2,000

* This also provides the heat for two boiling connections on the top of the stove. An additional incandescent heater for browning, of 350-watt capacity, can be put on when required, the current being temporarily switched off a water heater for this purpose.

is being reduced, as larger numbers are being sold. As long as the number of ovens in use is not too great, the load they give is very welcome to the central station manager. Londoners do not seem to appreciate that the custom of dining in the evening is the exception in country towns rather than the rule, hence there is no real fear of the heating peak coinciding with the lighting peak outside of London.

Should the cooking load become greater than the lighting load, there is no question that it will be difficult to handle properly when the ordinary apparatus is employed. Here then is the field for the heat storage oven, of which the "Therol" is an example, for taking, as it does, only a very small amount of power throughout the 24 hours of each day, it provides that load factor of 100 per cent. that every engineer is searching for.

Though the above comments have referred more particularly to domestic cooking, restaurant work can also now be carried out economically with electrical apparatus. The writer recently reported upon and advised a large London Institution to install electric cooking apparatus with a capacity for cooking 200 dinners daily, and is now superintending the installation of the apparatus Of course, a cooking plant of this size would not have been considered unless it were conclusively shown that it was better and more economical than any other method.

The Navy Department of the United States have decided upon the adoption of electric ranges and baking ovens as the standard cooking apparatus for their men-of-war, not only on the score of cleanliness, convenience, compactness and improved hygienic conditions, but also because electric ovens are slightly less expensive to operate than a coal range.

In conclusion, it may be mentioned that, of course, it is impossible to deal very comprehensively with such a big subject as electric cooking, in the limited space available here, but sufficient has been said to show that it is by no means any longer a visionary art.

THE ADVANTAGES OF ELECTRICITY IN THE PRINTING OFFICE.

From the Owner's Point of View.

The advantages of electric lighting and driving as applied to printing offices have been frequently referred to in our columns, but as the arguments are usually from the point of view of the electrical engineer, it might be said that they are not always quite disinterested. It is rarely that we are able to obtain the real views of the printing works proprietor, as there is naturally a tendency on his part not to emphasise the benefits which he has obtained, either in economy or in other directions, as a result of the electrification of his works, and we are therefore all the more pleased to give prominence to these views when they are expressed.

In a recent issue of the *Illustrated London News* a special supplement was included, which dealt very thoroughly and exhaustively with the production of this well-known and excellent publication. The works have been recently reorganised under the direction of the printing works manager, Mr. Rudd, who is recognised as one of the ablest men in the printing trade, and a complete system of electric light and power formed a part of the more comprehensive scheme. A few years ago the firm introduced one or two motors with a view to testing the question of economy, but it was decided as a result of these tests that, at the prices then charged for electricity, very little economy was to be gained. Since that time electric supply companies have cultivated and encouraged the power consumer, and prices have come down very considerably. When the reorganisation was put in hand, the firm called in an electrical expert, viz., Mr. Frank Broadbent, who is retained as technical adviser by several important London printers, and after going carefully into the matter, he advised them that very considerable economies could be effected in the cost both of power and lighting, assuming that suitable terms could be arranged with the supply companies.

As a very considerable proportion of the load is an all-night load, it was not difficult to arrange satisfactory terms, and the results, judging from the expressions of opinion the special supplement referred to, have fully come up expectations. The technical details of the installation not enlarged upon in this general description, and these, a matter of fact, are not of very great interest to proprietors, who are more concerned with actual resu The following quotations from the article referred to will of considerable interest to our readers, and will put i their hands arguments which are capable of being used w considerable effect in connection with any similar scher which they may have in view.

Dealing with the general conditions of the elect driving, the proprietors say :—

Perhaps most important of all the recent alterations which h been made in the change from the older style to the present mo office, is that of the adoption of electrical driving. The comp reorganisation of the works is surely nowhere more successful t in this direction. More wonderful still is the fact that the tr formation was so effected that regular work was continued and stoppage whatever resulted. The couple of horizontal compo engines and the old beam engines have gone entirely, together w their boilers, and the space they occupied provides a much-nee extension of accommodation for machines.

It is most difficult to realise, when standing in one of these roo that only recently older machines were installed, and that a per tangle of shafting and belting occupied the air space above presses. When one's eyes rest appreciatively upon the spick-a span automatically operated and motor-driven presses, remembra of the older condition arouses something like a shudder. And not forget that the former equipment was also very good in its and was typical of many of the best London offices.

The safety of electricity is emphasised in the follow terms :—

Danger from fire is minimised very considerably by the adop of electric lighting and electric driving, with the consequ absence of openings for belting from floor to floor, the remova the old steam boilers and the gas jets. These have given plac newer and safer methods.

There is an entire absence of shafting and belting overhead, thus no dust and grease flies about, the workers are safe from risk always accompanying belts and shafting, and the gain in l and general access is beyond praise.

The whole installation is not only entirely successful in provi safe and reliable means of lighting and driving, but in compar with the cost of the older methods is wonderfully econom Thus, the establishment not only gains materially in regar cleanliness and light, but the electrical power for the mach does away with noisy and dangerous shafting and belting. actual cost, too, there is a gain, this being but one-third of former heavy charge.

REPORT ON CHARGES FOR ELECTRIC ENERGY SUPPLIED FOR TRACTION PURPOSES FROM COMBINED STATIO

The Joint Committee of representatives of the I.M.E.A. and M.T.A., which has for some time been considering the a matter, has come to the conclusion (subject to the reservat and general notes which follow) that the following broad princ should be adopted as the basis for the charge for electrical en supplied for traction purposes from combined stations, viz. :—

1. That the charge should be based upon the actual cos production.

2. That in order to ascertain the actual cost of production necessary that the "standing costs" and the "running co should be properly separated, and the following allocatio suggested, subject to the general observations subsequently ma this report, viz. :—.

	Standing costs.	Runnin costs.
Coal...	25 %	75 %
Oil, waste and water	25 %	75 %
Repairs :—		
(*a*) Building	100 %	—
(*b*) Steam boilers, piping, &c. ...	75 %	25 %
(*c*) Engines and generating plant...	50 %	50 %
Repairs of joint mains in case of high-tension stations	100 %	—
Wages at generating stations	50 %	50 %
,, ,, sub-stations	100 %	—
Salaries of operating officials	100 %	—
Rents, rates and taxes on joint assets (not including income-tax) ...	100 %	—
Management expenses (salaries of administrative officials)	50 %	—
Interest in respect of all capital which is used in common for the various classes of supply	100 %	—
Depreciation in respect of all assets used in common for the various classes of supply	100 %	—

3. That the tramways department's proportion of the standing sts should be the ratio which the maximum demand for traction rposes at the generating station bears to the total maximum mand on the generating station, such maximum being arrived at the same manner in each case as hereinafter set forth.

4. That the tramways department's proportion of the running sts should be the ratio which the total number of units delivered feeders at the station for traction purposes bears to the total mber of units delivered to feeders at the station for all rposes.

5. That the traction maximum demand should be taken to be the an of the figures representing—(1) the maximum traction mand at any time of the year, and (2) the average of the daily ximum traction demand (Sundays excepted) taken over a period a month coincident with the maximum demand on the station. The method of ascertaining the traction maximum shall be taken the maximum observed load, deducting therefrom 20 per cent.

6. That in cases where storage batteries are in use the figure to adopted as the traction maximum demand, and used for allocat- to the tramways department their proportion of the standing sts under the headings of :—

(*a*) Rents, rates and taxes, and

(*b*) Management expenses

ould be the generating plant maximum plus the battery—and for e purpose of allocating the remaining standing costs—*i.e.*,

(*a*) Coal.

(*b*) Oil, waste and water.

(*c*) Repairs.

(*d*) Wages at generating and sub-stations, and

(*e*) Salaries of operating staff,

e maximum demand to be adopted should be the maximum mand of the generating plant only.

That the two-hour rating of any storage battery should be emed to be its kilowatt capacity, and that all repairs to the ttery, which could be used for the dual purpose of lighting and action, should be dealt with in the same manner as repairs to gines and generating plant. If, on the other hand, it is put in r purely traction purposes, it should be dealt with under the ading of repairs to exclusive traction plant.

7. That the total costs in respect of traction feeders and any her apparatus connected exclusively with traction distribution ould be wholly allocated to the tramways department, such costs include interest, depreciation and repairs.

8. That it is desirable, as a matter of ordinary commercial udence, that there should be established in connection with ctrical undertakings a suitable reserve fund for meeting any traordinary expenditure in any year, and that the tramways partment should bear their proper proportion of the annual sums be set aside for establishing such reserve fund, but it should be understanding that the tramways department should be a party the fixing of the annual amounts to be so set aside.

9. That the total actual cost of production of current for traction rposes may be summarised under the following heads, viz. :—

(*a*) Proportion of standing costs (ascertained as per Paragraphs 2 d 3).

(*b*) Proportion of running costs (as per Paragraphs 2 and 4).

(*c*) Total cost of traction feeders, &c. (as per Paragraph 7).

(*d*) Proportion of reserve fund (as per Paragraph 8).

10. That the question as to what amount of profit (if any) should paid to the electricity department by the tramways department, a matter which each municipality should settle for itself. The int Committee have only endeavoured to lay down what they nsider to be the correct method of ascertaining the actual cost of oduction, and upon which they suggest the charge should be sed.

General Notes Made by the Joint Committee.

Coal Allocation as Between Standing and Running Costs.—The estion as to the proper proportion of coal to be allocated to the anding costs received careful consideration by the Joint Committee. From the evidence in their possession it would appear that e amount of coal which is consumed to make up for radiation sses differs somewhat in the various stations. The general formation obtained showed that it averages from 4 lb to 5 lb. per lowatt of plant usefully employed per day. It is suggested by e Joint Committee that each municipality should carefully go to this matter with a view to ascertaining, as far as possible, the tual figure for their particular station. If, however, it is not ought worth while in any particular case to go into this detail, is suggested that the division suggested by the Joint Committee ould be adopted, viz., 25 per cent. to standing costs, and 75 per nt. to running costs.

Oil, Waste and Water.—The Joint Committee, after considering e allocation under this head, suggest that it should follow the vision proposed in the case of coal. They recognise that this ay not be strictly accurate, but they think that the smallness of e figure does not justify a different allocation.

Repairs to Steam Boilers, Piping, &c.—The figures suggested as ie allocation under this head are not less than 75 per cent. to anding costs, the balance going to running costs. The Joint ommittee suggest that the figures should be settled for each ation having regard to local conditions.

Salaries of Operating Officials.—Under this head it is suggested iat only the salaries of those officials should be included whose rvices are devoted to generation and transformation of electrical ergy.

Management Expenses (Salaries of Administrative Officials).—Under is head the proposal is to include the salaries of the administra- ve staff as apart from the staff engaged at the generating station. would include the salary of the chief engineer, the secretary, he accountant, and officers of that class. It will be observed that it is proposed to allocate half only of the management expenses to standing costs, the remaining half having no connection with the traction supply, is eliminated from the calculations.

Interest and Depreciation.—The capital it is suggested should be that which is used *in common* for the various classes of supply, and should be ascertained by taking the total capital expenditure of the undertaking and deducting therefrom all items which are *not* used in common, *e.g.* :—

Traction feeders ; lighting feeders and distributing networks and services ; meters, &c. ; motors (for hire) ; any other plant not used for the *common* supply.

In calculating the depreciation charges it is suggested that the "lives" of the various portions of the assets should be fixed in accordance with the actual provision made by the electricity department.

Method to be Adopted for accurately Measuring the Current supplied for Traction Purposes.—The Joint Committee suggest that all direct-current meters should be of the watt-hour type. When fixed in positions where they are liable to be affected by stray magnetic fields they should be astatic, and of a type containing no iron or permanent magnets, and should not be affected by momentary overloads or short circuits. Where meters containing permanent magnets or iron are used, it is advisable that they should be shielded as much as possible.

It is further desirable that all meters should be calibrated for the temperature of the surrounding medium in which they will be located. For loads up to 2,000 amperes the total current type is recommended, and above this output the shunted type—each with its own shunt.

Where polyphase currents have to be measured "Dynamometer" or "Induction" type meters may be used.

It is suggested that the two-wire wattmeter method should be employed as being the most satisfactory way of metering three-phase electrical energy.

The Joint Committee recommend, having regard to the importance of reliable measurements being obtained, that in all generating stations three wattmeters should be arranged in series. One meter being the property of the tramways department.

In all important sub-stations they consider that two wattmeters will suffice, one of which would also be the property of the tramways department.

Provision should be made for reference to an independent authority in the event of any dispute arising as to the accuracy of any or all of the meters installed.

Reservations made by the Joint Committee.

Traction Maximum Demand.—The Joint Committee in Paragraph 5 have suggested a method of ascertaining the traction maximum which they are of opinion could be equitably applied to the majority of tramway undertakings in the kingdom ; they consider, however, that it might not be applicable in every case where the "peaks" are accentuated or where the ratio of

$$\frac{\text{Sustained maximum demand}}{\text{Average maximum demand}}$$

is of an abnormally high value due to (*a*) geographical, or (*b*) service conditions. As an instance of the former they cite the case of those towns having very severe gradients on their system, and as an instance of the latter, the case of those towns having to deal with football or other abnormal rush traffic.

Capital Charges.—The Joint Committee have set forth in Paragraphs (2) and (3) and further amplified in the "General Notes" what they consider is the most practicable method of treating the question of the capital charges in the ascertainment of the costs of traction supply. They are aware, however, that circumstances may arise in connection with the development of electrical undertakings which might properly justify some departure from the method suggested.

They have had under their notice the case of stations where the principle of dealing with the capital charges on the "common plant" basis, or the "pooling system" as it may be termed, would not be in the best interests of either the electricity or the tramways undertakings. They therefore suggest the following as an alternative basis which might be applied in cases which come within this category, viz :—

(*a*) That the tramways department's proportion of the charges for interest on capital expenditure in respect of generating and transforming plant and boilers should be based upon the cost per kilowatt for such plant at the time of its installation, the amount of such plant to be ascertained on the maximum demand principle already described, plus a reasonable allowance for reserve or spare plant to be determined in accordance with the local conditions.

(*b*) That the tramways department's proportion of the interest on the capital in respect of land and buildings should be based upon the proportion which the kilowatt capacity of the traction plant bears to the total kilowatt capacity installed.

(*c*) That the depreciation charges should be determined in accordance with the paragraph under the heading of "General Notes" contained in this report.

The Joint Committee cannot make any recommendation as to which of the two methods outlined should be applied in any particular instance. Each case should be settled on its merits, having regard to the local conditions, and in the event of any dispute arising, the Joint Committee suggest that provision should be made for referring the matter to an independent engineer for settlement.

The Joint Committee acknowledge the special assistance which they have received from the Sub-Committee, consisting of Mr. S. L Pearce (Manchester), and Mr. T. Roles (Bradford), representing the I.M.E.A. ; and Mr. J. M. McElroy (Manchester) and Mr. C. J. Spencer (Bradford), representing the M.T.A.

NEW PATENTS APPLIED FOR. 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,576. "Means of charging tramway mains from a three-wire lighting system and *vice versa*." W. A. Stevens. September 18th.

20,586. "Regulator for dynamo-electric machines." T. Ferguson. (Convention date, September 17th, 1910, United States.) September 18th. (Complete.)

20,588. "Means of locking incandescent electric lamps into their holders." C. Spencer. September 18th.

20,614. "Arc lamps." H. E. Moul. (M. Korting, Germany.) September 18th.

20,620. "Telephone installations." W. E. Lake (firm of Gustav A. Meyer-Henniger, Germany.) September 18th. (Complete.)

20,631. "Holders for incandescent electric lamps." R. F. Peel. September 18th.

20,636. "Protective devices for dynamos, electromotors, and similar electric machines." F. V. Schiodt. (Convention date, September 17th, 1910, Germany.) September 18th. (Complete.)

20,638. "Apparatus for recording telephonic communications on phonographic dictating machines." A. Baumgartner. September 18th.

20,659. "Insulation of electric conductors." British Westinghouse Electric and Manufacturing Co., Ltd. (K. C. Randall, S. W. Farnsworth and C. Le G. Fortescue, United States.) September 19th. (Complete.)

20,667. "Electric condensers." Electric and Ordnance Accessories Co., Ltd., J. R. Garner and N. Collins. September 19th.

20,693. "Construction of armatures for dynamos, electric motors, and other electric machines." A. Cattaneo. September 19th.

20,695. "Apparatus for electrically heating water." W. H. Chipperfield. September 19th.

20,709. "Operation of electrical machines of the induction type." W. A. Price. September 19th. (Complete.)

20,713. "Treatment of salammoniac skimmings." G. Rigg. (Convention date, November 12th, 1910, United States.) September 19th. (Complete.)

20,718. "Electric shade carrier tongs." J. Ball. September 19th.

20,733. Motor-feed mechanisms for electric arc lamps and the like." H. J. Booker. September 19th.

20,745. "Electric sign or display system and apparatus therefor." E. M. Wildey and H. C. Merrett. September 19th.

20,761. Method of and means for changing the frequency of alternating currents." A. M. Taylor. September 20th.

20,787. "Working of telegraph and telephone circuits and the like." E. S. Heurtley. September 20th.

20,794. "Series electrical incandescent lighting." B. C. Atherton. September 20th.

20,810. "Apparatus for producing a perforated paper slip by electric current impulses." H. Bille. (Convention date, April 7th, 1911, Germany.) September 20th. (Complete.)

20,818. "Telegraph instruments, relays, and the like." P. E. Davenport and S. G. Fermor. September 20th.

20,829. "Single-phase commutator motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) September 20th. (Complete.)

20,833. "Regulatable electric resistances." A. E. Naumann. September 20th. (Complete.)

20,850. "Magnetic earth-wave appliance." H. Harris. September 21st.

20,860. "Electromagnetic relays." Western Electric Co., Ltd. (Western Electric Co., Ltd., United States.) September 21st, (Complete.)

20,898. "Telephone apparatus." E. A. Graham. September 21st. (Complete.)

20,899. "Sparking plugs for internal-combustion engines." Firm of Robert Bosch. (Convention date, December 3rd, 1910, Germany.) September 21st. (Complete.)

20,903. "Means of governing the supply of electricity where a meter may not be desirable." G. Wallace and J. Elphinstone-Graham. September 21st.

20,904. "Dynamo-electric generators." G. Inrig and Gavan Inrig, Ltd. (Divided application, 20,754/10, May 2nd, 1911.) September 21st. (Complete.)

20,905. "Dynamo-electric generators." G. Inrig and L. Inrig. September 21st.

20,919. "Speed regulation of electrically driven ring-spinning and twisting frames." Siemens Bros. Dynamo Works, Ltd., and J. F. Crowley. September 21st.

20,943. "Means of warming and airing beds or the like by electricity whereby all parts are heated by radiant heat." A. R. Oxley and A. R. Martin. September 22nd.

20,987. "Branch-clamps for electric conductors." K. Walseck and H. Starcke. September 22nd. (Complete).

20,995. "Safety device for electric cables." Siemens-Schuckertwerke G.m.b.H. (Addition to 17,046, 1911. Convention date, May 2nd, 1911, Germany.) September 22nd. (Complete.)

20,996. "Safety device for electric cables." Siemens-Schuckertwerke G.m.b.H. (Addition to 17,046, 1911. Convention date, May 2nd, 1911, Germany.) September 22nd. (Complete.)

21,000. "Artificial lines used in duplex telegraphy." S. G. Brown. September 22nd.

21,001. "Automatic sectioning means for limiting accidental interruptions of current supply in central stations." E. Brandenburg. (Convention date, October 8th, 1910, Belgium.) September 22nd. (Complete.)

21,025. "Magneto-electric ignition apparatus." B. Brooks and F. H. Alston. September 23rd.

21,026. "Electric heating apparatus." C. M. Holmquist. September 23rd.

21,042. "Electrical cooking and heating apparatus." B. Thomas and E. Thomas. September 23rd.

21,054. "Electrical plug-and-socket connections." A. F. Berry. September 23rd.

21,055. "Telephonic apparatus." H. W. Sullivan and C. T. Hay. September 23rd.

21,069. "Compensating device for telephonic circuits." S. G. Brown. September 23rd.

21,070. "Trolley heads for electric tramcars and the like." R. H. Hillman. September 23rd.

21,072. "Electric pocket lamps." E. Neudorffer. (Addition to 14,604, 1911.) September 23rd. (Complete.)

Southampton Electric Lighting.—The Harbour Board has decided to expend £354 in bringing the electrical equipment at the Pier and Town Quay to a state of efficiency.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Portable Electric Battery Lamps. K. K. Smith. 20,378. September 1st.

Apparatus for Treating Liquids with Ultra-Violet Rays. V. Hem A. Helbronner and M. von Recklinghausen. 20,486. September 1 Addition to 2,424/10.

Apparatus for the Electrical Production of Steel. T. Levoz. 20,5 September 3rd. (September 4th, 1909.)

Magnetic Separators. G. T. Meek. 21,045. September 9th.

Contact Clips for Electric Wires and Cables, Pipes and so forth D. Nield. 21,408. September 14th.

Electrically Heated Cooking Stoves or Ovens. Electric and Ordnan Accessories Co. and J. D. Morrison. 21,468. September 15th.

Light Reflectors and Means for Supporting Incandescent Electric La therein. R. G. Tyler and E. H. Freeman. 21,574. September 16th.

System of Point-Shifting Mechanism for Railways or Tramways, work from the Locomotive or the Car by means of Electricity. E. Piaca A. Pacini and O. Capellano. 24,524. October 22nd.

Means for Controlling the Traversing Motion of Electric Coal-Cutti Machines. T. W. Crossland and A. Crossland. 25,426. November 2nd.

Packing of the Plates of Electric Storage Batteries. B. M. Dra J. Waddell and D.P. Battery Co. 25,516. November 3rd.

Holders for Electric Lamps. C. D. Copland. 25,697. November 8th.

Incandescent Electric Lampholders. J. Barnes. 26,232. November 11th

Electrical Safety Fuses. G. Müller. 27,259. November 23rd.

Revolving Electrical Furnaces. O. Serpek. 29,715. December 21 (Addition to No. 29,299 of 1910.)

1911.

Terminals for Ignition Plugs, Magnetos, and other Electrical Conn tions. W. H. Moore and Ambrose, Shardlow & Co. 12,984. May 30th.

Electric Arc Lamps. Siemens Bros. Dynamo Works. (Siemens-Schuck werke Ges.) 14,685. June 21st, 1911.

Electric Light Attachments. J. A. Williams and G. A. Gillies. January 4th.

Electric Furnaces. H. Helberger. 419. January 6th.

Incandescence Electric Lamps. C. H. Weber. 1,210. January 17th. (Ma 26th, 1910.)

Magnetically Locked Miners' Safety Lamps. R. Cremer. 1,665. Janu 23rd.

Method of Constructing the Conduit and Track for a Slot System Electric Traction. G. S. Albanese. 3,022. February 6th. (Febr 5th, 1910.)

"Intensive" Osram Lamps.—The Deutsche Gasglühli Aktiengesellschaft have just placed on the market "Intensive" Os lamps for which they claim an efficiency of 0·8—0·9 watt per (hefner). This claim is certainly justified by Reichsanstalt t (see abstract in Table I), but it will be noticed that these were c carried to 1,000 hours (whereas an average life of 2,000—3000 h or over is now quite usual for Osram lamps), so that it is yet early to decide definitely that a considerable fraction of improved efficiency is not due merely to over-running the lamps

The new lamp is available in 200, 400, 600 and 1,000 hefner u and for line voltages of 100—160 volts or 200—260 volts, but c for the lower voltage range is 0·8 w./hef. c.p. claimed; the 20 260-volt lamps consume 1 w./hef. c.p. The list prices of several sizes are respectively 7s. 6d., 13s., 16s. and 22s., and operating costs, per 1,000 hours, of various "Intensive" Osram D.C. and A.C. arc lamps are claimed to be as shown in Table II which the lower mean hemi-spherical c.p. of the Osram lamp taken = 1·12 × M.H.C.P., allowing for the reflectors employed).

TABLE I.—Summary of Average Reichsanstalt Test D on Four "Intensive" Osram Lamps; 110·5 volts A.C.

Burning hours.	Current amps.	Hefner c.p. perpendicular to lamp axis (mean).	Watts per hefne c.p. perpendicula to lamp axis.
0·2	3·15	410	0·85
200	3·18	410	0·86
600	3·16	392	0·89
1,000	3·12	374	0·92

Best efficiency 0·83 w./c.p. after 200 hours; worst efficiency w./c.p. after 1,000 hours (same lamp in each case).

TABLE II.—Comparative Costs, per 1,000 Burning Ho of Various Lamps.

Lamp.	Lower mean h.-s. c.p. (hefner).	Cost per 1,000 bu hours (marks energy per B.T at 4½d.	at
200-hefner "Intensive" Osram ...	224	89	4
400 " " ...	448	172	8
600 " " ...	672	253	12
4-amp. D.C. carbon arc	187	131	7
6-amp. D.C. " "	356	184	10
4-amp. D.C. long-hour arc ...	262	218	10
6½-amp D.C. " " ...	517	341	16
2-amp. D.C. "Sparbogenlamp" † ...	211	114	5
6-amp. A.C. arc	82·5	108	6
15-amp. A.C. arc	105	232	12

* Approx. shillings (1 mark = 11¾d.). † High efficiency arc.

THE
ELECTRICAL REVIEW.

VOL. LXIX. OCTOBER 13, 1911. No. 1,768.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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Cheques and Postal Orders (on Chief Office, London) to be made payable to r. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE MINERS' DECISION.

THE Conference of the Miners' Federation is over, and though it did not actually decide to take a ballot vote for a national strike, there can now be but little doubt that the evil day is only postponed for a while. This, however, is something to be thankful for, as it allows time for sauer thoughts to prevail, and the miners' leaders have now an excellent opportunity of proving themselves to be leaders worthy of the name, by taking up a strong attitude against the recalcitrant section of their members who are in a state of mutiny quite as much against their recognised chiefs as against the coal-owners and society. Mr. Fenwick, M.P., of the Northumberland Miners' Association—all honour to him—in a well-timed and well-chosen speech, warned the members that the speech of Lord Furness was neither a boast nor a threat, but a bare statement of actual fact, and asked them to give it their serious and careful consideration, before entering upon a campaign which could only end in defeat, and which would involve themselves and others in useless suffering.

The words of Mr. Fenwick, however, appear to have fallen on barren ground, because on the Conference assembling on Thursday last week, it decided to support Northumberland to the extent of a national stoppage to obtain (*a*) a minimum wage of 30 per cent. above the 1879 basis; (*b*) the abolition of the three-shift system; and (*c*) the restoration of all short shifts which existed previously to the introduction of the Eight Hours Act operating in Northumberland.

As mentioned in our article last week, the Northumberland miners have already taken a ballot vote, and succeeded in getting a majority to strike for the second clause, but nothing was stated on the ballot papers regarding the minimum wage, and this has only been tacked on to the three-shift trouble so as to make it a wages question, in order to meet the Federation rule, which we believe we are correct in stating is to the effect that a national strike can only be commanded on a question of wages. Mr. Straker, in making the application on behalf of the Northumberland miners, referred to the Broomhill Collieries, and stated that they were situated quite as well as other collieries in the country to work a two-shift system. Against this, however, we have the statement of Lord Furness that the manager, Prof. Merivale, in a well considered report to the directors, said the increased cost of working the collieries on a two-shift system under the operation of the Eight Hours Act would be between £30,000 and £40,000 per annum; and surely we may take it that these gentlemen know what they are talking about.

On the question of "abnormal places," the Conference decided that each district should arrange meetings between the coal-owners and miners' unions, to try to come to some local agreement, and, failing this, the Conference will meet again on November 14th to decide whether a national strike shall be balloted for or not. We sincerely trust that the negotia-

tions locally may be successful in deciding this difficult problem, but considering the rebellious nature of the younger and more headstrong members of the unions, we confess we have little faith that it will bring any lasting peace. The minimum wage for all workmen would only be demanded with increased insistence: the action of the Northumberland men is also to be reckoned with, and we have little hope, judging from the speech of Mr. Straker, that they will see the folly of striking.

Considering everything, therefore, we are reluctantly compelled to admit that a national coal strike may be upon us possibly before the year is out; and it would be as well for all electrical undertakings to watch their coal supplies, but all the time to be prepared, as it is only by adequate preparation that one section of society can ward off tyrannous and unreasonable attacks from another. The success or defeat of the strike will largely depend upon such preparation, and finally, we would point out that to defeat the object of the miners would not only make for the benefit of the nation, but would be of lasting benefit to the coal trade and to the miners themselves.

The Demand for Technical Men.

A letter in the *Daily Mail* of September 26th, emanating from the Falcon Works, Loughborough, drew attention to the "difficulty in obtaining the services of young men properly trained in the erection and installation of electrical machinery and carrying out of contracts." So serious was this difficulty that the writer suggested that if recruiting for electrical service were not stimulated, British firms would have to import such men from the Continent.

This letter drew a joint reply from two correspondents in Taunton, who declared that the profession of electrical engineering was already overcrowded with qualified men, either earning a miserable wage or else unable to obtain a position in any capacity, and to enforce their argument they referred to our advertisement columns, which, they said, contained many advertisements for premium pupils, to pay considerable sums for the privilege of working for the advertisers, but only a few for trained men, and those at salaries from 10s. to 30s. a week. In their view, it was inadvisable for anyone to enter the profession, unless he had a private income! A third letter showed how the writer had placed two of his sons in medicine and the Church respectively, with immediately successful results, whereas two other sons who had been well trained in engineering, including electrical engineering, found it difficult to obtain employment at a salary above £150 a year.

What, then, are the actual facts? Excluding exceptional cases, is the profession of electrical engineering still overcrowded, as it certainly was a few years ago, or is it not? Too much importance must not be attached to the views expressed in the letters abstracted above; on the one hand we have a firm which takes a number of premium apprentices, and may find it less easy, for various reasons, to obtain them than formerly (be it noted that if an adequate supply of college-trained premium pupils is forthcoming, there will be no lack of choice among these on the completion of their pupilage to fill the posts referred to): on the other hand, there is a large class of men who have not had the benefit of technical training, and who, finding themselves unable to rise above the position of shift engineer, utter bitter complaints as to the overcrowding of their ranks, which they confound with the overcrowding of the profession. Whether the Taunton letter is of this nature or not we cannot tell; but it savours somewhat of that complexion.

More reliable indications, perhaps, can be obtained from two other sources: the technical colleges and the large firms who do not receive premium pupils. During recent years we have pointed out, in reviewing the annual reports of the City and Guilds of London Institute, that the number of students admitted to the electrical engineering departments of the Institute's Colleges has steadily declined for many years, while the number admitted to the civil and mechanical engineering departments has correspondingly increased. The Colleges in question have not by any means lost prestige during that period, but, on the contrary, have been greatly improved in staff and equipment—the Central Technical College, moreover, having become an integral part of the Imperial College of Science and Technology; the increase in the number of mechanical engineering students also goes to show that the Colleges are as popular as ever. The change, therefore, must be ascribed to the growth of a general public opinion that electrical engineering was overdone; and this view was, no doubt, in accordance with the facts.

But the turnover, which was not confined to the London Colleges, and was of considerable magnitude, was bound to have its effect in time; and, in fact, the time has arrived already. For the past two years, the demand for electrically-trained men from the Colleges has exceeded the supply. Large manufacturing works, which take no premium apprentices at all, apply to them for such men, and are unable to obtain them. At the present moment the City and Guilds (Engineering) College, at which 30 students received the Diploma in Electrical Engineering last summer, has applications for five electrically-trained men, but has none to send.

The pendulum has swung past the point of equilibrium and the excess demand is almost certain to continue to increase, for there is a time lag between public opinion and actual fact; just as the rush into electrical engineering continued until the profession was overstocked, so the shortage will probably endure for some years to come. The rapid and continuous development of the applications of electricity, which tends always to increase the demand, acts now in the same sense as the delay in public opinion, and the growing realisation of manufacturers that highly-trained men are essential to their business is a third factor with the same tendency. We believe, therefore, that parents who wish their sons to embark upon a profession of infinite possibilities and fascinating interest—even though it be not highly lucrative—might do worse at this time than place them in electrical engineering.

The Continental Glow Lamp Syndicate.

Various reports have recently been in circulation in Germany to the effect that the Continental Glow Lamp Syndicate, which only controls the trade in carbon filament lamps of the principal makers in Germany and Austria, is on the point of being dissolved. The Verkaufsstelle Vereinigter Gluhlampenfabriken, which is the title of the syndicate which has headquarters in Berlin, now states that the lamp-makers combined in the syndicate concluded agreements for a period of 10 years which will only expire on March 31st, 1914. It is added that in the meantime no proposal has been made from any quarter for an earlier dissolution of the combination. This compared with this statement, a Berlin newspaper observes that some of the constituents intend to give notice prematurely, and that the absence of a formal proposal at present does not mean much. On the other hand, a Frankfort newspaper states that the idea has prevailed in electrical circles for some time past that the continuance of the syndicate has become very doubtful, because the sales of 30,000,000 lamps provided for in the present year will scarcely be reached. The idea has a probability, but nothing definite can be said before the end of the season, which is now beginning. Taken as a whole, the business in carbon lamps has decidedly decreased, and, in point of fact, in the same degree as the prices of metallic filament lamps have been reduced. As will be remembered, this took place in the first instance about two years ago, and since then quotations have further declined in consequence

he aggravation of competition through large extensions orks on the part of the original makers, and through the tion of new works. Nevertheless, the wire lamp still s from three to four times the price of the carbon rival. idea of also syndicating wire lamps has repeatedly been ɔcated, particularly by the less important makers, whilst question has likewise been discussed at times by the st producers. The result has, however, hitherto been of a tive character, owing to the facts that the extension of ɔries has not been regarded as having been finished, and an end to technical improvements in the lamps cannot oreseen. In addition to these considerations, the profits nanufacturing—at least, those of the large firms—do not even at present prices to have been converted into a loss would compel one maker or the other to give way on question of a syndicate. If, therefore, the carbon-lamp icate should really be dissolved by the end of this year not be reformed under other conditions, a period of competition may be expected in German trade circles for types of lamps.

ıe Burden of Giving a Character.

One of the most troublesome duties which falls to the lot of the employer is the giving of a character. When the conduct of a workman has been satisɔry, to speak well of him is a pleasure; but it is irksome ɔeak ill of anyone, even in the performance of a duty. is it easy to escape from the task. To refuse a character ɡether is, from the worker's point of view, the worst ible course to adopt. It may well be that the reason a man was dismissed from one service will not militate nst his successfully filling another post. Some people avour to shirk responsibility either by giving a purely ırless character, or by confining themselves to one or two ls of commendation. Thus a man might be truthr described as a "skilful machinist," although he was unctual or lazy. Experience has shown that the only course is to reveal the truth, the whole truth, and ing but the truth. That anything in the nature of *ressio veri* is fraught with danger to the employer self is revealed in a case which was heard in the Maryne County Court last week. The facts were very ple. The plaintiff, a grocer, who advertised for an tant, received an answer from a man who gave the defendant's name as a reference. The plainapplied to the defendant, who said that the had been in his employment for three years, and that was honest and a good worker. Upon this he was emed by the plaintiff. After having been employed for months, he was convicted of theft. The plaintiff thereı brought suit for damages against the defendant. From somewhat meagre report, the judge appears to have been sfied that the plaintiff asked the defendant whether he knew thing against the assistant; that the defendant replied that did not, and that, in fact, the defendant knew that ther employer had alleged dishonesty against the assistant. the event the plaintiff had judgment and obtained nages. From this case it would appear that it is the duty n employer when asked a general question as to honesty eveal anything he knows, whether derived from his own erience or from information. On the contrary, suppose question put was: "Has he been honest while in your rice"? It is conceived that "Yes" would be a sufficient wer. Nevertheless it is clear that the employer would ır no liability to an action for libel whatever he revealed, ause all communications of this kind when made without ice are absolutely privileged.

Electro-Harmonic Society.—The 1911-12 season ns with the concert to be held on Friday next, October 20th. following are the dates on which concerts will be held:—

riday, October 20th, 1911.—Smoking concert.
onday, November 20th, 1911.—Ladies' night.
riday, December 15th, 1911.—Smoking concert.
riday, January 12th, 1912.—Smoking concert.
uesday, February 27th, 1912.—Ladies' night.
riday, March 22nd, 1912.—Smoking concert.

ll are to take place in the King's Hall, Holborn Restaurant, mencing at 8 p.m.

THE INFLUENCE OF WIRING METHODS ON HEATING AND COOKING.

By J. W. B.

The arguments in favour of systems of charging for electricity supply of the "Telephone," "Norwich" and other "fixed price plus cheap rate" class are many, although it is not difficult to bring forward an equal number in support of the separate-meter system. One of the principal advantages claimed for the "common meter" is that it allows energy for any purpose to be drawn from any part of an installation —a distinct benefit, but one not likely to have so far-reaching an effect on the introduction of electric heating and cooking in ordinary houses as some have imagined, for the following reasons:—

The general use of electricity for cooking, and, later, for heating, cannot be brought about by cheap supply rates alone, but must be assisted by facilities for hiring the necessary apparatus.

Heating stoves and cooking ranges can seldom be used at any point on a lighting system, owing to the wiring being too small for their requirements.

Small consuming devices such as irons, kettles and fans are not likely subjects for hire, although given an attractive system of charging for energy, it can be shown that it would pay to give them away, within limits, if such a course were possible.

It may be stated that the first field for electricity supply, after lighting, lies in cooking equipments for flats and houses of a value up to about £60 per annum in rental. In larger establishments the cooking appliances are usually satisfactory and combined with hot water supply, whilst economy in service is not a first consideration; therefore it appears that the principal revenue-earning apparatus will be used in positions where, on the one hand, separate wiring is essential, and on the other, owing to the energy being all taken at one point—the kitchen—the cost of such separate wiring need not be a serious item, and should be met by the hiring charge together with maintenance and inspection. In such cases the only objection which can be raised to a separate meter lies in the rental involved. As the actual extra cost of this to the supplier will be of the order of 4s. per annum, this also can be charged up in the general hire terms.

Amongst the advantages of the separate rates and meters are:—

The lighting account is not obscured, and can be averaged in case of meter failure; whilst any attempt to feed the lighting off the heating circuit can be more easily detected.

The lighting meter can be kept small—*i.e.*, accurate on light load. A meter which would be large enough for the requirements of a 2 to 3-kw. cooking outfit would in a short time allow 30 to 60 c.p. of light to be obtained free; this point should be borne in mind when framing the fixed charges for single-meter systems, an essential feature of which must be a comparatively high and protective fixed charge with the lowest possible rate per unit, because, owing to the great range of load upon such meters, and the impossibility of gauging their performance by inspection of the accounts, their average accuracy will suffer, and their revenue-earning responsibility should be reduced accordingly. In other words, the tariff must be so framed that the consumer has nothing to gain over the usual flat rate terms by wasting light, and so raising the peak unnecessarily, whilst the low rate per unit tempts him to employ electricity for every possible purpose, with resulting increase in diversity and load factor on the supply system.

These considerations with regard to separate wiring are of increasing importance in view of the efficiency of the metallic lamp, and the increased conductor loading permitted by the I.E.E. Rules. At the present time, installations of 30 to 50 lights are being carried out entirely with 3/22 or 1/18 wire, and on A.C. systems the use of voltage reducers still further complicates the question of using energy for other purposes than light. However, the low-voltage metal lamp has done so much to secure the position of electric lighting in the public mind that these drawbacks should

D

not be overrated, but the remedy should be looked for rather in cheap and simple systems of "heat" wiring, which may run from room to room, and either be metered separately or connected to the light wiring at the source of supply as desired.

Generally speaking, one heating point per room can be made to serve all requirements, multiple plugs being used if desired. From the service entry to the kitchen ample capacity should be provided, the conductors diminishing as the circuit travels through the house. For this work a loop-in plug socket with fuses "forward" and switch on the branch circuit is desirable.

For the circuit, several surface systems offer themselves. Stannos material, used double, lead-covered V.I.R. twin cable, heavily rubbered twin-wire "cab-tire" class, are all suitable and easily fixed, the latter having the advantage that it may also be easily removed, while its character and appearance is in itself a protection, it being difficult to mistake it for a non-electrical pipe, as may happen with the metal-covered conductors.

In running circuits of this class, it may often be found convenient and possible to run lead-covered wiring along the outside of the building, looping in and out of each room through the woodwork of the window frames.

In such cases the lead sheath should be made continuous and earthed and fixed only with lead cleats. Stannos material has been used extensively in a similar way, and although such circuits may be damaged by the operations of the builder or gardener, faults are easily found and remedied and internal disturbance is reduced to a minimum.

SUPPLY STATIONS AND ELECTRICAL CONTRACTORS.

[COMMUNICATED.]

Of recent years there has been much dispute as to the authority and justification for central stations carrying out wiring (and in some cases, supplying fittings), thus taking unto themselves the duties and profits usually the monopoly of electrical contractors. It is naturally difficult to secure disinterested views on this contentious matter.

One of the commonest arguments against such action by central stations is the statement that the latter thus attack private trading by the use of ratepayers' capital (where a company-owned station is concerned, the argument is, of course, inapplicable). It is often forgotten, however, that the station *provides* the contractors' field by the same means! The electrical contractor depends primarily upon the central station for his living, but the station is not necessarily dependent upon the contractor, who is therefore ill-advised to assume any unreasonable or domineering attitude. On the other hand, electrical contractors have done, and are doing, much excellent work, and are quite entitled to a fair living, providing they duly consider the position and needs of the supply station. Mutual co-operation between station and contractor is the best policy for both, providing each is willing to accept "rough" cases with the "smooth," to the ultimate joint benefit of the allies.

Going further, manufacturers should study the needs of central stations and contractors to a closer extent than is at present common, and contractors and stations alike should "push" the adoption of the best goods available (at a commensurable initial cost), and should study the consumer by selecting apparatus most economical in overall operating cost. By such co-operation and temporary sacrifice by individual parties, the utilisation of electric supply will reach such an extent, and at such a rate, as would otherwise be unattainable.

Station engineers frequently seek authority to assume the functions of electrical contractors (when such assumption is barred by their original statutory powers), on a plea of *(a)* the heavy losses of the central station due to the introduction of metallic-filament lamps, or *(b)* the contractor's laxity in seeking new business or attending to that already secured.

It is quite fair to argue that the contractor should not be expected to bear the burden of the metallic-filament lamp crisis, yet there is no reason why the vigorous pub and canvassing campaigns, now adopted by most sta should not return something more than a bare extens supply to the latter. The whole cost of such aggre well as of all specially favourable tariffs granted to c consumers, falls upon the central station, which, the seems quite entitled to at least a proportion of the pr equipment installed as the result of its efforts to exte demand for current. Many stations supply wiring fittings at a very low profit with the avowed intenti merely securing maximum satisfaction for their cons This policy is to some extent laudable, and certainly s the station from any reproach of direct interest in th tracting work, but it obviously causes more injury to tractors than would be inflicted if the station deman fair trading profit.

For the lethargy of contractors in supporting the c station, there can be not the slightest excuse. La energy on the part of the contractor is as adverse t interests of the station as to his own profits, but an worse evil is to be found in work badly design executed or performed at unreasonable rates. In instances, quite a wide loss of business may be incurr restricted developments on the premises of the victim, a those of most of his acquaintances. In any such case, the s station is fully justified in taking over as much c contracting work as it deems necessary in its own int

As regards publicity and canvassing, contractor supply stations should certainly work hand in hand. hearted efforts in this direction are worse than u Advertisements booming the use of electricity should to as wide a range of prospective customers as possible should deal with the latest methods and apparatus for application, and should degenerate to no set form. impression should be created that the whole electrical in is intensely "live" and prepared to cater for each and requirement. The despatch of publicity matter to, an vassing of, *individuals* must take very careful account probable temperament of the latter; no such aggressi ferocious style of approach, as is favoured in the would be tolerated by the average British householder,

Central stations as a whole, have still to overri general impression that they enjoy an autocratic, ra monopoly, and in closer co-operation between contracto central stations, in seeking and supplying fresh cons may be sought the most favourable means of se maximum profit to both and maximum satisfaction t sumers—the latter state invariably leading to developments.

EVENING CLASS REFORM.

By P. GOOD.

Evening classes in technical schools often include clas electrical engineering and electricity and magneti which instruction is given at very low fees.

There are two examining bodies, the Board of Edu and the City and Guilds of London Technological I ment. Broadly, the Board of Education deals magnetism and electricity as a science, and the City treats it as a trade.

If the fundamental object of these classes is th duction of an intelligent electrician as distinct from mechanic, it is necessary that the elementary train not too difficult, but it must be very accurate and on lines.

The students entering these classes vary very m age and early training. As a rule few know anyth the use of squared paper or the usual meaning of π. than half may know nothing of simple proportion, unable to do the most elementary algebra. Many wi no idea that there is such a thing as air pressure or q of heat, and the sine, cosine or tangent of an ang never before been heard of by them.

With this material, even with 40 classes in the the teacher can only get the more advanced throu

lementary examination, and then only by preparing the tudents with the one object. The other students gain ery little from the course, and the attendance probably lowly drops as the session proceeds.

The equipment of the class room sometimes leaves much o be desired. Particularly is this the case where several eachers have followed one another, each with his own ideas f the ideal apparatus for teaching purposes. Sometimes no ssistance of a skilled order is available to keep the appa- itus in perfect condition. Probably plenty of money has een spent, but it has been laid out in small amounts over number of years.

In the event of the teacher's absence, either he must find substitute or the class is not held. In one case the udents turned up for several weeks, and found no teacher. When the teacher returned he found no students.

At the commencement of the session the students usually sk for the name of a suitable text-book. If the teacher appens to be the author of an elementary work, however ad, it, of course, becomes the standard work on the subject. f he is not, then either he must find a suitable one or recom- iend the best available.

The elementary text-books may be divided into two asses : the theoretical and the practical. The first sually contains a lot of information, fairly accurate but nsuitably arranged, and the other is usually so fundament- lly inaccurate that it is only suitable for dabblers in the ubject. Looseness of expression perhaps better describes s chief fault.

The teaching is usually divided also into theoretical nd practical, and usually one hour is devoted to lecture and xercises and two hours to experimental work. In most ases the apparatus must be used for several classes, such as he senior and junior, so that an unfinished experiment ust be disconnected and a week afterwards got ready gain.

Having thus briefly stated the conditions under which the ork is at present being carried on, a few suggestions may e made for the removal of some of the difficulties.

The examining bodies should jointly set one elemen- ry course and examination called "Elementary Elec- icity." This should include some mathematics, physics nd chemistry, and no one not able to pass this should be lowed into the electricity, wireman's senior, electrical ngineering, telegraphy or other electrotechnical classes ; ementary wiremen's practical classes might be the only xception.

In the case of older students who have not passed the ficial examination, they should be obliged to satisfy the acher that they could pass it, and should then have to ke it at the same time as the more advanced examination.

This procedure would ensure a reasonable progress in the xt class, would bear fruit throughout every student's reer, and would raise the status of the whole profession in urse of time.

For this year's work and the one to follow, text-books ould be prepared to the order of the education authorities the most competent man available. He could be assisted less competent men if necessary, but it is essential that a ally clever man who has attained eminence in his profes- on should prepare these very elementary books. There are r too many at present written by the instructors and other ite ordinary men. These books are poison. The other pe of book frequently has a good name on it, but was ritten so many years ago that it is useless.

No doubt the publishers cannot afford to pay the fees cessary for the production of a good book when they have sell it at 2s. with a limited market, but if the City Guilds nd the Board of Education jointly produced one the sales ould be such that high fees could be paid without loss. here are several existing good books, but they cost om 5s. to 10s. each, and this is far too much. It is more an the fee charged for instruction for a whole session. he next step would be to prepare a full list of apparatus cessary for a class of 10, 20 and 30 students, and before aking any grants they should insist on this equipment as minimum and permit of no reduction. Other apparatus ere might be, but this list should be essential before a grant allowed.

Each course naturally requires a different equipment, and a small portion of the elementary apparatus could be available, if necessary, for the seniors.

These rules would ensure the satisfactory starting of the classes, and would prevent any local authority starting an Electrical Class tentatively. If students are invited to attend these classes, someone should see that one whole year of their time is not wasted owing to the fault of a parsimonious local authority.

The inspectors should be instructed to report on the condition of the apparatus as well as on the attendance.

At all the smaller institutions the major effort should be with the elementary work only. Then, even at the risk of reducing the average attendance, the men should be advised to go elsewhere if the work of the class is not likely to be beneficial.

Most of this is directly opposed to the somewhat influential class of educationists who advocate the suppression of the examination test and say, "Trust the teacher." This policy may be right if you have a highly skilled, highly paid staff of teachers, but even then it is probable that the early stages of any study require much more rigidity than the later ones, and these criticisms are not meant to refer to the very advanced instruction so ably given at some of the larger schools.

It is not desired to slight in any way the mathematics and general scientific classes usually held and frequently recommended to the students. These are very useful, but they would be more so if they were made compulsory.

PROCEEDINGS OF INSTITUTIONS.

Conference of the Institute of Metals.

The autumn meeting of the Institute of Metals was held in Newcastle-on-Tyne at the end of last month, when the usual crop of papers was presented. It is difficult to understand why this Institute (which we are pleased to note is making such excellent progress both in point of membership and in effective work), or the Papers Committee of the Institute, does not exercise greater care in the editing of the papers presented for reading and discussion at meetings. The subjects, as a rule, are all of them important and interesting, but the chief points are often obscured by a mass of unnecessary verbiage which makes it difficult to follow the authors' arguments. Did space permit, we should reproduce some of the long and involved sentences which we have underlined in two or three of the papers, and which leave the reader in a state of mental confusion. Such sentences are, more often than not, absolutely meaningless when they are intelligible, and the papers would gain considerably in value if they were deleted altogether.

Taking the papers as a whole, it is significant that a considerable portion of them dealt with the causes of corrosion in non-ferrous metals. It appears now to be admitted that corrosion is due to local electrical action, and it has long been known that it is assisted by the presence of moisture. From time to time suggestions have been forthcoming regarding precautions to be adopted in specific cases, but there is obviously a great amount of work yet to be done before the engineer can be freed from the troubles of pitting, erosion and brittleness in tubes, wires or structural parts where brass, copper or bronze is used under adverse circumstances. The paper by Mr. D. R. Pye on the mechanical properties of hard-drawn copper wire reveals the curious fact that, so far as relates to a particular set of observations, the breaking load is proportional, not to area, but to the circumference of the normal section.

Considerable vagueness exists in this country as to the properties of hard-drawn copper wires, and Mr. Pye complained that there was no standard specification to act as guide as to what might be expected in point of tensile strength and elongation before fracture. The Post Office specification of tensile strength of 27 tons per sq. in. is quite normal for wires of 0·2 in. diameter, but a strength of 23 or 24 tons per sq. in. is scarcely ever attained in wires of 0·5 in. diameter. At the present time a number of different specifications are in use, almost every tramway or other system having one peculiar to itself. Mr. Pye suggested that a satisfactory definition of hard-drawn copper should run somewhat as follows : "Hard-drawn copper, when in the form of circular wires, should have a tensile strength not less than that given by the formula $T = 30 - 20\ D$, and an extension per cent. on a marked 10 in. length, including the point of facture, of not less than that given by the formula $e = 5\ D$. where T = tensile strength in tons per square inch of original section, e = extension per cent., and D = diameter of the circular rod in inches.

The Engineering Standards Committee was criticised by Mr. Pye, and in the subsequent discussion, Mr. A. P. Trotter took upon himself the responsibility for the remarks made by Mr. Pye under that head. Mr. Trotter further said that it was clearly necessary that further tests should be carried out ; but the whole process of wire drawing was a mystery to outsiders ; he complained that manufacturers would not describe their processes, and users had to take

what they could get rather than what they wanted. Sir Gerard Muntz said it was essential in drawing up a specification to take into account differences of diameter.

Dr. Wm. Guertler presented a paper in which he drew attention to the property of electrical conductivity in its bearing upon the practical determination of the constitution of alloys. He indicated the limitations of methods that metallurgists were in the habit of using for the investigation of the constitution of alloys. The relationship between concentration, temperature, and any given property—electrical conductivity, magnetism, &c.—was, he said, best brought out by the employment of the co-ordinate system in these dimensions. Thus, taking concentration as the base, ordinates should be erected from it, having lengths proportional to the numerical values under consideration. Thermal analysis often failed, particularly when a state of complete stable equilibrium was unattainable within a comparatively short interval of time. Dr. W. Rosenhain, in discussing the paper, thought that a good deal of work would still have to be done in the direction indicated by the author, but he did not deprecate the value of electrical methods, and complained that metallurgists had neglected these methods too much in their adherence to thermal analysis and microscopical examination. Dr. C. H. Desch expressed the opinion that Dr. Guertler's method was likely to prove of the greatest value, while Prof. T. Turner was satisfied that the author had drawn attention to the hopelessness of expecting to obtain material of good conductivity from an alloy.

The method of electrical conductivity can be employed, as Dr. Guertler showed, as a means of obtaining the necessary data for the construction of an equilibrium diagram, in a manner analogous to the application of thermal analysis, a matter which was adversely criticised by all who took part in the discussion of Dr. Guertler's paper. But the conductivity method has the great advantage that it is independent of time, and no measurement need be taken until we are assured that perfect equilibrium has been obtained. Granted that we know the equilibrium diagram with certainty, we can, if we have the absolute values, compare the different concentrations with one another and construct isothermals from them, from which in their turn we can find the breaks which correspond to the passage of boundaries of the phase regions, and more particularly of those which run vertically, and which cannot consequently be obtained by other than the electrical method.

Before leaving the subject of the Conference, whose proceedings we have just discussed, reference should be made to an eminently practical paper presented by Mr. George Hughes on the use of non-ferrous metals in railway work. This paper was one of the best that has ever been read before the Institute of Metals; it was clear and free from involved theory and represented results obtained in actual practice. Aluminium, said Mr. Hughes, was slowly supplanting the use of other metals in railway engineering and rolling stock. The outside panels of electric cars built for the Liverpool and Southport line of the Lancashire and Yorkshire Railway to work in conjunction with the Liverpool overhead line are made of No. 16 S.W.G. aluminium, the largest panel at the side of the car being 6 ft. 7½ in. long × 2 ft. 8 in. wide. According to Mr. Hughes, the initial cost of aluminium panels is much greater than for mahogany or steel, but a reduction in the cost of haulage of nearly 33 per cent. as compared with the former, and nearly 60 per cent. as compared with the latter, is obtained. Mr. Hughes remarked that the soldering of aluminium was a difficult problem, but a good deal of use is now being made of the autogenous welding process, and, as Mr. Hughes is probably aware, this is giving satisfactory results.

Electricity in Mines: The Avoidance of Accidents.

At a joint meeting of the Scottish Branch of the National Association of Colliery Managers and the West of Scotland Branch of the Association of Mining Electrical Engineers, the discussion was resumed on the paper recently contributed by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, Home Office, London, on this subject.

Mr. C. A. Atchley, Kilmacolm, said the question of accidents due to electricity in mines was becoming a very serious one. He thought that in the majority of instances, particularly in new work, armoured cables were safer than unarmoured cables, but feared that in introducing armoured cables right away in preference to unarmoured cables, which represented at present the bulk of underground cabling, they were going much too fast. The class of men which was quite able to keep up an unarmoured cable installation was not—except after a considerable period of training—equal to the responsibility of maintaining an armoured cable system. Until they had had an opportunity of training a body of men capable of undertaking the work, the compulsory use of armoured cables in a colliery, particularly with the D.C. system, should be gone about slowly.

Mr. A. B. Muirhead, Lenzie, said he was not satisfied that the earthing of everything was going to result in safety. If everything electrical in the pits was to be connected up through armouring and carefully earthed, the standard of insulation might begin to deteriorate, with the result that, very soon, they would be worse off than before. The question of insulation was not receiving the same amount of attention as earthing.

Mr. McVie, colliery manager, Bothwell Park, Lanarkshire, said that colliery managers were in somewhat of a difficulty, because they had the Home Office issuing rules that every system was to be earthed, while, on the other hand, they had experts like Mr. Muirhead asserting that the Home Office was practically in the wrong. The Home Office was altogether on wrong lines in insisting upon earthing throughout the whole of an electrical system.

Mr. G. L. Kerr, Glasgow, asked whether it was preferable t earth a section of the plant underground locally, or to bring th whole of the earthing to some central point at the surface. The there was the further point as to whether the earth wire we better carried outside or inside the cable. At least one fat accident had occurred where the victim actually lost his life on th earth wire.

The Chairman said the point raised by Mr. Kerr as to whethe the earth wire should be outside or inside the cable, was one whic was giving electrical engineers some concern at the present tim At one period he favoured the idea of the earth wire being insid but now, in the majority of instances, he was absolutely opposed t that if he could get it on the outside. If an earthing system we adopted they could not have too many earthing points; the surfa should be one of these points. With regard to the question wheth three-phase or direct current was the more dangerous system, h had no hesitation in pronouncing against three-phase.

At the close of the discussion, Mr. Frank Anslow (Glasgo said he did not think that it would be possible to mai tain such a perfect condition as to render it impossible obtain a shock by touching either pole; that, given go material, workmanship and supervision throughout, an una moured system could be made and maintained as safe as armoured system. It certainly looked as though an armour system, when efficiently earthed, would, at the present tim offer the best solution. In very many cases an imperfect ear had been secured, which was considerably more dangerous than earth at all, as it gave a feeling of false security. Earthing mi be carried out well, and he agreed with Mr. Nelson that two eart plates placed at a suitable distance from one another were far mo effective than one earth-plate of double the size.

THE BRITISH ASSOCIATION.—V.

On the Radiation Producing Aurora Borealis.

By L. Vegard.

Section A. (Abstract.)

Starting from the view advocated by Birkeland, that auroræ caused by electric solar radiations, the author treats the prob of determining their physical properties. He arrives at the c clusion that the law of absorption of the solar rays is essenti the same as that of α-rays. It is found, from the relation betw range and velocity, that α-rays will get down to heights vary between 70 and 300 km., which is the interval actually observed most auroral forms. Further, calculations show that α-rays strike the atmosphere at an angular distance from the magn axis of about 17°, which gives the right position of the auroral z The distribution found for a number of polar stations shows distinct night maxima, and their existence is found to be in acc ance with mathematical theory.

The author finds that the α-ray hypothesis, as far as our pre knowledge goes, explains in a satisfactory way the properties of definite auroral forms, while the assumption of a radiation of β-ray type meets with serious difficulties.

Magnetic Observations at Falmouth Observatory.—Rep of the Committee.

Section A. (Abstract.)

The mean values of the magnetic elements for the year 1910 re as follows:—

Declination	... ...	17° 41·6′ W.
Inclination	... ...	66° 29·0′ N.
Horizontal force	... ...	0·18802 C.G.S.
Vertical force	... ...	0·43208 C.G.S.

The magnetographs at Eskdalemuir have now been arrange record directly the variations in the northerly, westerly and ver components of the magnetic force. Regular tabulation of the cu commenced with January 1st, 1911.

Smoke Abatement.

By Dr. J. S. Owens.

Section G. (Abstract.)

The present legal standard of "black smoke in sufficient qua to be a nuisance" is admittedly unsatisfactory, as black smok thing rarely, if ever, seen: also, the blackness alone is no me of the amount of pollution nor even of the amount of soot pe of coal burnt. The present standard is therefore out of date.

A sound standard of maximum allowable amount of s should be fixed and enforced. The standard suggested is o *maximum density for maximum time of emission.* By densi meant amount of soot per unit volume of flue gas. A smo great density would be permitted for a short time only, wh one of less density might be permitted for a longer time.

The method of measuring the density suggested is by mat the opacity of the smoke to that of calibrated smoked glasses, glass representing a certain density of smoke in a column of

hickness. The final figure for comparison is obtained by dividing he density represented by the glass by the diameter of the chimney. By careful construction and the elimination of certain errors, an nstrument can thus be made to give a fair basis of comparison vith a standard density. The author has devised and experimented vith an instrument of this type, with promising results.

Power Generation by Overtype Superheated Steam Engines.

By W. J. Marshall.

Section G. (Abstract.)

The overtype superheated steam engine consists of a special ubular boiler with the engine mounted on the top of it, the boiler orming the foundation or bed-plate for the engine. A superheater s placed in the smoke-box and forms an integral part of the plant, as also do the air pump, condenser, &c., when such are fitted. The esult of this arrangement is that steam pipe losses are reduced to minimum, and the full value of the superheated steam can be employed. The cylinders can also be jacketed with high-pressure team from the boiler without any loss due to drains or steam raps, as the cylinder casing forms a portion of the steam space of he boiler. The boiler and the superheater are carefully designed as regards their heating surfaces to give the highest efficiency. Particulars of exhaustive trials on one of these engines were given, howing that 1 B.H.P. can be obtained with a consumption of ·21 lb. of steam coal per hour. A detailed description of the "Garrett" engine giving full particulars of its construction was lso given, with drawings and photographs showing actual nstallations of some of these engines.

A Friction Permeameter.

By W. H. F. Murdoch, B.Sc., M.I.E.E.

Section A. (Abstract.)

This instrument is a development of those described in a paper by he author, viz., "Magnetic Testing of Iron."

The object of the arrangement is as follows: To keep the nagnetic circuit invariable during a test; to keep the coefficient of friction constant; to have unidirectional sliding of the moving portion and no necessity to reset the specimen at each reading; to rrange matters so that the magnetic induction over the gap is as niform as possible, so that the law of traction is fulfilled; to liminate errors in H, the resistance of the magnetic circuit should e reduced to a minimum; the instrument also should be direct eading and portable.

The instrument consists of a specimen of cylindrical section, nagnetised by a solenoid excited by an electric current, and entirely urrounded by a hollow cylindrical yoke of iron. This yoke is livided symmetrically at the middle and the lines of induction act n this gap together with other attractive forces. If now the top portion of the yoke is rotated about the specimen as a vertical axis, nd slides steadily on the lower portion of the yoke, then the torque nay be measured, or the angular displacement between the zero and pointer be read while sliding is occurring. To elimate the friction ull previous to magnetisation, the pointer is adjusted to read zero nder mechanical friction only. Consequently when the specimen s magnetised the magnetic pull is taken up on the surfaced faces nd the angular displacement is due to the magnetic induction only. Therefore the magnetic induction in the test specimen can be btained by multiplying the square root of the reading by a con-tant. Owing to the completeness of the magnetic circuit, tests at igh inductions can be made, and the results agree closely with allistic tests besides possessing the advantage of great rapidity.

The Electrical Conductivity of Light Aluminium Alloys.

By Prof. Ernest Wilson.

Section G. (Abstract.)

The last report on the exposure tests of a certain series of light luminium alloys was made in 1908. The present paper includes ests made in July, 1911. The copper series have shown that lloying commercial aluminium alone with copper to the extent of ·6 per cent. is not to be recommended. The copper manganese pecimens have not seriously deteriorated in 10 years. The alloy nown as "duralumin" has been tested, and a report is made hereon. Its specific resistance is $5{\cdot}35 \times 10^{-6}$ ohms at 15° C. as gainst $2{\cdot}76 \times 10^{-6}$ for pure commercial aluminium.

The Single-Phase Repulsion Motor.

By T. F. Wall, M.Sc., M.Eng., A.M.I.C.E.

Section G. (Abstract.)

It is not easy to adapt the methods used for other types of A.C. machinery to the A.C. commutator motor, since this machine partakes of the nature of an alternator and of that of a trans-former. The author deals with the subject on lines which he hopes will render the results obtained of immediate use to the engineer. Experimental evidence as to the accuracy which may be expected from the theory is given in the form of tests on a 6-B.H.P. motor. The only assumptions made are that the iron losses and commutation effects are small, and that the perme-ability of the iron is constant.

Formulæ are established for the maximum values of the flux linkages of the stator winding, due to an alternating current in that winding and due to an A.C. in the rotor winding, and of the rotor winding due to alternating currents in the stator and rotor windings, as well as of the E.M.F. induced in the rotor winding when rotating in the field due to an A.C. in the stator winding.

The author then utilises these in a detailed examination of the mutual reactions of the stator and rotor, with the aid of numerous diagrams, and constructs a circle diagram from which the current, power factor, speed, power and torque of the motor can be deduced, first when the resistances and leakages of the stator and rotor windings are neglected, and, secondly, when these are taken into account, the diagram being correspondingly modified. Lastly, the results of calculation and experiment on the motor above mentioned are given, and it is shown that the curves for power factor agree well at the higher, but diverge at the lower speeds; the curves for stator current agree fairly at all speeds. The effect of the circulating currents in the short-circuited coils is shown to be small.

In the last part of the paper a method of determining the open-circuit characteristic is given, taking into account the effects of saturation on the curve of flux distribution in the air gap, and the distortion of the current wave form due to saturation.

DIESEL ENGINE PROBLEMS.

[COMMUNICATED.]

While the steam engine increases its duty per lb. of steam used as the engine becomes larger, there appears to be little or no better efficiency in the case of large than of small Diesel engines. It is difficult to see why this should be so, unless the makers of the Diesel engine do not find it practicable to increase the ratio of expansion. The question may well be examined with a view to fixing ideas in the salient points involved, and endeavouring to trace out the sequences.

In a steam engine, one of the first cares of every steam engineer is to see the cylinder well protected against loss of heat externally. No heat is allowed to pass outwards through the walls if this can be prevented. Two methods are in use to prevent this. First, the cylinder is clothed by some protecting non-conducting substance; in other cases the cylinder is surrounded by a steam jacket which may actually cause a flow of heat towards the interior of the cylinder. This jacket will itself be protected by the non-conducting jacket of the first method.

Both methods aim to prevent the formation of water in the cylinder; the second method is the more effectual, of necessity, and, by accepting the formation of water within the jacket itself, water is prevented from forming in the cylinder, where it is so harmfully effective. Superheating aims to supply heat to the inside of the cylinder in order that the unpreventable outward travel of heat may take place with a minimum production of water in the cylinder, the steam losing temperature only, and not latent heat.

The area of a cylinder end is $d\pi \times d/4$; the area of the wall of a cylinder is $d\pi \times L$: thus, for the end and the wall to be of equal area, the stroke of the piston must be a quarter of the diameter.

Since the cylinder wall is exposed only for a portion of the stroke, this ratio is perhaps approximately secured. As the engine grows larger in size, the tendency is for its cylinder walls to increase at a slower rate than its area. The walls are thus less effective as condensing agents. A cylinder of large volume loses less through its walls than one of small volume. Its ends and its piston area remain of the same ratio to the admitted steam only as regards equal lengths of stroke. But the large engine has a longer stroke, though its stroke ratio may be less. The cylinder end is thus of less ratio to the weight of admitted steam in large than in small cylinders. This is all in favour of the larger engine, and, without further argument, may be accepted as a sufficient reason for the better economy of the bigger engine without calling upon any superior piston speed it may possess to strengthen the argument.

Now, in the case of the Diesel engine, there is a designed loss of heat to the cylinder walls and ends; that is to say, these parts are water-jacketed, not, primarily, in order that they may lose heat, but in order that they may not be destroyed by temperature. Incidentally heat must be lost, but this heat need not exceed the same amount per unit of wall surface, and should therefore, as in the case of the steam engine, be a less ratio of the total heat in the cylinder when this is of large than when it is of small volume, and the economy of the larger engine should be better. It is said not to be so.

If the larger engiue does not therefore convert a bigger ratio of its heat supply into work, if it rejects, as seems probable, a smaller proportion of total heat to the jacket water, necessarily either it must burn its fuel less effectively or it must turn more heat away in the exhaust gases.

With equal ratios of clearance volume to total cylinder volume the compression should be alike in all engines, and the bigger engine would have the higher final pressure and temperature. It would, therefore, warrant a greater degree of expansion in order to make use of this. But to get this greater expansion the cylinder must be lengthened relatively to the clearance space, and this would produce a higher initial pressure unless means were employed to keep open the exhaust valve during the first part of the compressive stroke in order that compression may remain the same in degree and expansion may be carried further. We have no information as to whether anything of this sort is done, but

assuming that it is not done, it would serve to explain why Diesel engines are so remarkably alike in their performances.

The original conception of the Diesel engine included the use of finely powdered coal as fuel. This seems to have been quite abandoned, probably for very good reasons. We believe it also included the use of gaseous fuel, and we do not see why gaseous fuel is not used on Diesel principles.

The liquid fuel Diesel engine employs an air spray of 800 lb. pressure to feed the oil into the cylinder. This demands pressure pumps. Why should not gaseous fuel be compressed to this same degree, so as to feed itself into the cylinder with or without any further jet of air? It seems certain that the energy of the gas itself would be quite ample for securing good mixture in the cylinder with the air already compressed therein. With compressed gas thus fed in there would be every reason to expect all the easy combustion which accompanies the oil-burning engine, the gas being fed in throughout a sufficient length of stroke to preserve an even pressure as it burned.

The Diesel engine of the four-stroke single-acting type is necessarily heavy for its power, especially in its crankshaft. The use of gaseous fuel would seem to offer itself as a means of developing the engine on two-stroke lines and double action, with perhaps less difficulty than may accompany the development of the oil-fuel engine on similar lines. It has been objected that the presence of a piston rod would interfere with the combustion of the charge, but with two or more admission points this should be negligible, and in cylinders of large diameter the single admission ceases to be sufficient even with no central rod.

It may, we think, fairly be agreed that the Diesel engine should be extended to use gas, and that, like the steam engine, its larger sizes should ultimately be made to work with better economy than the smaller sizes.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A COMPANY, called the Electric Power Co., which is developing a number of water powers along the Trent and Otonabee Rivers in Ontario, has now been supplying electricity for some months to several townships and large industrial undertakings.

A generating station of about 4,000-KW. capacity, situated near Campbellford, on the Trent River, was the first to be operated. Last month another station at Trenton, at the mouth of the river, where it flows into Lake Ontario, was started up, and is now operating satisfactorily in parallel with the former station.

Current is generated at 6,600 volts, stepped up to 44,000 volts by means of Westinghouse oil-insulated transformers, and transmitted at this pressure on overhead aluminium lines to the various sub-stations, of which there are at present 15 in operation and four under construction. Over 200 miles of 44,000-volt lines are now in use.

The district to be served by the Electric Power Co. extends from Toronto eastwards as far as Kingston, a distance of about 150 miles, and from the shore of Lake Ontario northwards for a distance of about 50 miles. The transmission system of the Electric Power Co. will be uniform throughout the whole area, viz., three-phase, 60-cycle, 44,000 volts, stepped down, in most cases, to 2,400 volts and 600 volts for power, and 220 volts for lighting. A pulp mill at Campbellford making ground wood pulp, is in operation, taking, at present, some 800 H.P., but by the end of this year it will be taking 2,000 H.P.

A paper mill near by has just commenced taking 200 H.P., and will next year require about 600 H.P. The township of Lindsay has just decided to purchase electric power from the company instead of putting down a municipal plant, which was the alternative proposal.

Altogether about 12,000 H.P. is being supplied now, the ultimate capacity of the water-powers to be developed being about 100,000 H.P. The work most recently started by this company is the construction of a power house at Healy Falls, on the Trent River, about five miles above Campbellford, where there is a head of 76 ft.

The immediate installation at this station will consist of two 3,750-K.V.A. 6,600-volt three-phase 60-cycle generators driven by horizontal water turbines running at 240 R.P.M. Space will also be available for two more similar units. Two 3,750-K.V.A. transformers will be installed to step up to 44,000 volts.

It is expected that this station will be operating by about September, 1912.

An interruption to the supply, of a rather unusual nature is reported to have occurred in a certain Ontario town recently. Power is generated about 20 miles from the town and low water in the river is stated to be the cause of the stoppage, but, to go a stage further back, it appears that the low water is due to beavers having built dams higher up the river, the water being thus held back. The supply company is unable to do anything, owing to the stringent laws which prevent anyone from interfering with the beavers, and an appeal is being made to the Provincial Government for special permission to destroy the dams. Until this is obtained several townships will be in darkness and industries will be held up.

Owing to the recent change of Government in Canada the recently-formed British-Canadian Shipbuilding and Dock Co., of which Sir Henry M. Pellatt is chairman, is apparently awaiting developments. It was anticipated that from the Liberal Government this company would receive extensive orders for naval construction work, but the views of the new Government on the subject of a navy for Canada do not coincide with those of the late Government.

The Hydro-Electric Power Commission, an Ontario Government institution, has recently obtained powers to supply electricity to farms, and it is intended to interest farmers in the utilisation of electric power. The chief difficulty at present is how to get the current transmitted to sparsely-populated districts, while supplying at best only a small demand, at a sufficiently low cost to make it pay the farmer to use it; the question of the Commission making a profit does not arise, as none is looked for.

Many readers of the ELECTRICAL REVIEW no doubt know something of this Commission, but a few explanatory remarks may not be out of place here.

In 1905 three Commissioners were appointed by the Ontario Government, and in 1906 they were granted power to inquire into the question of the utilisation of the water powers of the Province for hydro-electric power.

In 1908 an agreement for 10 years was made between the Commission and the Ontario Power Co. of Niagara for the supply of electricity, the maximum requirements of the former being stated as 100,000 H.P. At first it was intended that the transmission voltage should be about 60,000, but later this was altered to 110,000, the highest in the world. The latter voltage has been adopted, and three-phase current at 25 cycles is now being transmitted on overhead lines, some 300 miles of which will be required altogether; about half of this length is in operation now.

Electrical energy is supplied to municipalities, villages, &c. at cost, as the Ontario Government does not intend to make any money out of the scheme.

Further details of the work recently carried out by the Commission, and the general progress and prospects of the undertaking, will be available shortly in a report which is to be published.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Olympia Electrical Exhibition.

In the Electrical Exhibition supplement of your current issue, you again raise the point of the supply authorities failing to purchase and distribute admission tickets. I do not know whether it is clear to you that these tickets had to be paid for whether used or not, and it seems natural under these circumstances that the supply authorities, whose business position is different from that of the manufacturing exhibitors, should be cautious in their purchase of tickets.

The undertaking with which I am connected, and I believe many others, would have been prepared to issue large numbers of tickets and pay a reasonable price for those presented, but the Executive Committee, with its complete

e from the policy of the Manchester Exhibition, has ently eliminated the right as well as the wrong class itors. Many exhibitors may also feel that the high of space should have obviated the keen seeking after noney.

ır article admits, what has also been the subject of riticism elsewhere, that the Executive Committee, in of the assistance of organising managers, have mis- ated the necessities of the case.

hough present on the second day of the Exhibition, I nfortunately, only able to visit it again on Wednesday eek. As a result the letters enclosed were written :—

To the other exhibitors of arc lamps.

To the members of the Executive Committee.

Justus Eck.

ıdon, S.E., *October 6th*, 1911.

Is the Arc Lamp Superseded?

Sirs,—The approach to Olympia Electrical Exhibition is ıro lamps, but it only leads up to a paltry display of glow and two small projectors lighting nothing.

gas industry are doubtless already laughing at the inadequate g, and satisfying shopkeepers and factory owners of the rity of all electric lamps to the modern high power gas unit.

ellow-exhibitors, we suggest that all arc lamp firms should he Exhibition Executive to at once improve the exterior ıation, and to offer to supply all or part of a sufficient r of lamps to illuminate the front of the building free of , provided the lamps are properly wired and maintained at ense of the Exhibition.

re making such an offer by this post.—Yours faithfully,

Union Electric Co., Ltd.

ber 5th, 1911.

Unattractive Olympia.

Sirs,—The exterior of the Electrical Exhibition is un- lly dull and unattractive, as the selected glow lamps com- n is ludicrously insignificant.

ıe inaugural dinner, Mr. Hirst expressed regret at the absence lood of light," and, no doubt, the gas industry are pleased at sent dreary appearance.

ıre willing to lend, free of charge, eight (or possibly more) intense flame arc lamps to assist in lighting the front, d they are immediately put to use, properly trimmed, and ly used after dark during at least the last two weeks of the tion.—Yours faithfully,

Union Electric Co., Ltd.

ber 5th, 1911.

e believe we are correct in stating that, while better al lighting would be desirable, it is impossible to the necessary supply of electricity for that purpose. E.R.]

Charging Ignition Cells.

our issue of September 29th "E.C.E." criticises the ng of small ignition cells from end regulating cells on grounds.

h regard to No. 1 objection—*i.e.*, that of the possible ning of the life of the end cells—in some stations pre-supposing ten or a dozen cells on the positive and ve ends) these said cells do not get enough taken out m to keep them in good condition; here is an oppor- to keep them so. It is only a question of looking battery as it should be looked after, and not allowing be looked upon (as in some stations I could mention) negligible quantity."

ection No. 2. Not so much constant attention is ed as "E.C.E." seems to think, as it may only be ary to vary the rate of charge when the end cells are or taken off charge.

rdly, "E.C.E." says that separate regulating resistances to be rigged up if different sizes of cells are to be d; this is also required if charging is done through a of lamps (extra charging circuits being required). motor-car lighting accumulators can be charged gh a larger resistance on the end cells of the opposite of the battery. Just think of the C^2R losses in ng a portable accumulator for 10 hours at a rate of peres through banks of lamps, arc lamps, or a water nce from a 230-volt circuit (the charging units being ratio of 40 to 1 in favour of the end cell method). he greater part of the business in small ignition-cell charging is done in the lighter months, it is not always possible to make use of the light, as suggested by "E.C.E."; or if the lamps are out of view, as in such places as condenser-pits or basements, it is possible for some person with an experimental turn of mind to substitute higher candle-power lamps or incidentally short-circuit lampholders.

I may say that I have used the end-cell method of charging small cells, and also for meter testing, for several years, and have not found it prejudicial to the cells.

P.

Trade Discounts to Private Consumers.

The correspondence published by Messrs. William Coates and Son in your issue of September 29th raises an interesting side issue. They write of a rule "that if a customer selects fittings for himself, the manufacturer inquires who is the contractor and sends the account to him with the discount taken off." Where does this rule exist, except in Messrs. Coates's brain? Surely the contractor must earn a trade discount by some service or recommendation!

Let us assume what may in fact have taken place here: that Messrs. Coates advised their customer to go to Messrs. A. & Co., or B. & Co., to select fittings; their customer, however, for reasons of his own, or on the recommendation of a friend, goes to X. & Co. Messrs. X. & Co. have thus got the order, not through any service of Messrs. Coates, but literally in spite of them. Would Messrs. Coates seriously expect to receive any consideration from Messrs. X. & Co.? and, if so, on what ground?

It appears to us that, in offering Messrs. Coates 10 per cent., X. & Co. acted generously, and that Messrs. Coates quite deserve the snub they finally got for pressing a claim for further consideration.

Another Manufacturer.

With reference to the letter from Mr. C. G. Fox in your last issue *re* above, as he is evidently not a contractor, I should like to point out to him that the price of wiring is cut very fine, and that we often have to depend on the trade discount to pay for carriage, wiring and fixing, which does not leave much for profit, even with a liberal trade discount, unless our customer happens to place a large order with one manufacturer. Perhaps Mr. Fox is under the delusion that a trade discount arranged by the manufacturers is meant for any trade. I was once asked by a wine merchant what discount I would give him off fittings, and when I told him the same as he gave me off whisky, he said no more.

As to Mr. Fox's last paragraph, I presume he is not a business man, and, for his information, I would like to explain that before manufacturers invoice goods they obtain a written order. We have no objection to the manufacturer dispatching and invoicing to our customers orders direct, providing they credit us with the full discount to which we consider we are entitled. It is quite another matter if we wish to split the discount or profits with builders and ironmongers, &c. I should consider myself very lucky if I made a 10 per cent. net profit on my turnover, including the interest on my capital and my personal labour.

A. F. Lord.

Plymouth, *October 9th*, 1911.

The Evolution of Wiring Systems.

I have read with interest an article on the above by "J. W. B.," and must say that this does not seem to be up to your usual standard. The article, in the first place, is very misleading. As regards the cost, there is a table of costs per point, complete with tungsten lamps. The tungsten lamp might cost 2s. 6d., 2s. 9d. or 4s., and, of course, this would considerably alter the cost of wiring. The writer does not specify which he means, so that the value of the table is practically nil.

Assuming that the lamp was an average one, which should cost 2s. 9d., the cost of an installation per point in screwed seamless conduit would be 19s. 3d., in brazed conduit with continuity fittings 18s. 3d., and in close-joint slip conduit 15s. 3d.

To go no further, it would be pleasant to know where

prices of this sort can be obtained for installation work. The average contractor should be able to tell the author something about competitive prices which would astonish him. Such prices as these were obtainable some years ago, but we would suggest that 14s. 6d. for screwed, 12s. 6d. for brazed and 10s. 6d. for close joint are about the average prices for installation work in small houses in practically all the chief towns in England. He also states that enamelled wire for the insulation of lighting leads is quite a new system, but surely he must be aware that nearly five years ago this wire was put on the market by Messrs. Connolly Bros., and has been used for this purpose ever since, although not extensively.

As No. 10 system he mentions heavy rubber ("cab tire") as being a comparatively new form of cable. One might admit that the name is; but this cable, in the kindred forms of hard cord special flexible and metallic-braided flexible, has been in use for more than seven or eight years, and certainly these are very adaptable cables for hand lamps, cooking circuits and radiators.

With reference to No. 8 system, it might be pointed out that the price of 10s. for this method with non-Association cable is also very excessive. The cost of this wiring, inclusive of a 2s. 9d. metal-filament lamp, as quoted by some of the companies who specialise in wiring in small towns is 6s. 8d. It might be pointed out that this system seems to be coming into vogue, and affords considerable advantages over others, owing chiefly to the simplicity of installation and the cheap cost of running. Of course, it is more generally used in works and mills, owing to objections from an artistic point of view; but if the wiring is installed with suitable decorations, such as painting the wires, and using tinted cleats, these objections are largely overcome. The system has also been very much handicapped by want of special fittings, but latterly several of these have been placed on the market, which facilitate this class of wiring.

As regards the cost of surface wiring in works and mills, some astonishing results have lately been obtained. In one mill installation of fair size, the price of a surface system fitted with ordinary switches and fuses and V.B. cleat ceiling roses, complete with switches, flex, fuseboards, mains and carbon lamps, ran out at 3s. 10d. per point. In another case it was found that a wireman and his mate working on a surface system, and using the V.B. cleat ceiling rose, fixed 50 lights per day, which means that the labour was roughly 3d. per point. The chief difficulty which this system has encountered is not mentioned in your article—the insurance companies—and these companies have probably done as much to keep surface wiring back as they possibly could, and the still more curious fact is that in some of the Colonies they are even more opposed to it than they are in England.

However, insurance companies now seem to be realising that a properly installed surface system gives as great a security as any other method, and in very many cases a higher insulation test. It may be mentioned that only a short time ago Messrs. Bonnella Bros. erected a large factory off Tottenham Court Road, which they wired with braided wire on the surface wiring system, using modern fittings, and that this was connected to one of the supply companies' mains, and also insured at ordinary rates by a first-class insurance company.

An Electrician.

CONSUMERS' FAULTS.

By H. H. JOWERS.

A great difficulty which a mainsman has to deal w that of small "earths" which occur from time to tim consumers' installations. These are first noticed b recording ammeter in the earth circuit, and remain on fo a few hours in the evening. Now, the difficulty aris locating these. It may be done in the case of a three system by putting the opposite pole to that which the is on, to earth potential, and thus trying to break the down, but this is a dangerous practice, especially duri hours of load, for it may break down other install which are not quite up to standard, and cause, as in known, a fire, or public buildings to be plunged into ness, besides which it is a most clumsy method, an which would not appeal to the engineering side mainsman.

The method which the author has found successful is t having a test bar running the whole length of the feeder which, by means of switches, can be switched on to any (see fig. 1); a motor-generator, or a small steam set, is until the current is equal to that of the load on the

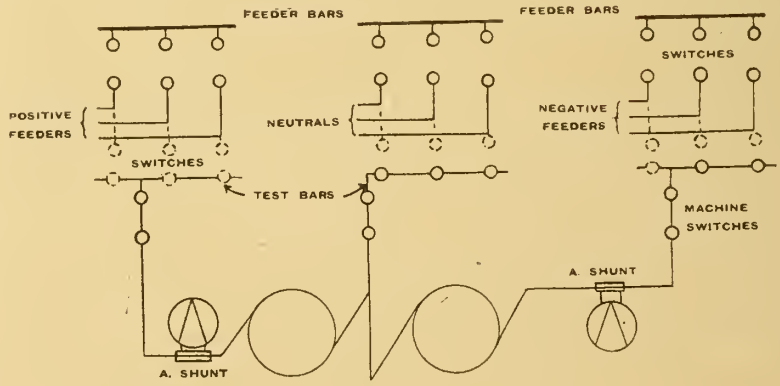
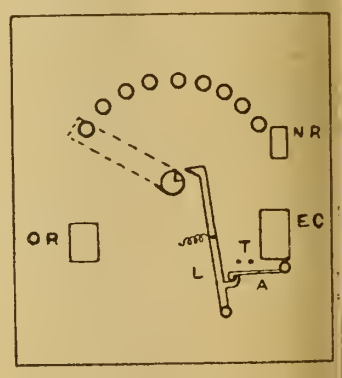


Fig. 1.



N R, No-volt release coil; O R, Overload release coil; E C, Earth

A current going to earth energises the coil E C, which up the armature A, short-circuiting the two terminals T, short-circuit coil N R, and at the same time releases le which locks the starter handle in the off position. The s is semi-enclosed, the cover being under seal.

Fig. 2.

which is to be first switched over, the distributors havi previously divided into sections, each feeder supply independent section; the feeder switches are then and the one section comes over on to the test-bars. A then an independent supply, it is readily observed fault remains; in this way the section can be found i minutes. When it is found, it is simply a matter of trans lengths of distributors until the faulty length is ide the consumers on this length are then tested the fo day, and the fault is readily localised.

The above is for faults on lighting installations: t trouble, of course, is experienced with motor use the same method can be applied for localising these author has, however, applied an additional meth locating "earths" on motors, and this is more es necessary in the case of motors which are let out on system, where the motors are maintained by the authorities, and it is necessary that greater care be t the plant. With motors properly wired and "e the fuse would immediately blow, but this often damage to the motors due to the fact that stronger f put in to try and remove the trouble; also in som the author has found the earth wire either cut connected when the fuse has blown. The meth by the author is that of placing a small coil in with the "earth" as shown above in fig. releases the starter handle by short-circuiting the release coil, and at the same time locks the handl starter in the off position, so that an inspector

ower station has to be called before the motor can be started, the starter case being under seal. This method undoubtedly keeps the maintenance figure of the motor-hire system low, for faults can be rapidly removed at a low cost whilst in their initial stage, and not allowed to develop into more expensive jobs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Rail Insulators.

Messrs. Doulton & Co., Ltd., of Lambeth, London, S.E., have long made a speciality of stoneware insulators for various classes of electrical work, and one particular section of this department

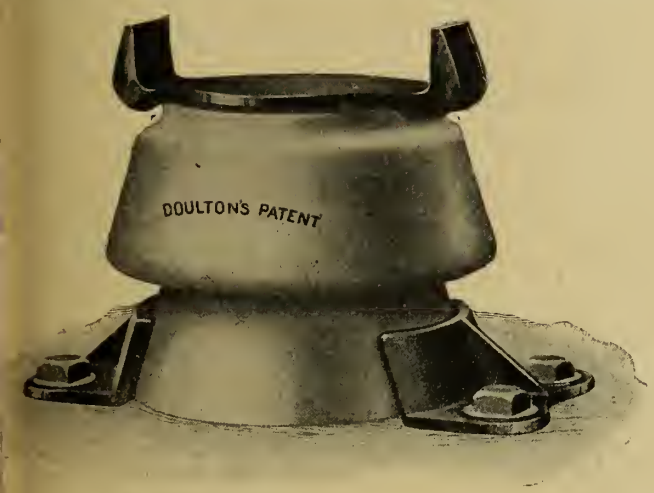


Fig. 1.—"Pedestal" Type Insulator.

of their business has been devoted to electric railway requirements. An example of third-rail insulators is illustrated herewith (fig. 1). It is the Pedestal third-rail type that has been applied for most of the railways electrified in this country, including the N.-E. Railway, L. & Y. Railway, G.W. Railway, Metropolitan, London, Tilbury and Southend, and Mersey systems.

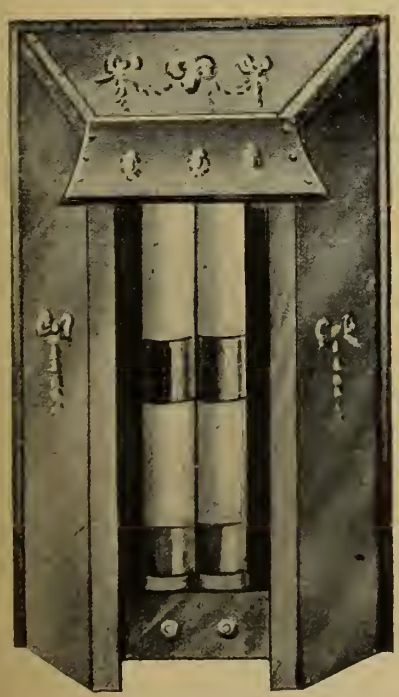


Fig. 2.—Dowsing Tubular Radiator.

The same type is now being supplied for the refitting of the Metropolitan District Railway. It is made to carry a flanged rail or rail of rectangular section, it has malleable cast-iron fittings, and is made to suit various sections and widths of rail. The "Pedestal" insulator is also made to carry rails of inverted channel section. The "Tubular" type of insulator is employed on all the tube lines of the London Electric Railways Co. It consists of a block of cream-enamelled stoneware of tubular or multitubular form, grooved to receive the rail, and resting upon the sleeper, to which it is secured by clips. Messrs. Doulton, of course, also make all types of insulators for high and low-tension work, both in white porcelain and in stoneware, to standard and to special designs.

Dowsing Radiators.

The Dowsing Radiant Heat Co., Ltd., of 105, Great Portland Street, London, W., have a number of new designs among their electric radiators for the present season. One of these of quite artistic type, is illustrated in fig. 2. It is the firm's type 1,003 double-tubular radiator, with a gilt lacquered frame, patent copper interior and reflector, and four luminous heat lamps. It is 36 in. high, 21¼ in. wide, 6½ in. deep and weighs 13 lb. Fig. 3 shows a cheap combined radiator or radio-convector, on the Dowsing-Huntley system, with a block-iron frame and copper reflector. It

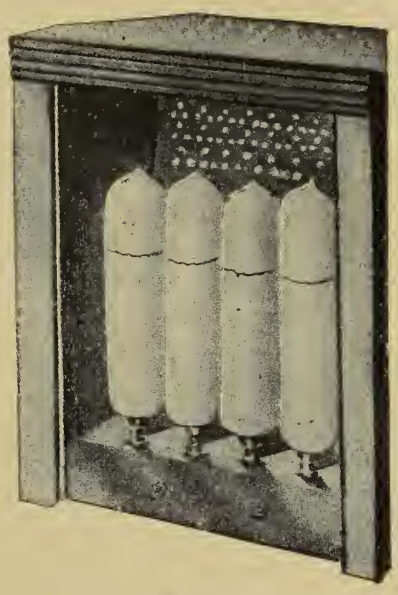


Fig. 3.—Combined Radiator.

has four luminous heat lamps, and is also fitted with non-luminous heaters. It measures 19½ in. high, 18¼ in. wide, and 9 in. deep, and weighs 18 lb. Numerous other designs are shown in the new season's price list just issued. Electric flat-irons and cookers for household service are also supplied.

LEGAL.

Johannesburg Council *v.* D. Stewart & Co. (1902), Ltd., and Wm. Beardmore and others.

Judgment has been given in the Scottish Court of Session in this action. Decree is given by Lord Ormidale for sums amounting altogether to £340,177.

The action was raised in respect that the defenders, Messrs. Stewart & Co., had abandoned and failed to implement contracts entered into by them with the Municipal Council of Johannesburg for the installation of electrical plant, gas producing plant and gas engines for the city of Johannesburg for tramways, lighting and power purposes. Messrs. Stewart & Co. denied the breach of contract, and stated that the installation was made according to the specification of the pursuers, and that any failure of the installation to reach the prescribed tests was due to unsuitability of coal supplied by pursuers to the defenders, Messrs. Stewart & Co., for gas producing purposes. The defender, Mr. Beardmore, was guarantor for the performance of the contract by the other defenders, his liability being limited to the amount contained in a bond, viz., £115,134. The balance of the sum sued for was £145,000 for repayment of the part of the purchase price paid to Stewart & Co., and about £200,000 for damages for breach of contract. The proof in the Scottish Court occupied about a month, and the productions in the case numbered fully 14,600.

Lord Ormidale finds and declares in terms of the declaratory conclusions of the summons, decerns against the defenders, D. Stewart & Co. (1902), Ltd., and the defender, William Beardmore, jointly and severally, for payment to the pursuers of £115,134, with interest at the rate of 4 per annum from July 1st, 1909, until payment, reserving to the defender, William Beardmore, such right of relief against the defenders, D. Stewart & Co., Ltd., as may be competent to him. Further, his Lordship decerns against the defenders, D. Stewart & Co. (1902), Ltd., for payment to the pursuers of, first, £27,961, with interest at the rate of 4 per cent. per annum, from July 1st, 1909, till payment; second, the sum of

£127,907; and, third, the sum of £69,175, with interest on the sums of £127,907 and £69,175, at the rate of 5 per cent. per annum till payment. The Judge finds the defenders, other than Mr. Beardmore, liable jointly and severally to the pursuers in expenses. His Lordship said that the question in fact he had to decide was whether the contractors repudiated their contract. His Lordship held that they did. The plant and machinery were not in a condition to allow the stipulated tests to be carried out, and on the back of that admission they threw off the contracts and ceased working. He had no doubt that the pursuers were entitled to treat the contracts as at an end, and this, his Lordship thought, was what they did substantially as from the date of the contractors' abandonment or repudiation. The contracts having been repudiated by the defenders, and the pursuers having accepted that repudiation, the latter were entitled to reject the plant, which was not up to the contract, and to claim damages. The next question was, what was the position of the sureties? His Lordship held that on the view he took of the contract, it appeared to him the sureties were liable under the bond. The contractors not having in all respects duly and punctually performed the agreements, &c., in the contracts, their failure in performance was absolute and complete, and therefore the sureties were liable to the full amount of the money obligations undertaken by them.

[We hope to allude to the above matter in our next issue.]

Overhead Wires.

On Monday, at the Lambeth Police Court, Mr. Hopkins, sitting as arbitrator under the Telegraph Act, 1878, gave his decision on the case between the Postmaster-General and the Southwark Borough Council on the refusal of the latter to consent to the erection of overhead telegraph wires in certain streets in the borough. As reported in the *Times*, Mr. Hopkins said that the argument that three fire-alarm posts in an obscure corner of the Borough of Southwark should not be electrically connected to an adjacent fire station, except at a cost of £340, was, to his mind, a position which could not be successfully maintained. He had walked over the streets, and had been quite unable to discover any reason for apprehending danger, disfigurement or inconvenience. His award was that the Post Office should be at liberty to carry the necessary overhead wires in accordance with their plans.

Damages against the L.C.C.

In a case heard at the Westminster County Court on Monday, a boot worker named Jass was awarded £28 18s. damages against the L.C.C. for injuries sustained owing to the sudden restarting of a car during a rush to board a tramcar at the Old Street and City Road junction. Plaintiff's counsel said that when the conductor was taking fares at busy periods of the day extra men were needed to signal for the starting and stopping of cars.

BUSINESS NOTES.

The Question of Preferential Contractors.—The practice of allocating contracts always to one firm was referred to at the recent meeting of the Hamburg Electricity Works Co., when a shareholder, in drawing attention to the impending extensions of the works at a cost of £750,000, pointed out that the Siemens-Schuckert Works Co. had hitherto always received orders for the whole of the work, the reason being, as he had heard, that the company held most of the shares. Nevertheless, the other firms also supplied satisfactorily, and the electricity works should, therefore, select open competition. In reply, one of the directors stated that the Siemens-Schuckert Works had not received the orders on account of shareholding, but solely because the State of Hamburg desired their participation, and also had an interest in the delivery of faultless machinery. As a matter of fact, the deliveries of the company had met all requirements. The shareholder thereupon declared that he failed to understand what interest the State could have in the internal equipment of the works, but his request for information met with no response.

Australian Mica.—The Western Australian Government *Gazette* of August 25th, publishes the text of regulations, dated August 22nd, for the payment, for two years from that date, of subsidies in encouragement of the production in that State of dressed mica and manufactured mica goods from crude mica produced in Western Australia. Subsidies will be payable as follows: (1) One-half the cost of transport of mica from the mine to the place of manufacture or export, up to 3s. per cwt.; (2) 10 per cent. of the selling price of mica sold at not less than 2s. per lb.; and 15 per cent. of the selling price of mica sold at less than 2s. per lb. The total subsidies payable to any one firm are not to exceed £250 per annum.—*Board of Trade Journal.*

Rubber Exhibition in New York.—Mr. A. Staines Manders, organising manager of the Rubber and Allied Trades Exhibition recently held in London, has cabled from America to state that a rubber exhibition will be held in the Grand Central Palace, New York, in September of 1912.

Vacuum Recorder.—Referring to the exhibit at Olympia which we noticed last week of a vacuum recorder "which is the first placed on the market for this purpose," Messrs. Thermo and Pressure Instruments, Ltd., of 60, Salusbury Road, N.W., point out that the "Fournier" vacuum recorder, based on the pressure of saturated vapours, has been on the market for a short time already, and has shown its value in application at various electricity generating stations.

Stoker Contract.—We learn that Messrs. Erith's Engineering Co., Ltd., have received the order of the Bolsover Colliery Co., Ltd., for 24 more of their grateless stokers, complete with their system of automatic response of fuel and air to varying loads. This is their ninth order in seven years, completing 88 Erith's stokers for this one company, who also heat and soften their water by the same maker's "no lime" process in Erith's heater-softener.

Electric Haulage on Rivers and Canals.—The chief engineer of the Special Service of Navigation between Belgium and Paris, 5, Rue de l'Aigle, Compiegne (Oise), France, is inviting tenders until March 1st, 1912, for the concession for the establishment and working of a system of electric haulage of the boats on the Haut-Escaut River, between Etrun and Janville, on the St. Quentin Canal, and on the canal at the side of the River Oise.

Book Notices.—*Report on Rating of Electrical Machinery.*—We have received a copy of the above report, which, the preface informs us, has been drawn up to assist the Electrotechnical Commission in the study of the international rating of electrical machinery. The report was specially mentioned by Prof. Elihu Thomson in his address to the I.E.C. at Turin, and has been referred to the small International Committee formed to study the rating of electrical machinery, which, indeed, is one of the most important objects for which the Commission was instituted. The report is limited to continuous-current machinery, and contains extracts from the standardisation rules in vogue in Belgium, France, Germany, Great Britain, Sweden and the United States of America. It shows that international agreement as to rating and general tests should not prove so difficult to tackle as was anticipated. Besides giving in a simple and clear manner the recommendations of the different countries with regard to power, service recognised or rating, as we call it, heating, overload, efficiency, dielectric tests, &c., an appendix is added giving the latest information issued by the American Institute with reference to the resistivity of copper, and also an interesting table of tolerances as regards guarantees employed in France. Altogether it is an interesting production, and well worth study by engineers and manufacturers, for it not only shows the lines upon which international agreement is likely to be obtained, but in the meantime can be of use to anyone specifying continuous-current machinery. The report is to be obtained from the general secretary, 28, Victoria Street, Westminster, at the price of 4s. 2d., post free.

"Charter, By-Laws and List of Members of the Iron and Steel Institute, 1911." London: The Institute. Price 1s.

"Motor Cycling Manual." 1911. London: Temple Press, Ltd. Price 1s. 6d. net.

"Science Abstracts." Sections A and B. Vol. 14, Part 9. September 25th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVII, No. 7. September, 1911. New York: The Society.

"Catalogue des Instruments Mathematiques et Scientifiques. Exposition Universelle de Turin, 1911." (Section de la Grande Bretagne.) London: Eyre & Spottiswoode, Ltd. Price 50 centesimi.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, Part 7. August, 1911. Johannesburg: The Institute. Price 2s.

"Boilers and Boiler Control." By John B. C. Kershaw. 1911. London: Davis Bros. Price 1s. net.

"Alternating Currents." By Dr. Alfred Hay. Third edition. 1911. London: Harper & Bros. Price 6s. net.

"The Electric Propulsion of Ships." By H. M. Hobart. 1911. London: Harper & Bros. Price 5s. net.

"Multiplex Telephony and Telegraphy by means of Electric Waves Guided by Wires." By Major G. O. Squier. 1911. Chicago: From the Author.

"Quarterly Bulletin of the American Institute of Architects." Vol. XII, No. 2. July, 1911. Washington: The Octagon.

"A Study of the Current Transformer, with particular Reference to Iron Loss." By P. G. Agnew. 1911. Washington: Government Printing Office.

Bankruptcy Proceedings. — Cuthbert Fenton Lindop, electrician, 16, Moss Lane, Aintree, Liverpool, late of 62, Dale Street, Liverpool.—Mr. Registrar Cooper held a sitting at the Court House, Government Buildings, Victoria Street, Liverpool, last week for this adjourned public examination. The case was adjourned owing to the non-production of documents.

W. H. Ridpath (Ridpath & Wells), electrical engineer, Ilkeston.—First and final dividend, 1s. in the £, payable October 17th at 5, Victoria Buildings, Derby.

G. V. B. Barker, electrical engineer, Roundhay, Leeds.—First and final dividend of 5s. 6½d. in the £, payable October 16th at Official Receiver's office, The Red House, Duncombe Place, York.

W. F. Flint, electrical engineer, Jameson Street, Hull.—A meeting of creditors was held at Hull last week. The gross liabilities were returned at £1,785, and the assets at £639, leaving a deficiency

£1,105. The debtor, who commenced business three years ago ith a capital of £270, attributed his failure to heavy losses on ntracts, keen competition, and bad debts. A trustee was ppointed with a committee of inspection. Trustee, Mr. W. G. Hall, lver Street, Hull.

Trade Announcements.—Messrs. E. E. Porter & Co., rd., 14, Canton Road, Shanghai, who have been established for very any years as electrical contractors in Shanghai—we understand at they were the first to open out there—are desirous of receiving otations for general electric light and bell accessories and fittings r the coming year.

Messrs. J. Dodimead & Son, of 50, Tottenham Court Road, W. hose senior partner, Mr. J. Dodimead, recently passed away, as ready stated in our pages), announce that the business is now ing carried on by Mr. Charles E. Dodimead, the son of the deceased ntleman. The title of the firm will not be changed.

Mr. Percy Pitman, of Acton, has registered the following tele- aphic address : " Hydromotor, London."

Mr. H. G. Frost, late of Deal, has taken over the business of essrs. T. Stone & Co., electrical engineers, &c., High Street and ink Street, Gravesend.

The North-Western Electrical Appliance Co., formerly of asgow, have removed to new and up-to-date works at Darlington. ley have recently experienced a rush of business. Their address now Railway Appliance Works, Darlington, Co. Durham.

The London Brass and Aluminium Die Castings Foundry, inner Street, E.C., are now fully equipped for undertaking the anufacture of die cast parts for patented articles.

Messrs. Brotherton Tubes and Conduits, Ltd., have removed eir stores from Bennett's Yard, Marsham Street, to Brewer's reen Yard, Victoria Street, London, S.W. The change is conse- ent upon increased business, and the new premises are more mmodious, enabling orders to be promptly handled.

Mr. Leoline Edwards, of 81, St. Margaret's Road, Twicken- m, has taken over the sole agency for London, and the South, e Eastern and Western districts of England and South Wales, for e Broughton Copper Co., Ltd., for all electrical goods manu- ctured by them. He has sent us a price card of standard stock es of patent forged copper cable sockets for electrical con- ctions.

Catalogues and Lists.—Messrs. Litholite, Ltd., , Hackney Grove, London, N.E.—New sheets (13, 14 and 15), placing others already in their catalogue, regarding standard tholite caps and insulators. Three new sheets (24, 25 and 26) are ded showing some new patterns of handles, insulating bolts, &c.

The Abbey Electric Co., 17, Victoria Street, Westminster, W.—Two pamphlets showing and pricing the " Abbey " enclosed c lamp, and flame lamp.

The Midland Electric Manufacturing Co., Ltd., Stafford orks, Rea Street South, Birmingham.—Pamphlet (illustrated) 40 pages showing, and clearly setting out prices of, a variety of itchgear, including various patterns of ironclad switches and fuses, seboards, motor-control and supply panels, distribution switch d fuseboards, and accumulator switchboards.

The Electro-Mechanical Brake Co., Ltd., West Bromwich. Illustrated list relating to their patent unbreakable and jointless id resistances.

The British Prometheus Co., Ltd., Salop Street Works, ighgate, Birmingham.—A number of cards have been received nstrating and briefly describing the Prometheus domestic tchen range, electric ovens, steamers, boiler and stock pot, pastry en, Bain Marie, hot cupboard and carving table and hot press, r hotel and restaurant kitchens.

The Cambridge Scientific Instrument Co., Ltd., Cam- idge.—List No. 92 (24 pages), containing detailed descriptions, cluding suitable exterior and sectional views, also line diagrams, their tilted electrometer, simple micro-electroscope, Universal rtable electrometer, string electrometer, Dolezalek quadrant ctrometer, radio-activity measurement apparatus, the Weston rmal cell, and silver voltameter. A separate leaflet (No. 90) nilarly describes Callendar's apparatus for the determination of J," the mechanical equivalent of heat. Prices and code-words e given in both lists.

The A.E.G. Electrical Co,, of South Africa, Ltd., Caxton ouse, Westminster, S.W.—A batch of literature has been received follows:—A 32-page brochure, containing a full description, ith many half-tone and line illustrations, of the hydro-electric ant of the Adamello Electric Supply Co., which is utilising drauliс power in the Camonica Valley for supplying energy to her companies and consumers in the provinces of Brescia, rgamo, Milano, Como, Piacenza, Parma and Cremona ; a 20-page mphlet effectively showing in colour, a number of fittings for high ndle-power metallic-filament lamps, and street spanning and mp lowering devices ; 16-page pamphlet, describing the fferential protective system for the protection of cables and ansformers: the A.E.G. *Journal* for September ; and the full talogue of A.E.G. meters (92 pages) of which mention has already en made in our columns.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, ondon, E.C.—16-page catalogue (N 80) containing illustrated scriptions and prices of the " Globe-Nadir " electric measuring struments, including the universal testing set, portable galvano- eters and ohmmeters, metal-filament lamp testing apparatus, ermo-electric pyrometers, recording pyrometers, switchboard and rtable ammeters and voltmeters, and standard resistances.

The Electrical Engineering and Agency Co., Ltd., 109-111, New Oxford Street, London, W.C.—Two leaflets, one giving illustrations, prices and other particulars of Riding's flame arc lamps and enclosed lamps, also resistances and choking coils ; the other contains fully illustrated information and prices of arc lamp raising and lowering gear and accessories.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—Four lists, the contents of which consist almost entirely of fully tabulated sizes, weights, shipping dimensions, prices, and so forth, of the following : List M 2, two and three-phase induction motors, 4, 6, 8, 10 and 12 poles respectively ; M 1, continuous-current motors and dynamos, variable speed and reversible interpole motors ; M 3, continuous-current motor starters, ironclad motor-starting panels and shunt regulators ; M 5, motor-generators, single field rotary transformers, small rotary converters and induction motor-generators. Copies can be obtained on application.

Messrs. Medway's Safety Lift Co., 10, Bush Lane, Cannon Street, London, E.C.—12-page booklet describing Scott's patent system of automatic push-button control for electric lifts, also Scott's car switch and semi-automatic push-button control. Copies will be sent on application.

The Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—New catalogue (24 pages) containing illustrated descriptions and prices of a variety of lanterns and fittings for street, shop and works lighting. " Streetlites," ventilated cluster fittings, sign and shop-window types, " Beatark " type fittings, Barrow suspension devices, watertight fittings, " Deflectorlite," " Onelite," and " Drawlite " fittings, brackets, &c.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. Mailing card showing their Simplex hair dryer.

The Weston Electrical Instrument Co., Audrey House, Ely Place, London, E.C.—Manifold list illustrating and briefly describing a complete line of Weston A.C. switchboard indicating instruments.

The Unbreakable Pulley and Mill-Gearing Co., Ltd., West Gorton, Manchester.—New pocket edition (twenty-fourth) of their catalogue, of over 100 pages. The first 10 pages are occupied with useful tables for engineers and others, and a telegraphic code follows. Illustrated descriptions with prices are then given of various shafts and couplings, bearings, clutches, pulleys, &c. Among the new contents is information regarding the following : Ball, roller and forced lubrication bearings ; heavy bearings for main drives ; Reny flexible coupling ; the Benn friction clutch and actuating gears.

Messrs. Brotherton Tubes and Conduits, Ltd., Commercial Road, Wolverhampton.—We have received a finely got-up and well-bound catalogue (No. 6) of 180 pages, in which are fully illustrated descriptions, with price information tabulated clearly on facing pages, of their " Excelsior " electrical conduits and fittings. A series of excellent photographic views of the different departments at the works precede the general catalogue information, and the latter is followed by a number of generally useful features such as wiring rules, Board of Trade regulations, Fire Office rules, table of conductors, and particulars of electric light and power stations at home and abroad. The catalogue should be interesting and useful to contractors and exporters.

Dissolutions and Liquidations.—Lahmeyer Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. C. Pfeffer, 135, Oxford Street, W.C., as liquidator. A meeting of creditors is called for October 19th.

Amalgamated Radio-Telegraph Co., Ltd.—A meeting is called for November 10th, at 58, Coleman Street, E.C., to hear an account of the winding up from the liquidators (Messrs. F. W. Pixley and H. Allen).

Doncaster Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. A. E. Stringer, Cheapside Chambers, Bradford, as liquidator.

Solium Electrical Co., Ltd.—Mr. E. Harlow, 33, King Street, Nottingham, the liquidator of this company, notifies that he is now in a position to pay all creditors in full. Action was taken against the vendor of the process (Mr. A. Hurter, of Oerlikon, Switzerland) for non-fulfilment of contract and damages. Judgment was obtained, which has enabled this distribution to be made.

Machine Tool Association.—We are informed that among recent additions to the membership of the Machine Tool and Engineering Association, Ltd., are the following :—Craven Bros., Ltd. ; Hulse & Co., Ltd. ; Birmingham Small Arms Co., Ltd. ; S. Osborn & Co., Ltd. ; Consolidated Pneumatic Tool Co., Ltd. ; B. & S. Massey ; Roberts Bros. : Hoffman Manufacturing Co., Ltd. ; Dron & Lawson, Ltd. ; Joshua Heap & Co., Ltd.

LIGHTING and POWER NOTES.

Aldershot.—The U.D.C. has decided to install at the electricity works a Diesel engine of 200 B.P. at a cost of £2,298.

Belfast.—Mr. P. C. Cowan, of the L.G.B., held an inquiry last week relative to the application of the T.C. for sanction to a loan of £40,000 for extending the electric light undertaking. There was no opposition to the applications. The town solicitor

explained briefly the objects of the loan applied for in connection with the electrical undertaking. The amount asked for was made up as follows:—Plant, £12,850; distributing mains, £9,500; feeders, £6,100; services, £8,550; meters, indicators and time switches, £3,000. The city electrical engineer, said, judging from the growth of the demand for electricity during the period 1904-1911, the probable demand for the winter of 1911 would be 4,600 KW., and for the winter of 1912 4,920 KW. The total plant capacity for lighting at present was 7,300 KW., and it was necessary to reserve 1,800 KW. as spare, and for driving auxiliary motors. The available plant was, therefore, reduced to 5,500 KW. In addition to the usual increase they had secured a power consumer of 390 B.H.P., which would add about 350 KW., allowing for efficiency and drop. Adding this to the ordinary estimate for the year 1912, they got a total demand of 5,270 KW. It would, therefore, be necessary to have more plant after that date, and he had allowed for the addition of a duplicate 1,500-KW. turbo-dynamo and condensing plant with spare armatures, and he intended the spares purchased under the last contract to fit the new machines. The existing switchboard would require the addition of five panels—one dividing, three feeding, and one generator panel. The estimate also included one boiler of 20,000 lb. per hour capacity, together with an economiser, mechanical stoker, and pipe-work, the available space in the boiler house being limited to this extent. Witness went on to give further details concerning the plant already in the electricity station, and the new plant about to be acquired, and he quoted statistics showing the growth of the demand for current both for lighting and power purposes. Some of the extensions contemplated were required immediately, but others would not be carried out until there was a guaranteed consumption equivalent to 20 per cent. of the cost of laying the mains. The town clerk remarked that over and above the proposal now before the inspector, the electrical engineer had made a recommendation to the Committee for still further and much more important extensions, with a view to being prepared for some years ahead. The Committee had had the matter before them, but had not yet given it full consideration. In answer to the inspector, Mr. Bloxam said the work done under the loan now applied for would enable them to carry on the undertaking for the next couple of years, and at the end of that time he contemplated the provision of another power-house. The Corporation was satisfied with the progress that the undertaking had made since its initiation. The inquiry afterwards terminated.

Bexhill.—At the meeting of the Council on Monday last, it was resolved to make application to the L.G.B. for sanction to borrow £2,000 being the estimated expenditure necessary in respect of cable extensions, and £400 in respect of house services, during the period of two years from March 31st last.

The B. of T. has issued a report of a preliminary inquiry conducted by Mr. C. Wren Limpricht into an explosion at the Bexhill Electricity Works, which occurred on Sunday, May 14th. The Inspector describes the machinery concerned in detail, and says as regards the cause of explosion: "The explosion was caused by water-hammer action, the water of condensation from the previous run having lodged in the superheater pipes adjacent to the equalising valve, and, being set on motion by the opening of the superheater drain, produced such stresses in the body of the valve as to cause its fracture."

Bispham.—Last week considerable damage was done to the new electric lighting station at Bispham by the gale. The wind veered round in the early morning, and the west wall of the building collapsed. The wall was about 50 ft. long and 22 ft. in height.

Blackpool.—The electrical engineer has been instructed to submit a report and estimate respecting any necessary extensions to the plant for lighting and tramway purposes.

Bradford.—The Joint Electricity and Tramway Sub-Committee of the Corporation, recently appointed to consider the charge for current for tramway purposes, has decided to recommend that the price of electrical energy for tramway purposes this year be 1d. per unit.

An electric cable is to be laid from Apperley Bridge to Strangford, on the Esholt Estate—where sewage disposal works are being constructed for the Corporation—at an estimated cost of £735.

Burnley.—With a view to encouraging the greater use of electricity for power purposes, the Corporation has adopted the following supplementary charges, viz.:—Where the consumption is equal to or above 400 units per E.H.P. per quarter, 1d. per unit flat rate; if equal to or above 500 units per E.H.P. per quarter, ·9d.; if equal to or above 600 units per E.H.P. per quarter, ·8d.; and where the consumption is more than 600 units per E.H.P. per quarter, a consumer may elect to be charged on the following scale:—A fixed charge of 25s. per E.H.P. per quarter installed, plus a running charge of ·4d. per unit for current as metered. The new charges, so far as they affect the present consumers, will come into operation on January 1st, 1912, or after the last reading of their meters if before that date, and as regards new customers on such date or dates as they shall commence to take electricity from the Corporation.

Burton-on-Trent.—The T.C. has decided to extend the supply by overhead cable to Horninglow, so as to supply current to St. John's Church and private consumers in the vicinity. A similar extension is to be made to Bretby Lane. The cost of the extensions is only one-fifth of that of underground cables.

Bushey.—The Electric Light and Tramways Committee reports that it has retained Mr. W. H. Patchell to advise the Council in the matter of obtaining terms from proposed electric light undertakers, and examine and report on the necessary agreement between the Council and the undertakers.

Canada.—Within a very few weeks electrical energy will be coming into the city of Winnipeg from the municipal plant situated at Point Du Bois, which is rapidly nearing completion. It is interesting to note the important industrial development in the Western metropolis of late, owing to this assurance of cheap power in unlimited quantities.

The Hon. Adam Beck, chairman of the Ontario Hydro-Electric Commission, while in Europe during the past summer, purchased a quantity of farm implements and machinery designed to be operated by electricity on the farm. This machinery and the farm appliances have been placed on the provincial Experiment Farm, Guelph, to be put into practical use for ploughing, seeding, drilling, cultivating, digging, &c.

After fully demonstrating the adaptability of the electric current to the amelioration of farm labour, not only at the Agricultural College, but at several private farms, current will be offered to the farmer through the township municipality, at the same, or cheaper rates than is now given to the Ontario towns and cities.

Continental.—GERMANY.—The T.C. of Munich, has decided on the erection of a new municipal electric works in the Bavarian Oberland, connected with the Leitschach station, near Miesbach. The scheme will be carried out by a trust company composed of Berlin and Bavarian capitalists, and of the share capital of M. 6,000,000 the city of Munich will take 51 per cent.

FRANCE.—To supply the industrial region in the Department of l'Oise, embracing the cities of Beauvais, Clermont, Compiègne and Senlis, two schemes are being put forward. The one proposes to erect a station at Crèil for the supply of the places named, and intervening villages; the other contemplates catering for Creil, Clermont, Beauvais and Meru. MM. Drin & Ferré are the authors of the latter scheme, and the official inquiry has already been made without the result, however, as yet transpiring.—*Revue Pratique de la Electricité.*

RUSSIA.—According to the Russian journal *Elektritchest* there existed in 1910 in Russia, 156 central stations. Of 111 these, 81 utilised continuous current, five continuous and alternating current, and 24 alternating current. No particulars are available of the 45 remaining stations. Of the 111 stations, worked at pressures of between 110 and 150 volts; 65 at between 150 and 240 volts; five at between 500 and 600 volts; 20 between 2,000 and 5,000 volts; and four at pressures between 5,000 and 8,000 volts. 37 works, of which complete particulars are given, have an aggregate capacity of 117,141 KW. Among this number are comprised the four stations at St. Petersburg, having together a total capacity of 41,650 KW. The price for light at these 37 stations varies between 40 and 124 centimes per KW.-hour, and for motive power, between 19 and 80 centimes per KW.-hour.

Crewe.—It is proposed to incur an expenditure of £3,[illegible] for new plant in connection with the electricity works. The works are to supply energy to the new County Training College, Crewe Green, and the new postal sorting office in Weston Lane, outside the borough.

Dover.—The T.C. has applied to the B. of T. for consent to the use of overhead wires for the purpose of supplying current in the parish of St. Margaret's-at-Cliffe.

Darlington.—The T.C. has applied for a loan of £3,[illegible] for the installation of a new generating set.

An agreement has been entered into for the supply of current to the extensive works of the Cleveland Bridge and Engineering Co., Ltd.

East Ham.—With regard to abstract of accounts of the electricity and tramways undertakings for the year 1910-11, the Electricity Committee has decided to carry forward the deficiency on the tramways fund revenue account to the current year, and to apply the credit balance of the electricity fund revenue account in writing off capital in respect of amounts deducted from borrowing powers by the Local Government Board. It has further decided to reduce the price of current supplied to the tramways undertaking for traction from 1·25d. to 1·125d. per unit.

Fareham.—The U.D.C. has decided to give a whole-day supply of current for the benefit of those needing energy for motors and radiators. This will entail an additional cost of £150 per annum, but it is considered that this will be ultimately met by the increased use of current.

Grays.—The U.D.C. has decided, in order to encourage the more extensive use of arc lamps for the outside of business premises, to reduce the charge for current for outside lamps. to [illegible] per unit.

Great Harwood.—In connection with the scheme prepared by Mr. Speight for providing the district with electric light, a sub-committee of the U.D.C. has been authorised to visit Penrith to inspect a similar scheme in operation there.

Greenock.—Many of the leading manufacturers and contractors in the county have promised their support to the electrical exhibition being promoted by the Corporation, and to take place in the last week of this month. A special scheme of decoration illumination has been arranged.

Hessle.—Arrangements have been made by the U.D.C. obtain current in bulk from Hull T.C., who will give the supply the rate of 70,000 units at 2d. per unit, and 100,000 units at 1½d. e agreement is for ten years.

Holmfirth (Yorkshire).—The U.D.C. has taken a poll the ratepayers respecting the project for a public installation lectric lighting. The result was declared on Monday as follows :— electricity, 1,276 ; against 580 ; neutral 204.

India.—At a recent meeting of the board of the Tata dro-Electric Power Works, applications were considered and epted up to a total of approximately 34,000 H.P., which amount ctically reaches the limit of the resources of the scheme in hand. ts are now being made by the company for the purpose of ascer- ning the exact requirements of several mills which have applied, l no further applications will be considered until these tests are npleted.—*Indian and Eastern Engineer.*

Johnstone.—Another step in the movement to introduce tricity was taken by the Corporation last week, when a meeting s held with the representatives of the various industries in the n. The conference, which was of a cordial nature, was burned in order that more information might be obtained.

Lewes.—The T.C. has, by 14 votes to 7, decided to pt electricity for public lighting, and to accept the tender of the ctric Supply Co. at £390, an average cost of £3 1s. 5d. per lamp. e gas company tendered at £448, the average per lamp being 10s. 6d.

London.—Fulham.—Additional coal storage is to be structed at the Electricity Works at an estimated cost of about 0, by the provision of a new bunker with a capacity of approxi- tely 1,000 tons.

Stepney.—The Finance Committee has considered a letter from Electricity Committee stating that the £500 already advanced supply consumers with apparatus and fittings on the hire-pur- se system had nearly been expended, and asking for a further 00. It has been decided to approve an estimate for the amount. further letter was received stating that the Committee was irous of borrowing a further sum of £2,500 for defraying the t of meters. This is also to be granted. Mains are to be ended in four streets. The Electricity Supply Committee has epted the tender of Edward Wood & Co., Ltd., at £311 for lacing with steel plates the concrete slabs in three of the coal kers at the Limehouse electricity station.

Hammersmith.—The Council last week had before it a recom- ndation of the Electricity Committee (sitting on September 29th) t the expenditure of £45 on tickets for the Olympia Exhi- on be approved. The Committee also expressed the opinion that Fair Wages Clauses suggested by the L.G.B. were clearer and re comprehensive than the clauses usually inserted in the ncil's contracts, and recommended their adoption in substitution refor.

St. Pancras.—The Parliamentary and General Purposes Com- ttee reports having had under consideration a communication from clerk to the Clerkenwell Police Court, stating that an appli- ion has been made to the Magistrate, by a firm of electrical gineers in the borough, to appoint an Electrical Inspector under provisions of Sec. 28 of the St. Pancras (Middlesex) Electric hting Order, 1883. This firm had objected to the Council's uirements in respect of fuses, as specified in the conditions ich have to be agreed to by consumers when taking a supply. ter careful consideration, the Committee decided to give in- uctions to its legal representatives to attend the Court on the y fixed for the hearing of the case, and should the Magistrate nk it necessary to appoint an Electrical Inspector, to urge that should be appointed for the purposes only of the application present before him. The Electricity and Public Lighting Com- ttee has under consideration a letter from Messrs. Marryat and ce, offering a tender of £1,000 per annum for the use of lamp- sts in the borough for advertising purposes.

Southwark.—The Electric Lighting Committee has had under sideration a report from the electrical engineer on the question of e hiring out of motors to customers. This system, he states, peared to appeal to a large number of consumers, and there was ery probability of the system being largely extended in the ture. At the present time it was the practice of the Council to preciate arc lamps and other apparatus on the basis of a life of e years, which worked satisfactorily for such apparatus, as tings, lamps, radiators, &c., were always being superseded by proved apparatus. But with regard to motors the case was fferent, the useful life being not less than 15 years, and it was not ssible to obtain for hire from the consumer a sum sufficient to ver depreciation and maintenance at that rate, so that with ery probability of the hire system increasing, there would be a rious deficit to be met on the hire account for at least five years less the period was extended. The usual rate for hire was 10 to ½ per cent. on the cost of the motor, and the engineer suggested at the cost should be written off in 10 years, which in considera- n of the fairly high residual value would leave a margin each ar to cover repairs and make the scheme self-supporting, thus oiding the necessity for making a charge on revenue account. fter fully considering the views of the engineer, the Committee cided to extend the time from 5 to 10 years.

Moseley.—The Birmingham T.C., which is about to pply current at Moseley, has opened a showroom for electrical tings and appliances in Alcester Road.

North Berwick.—In connection with the proposed electric lighting installation for the town, a communication has been received by the Council from Messrs. Crompton & Co. to the effect that they are unable to accept the gasworks site for the proposed electricity works. The cost involved in the laying of cables from a site so far out of the town would, in their opinion, be prohibitive.

Romford.—The Electrical and Engineering Supplies Co., Ltd., are about to extend their mains to Harold Wood, and have applied to the R.D.C. for permission to open the roads and footpaths for this purpose.

At the last meeting of the Board of Guardians it was decided to obtain particulars from other unions as to the estimated cost of electric lighting.

St. Helens.—The B. of T. has consented to the T.C. using overhead lines for the purpose of supplying electricity to the Sutton Moss Peat Works, at a pressure of 400 volts.

The T.C. has received the sanction of the L.G.B. to a loan of £10,800 for extensions to the electricity works.

Salford.—The T.C. has appointed Mr. C. D. Taite to report upon a proposal to install an additional turbo-generator at the electricity works, and also in regard to other matters in connection with the plant thereat, at a fee of 50 guineas.

Sheffield.—It is proposed that the chief officials of the electric light and tramways departments should be instructed to report to their respective Committees on the advisability of arranging for the mutual transference of electrical energy between Neepsend power station and the Kelham Island power station of the city tramways in case of necessity, with an estimate of the approximate cost.

Stafford.—The T.C. has decided that the present system of gas lighting in the main streets be abolished, and that in future the lighting be by electricity, the annual charge for the latter being £267, or £6 less than the charge for the present mixed lighting.

Tiverton.—At a meeting of the T.C. on Monday, a letter was read from Dr. Purves, of Exeter, who some time ago notified that he was applying for an electric lighting provisional order. He suggested that, as the Council owned the gas undertaking in Tiverton, the following plan might be adopted : That the Council grant him permission to erect, at his own cost, an electric generating station, on a site to be approved by the Council, and a refuse destructor ; and to operate and work that combined undertaking with the object of supplying electricity in bulk to the Corporation at, say, 3d. per unit, with a guaranteed minimum payment of, say, £750 per annum, and that for all electricity consumed in excess of that the charge be reduced to 2½d. per unit The letter was referred to the Lighting Committee.

Torquay.—The Council has received an intimation from the overseers to the effect that they propose to increase the gross assessment of the electricity works from £300 to £450.

Walsall.—There have been several complaints recently respecting the failure of the electric light and traction supply, and the Corporation Electricity Committee has, therefore, felt it necessary to issue an explanation in which it states that it is working under great disadvantages, owing to the alterations and extensions now in progress at the generating station during the reconstruction of part of the works.

Wath.—The U.D.C. has decided to oppose the application of the Yorkshire Electric Supply Co. for a prov. order for electricity supply.

Wimbledon.—With regard to the proposed purchase from the Polytechnic Estate, Ltd., of a plot of freehold land with buildings thereon, as a site for an electric transformer sub-station, and the electric mains on the estate, the offer has now been withdrawn. The borough electrical engineer reports that in connection with the supply of electricity to Maldens and Coombe, it will be necessary to erect an electric transformer sub-station in the parish of Coombe, and that the Maldens and Coombe U.D.C. has offered to lease a site for a term of 18 years ; the T.C. has agreed to this.

Worthing.—A statement as to the financial position of the Corporation electricity undertaking was made to the T.C. on Friday last by the chairman of the Finance Committee, when introducing the estimates for the coming half-year. Dealing with the electricity revenue account, the Alderman pointed out that the net result of the trading for the past half-year was that they were £95 better off than they expected to be, and it was anticipated that they would next March show a credit balance of about £395.

TRAMWAY and RAILWAY NOTES.

Argentina.—Although, owing to lack of capital and the difficulties of transport, the mining industry is only in a latent condition in Argentina, this state of things will, according to the Belgian Consul at Mendouza, tend to disappear when the concession to utilise the falls of Ninil, on the River Atuel, is carried out. It is intended to appropriate some 40,000 H.P. for the working of railways

in the Department of San Rafael, in the southern portion of the province, a region containing some extremely rich belts of ore. The concession is now under the consideration of the Governor of the province.—*Revue Pratique de l'Electricité.*

Australia.—The Launceston (Tasmania) municipal tramway system was formally opened for traffic on August 16th. The total length of track is about 5¾ miles, with a total length of line of 7 miles. The line is 3 ft. 6 in. gauge, laid on Tasmanian hardwood sleepers and macadam roadway, the rails are 90 lb., with 96-lb. rails at curves; the shortest radius of curve is 52 ft. The equipment consists of ten motor-cars and four trailers, the cars having an enclosed compartment in the centre and an open section at each end. Power is taken from the Council's three-phase system to a sub-station in Cameron Street.

The B. of T. has received copies of reports of the Victorian Parliamentary Standing Committee on Railways, recommending the execution of certain works. The Committee further points out the advantages of the electrification of the suburban railways of Melbourne, at a total cost for the 218 miles of £2,227,050; and states that, should the electrification of the Caulfield and Camberwell lines not be sanctioned by Parliament early in 1912, it will be necessary to duplicate those lines, at a cost, including regrading, of £964,000.

Bradford.—The Corporation Tramways Committee has considered the report of the general manager on the question of the extension of the railless trolley system, and has decided to recommend the City Council to include in its application to the B. of T. for a prov. order authorising the Corporation to use trolley vehicles on certain routes within the city, three additional routes. The general manager has reported to a sub-Committee upon the subject of fixing shock absorbers on the railless trolley cars on the Dudley Hill section, and has been authorised to have the work carried out on approval, one car to be fitted with lever springs and the other with hydraulic buffers.

Brazil.—A contract has been made between the Government of the State of Alagoas and a Maceio company for the installation of sewerage, water-supply and electric traction systems in that town. Work is to be begun within 12 months from October 22nd.

Burnley.—On October 4th, two Corporation employés were at work on the overhead tramway wires when the "tower wagon" dropped on its side. The men on the wagon saved themselves by hanging on to one of the overhead wires. A police constable released them from their predicament, throwing a rope by which they were enabled to descend. The shafts of the wagon were broken.

Continental Notes. — Portugal. — The Companhia Carris de Ferro do Porto has applied for a concession for the construction of an electric railway from a point on the Paranhos line to the works of the Portuguese Sugar Refining Co.—*Board of Trade Journal.*

Italy.—The Government has decided to entrust to private contractors the construction of the new electric railway from Naples to Atripalda. The line will have a length of 55 km., and will open up a rich agricultural district having a population of 100,000.

France.—The historically interesting portion of Normandy, embracing Caen, Honfleur and Falaise and some 20 towns in the neighbourhood, is about to be served by an electric tramway to run from Potigny to Mezidon. The district has considerable industrial interest, and the local Chambers of Commerce are strongly in favour of the scheme. The official inquiry will take place towards the end of the month.

Germany.—A treaty is in course of arrangement between Hamburg and Prussia, which will allow of the advantageous development of the electric railway systems of these two important sections of the German Empire. Prussia accords its consent to Hamburg extending its railway to the villages of Farmsen, Volksdorf, Wohldorf and Gross Hansdorf through Prussian territory. The cost of this railway, which the citizens have yet to ratify, is estimated at 9,000,000 M. On the other hand, Hamburg gives its assent to the extension by Prussia of the Blankensee-Ohlsdorf Railway, the first full-gauge electric railway to run in Germany. Prussia has two objects in this extension; it will be able to open up communication with the townships in the Alster Valley and, later, an extension to Segeberg will be made, in order to secure control over the heavy goods traffic from the North-East to Hamburg without the participation of the Lübeck-Büchen Railway. An ultimate object is the cheap acquisition of the last named, a prosperous private undertaking whose shares were recently quoted 184¾, with a dividend of 8½ per cent.

The project of an electric tramway at Wilhelmshaven, in Hanover, was recently brought to a standstill by an interdict lodged at the instance of the Kaiserlichen Observatorium. The dispute has now been settled by the payment of a sum of 30,000 M. as compensation. In consequence, the scheme will now be proceeded with.

Switzerland.—With regard to the special form of electric traction to be adopted on Swiss Federal railways, the Commission nominated to study the question has decided in its report to recommend the adoption of single-phase current at 15,000 volts. The Commission acknowledges that traction by continuous current conduces to a lower consumption of current, but this advantage is offset by various inconveniences, and in particular by an increase in the first cost. Transformation would cost about 70,000,000 fr.; the economies realised on working expenses would be about 10 per cent. The Federal Budget has already anticipated credits for the purchase during the present year (1911) of a certain number of waterfalls, to be utilised to supply electricity the railways.—*La Revue Electrique*

Hungary.—Plans are being prepared in respect of a project electric railway between Budapest and Budakesz.

Darlington.—At a meeting of the T.C. on the 5th ins a report was submitted from the Electricity and Light Railw Committee on the use of railless trolley cars and motor-omnibu Mr. Lunn (the engineer) explained that he had visited Leeds a Bradford, where railless cars were in use, and found that th gave no trouble, and the Corporation was well satisfied with the The cost of cars similar in size to those in use in Darlington, v £700 approximately, and the overhead equipment cost from £1,2 to £1,500 per mile. The cost of running the cars on a minutes' service was about 7d. per mile, including interest a depreciation, but not the repayment of the expense of obtaini Parliamentary powers. Motor-omnibuses cost from 9d. to 1 per mile, or 1s. including capital charges. If a service was to run in the Greenbank and Hopetown districts, he recommen the railless system as the cheapest and most reliable, but thou there was not sufficient traffic along these routes to make service pay. He also thought that they could not expect to e 7d. per mile on the Victoria Road route. Mr. Bates, a member the Tramways Committee, said probably they would soon h something further to go upon. The report was adopted. amendment by Mr. Gregg that the report be taken back for a consideration of a proposal to extend the system, being defeate

Dundee.—The Trades Council seems determined to k alive the agitation against the withdrawal of the workmen's c and the reduction of the ½d. stages. At its last meeting matter was again raised, and strong dissatisfaction expressed at Tramway Committee's action. The members unanimously agr to hold an indignation meeting to protest against a continuanc the scheme.

Edinburgh.—In connection with the proposal to ad the railless traction system, members of the Corporation Tramw Committee recently visited a Princes Street picture house had a private view of moving pictures, showing the running railless cars in the towns visited by a recent deputation. Committee afterwards went over certain routes which it is sugges might be equipped for the new system. If thought advisabl provisional order to enable the system to be adopted may be appl for during the ensuing session of Parliament.

Halifax.—The Corporation Tramways Committee decided to ask the T.C. to double the tramway lines on vari routes where there is at present only a single track. An expe ture of about £10,000 will be involved.

Haslingden.—The Accrington Corporation Tramw Committee has requested the Haslingden T.C. to take in conside tion the installation of automatic signalling arrangements on tramways. The question has been left in the hands of chairman, vice-chairman, and the engineer.

Heston and Isleworth.—The chief engineer of electricity department reported at the last meeting of the Cou that experiments were being tried in lighting the High Street w Jandus arc lamps.

Hull.—The assessment of the Corporation tramways been reduced from £13,753 to £11,500.

Powers are to be sought to extend the tramways down Clevel Street and Stoneferry Road to Stoneferry.

Ilford.—The question of extending the tramways do Cranbrook Road by either an extension of the present system railless system is under consideration.

Japan.—The T.C. of Tokio has received the Gove ment's sanction for the establishment of electric tramways. new lines are to be laid, and some 500 new second-class cars acqui as also open cars for the carriage of workpeople.—*Elektrotech und Maschinenbau.*

Leeds.—The tramways have had a most successful h year. No fewer than 43,466,288 passengers were carried in the per so that estimating the population at half a million, the popula was carried over 87 times. The number was 2,911,011 more tha the corresponding period of the previous year, or an increas 7·18 per cent. The receipts were proportionately higher, re senting an increase of £15,237.

Liverpool.—The question of applying to the Tramw Committee to place first-class cars on the Stanley Road route, w is the only route on which they are not running, was raised the meeting of the Bootle T.C. on Wednesday, October 4th. Co cillor Watson thought a more important matter was the neces of a better third-class service, especially at night time. A further discussion, Alderman McMurray protested that this was laughing matter. When first-class cars were introduced in Li pool, the new departure was treated with levity and sneers, but service had proved a great success, and if the committee willing to entertain this suggestion, he did not see why a mon trial should not be given. No resolution was submitted.

London.—In connection with the Earl's Court Stat of the District and Great Northern and Piccadilly Railways, escalator or moving staircase has now been put to work; sim methods are proposed for connecting the Charing Cross Dist Railway station and the new tube station which is to be structed beneath it; also for connecting Paddington Station w Edgware Road Station, and the new tube station which is t built under Paddington.

Nelson.—At the T.C. on October 5th, a letter was read from the Colne and Trawden Co. suggesting a conference of representatives of the Burnley and Nelson Tramway Committees and the company as to through running over the three systems. The Nelson Tramways Sub-Committee had met Mr. M. Turner, manager of the Colne and Trawden Co., respecting the provision of additional covered cars, and two are to be obtained.

St. Helens.—The T.C. has appointed a Special Committee of nine members with a view to ascertaining the exact position of affairs between the St. Helens Tramways Co. and the Corporation, and to inquire into all transactions, leases and agreements concerning the same, and to report thereon to the Council. Mr. Grace, who moved the resolution at the Council meeting on Wednesday, October 4th, alleged that the tramway company had treated the Corporation contemptuously in the matter of fares and other things, and it was an injustice to the ordinary consumers and ratepayers that the company got a great advantage in the supply of electricity from the Corporation. After criticising the car service and the condition of the cars, and the track, he argued that if the company said it could not make money on the present basis, the time had arrived for it to say so, and to ask that the Corporation should take the concern over. Alderman Forster pointed out that the Corporation was the owner of the tramway system, and leased certain powers to the tramway company. He admitted that its relations with the tramway company were not so cordial as they might be.

A Sub-Committee has been appointed by the Corporation to consider and report upon the railless trolley system.

Rotherham.—The Corporation Act, 1911, authorised the Council, among other things, to extend the Wellgate tramway along Broom Road and Wickersley Road to the borough boundary at Herringthorpe Lane; to extend the Dalton tramway along Doncaster Road to Thryburgh; and to run a trolley vehicle route from the borough boundary on the Wickersley Road to Maltby. With regard to the former, the Electric Lighting and Tramways Committee has decided to proceed with the work forthwith, and has instructed the borough engineer to prepare the necessary plans and specifications, and to invite tenders for the rails and other materials required. With regard to the trolley vehicle route, application is to be made to the B. of T. for permission to commence the construction thereof before January 1st, 1912. The borough engineer, in conjunction with the tramways manager, is to prepare plans for an extension of the tramways depôt.

Walsall.—The Tramways Committee of the Corporation is purchasing St. Paul's Buildings on the bridge for the sum of £2,150, with the intention of adapting them for the purposes of cash and other offices.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postmaster-General last month accepted the tender of the Automatic Electric Co., of Chicago and Sydney, for an automatic switchboard for the new Geelong telephone exchange, costing £14,293. The lowest tender for a manual board was £7,773.—*Australian Mining Standard.*

Hythe.—A dispute has been in progress for 12 months between the National Telephone Co. and the Town Council of Hythe, the latter having called upon the company to remove a number of poles which carry 64 lines along the bank of the military canal, through a part of the town considered exceptionally beautiful. As no alternative route could be found, the company was unable to accede to the request, but last month the T.C. gave the company 14 days' notice to remove the poles. The company then informed the local subscribers that the telephone service would be discontinued on Wednesday this week. However, the Council was unable to withstand the protests of the townsmen, and a temporary truce has been established, during which the Post Office will be approached to ascertain whether, on taking over the company's business, the former will place the wires underground, or whether it will insist on replacing the poles.

London.—Southwark.—On Monday last Mr. Hopkins, as arbitrator between the Postmaster-General and the Southwark B.C., in a dispute concerning the erection of overhead wires along certain streets for fire alarm signals, gave his decision in favour of the Post Office, stating that he could discover no reason for apprehending danger, disfigurement or inconvenience from the use of overhead wires.

The P.M.G.'s Report.—The fifty-seventh report of the Postmaster-General on the Post Office Dept. for the year to March 31st last has been presented. Although there were 634,000 inland telegrams less than in 1909-10, the foreign messages increased by 419,000, leaving a loss of only 0·2 per cent. on the total number of messages dealt with. The receipts show an increase of £4,213 on a total of £2,773,266, a result which can hardly be considered satisfactory. During the year under review 160 new post offices have been opened, but only at 999 out of a total number of 11,451 offices open for the receipt of telegrams, is the business carried on under guarantee.

High-speed telegraphy and other improvements have been developed, and an attempt has been made to effect delivery of telegrams by telephone in order to economise in messenger service.

With regard to the foreign telegraph service, the agreements between the Atlantic Cable Companies, by means of which the British Companies are practically absorbed by the American Company, are vaguely referred to as conferring "an improvement of the facilities for sending telegrams to and from North America," and it is stated that "a measure of Government control over the rates charged by the companies for telegrams between the United Kingdom and North America will be secured through the licenses to land cables in this country which are about to be issued."

Plain language in foreign telegrams at half rates is stated to have been accepted by the British and American Cable Companies, but we do not quite agree that the conditions of the acceptances have been settled or can be settled until the question of the 24 hours' deferment of transmission has been determined, as well as other material questions for consideration, such as the transmission of dates, code times, &c., necessary to distinguish these telegrams. It is an easy matter to devise schemes such as the above, but to be useful they should be general, not partial, in effect, and should be put into force after proper discussisn and agreement on European lines as well as on the extra-European systems. The question of examination of codes might very well be settled by charging at a letter rate, thus disposing of what appears likely to become an everlasting question.

Wireless telegraphy is moving, as it should do, but there does not appear to be a separate account showing the cost of erection, and this is very material when expansion of business and revenue is considered. £16,000 is now to be spent on reorganisation. The telegraph deficiency account is a serious one, and seems to be increasing annually. It is stated at £1,182,321, and a footnote calls attention to this being overstated by the telephone proportion of the cost of new mixed works charged temporarily to the telegraph service extensions, but the amount is not given or estimated.

The telephone revenue was £1,938,330, an increase of £233,764, and the expenditure £1,980,160, an increase of £192,531. The net deficit, therefore, was £41,830, about half as much as last year.

The number of wireless telegrams handled by the coast stations of the Post Office was 5,640 outward to ships, compared with 3,266 in the previous year, and 34,161 inward, compared with 27,727; the total increase was 8,808, or 28·4 per cent. The revenue was £7,941. There were 290 British ships equipped with wireless telegraph apparatus, compared with 130 in the previous year—a very large increase.

The report on the P.O. telephone service shows that there were 678 trunk exchanges open, an increase of 35, and 2,848 trunk circuits, an increase of 182. The capital expended on this branch amounted to £5,337,725, an increase of £283,153, and the conversations over inland trunk lines numbered 30,100,068, an increase of 13 per cent. The revenue was £765,282, an increase of 15 per cent. The receipts from Continental calls amounted to £24,666, an increase of £531.

New Post Office telephone exchanges to the number of 137 were opened in the provinces, mainly in less populous parts where they produce no profit, but sometimes a loss. The total number of lines connected with the Post Office exchanges was 28,441, compared with 26,112; and the number of exchange telephones was 36,650, compared with 33,330. In London the Post Office subscribers numbered 73,305, as against 64,200. The number of calls was about 85½ millions, compared with 70 millions. The telephone was used to forward 5,372,000 telegrams last year, an increase of 9·1 per cent., and 196,000 express letters, an increase of 20 per cent.

Wireless Telegraphy in Ceylon.—Messrs. Marconi's Wireless Telegraph Co., Ltd., has entered into a contract with the Crown Agents for the Colonies for the establishment of a radio-telegraph station in Ceylon, capable normally of sending a wave 600 metres in length. In addition, however, with any wave between 1,000 and 2,000 metres, the station will maintain communication with any ship off Madras, or with any ship up to a distance of 450 miles over sea (except during periods of severe atmospheric disturbances), provided the ship is fitted with an aerial having a mean height of not less than 100 ft., and suitable receiving apparatus. The generator will consist of a 10-H.P. motor, taking power at 100 volts, 60 cycles, from mains direct coupled to a 5-KW. alternator and exciter. The discharger will be of the disk type direct coupled to the motor-alternator, and designed to produce a musical spark. The receiving apparatus will consist of a magnetic detector in combination with a multiple tuner, which will be constructed to provide a highly syntonisd circuit for all waves between 100 and 2,500 metres, and a receiver of the valve type, which will be used in place of the magnetic detector in reception from 1,600 to 4,000 metres. Two masts will be provided, each 270 ft. in height overall.—*The Marconigraph.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—October 28th. Gas-raising and by-product recovery plant, one 1000-H.P. gas engine, and one 750-KW. E.H.T. generator, for the Corporation. See "Official Notices" to-day.

Algeria.—October 24th. The Algerian Post and Telegraph authorities in Algiers are inviting tenders for a quantity of bronze wire and lead and rubber-covered cables.

Australia.—Western Australia.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th

South Australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 29th. One portable hand-driven desiccating plant, and binders, sleeves, tapes and copper wire, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 15th.—Telephone cords and ear-pieces, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M.G. See "Official Notices" October 6th.

Queensland.—November 8th. Ironwork, measuring instruments and protectors, switchboards, switchboard parts and accessories, telegraph and telephone instruments, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 22nd.—Cable for the P.M.G.'s Department. See "Official Notices" September 29th.

Victoria.—November 28th. Ebonite earpieces, calculagraphs, and insulators for the P.M.G. See "Official Notices" October 6th.

Belgium.—The municipal authorities of St. Chislain (Hainaut) are about to invite tenders for the establishment of a small electric lighting and power plant at the Ecole des Arts et Metiers in that town. The plant will comprise a 40–50-H.P. gas engine, a dynamo, three small dynamos, a battery of accumulators, and the necessary material for an installation of 250 lamps.

Canada.—Lethbridge.—November 24th. Municipality. Power station equipment comprising boilers, economiser, steam turbo-generator, condenser and sub-station equipment; 10 per cent. deposit with tender. Plans, &c., from A. Reid, superintendent engineer. Lethbridge.

Dublin.—November 6th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" to-day.

Great Western Railway.—October 16th and November 7th. Stores for a year. See "Official Notices" October 6th.

Grimsby.—October 16th. Paper-insulated lead-covered cables, house fuse boxes, and mains service boxes for the Corporation. See "Official Notices" September 29th.

Hastings.—October 18th. Electric lighting of the workhouse, Orc, for the B.G. See "Official Notices" September 15th.

Italy.—Rome.—October 30th. Open to foreign competition, 10 per cent. deposit with tender. Lamps and lamp fittings for electric light installations, about £8,000. Particulars from Direzione Generale dei Servizi Amministrativi, Ministero della Marina, Rome.—*Board of Trade Journal.*

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

Newcastle-on-Tyne.—October 24th. (*a*) Tramway rails, and (*b*) tie bars, for the T.C. City Engineer (returnable deposit £1 1s.).

Rotherham.—The borough engineer is to prepare plans in connection with the extension of the tramways to Thrybergh and to the borough boundary. Tenders are to be invited for the rails and other materials required.

Sheffield.—November 13th. One 5,500-KW. steam turbine, condensing plant, pumps, pipework, &c., and alternator and exciter, for the Corporation. See "Official Notices" to-day.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

South Africa.—November 22nd. Posts and Telegraph Department. Tenders for power-generating plant, consisting of motor-generator, accumulators, switchboard, &c. Forms of tender and specifications from either District Stores Clerk, G.P.O., Johannesburg, or Controller of Stores, G.P.O., Capetown.

Spain.—The municipal authorities of Caudiel (province of Castellon) have recently invited tenders for the concession for the electric lighting of the town during a period of eight years.

Tenders have lately been invited by the municipal authorities of La Mata (province of Toledo) for the concession for the electric lighting of the town during a period of five years.

Swansea.—October 16th. Electrical installation at the cattle market and slaughter house, for the T.C. C. A. L. Prussmann, borough electrical engineer, Strand (returnable deposit, £1 1s.).

Taunton.—200-K.V.A. single-phase alternator, superheater, cables, and induced-draught fans for the Council. See "Official Notices" October 6th.

Truro.—October 21st. Installation of private internal telephone system, at the new offices, for Cornwall C.C. Clerk of the Works.

Warrington.—October 20th. Electric lighting of Evelyn Street Council School. Specification and forms of tender obtainable from Mr. F. V. L. Mathias, electrical engineer, Electricity Department.

CLOSED.

Belgium.—La Société d'Electricité du Borinage submitted the only tender that conformed to the conditions for the concession for the supply of electrical energy for lighting and power purposes in the town of Mons.

Blackburn.—The T.C. on October 4th accepted the tender of Mr. Frank L. Yates for the electric lighting of the sub-police station.

Bradford.—The Technical College Committee of the Corporation has been recommended to accept the following tenders:—

Six electric motors.—Phœnix Dynamo Manufacturing Co., Ltd., £380.
Eighteen alternating motors.—Siemens Bros. Dynamo Works, Ltd., £330.

The Tramways Committee has accepted the offer of the Jandus Arc Lamp & Electric Co., Ltd., to supply "Jandus" electric arc lamps and other fittings for lighting the new car depôt at Bankfoot for £111.

Chesterfield.—The Electric Energy Committee of the T.C. has accepted the tender of Mr. H. Furness for slack coal, 2,000 tons of Glapwell at 4s. 1d. per ton, 3,000 tons of Hardwick at 4s. 3d., and 200 tons of Langwith at 4s. 10d.

London.—The contracts for the electric lighting of the following mills have been placed with Messrs. G. Weston & Sons, Ltd.:—The Hovis Bread Flour Co., Ltd.; Messrs. Peek Bros. and Winch, Deptford; Messrs. A. Lloyd & Son, Ltd., Deptford.

Messrs. Willans & Robinson, Ltd., have received an order from Messrs. D. Napier & Son, Ltd., for a Willans-Diesel oil engine to drive a 200-KW. direct-current dynamo, for installation at their works at Acton Vale, London, W.

Bermondsey.—The tender of Messrs. S. Pontifex & Co. has been accepted, at £48, for the supply of 50 16-in. electric street lamp and frog-irons.

Islington.—The Guardians have accepted an offer from the Tudor Accumulator Co., Ltd., at £98, for replacing the plates of the electric battery at the Highgate Hill Infirmary.

Southwark.—The B.C. has accepted the tenders of the British Insulated and Helsby Cables, Ltd., at (1) £232, for the supply of 440 yards of 3 low-tension triple-concentric cable, and at (2) £4 for an 8-way feeder pillar.

Woolwich.—The T.C. has accepted the tender of Messrs. W. Cory and Sons for 10,000 tons of coal, at 8s. 7d. per ton, for the electricity works.

Messrs. Pope's Electric Lamp Co., Ltd., have secured a portion of H.M. Office of Works' contract for metal-filament lamps.

Rotherham.—The T.C. has accepted the following tenders:—

Callender's Cable and Construction Co., Ltd.—The annual supply of vulcanised bitumen cable, at £914.
Ferranti, Ltd.—Electricity meters for the ensuing year.
W. A. Durnford (Earl Fitzwilliam's Colliery).—Coal at 6s. 8d. per ton.
Sheepbridge Coal and Iron Co., Ltd.—Coal at 5s. 4½d. per ton.
British Westinghouse Co.—Armature coils (DK 25a).
Dick, Kerr & Co.—Armature coils (DK 9).
Anti-Attrition Metal Co.—Armature brasses and axle brass keeps.
British Westinghouse Co.—Okonite tape, gear wheels.
L. Andrews & Co.—Tape.
National Rail and Tramway Appliance Co.—Brake blocks.
Imeson, Finch & Co.—Trolley heads, cheeks, and harps and controller fingers.
Brecknell, Munro & Rogers.—Trolley bushes.
M. Bonser & Co.—Trolley spindles, washers and binding wire.
Le Carbone.—Carbon brushes.
W. E. Burnand & Co.—Presspahn paper.
A. Wiseman, Ltd.—Pinion wheels.
The Tenter Foundry Co.—Brake castings, &c.
The Weldless Chains, Ltd.—Brake chains.

The tender of Messrs. Renton, Holdsworth & Co., Ltd., at £92, has been accepted for completing the electric wiring at the South Grove Higher Standard School in lieu of that of Messrs. Hall & Matthews.

Stoke-on-Trent.—The following tenders for the electricity works have been accepted by the T.C.:—

Sneyd Collieries, Ltd.—Cockshead beans to Burslem Works, 7s. 9d. per ton.
Bakewell & Butterworth.—Great Row slack to Hanley Works, 8s. per ton.
Mossfield Colliery, Ltd.—Engine slack to Longton Works, 6s. 9d. per ton.
Heenan & Froude, Manchester.—Ironwork for power house, £300.

Swinton and Pendlebury.—The tender of Messrs. Halliwell, of Manchester, at £132, for electric wiring and fitting at the new Council School has been accepted by the Education Committee.

Watford.—The U.D.C. has decided to obtain tenders for a 12 months' supply of transformers. The tender of the Clay Cross Co. has been accepted, at £67, for the supply of a new suction pipe for the turbo-condenser.

West Ham.—The T.C. has accepted the tender of Messrs. Strachan & Henshaw, at £4,398, for the supply of coal-handling and discharging plant at the electricity station.

Wigan.—The T.C. has accepted the tender of the Reed Roturbo Co., Ltd., at £261, for two electrically-driven centrifugal pumps, with valves and regulating gear, for the water department. It has further accepted the tender of Messrs. Ormandy, Spensley and Co., at £550, for steam plant, including three Lancashire boilers, economisers, pipes and fittings, for the Pemberton electricity station.

(*Continued on page* 622)



SUPPLEMENT.

SOME OF THE EXHIBITS AT OLYMPIA.—IV.

(The figures in parentheses are the numbers of the stands.)

Walker, Horrocks & Co., Ltd. (231), 45, *Newhall Street, Birmingham.*

This firm's exhibit consists of two automatic electric lighting ants, suitable for private installations in country houses, farms, chts, &c.

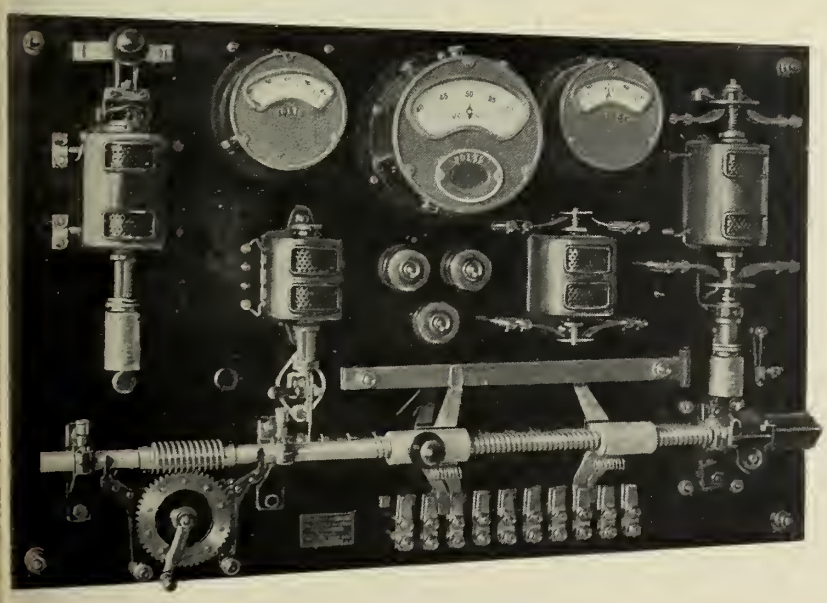


Fig. 162.—Automatic Control Board.

Our readers are miliar with the neral idea of such ants, which consist iefly of an engine, namo and battery, gether with an auto- atic switchgear which ntrols the discharging d charging of the ttery. In this plant fall in battery pres- re to a specified limit uses the automatic gulator to add regu- ing cells, one at a ne, until they are all use, when it operates e solenoid control vitch of an automatic arter and a magnetic trol tap, enabling the ttery (operating the namo as a motor) to art up the engine, and e latter in turn to nerate current for re- arging the battery. As the charge pro- ceeds the regulator cuts out cells, and finally, when the battery is fully charged, breaks the solenoid circuit of the starter and petrol tap and stops the engine. A reverse current time-element circuit-breaker is fitted to prevent the generating set from motoring, due to failure of fuel supply, &c., the time lag allowing for the normal starting-up of the engine. The operation of the breaker (which isolates the dynamo and prevents waste of battery current) is indicated by a red lamp fitted in a conspicuous position.

To prevent the regulating cells from being overcharged, the connections are such that when all of these are in the discharge circuit, they are all out of the charge. To meet a heavy temporary demand on the plant, by means of a maximum coil in the discharge-circuit or a switch coupled to the power-feeder switch, the engine may be started up irrespective of the battery.

On the firm's stand one small and one large plant are shown; the former (see fig. 163) is fitted with an ironclad controller, while the larger plant has a controller of the switchboard pattern, illustrated in fig. 162, in which, in addition to the usual instruments, the battery charge and discharge switch, time-element circuit-breaker and automatic starter can be seen.

We may add that the dynamos used are specially wound to give a constant output in watts at a voltage varying with the state of the battery, and the smaller sizes are fitted with ball bearings. The engines are direct-coupled to the dynamos, and are fitted with H.T. magneto ignitions.

The plants can be seen in operation, with both a lighting and a heating load connected; they are well finished and well worth inspection.

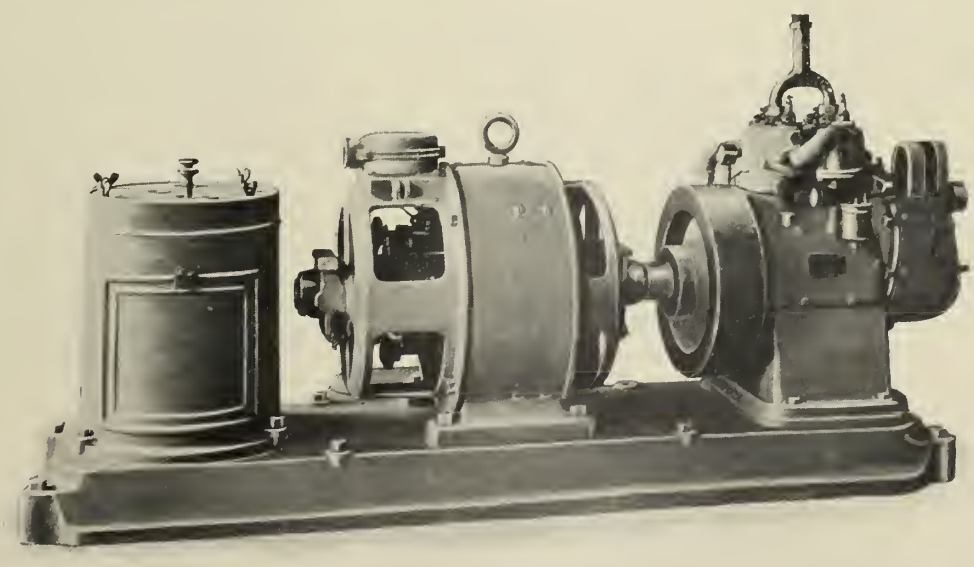


Fig. 163.—Automatic Electric Lighting Set, with Ironclad Controller.

G

Messrs. Isenthal & Co. (20, 41),
85, *Mortimer Street, W.*

This stands presents a striking appearance, owing to the batteries of condensers, line dischargers and other protective devices which form its most prominent features. The theory of surges in transmission lines and the practice of line protection are alike unfamiliar to the majority of British engineers, owing to the conditions which render the occurrence of surges comparatively infrequent in this country; nevertheless, as transmission lines develop in length and the current and pressures employed increase, these phenomena are

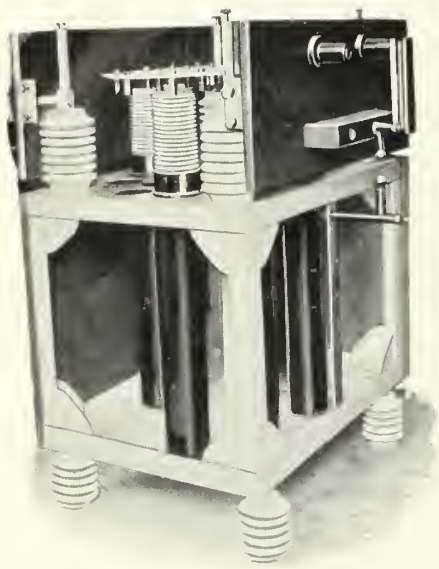


Fig. 164.—Battery of Condensers for Wireless Telegraphy.

bound to make themselves unpleasantly felt, and already some of our larger systems have suffered severely from their consequences. In the British Colonies, however, and other parts of the world where high-pressure transmission over long distances has attained to greater dimensions, the importance of the subject has compelled attention, and the excellent system of protection introduced by Messrs. Isenthal & Co., who have specialised in this direction, has

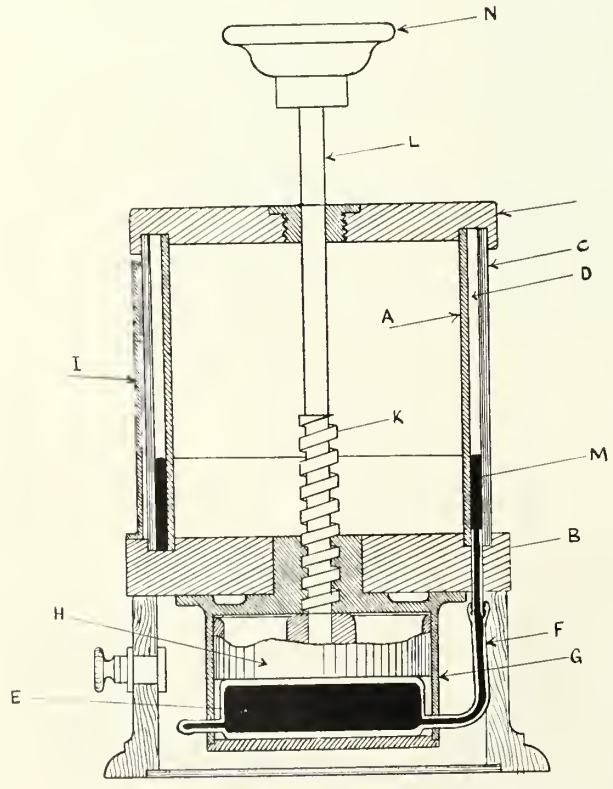


Fig. 165.—Section of Mercury Condenser.

been extensively adopted there. We have already described the ingenious Moscicki condensers, which are designed so as to possess large capacity jointly with great reliability, in small space; these have been further improved. The "Giles valves," which by a clever combination of spark-gaps, resistance and capacity provide an easy outlet for surges and lightning discharges whilst obstructing and quickly stopping the following power discharge, have also been described. The former apparatus are exhibited as made for pressures of 35,000 and 18,000 volts, and the latter for 9,000 and 12,000 volts, but the makers are able to supply them for ar pressure used in practice. In this connection it is interesting note that in Australia a pressure of 80,000 volts is being employe Complete outfits, with iron choking coils and liquid disconnecti switches, are shown as fitted up in central stations.

Another purpose to which the Moscicki condensers have be very largely applied is that of wireless telegraphy. The compac ness and reliability of the condensers renders them particular suitable for this purpose, and large numbers have been supplied the British Admiralty, War Office and Post Office, as well as foreign Government departments and the Marconi Compani These are made for 60,000 volts. We illustrate a battery, part opened to show the interior, as supplied to a foreign Gover ment (fig. 164). New types of insulators for the rigging of aer masts and for antennæ are exhibited; these are exclusively used the German Navy.

One of the most interesting novelties shown is a new varial condenser, which we illustrate (fig. 166). This is based on a no principle, and combines very large capacity with simplicity a compactness. As shown in the cross-section, fig. 165, it consists o metal cylinder A fixed to an ebonite base B, and covered witl thin sheet of mica, in contact with which is a layer of mercury contained in the annular space between the mica and a gl cylinder C. The height of the layer of mercury is varied squeezing a rubber bag E containing mercury, in communicat with the annular space D through a tube F. For this purpos

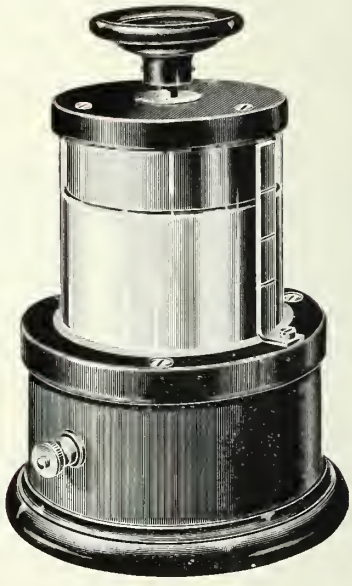


Fig. 166.—Isenthal Variable Condenser.

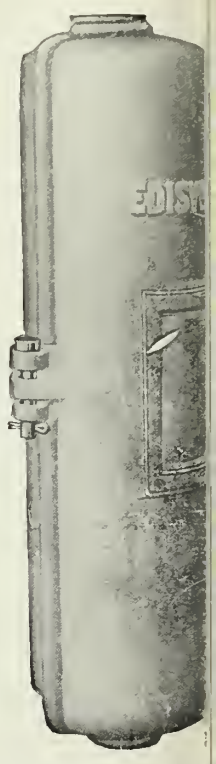


Fig. 167.—Ediswan Ho Service Cut-out.

piston H is pressed down in a cylinder G by the screw K L and ha wheel N. The capacity is, of course, proportional to the area of mercury surface and therefore to the height of the mercury, wl is read off on an index I. It will be seen that there is nothing t wrong in this device; it will not spark over, it remains at the v it is set for without locking, and the same capacity is containe a volume less than one-fourth that of the usual type of variable condensers.

Regulating resistances of the "Rheogot" type form ano interesting feature of the exhibit. These are very neat vari resistances, made in various patterns, consisting of single or t insulated metal tubes upon which wire is wound, contact with wire being made by travelling brushes. A large demand has l experienced for these apparatus, which are applicable to a g variety of purposes.

The absence of cooking apparatus from the stand is noticeo although at the 1905 Exhibition the "Elektra" cooking ute took the first prize. Messrs. Isenthal are preparing to make t at their new Neasden works, whither their condenser manufact at present carried on in London, will shortly be removed. their condensers, &c., are made at their London workshops, and exhibit, it should be noted, consists entirely of apparatus taken of stock, without special finish—though no one could find f with their appearance.

Edison and Swan United Electric Light Co., Ltd.
(15, 16, 45, 46, 98, 117),
Ediswan Buildings, Queen Street, E.C.

This company has, on its two large stands, an exhibit worth its reputation and its long standing, dating from the inventio the glow lamp. Naturally the "Royal Ediswan" tungsten l is given special prominence, being shown in all sizes, from 1,000 c.p., and for voltages from 2 to 260 volts. A similar dis

f the "Royal Ediswan" carbon-filament lamps is also made, for here are many purposes for which the carbon lamp is still more uitable than the metallic. Besides the brilliant display of lighted mps on the stands, the company shows four large signs in the ody of the hall, illuminated with 16-c.p. tungsten lamps. A large ariety of fittings for incandescent lamps is also shown; we illus-rate in fig. 169 the Ediswan outside fitting for metal lamps, suitable r street lighting and similar purposes.

Switchgear is another line in which the company has specialised r many years, and this is exemplified by numerous switches for witchboard and other uses. The "Phlatta" switch is shown in



Fig. 168.—Phlatta Switch.

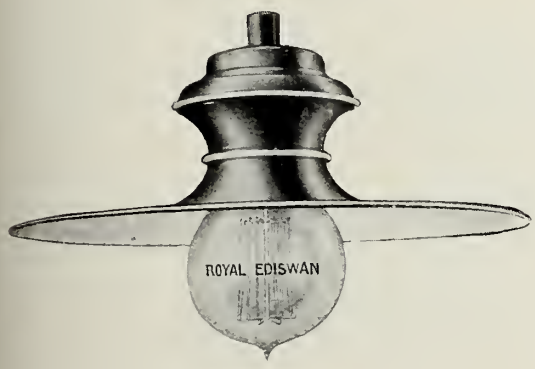


Fig. 169.—Ediswan Outside Fitting.

g. 168, for house wiring and similar work; it is made on the firm's atent wedge system, and has the minimum amount of projection rom the wall surface. It is made in round and rectangular atterns. A house service cut-out is shown in fig. 167, of simple and obust construction, and there are many other examples of fittings nd accessories, lampholders, &c., as well as measuring instruments f the gravity and moving-coil types, switchboard instruments, alvanometers, batteries and portable instruments.

Robt. W. Paul (240),

New Southgate, London, N.

Mr. Paul's instruments are shown in great profusion, the exhibits umbering upwards of 150, of which more than two-thirds have een developed or redesigned during the past two years. The tand itself is flanked with showcases, the interior being fitted up s a working laboratory in which the apparatus is demonstrated.



Fig. 170.—Paul Flush Resistance Box.

Among the instruments which have already received attention in hese columns are the well-known Unipivot galvanometers of high ensitivity, test sets, milli-voltmeters and pyrometers. The last amed are now made on the thermo-electric, resistance and radiation rinciples, in all of which important improvements have been ntroduced, tending towards simplification of use and of renewals.

For alternating-current measurement Mr. Paul has developed instruments both of the dynamometer type, and also on the thermo-electric principle; these are made for ranges as low as 10 milli-amperes for the full scale deflection, and put up in portable form with series resistances and shunts for general testing.

In redesigning the large range of testing apparatus, the opportunity has been taken to standardise all the components, thus securing greater efficiency at lower cost. As an example, we illustrate in fig. 170 a new construction of resistance bridge, in which the brass blocks are embedded and firmly keyed in a substantial slab of insulating material, thus ensuring that the plugs will fit always with their original accuracy, and presenting a flat and easily cleaned surface, in which there is no crevice to collect dust. The heads are moulded on the taper plugs, as shown in the detail views, fig. 171.

The novel terminal which we illustrate in fig. 174 is designed to

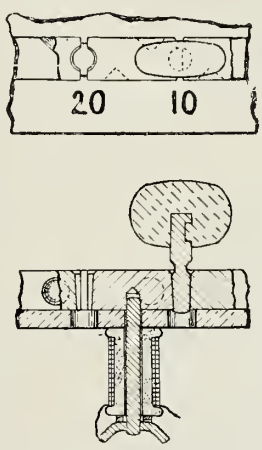
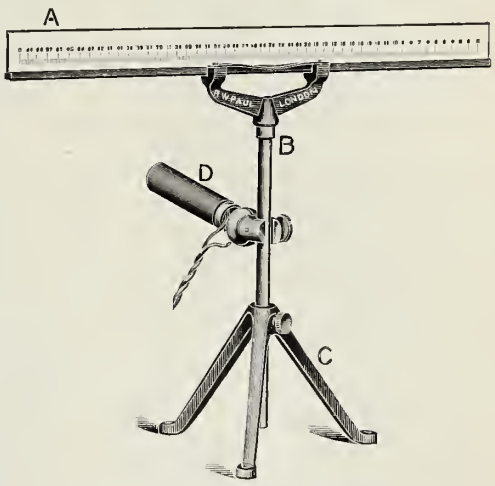


Fig. 171.—Details of Flush Resistance Box.



A, scale; B, pillar; C, tripod; D, lamp.

Fig. 172.—Scale Stand.

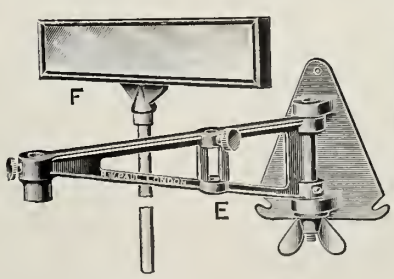
clamp stranded conductors as well as round wires of any size within its capacity; instead of tending to spread the strands as in the ordinary form, it compresses them into a solid mass in the tapering slot. The device is remarkably efficient, and should attract the attention of manufacturers of accessories as well as of instruments.

We also illustrate a novel type of scale stand, which is instantly adapted to work in any position on the wall or bench, and occupies a minimum space (figs. 172 and 173). The illumination is given by a 2-volt metal lamp with thick filament. Among the many other novelties we may mention the new Harris ohmmeter with generator, which has twice the scale length and range of the popular types. We are pleased to note that Mr. Paul has added another Grand Prix (at Turin) to his list of highest awards.

Messrs. T. & E. Wannbacher (308),

5, Appold Street, E.C.

Excellent examples of various precision movements are exhibited at this stall. Among those of most direct electrical interest may be noted movements for various indicating and recording instruments, for arc lamps, time switches and time elements, for electric one and two-rate meters, master and secondary clocks, signal clocks, Morse recorders and photographic frequency recorders. The quality, finish and cheapness of these movements are very striking, and we are informed that the makers are prepared to undertake any class of movement from samples or drawings.



E, socket for F, mirror.

Fig. 173.—Bracket for Scale.



Fig. 174.—Patent Terminal.

The Micanite and Insulators Co., Ltd. (322),

Empire Works, Walthamstow.

An interesting exhibit of their well-known insulating materials is shown by this firm, together with useful data concerning their dielectric properties. Specimens of natural mica, worked and unworked, are shown, as well as samples of micanite cloth and micanite tubes, rings, sheets and mouldings of various patterns. Other materials, such as "Empire" paper, tape, canvas and silk, red rope paper, presspahn, leathcroid and fibre plates, are also represented. The whole collection deserves close notice.

The Kingolite Co. (262),

118, 120, *Wardour Street, W.*

The "Kingolite" candle fittings are in use in the Royal Palaces and on board the *Olympic*, among other places. Carbon, tantalum and tungsten renewable lamps with screw sockets are available, and a special feature is the patent connector, which adapts the lamps to any standard candle socket, and by means of a screw flange

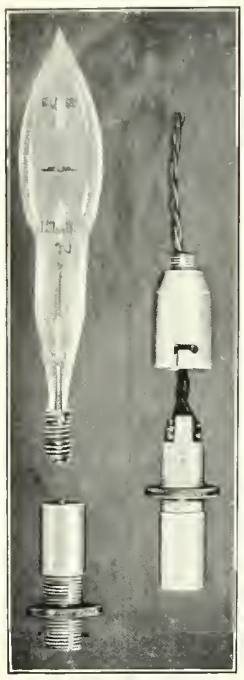


FIG. 175.—DETAILS OF CANDLE FITTING.



FIG. 176.



FIG. 177.

ORDINARY AND SELF-LOCKING HOLDERS.

ensures perpendicularity and rigidity in the fitting. The "Kingolite" shade carriers as applied to bayonet lampholders dispense with screw rings by the use of spring plungers engaging in holes in the shade cap. An automatic locking-holder for B.C. lamps depends on the use of similar plungers; while easily manipulated by authorised persons possessing a release key, this holder affords ample security for shop and corridor lamps, &c. Fig. 175 shows the internal construction of the candle or holder fitting, fig. 176 illustrates an ordinary holder with shade carrier, and fig. 177 a cord-grip self-locking holder with shade carrier.

Mr. G. H. Alexander (295),

Doe Street, Birmingham.

Whitmore's belt dressing and similar compositions have been well known in this country for the past 10 or 12 years, but some four years ago there was introduced to the English market a gear-protecting and lubricating composition which has steadily grown in favour, though, by its very efficacy, it lacks many British testimonials, since gears to which it is applied have 80-85 per cent. longer life than if run with any other lubricant, and therefore frequently work two or three years before the full value of the protective composition can be judged. We understand that the



FIG. 178.—EXAMPLES OF PINIONS, SHOWING WEAR.

compound contains a high percentage of lead in a form which perfectly amalgamates with the grease employed; the material, as sold, runs when hot, but will not gum or clog; it produces a thin anti-friction film on the gear teeth, and protects the latter against abrasion and corrosion. Though English evidence is lacking, for the above reason, visitors can inspect illustrations of various American gears on which extraordinary, and perfectly authentic, results have been achieved. A gear and pinion, in service for over 3½ years on the Spokane and Inland Empire system, ran 194,700 miles, being lubricated by the Whitmore composition; in this time the pinion teeth wore 0·029 in. (mean), and 0·055 in. (maximum), while the gear teeth wore 0·026 in. (mean) and 0·06 in. (maximum). Referring to fig. 178, A represents a new inter-urban tramcar pinion; B represents a similar pinion after 29,286 car-miles, using Whitmore's composition; and C, another similar pinion after 23,078 car-miles (same track, load and season), with graphite grease. The pinion shown at D was lubricated with the composition, and ran 55,330 miles in nine months on the forward truck of a 32-ton high-speed inter-urban car.

The gear composition is supplied in various consistencies to suit different loads, but a valuable property of all grades is their indifference to moisture; in numerous instances the lubricant is applied to gears running in water. The material is already in use by many English industrial and manufacturing concerns, and a rapid extension in its application to tramcar gears is anticipated in the immediate future. Its high cost is only apparent, owing to its great durability and the gear economy effected.

Other interesting exhibits on this stand include chain, cam and wire-rope dressings, various shears and punches, and an example of the Dennis automatic boiler-damper regulator.

Oliver Arc Lamp, Ltd. (58, 65),

Cambridge Place, Woolwich.

The firm's standard product is, of course, arc lamps, and the well-known "Oriflamme" and other flame lamps find a place in the exhibit. The "Oriflamme" is a magazine lamp provided with an ingenious miniature "conveyor" for feeding the carbons, which has been frequently referred to in our pages; an improvement recently introduced is a carbon break switch in place of a mercury switch for controlling the circuit of the racking coil, by means of which the period of extinction for carbon changing has been reduced to 9 sec. The firm are making an exhibit of Varley patent coil windings produced on specially-designed machinery. The system briefly consists of winding, instead of a cotton or silk covered wire, one or more bare wires in parallel with a silk insulating strand which separates and insulates each turn from it

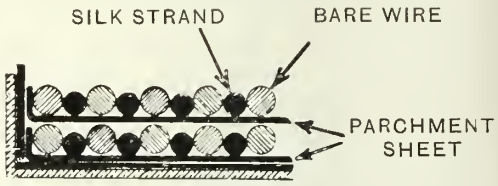


FIG. 179.

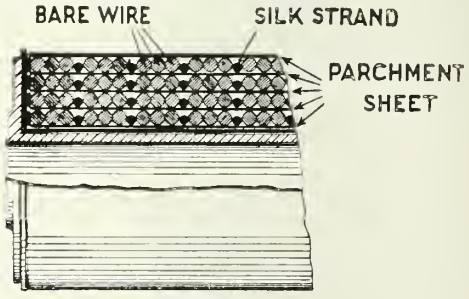


FIG. 180.

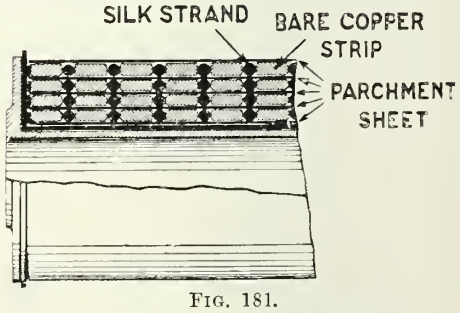


FIG. 181.

VARLEY PATENT COIL WINDINGS.

neighbour throughout the layer. Each layer of bare wire is insulated from the one below with a sheet of specially prepared high insulating material, which is inserted by the machine on the completion of each layer of finished wires as the feed reverses to start the next layer.

The section in fig. 179 shows the simple application of the system to winding a single-wire coil. The very finest wires may so be wound—as fine as No. 50 S.W.G.—without the slightest fear of a breakage escaping attention.

Generally in practice two or more wires are wound in parallel as shown in fig. 180.

In many cases a still greater number of turns may be placed in the same coil space by employing rectangular copper strip instead of round wires. This winding is illustrated in fig. 181. It is possible to wind coils with this strip down to an equivalent section to a No. 33 S.W.G.

The system particularly lends itself to the manufacture of windings intended to withstand severe mechanical and climatic conditions. In these cases coils are specially treated, according to requirements.

The main advantages claimed are the saving in space occupied, better insulation, absolute uniformity of product and reduced cost, the latter being usually less than the cost of covered wire alone without winding.

As regards space saving, with coils wound as in fig. 180, at least 10 per cent. increase of turns can be obtained over a coil wound

ith covered wires ; and if wound with copper strip, as in fig. 181, n increase of 20-30 per cent. of turns can be obtained. It is no ecret that these windings are in use by many of the best-known rms for small coil work of all kinds.

Amongst other things, the Oliver Co. are showing a selection of analium castings. Vanalium is a comparatively new metal alloy ossessing the lightness of aluminium, the ease of working of un-metal, the general properties of bronze and the stiffness and ensile strength of wrought-iron and steel.

The metal is non-magnetic, and only a little heavier than luminium ; when cast, it has a tensile strength of over 11 tons er sq. in., while drawn Vanalium will withstand up to 33 tons per q. in. Visitors to the Oliver stand can inspect a piano frame in his metal, and lift it too.

Engineering and Arc Lamps, Ltd. (327),

Chingford, Essex ; St. Albans, Herts.

Gilbert and Davy flame and enclosed arcs are too well known nd have been too often treated in these columns to need very etailed mention. The "Beacon" flame arc lamp has been brought



Fig. 182.—The "Beacon" Flame Arc.

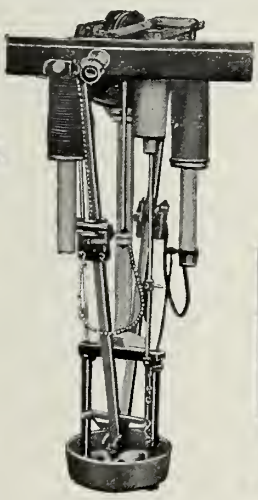


Fig. 183.—Mechanism of the "Beacon" Arc.

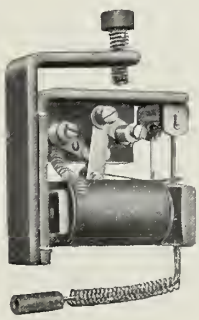


Fig. 184.—The "Attractor."

to such perfection that it is sold under a three years' guarantee. The four standard sizes burn 11, 17, 24 and 35 hours respectively, and may be burned in series without idle line resistance. Great current economy is thus secured ; carbon costs are very low, the globe is free from deposit, and the lamp runs satisfactorily on 25 cycles or even lower frequencies. As shown by fig. 183, the internal mechanism of the lamp is very simple and robust, while visitors will themselves observe the elegance of the external appearance of the whole. No clockwork feed is employed, and the moving parts are totally enclosed from the arc fumes.

The various suspension and other fittings used in conjunction with the lamps made by this firm have proved so satisfactory in the past that visitors will notice few novelties in this branch of the exhibit. Continental and American, even more than English, engineers will be interested in the latest patterns of constant current transformers, for series A.C. arc lighting, and "automatic regulator," or moving-coil choker.

An interesting advertising novelty is to be found in the "Attractor," fig. 184. In conjunction with any flash-light advertising sign, a small electromagnetic hammer, built exactly on the principle of an electric bell, is used to set up a sharp, insistent rapping on the glass of the sign during the time the lamps are extinguished, thus attracting the attention of passers-by. The device is simple and cheap to install and use, and is certainly very effective ; it has many obvious applications other than that suggested.

Brook, Hirst & Co., Ltd. (153),

Chester.

This firm's stand is fully occupied with "Brookhirst" ironclad starters of various designs and other switchgear suitable for motor-users. The firm's standard pillar type panels are substantially constructed in various patterns for constant and variable speed motors, and will well repay careful inspection on the part of prospective users of such apparatus.

We illustrate in fig. 185 one of their constant-speed wall-pattern panels fitted with a B type "no-volt" release starter and dead-beat ammeter in the upper part, and with a D.P. interlocked no-volt and overload release circuit-breaker in the lower portion. A press button release is provided, also a laminated copper swivel final contact for the starter.

It may be explained that all the firm's standard panels are provided with a starter having a "no-voltage" release independent of the motor field current ; a D.P. magnetic blow-out circuit-breaker, with "no-volt" and "overload" releases which are perfectly free to act either during or after the operation of starting ; and an overload preventor, which, by tripping the circuit-breaker, prevents too rapid starting, and is therefore a substitute for a slow motion device.

The equivalent of the "loose handle" circuit-breaker is obtained by interlocking the starter and no-volt circuit-breaker, so that the latter can only be put "on" when the starter is "off," and the starter put "on" when the circuit-breaker handle is free. By using a "no-volt" circuit-breaker, the solenoid type overload preventor can be made to operate by opening the "no-volt" release circuit. Fuses can safely be dispensed with, but where it is desirable to introduce the equivalent of their delay action, a further overload trip is fitted in the form of a thermal element with adjustable time lag. When this device is introduced it is connected in the opposite pole to the solenoid trip and is absolutely independent of it.

Under certain exceptional conditions, a slow motion starter is considered desirable, and a fine example of the firm's work embodying this feature is shown in fig. 186, representing a standard constant speed multiple lever type motor-starting panel, with "step-by-step" starter and slow-motion ratchet handle.

Each of the levers, in the upper portion, is fitted with a main copper plate contact and auxiliary copper sparker, and the fixed contacts each have a main laminated copper brush and auxiliary carbon sparker—contacts and sparkers being all renewable. A D.C. electrically operated no-volt and overload release circuit breaker, with trips to both poles, is fitted in the lower chamber, where the middle switch is the final contact of the starter. An 8-in. dead-beat ammeter is also provided in the upper chamber.

As previously mentioned, a great variety of the other switchgear is on view.

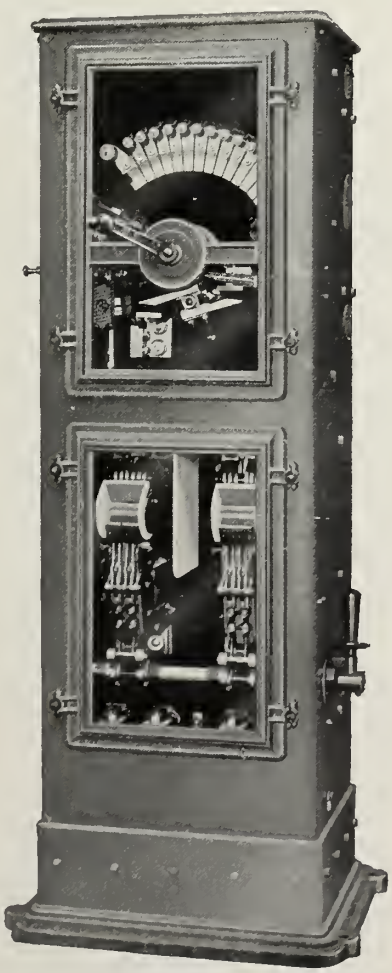


Fig. 185.—"Brookhirst" Standard Starting Panel.

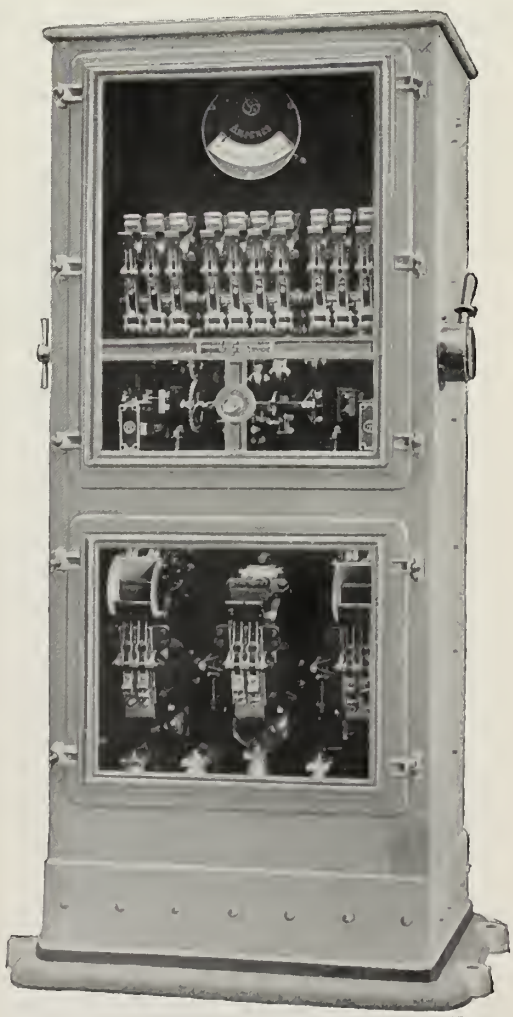


Fig. 186.—"Brookhirst" Multiple-Lever Type Starting Panel.

The British Prometheus Co., Ltd. (197, 218),
Salop Street Works, Birmingham.

In this exhibit we find a most substantial and imposing display of electrical cooking apparatus on the grand scale. Most prominent is a large cooking range capable of cooking for no fewer than 60 persons; it is shown in fig 187, and consists of roasting and baking ovens, griller and toaster, water boiler, &c. It presents a striking

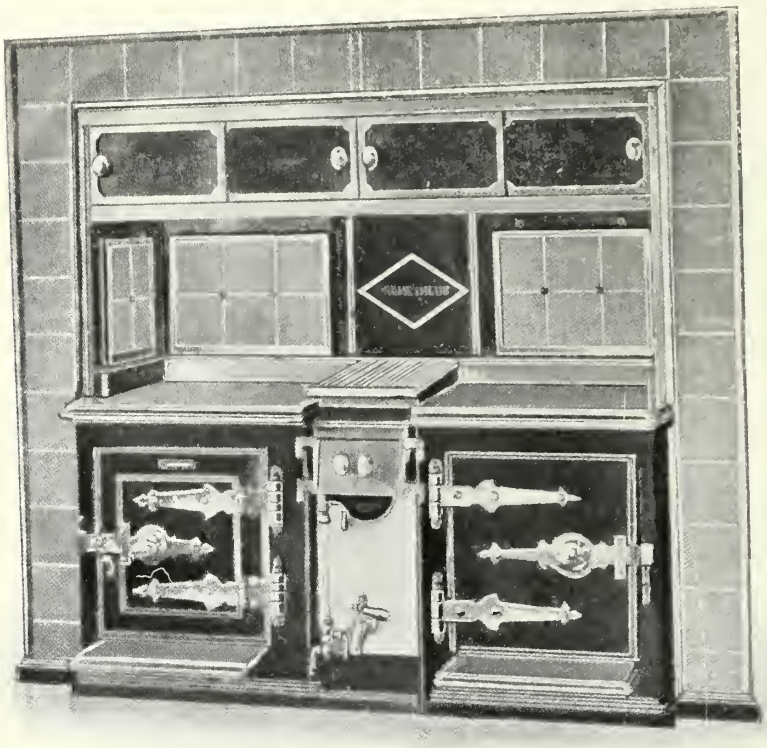


Fig. 187.—Electric Cooking Range for 60 Persons.

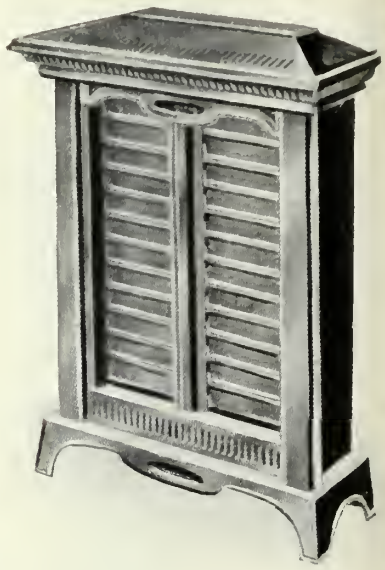


Fig. 189.—British Prometheus Convector.

appearance, as all the facings are nickel-plated, and the top of the range is polished. The roasting oven is 20 in. wide × 19 in. high × 22 in. deep, and has a cast-iron interior, with white

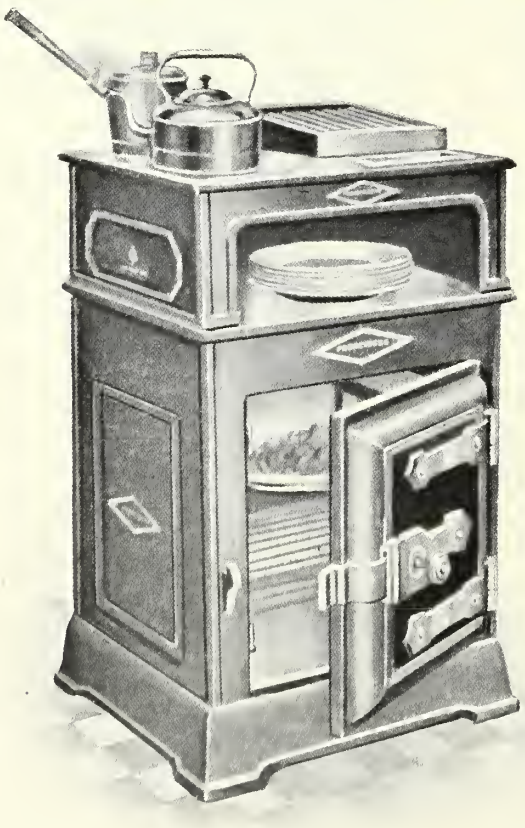


Fig. 188.—Domestic Electric Cooker.

porcelain enamelled ribbed plates round three sides; the heating elements are fixed behind these plates. At the top of the roasting oven is a radiator for browning joints, &c. The oven has a large glass inspection door, through which the whole of the interior can be seen, and an outer iron door, and a thermometer is provided. The baking oven is similar, but without the glass door and the heater, and both ovens contain the usual fittings. Between the is a cast-iron water tank containing an electric heate on the continuous hot-water supply system, and above the boiler a Silundum toaster in three sections, separately controlled this, taking the place of the coal fireplace, gives a familiar aspe

to the range. Above the toaster again is a nickel-plated grill, a on either side of it is a polished hot-plate—one for simmering, t other for boiling. In the top of the recess in which the range fixed is a hot cupboard for plates, &c. The range has a possi maximum demand of 17 kw., but takes only 6 or 8 kw. in norm use, and ample regulation is provided by means of a set of switch This range is shown in operation every day. It is not the larg made by the company, for they have supplied ranges capable cooking for as many as 500 persons, but it admirably shows t

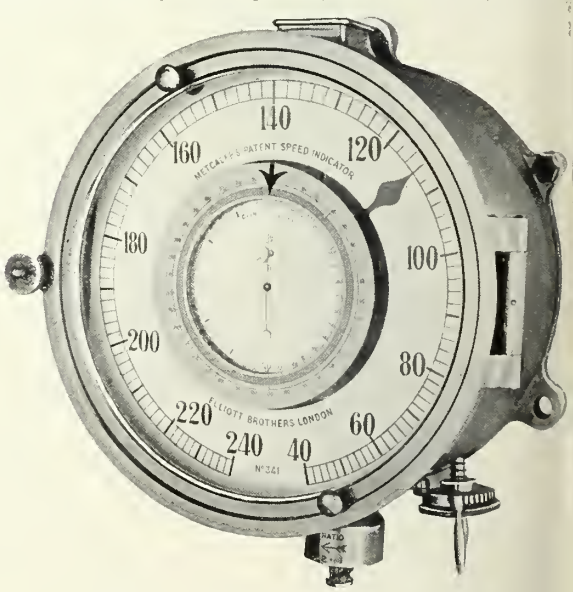


Fig. 190.—Metcalfe Speed Indicator.

enormous progress that has been made in electrical cooking—su ranges would not be made unless they were in demand.

Adjoining the large range there is an electrical steam generat taking 15 kw. to heat it to a steam pressure of 15 lb. per sq. i which is accomplished in 15 minutes. This works in conjuncti with an ordinary steam cooker, having a capacity of 1 cwt. potatoes, in two compartments. About 5 kw. is required to mai tain the steam supply during cooking, at a working pressure 8 or 10 lb. The boiler is fitted with an automatic valve whi admits water from the mains as required.

Another exhibit is a domestic cooker of more ordinary dimensions —capable, however, of cooking for 18 persons. We illustrate this n fig. 188. It takes a maximum of 4·5 kw. The oven is generally similar to the roasting oven described above, and on top of it there s a space for warming plates; above this there is a grill, frying

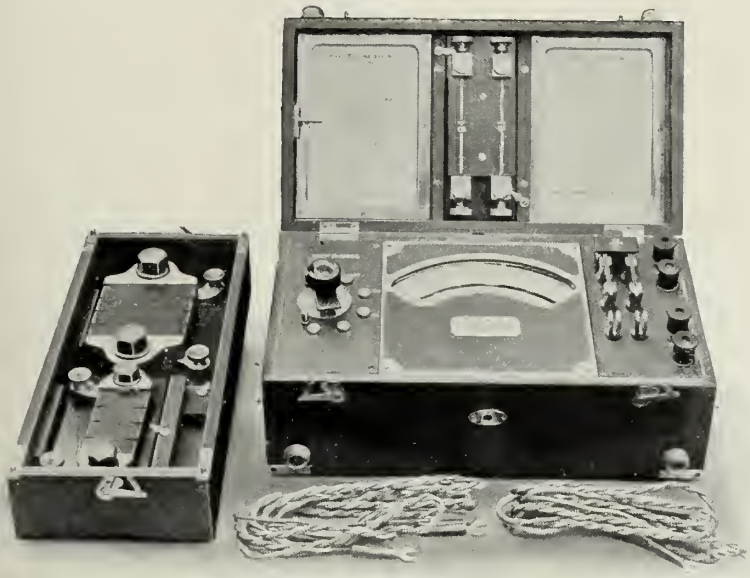


Fig. 191.—Century Testing Set.



Fig. 192.—Elliott Bros.' Recorder with 6-in. Chart.

an and simmering and boiling plates. The oven is 16 in. wide × 8 in. high × 16 in. deep. A plate warming cupboard taking up o 3·5 kw., with a heated carving table on the top, and a cast-iron tock pot containing 12 gallons, taking 6 kw. to heat up, and 2 kw. o maintain the temperature, are also shown, besides a variety of maller cooking utensils, artistic afternoon tea tables, &c.

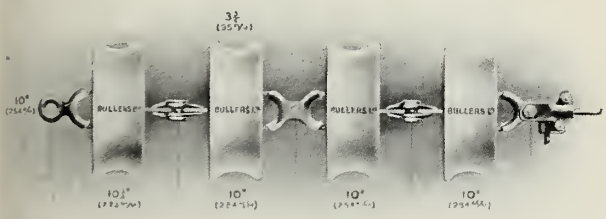


Fig. 193.—Bullers' Strain Insulator.

Mention must be made of the numerous patterns of convectors vith which the company's name has so long been associated; these .re heated with elements consisting of pure inoxidisable metals leposited on mica, which have a long life. We llustrate one of them in fig. 189—a polished copper convector, controlled by three switches, and illuminated inside by a ruby lamp giving a cheerful glow.

Elliott Bros. (54, 69),

Century Works, Lewisham, S.E.

A very interesting collection of apparatus is shown by this firm, including as it does many novel features. The Anschutz gyro compass is, of course, the most noteworthy innovation; it consists of a gyroscope driven by a three-phase motor, and provided with an ingenious damping device, to prevent oscillation. It is absolutely unaffected by magnetic influences, and therefore points to the true north in all parts of the world. Possessing considerable directive torque, it can be used to transmit controlling currents to subsidiary compasses in other parts of the ship, and to show deviations from a predetermined course on a greatly magnified scale. This instrument is one of the most beautiful applications of science to industry that we have ever seen. It is in use in the British and other Navies.

Messrs. Elliott Bros., in fact, devote a good deal of their show to naval and mercantile apparatus. The Forbes log, for instance, is a combined speed indicator and distance recorder; it is operated by a small propeller fixed in a kind of Pitot tube, which can be protruded through the hull of a ship. The propeller drives a magneto dynamo which gives the speed indication on a voltmeter calibrated in knots, while an intermittent contact device actuates a step-by-step recording instrument, showing the distance covered in miles. Any number of the instruments can be operated from a single magneto, and can be situated anywhere in the ship, simple means being provided to adjust the circuit resistance to suit the number of indicators in use. When not required, the tube can be pulled inboard and the outlet closed with a valve.

Engine room telegraphs showing the speed ordered to one revolution from 40 to 140, and provided with check reply, are shown; these operate by an electric step-by-step device, and work accurately at any distance apart, unlike mechanical telegraphs. The Metcalfe speed indicator (fig. 190) is an allied apparatus of much interest, used to show whether the speed at which the engines have been set is correctly maintained. A friction disk is applied to a cone driven by the engine, and in turn drives a clock round the same axis as a pointer driven by the clock in the opposite direction. Thus, if the speed of the clock and that of the hand are equal and opposite, the latter will remain stationary, pointing to a mark, while if the clock rotates too slowly or quickly, the pointer will move one way or the other, indicating loss or gain of speed. The friction disk is set to the correct speed marked on the dial, and the engine is regulated so that the pointer remains stationary, the speed of the engine being then constant—an important matter nowadays, when the speed of revolution of the propeller is used as an approximate measure of the speed of the ship.

Other interesting items are the Wimperis recording accelerometer, which registers the acceleration and retardation of trains or tramcars over any distance, the superelevation of rails on curves (when the instrument is fixed transversely), and so on; and the Century testing set (fig. 191), which is accurate to $\frac{1}{5}$ per cent., and reads to various ranges of amperes and volts, besides affording a check test between the two measurements; spare shunts are carried in a separate case readily hooked on to the main instrument, which is of shallow depth so as to be easily carried. Fig. 192 shows a recording instrument with chart 6 in. wide, which can work off an ordinary ammeter shunt; the chart is driven by a pin-wheel, which the makers find the only satisfactory method, and the pen is very light and easily cleaned. These recorders can be arranged as a "feeder log" with volt and ammeter records, or battery charge and discharge with cell voltage



Fig. 194.—Pin Type.



Fig. 195.—Hooded Type.

Bullers' High-Pressure Insulators.

chart. Micrometer gauges accurate to $\frac{1}{10000}$ in., at moderate cost, with a triple coating of japan to prevent heating by the fingers when in use, and many other interesting instruments are shown.

Messrs. Bullers, Ltd. (118, 141),

6, Laurence Pountney Hill, E.C.

This stand is very much up-to-date, for on it are shown, for the first time in this country, we believe, insulators for overhead transmission lines of over 100,000 volts. The firm has, of course, long

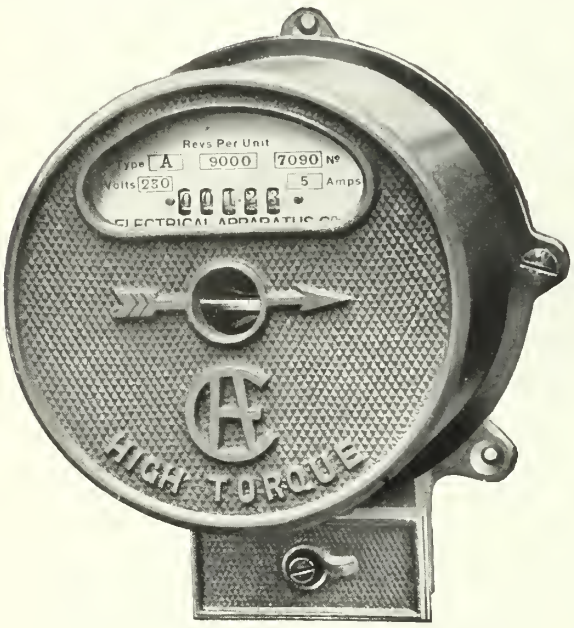


Fig. 196.—E.A.C. High-Torque D.C. Meter.

specialised in the manufacture of porcelain insulators, and makes large quantities of these for the British Post Office, as well as other authorities, for telegraph and telephone lines; pin type insulators are also exhibited for pressures up to 50,000 volts, in standard patterns, one of which is illustrated in fig 194. The

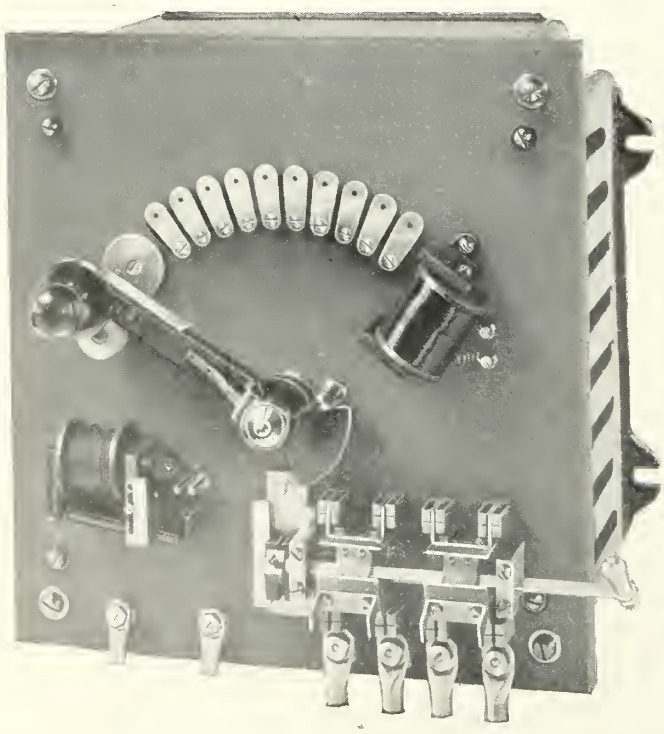


Fig. 197.—E.A.C. Reversing Starter.

novel feature is the introduction of the suspension type of insulator, which has successfully solved the problem of insulating the lines at extremely high pressures now in use in the United States and elsewhere. As licensees of the General Electric Co., of Schenectady, the firm show the type of insulator, in which the flexible steel loops are interlinked, so that the breakage of an insulator would not allow the line to drop. Messrs. Bullers show also a pattern made under their own patents, which we illustrate in fig. 195. In this case the porcelain is not perforated, the metal parts being securely attached to the porcelain by suitably cemented joints. This is known as the "metal-hooded" type of suspension insulator. Both types are capable of withstanding a pull of three tons, and a Denison testing machine on the stand i used to prove the truth of this assertion. The foregoing types ar intended for use in the vertical position; fig. 193 shows one for us as a strain insulator, in an approximately horizontal positio With these insulators practically any pressure can be provide against, the value depending upon the number of insulators pu in series. A transformer on the stand is employed to carry out test up to 85,000 volts, on insulators subjected to a heavy shower o water, demonstrating their ability to withstand the pressure an to prevent flashing-over. We understand that the suspensio type of insulator has already been brought into use on tran mission lines in this country, though not at such high pressures are used abroad. Messrs. Bullers claim to be the only firm in th world that can put their unglazed insulators through exactly th same tests as when glazed—the insulation depending upon th perfect vitrification of the porcelain, and not at all upon th glazing. Various types of shackle and other insulators are al shown, and an interesting feature of the stand is a tall steel latti tower—some 40 ft. from the ground level—fitted with three cros arms.

Electrical Apparatus Co., Ltd. (24, 37),

Vauxhall Works, South Lambeth Road, S.W.

Standard and prepayment meters, a variety of motor-control ge cinematograph resistances, and fuse specialities form the basis this exhibit. In the motor-control line, the company cover a wi field of usefulness, and in addition to the various controllers show on this stand, engineering visitors should take the opportunity examine their latest induction controller for slip-ring inducti motors, which was recently described in our pages, and is show in use on the adjoining stand of the Homopolar Co.

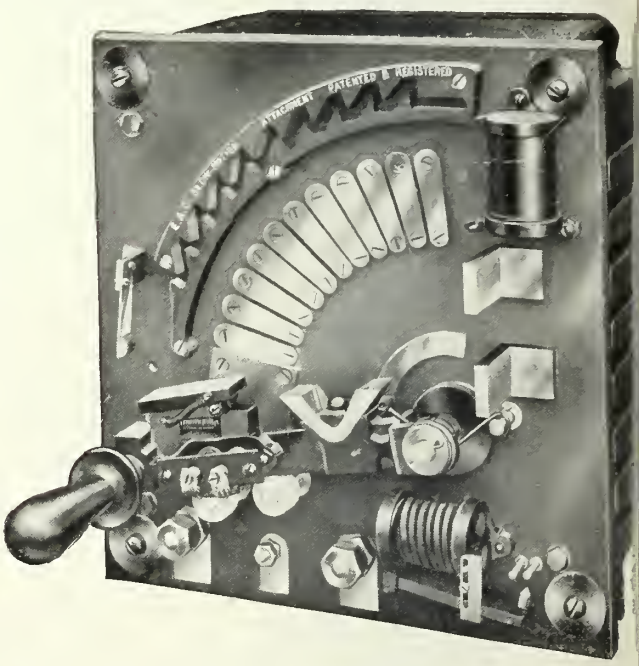


Fig. 198.—E.A.C. "One-Minute" Motor Starter.

We illustrate in fig. 196 an E.A.C. high-torque D.C. meter fi with a new terminal box. This is an integrating motor-mete the ampere-hour type, in which the moving element consists of armature rotating in a field of two permanent magnets, curr being led in by two 18-carat gold brushes bearing on a miniat commutator built up of gold segments. The armature is c nected across a main shunt which is in series with the load.

The moving element is exceeding light, and the meter is clai to start on considerably under 1 per cent. full load current feature of importance in view of the general use of highly econom lamps.

A new 1911 pattern "one-minute" motor starter, fitted w carbon break and magnetic blow-out, is shown in fig. 198. In the slow motion is attained by a pawl carried on the lever, moving in a zig-zag slot which necessitates a quick forward mo ment and dead stop in the centre of each segment, but does interfere with backward movement. The resistance is rated fo 60-sec. start at 50 per cent. overload every three minutes.

These starters are built in sizes up to 50-75 H.P., and in o semi-enclosed and totally enclosed (gas and watertight) patterns

A further example of the firm's apparatus is shown in fig. representing a reversing starter for series or short-wound mot The reversing switch and starting lever are interlocked, so that former must be properly closed in one direction or the other, be the starting arm can be operated, while the latter must also b the "off" position before the reversing switch can be operated.

Messrs. Krausse & Auerbach (323),

45, Basinghall Street, E.C.

Steatite, china and earthenware parts for electrical accesso &c., are shown in great diversity: and special designs, in whole quantities, are undertaken to order.

Messrs. Pooley & Austin (49, 74),
25, *Victoria Street, S.W.*

The very comprehensive exhibit of this firm is composed of typical manufactures of three of the firms for whom they act as London office, viz., Messrs. Mawdsleys, Ltd., of Dursley; Messrs. Spagnoletti, Ltd.. London; and Messrs. Engineering Instruments, Ltd., of Darlington.

Messrs. Pooley & Austin supply complete electrical equipments for factories, country houses and similar situations, and their leading exhibit is a 80-H.P. four-cylinder paraffin engine coupled to a 50-KW. Mawdsley dynamo. This set runs at 500 R.P.M., and is fitted with magneto ignition; it starts on petrol or by means of a blow-lamp. Water cooling is largely employed, and the lubrication is on the gravity circulating system, with an oil pump and oil strainer. The makers of the engine obtained considerable renown in connection with the plant supplied to *Maple Leaf III*, the fastest boat in the world. In contrast to this set is a ½-H.P. one, coupled to a 250-watt dynamo, and suitable for bungalow or yacht lighting; several electrically-driven pumps are also shown.

The Mawdsley exhibit includes several other machines for special uses, and ranging in size down to a ¼-H.P. motor, for 1,000 R.P.M., which, despite its diminutive output, is as scientifically and carefully constructed as its larger brethren near-by.

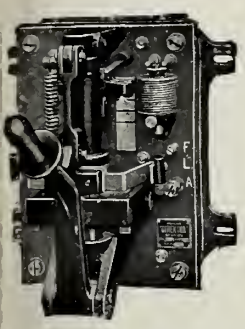


Fig. 199.—The "Direkton" Starter (Engineering Instruments, Ltd.).

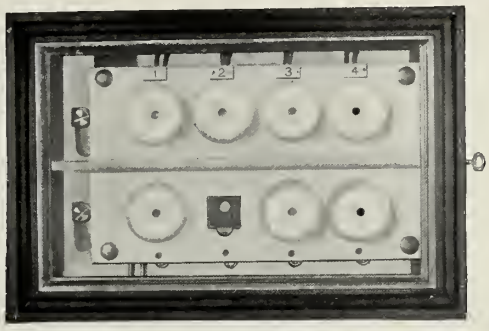


Fig. 200.—Home Office Type Fuseboard (Spagnoletti).

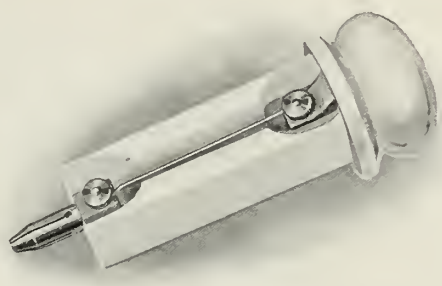


Fig. 201.—Indicating Fuse Plug for H.O. Fuseboard.

station panel. In the case of the former it is necessary to switch off before the isolating switch chamber can be opened, and the latter operation automatically withdraws the isolating switches, thus safeguarding the operator as far as possible when a switch panel has to be made "dead."

The low-tension switchgear comprises examples of generator and feeder panels, accumulator regulating boards, circuit-breakers and distribution switch and fuseboards. Feeder pillars represent types used on systems of distribution for street lighting and traction. A new speciality is a type of switch having a quick make as well as quick break, the switch itself carrying a fuse if required. Another new line is a three-phase oil switch having a quick make and break, and fitted in an iron case having a locking arrangement so that the switch must be in the "off" position before the case can be opened and whilst opened; the case is watertight and gas-tight, and the oil tank slides down on runners, thus catching any oil dripping from the switch, see fig. 203. This form of switch can also be fitted with fuses.

Another and new exhibit is the "Bowie" safety lamp re-lighter for electrically re-lighting miners' lamps without danger of explosion, fig. 204. The generator is interlocked with the case, so that it can only be operated when the case is closed perfectly gas-tight; the lamps are fitted with special contacts for obtaining the small spark necessary in the lamp, and the operation is perfectly safe. In addition to their exhibit in the body of the hall, Messrs. Spagnoletti are showing on Stand 311, in the gallery, the Therol system of electric heating, with which our readers are already well acquainted.

The system is essentially a heat-storage one, and, in addition to the original purpose of water heating, it has now been developed for cooking.

The cooking apparatus is made on the same principle as the water heater. The current for the cooker when not being used is taken in heating the iron mass placed below the oven. When the oven is required to be used it is merely necessary to open two dampers, and the oven in a few minutes reaches the required temperature—from 300 to 400° F. By adjusting the dampers the heat can be regulated in the oven to any required temperature. We illustrate in one of our views (p. 616) the firm's cooker.

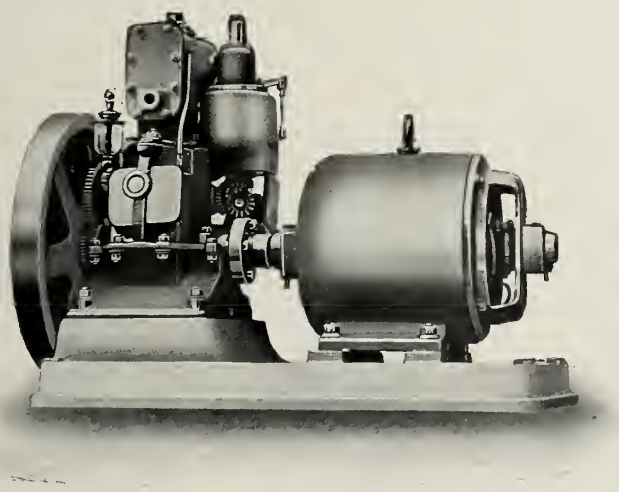


Fig. 202.—Country-House Generating Set (Pooley & Austin).

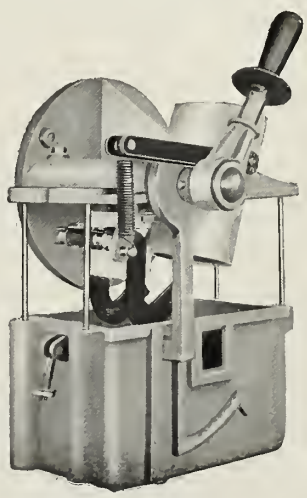


Fig. 203.—Oil Switch, with Tank Lowered (Spagnoletti).

Messrs. Engineering Instruments' exhibit consists principally of ironclad, heavy-type motor-control gear, in panel or pillar form.

A large ironclad motor-control panel for 50 H.P. is shown. This is divided into three sections, the upper one carrying an ammeter with double-pole fuses and double-pole quick-break main switch; the central one contains a massive starter with no-volt and overload releases; and the lower one contains a shunt regulator for speed variation.

Open, semi and totally enclosed "Direkton" starters are on view, the great advantage of these being that one motion on the part of the operator only is necessary to switch on the motor. When the starting handle is pressed home, a spring is compressed, and this spring drives the starter arm over the contacts against the suction of a totally enclosed oil dash-pot. Thus the operator has no control over the speed at which the resistance is cut out of the armature circuit, and the overload and no-volt releases are operative during the whole time of switching on.

There are examples of a new standard type of starter just brought out by this firm, in which the interesting feature is a special type of easily renewable contact. To renew any one of these contacts, it is only necessary to take out one screw, and there is no need to touch any nuts at the back of the starter.

In another section of the stand are the switchgear and instrument exhibits of Messrs. Spagnoletti, Ltd.

These include a three-phase 6,000-volt stone cubicle switchgear for central station use, and a smaller 2,000-volt ironclad sub-

Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd. (179, 184, 206 and 209),
Carlton House, Westminster, S.W.

This is one of the largest and most varied exhibits in the hall; in the main it consists of examples of the numerous accessories and supplies and current-consuming devices of which these companies offer so wide a range, including cables and wires, telegraph and telephone apparatus, railway signals, arc and incandescent lamps, X-ray apparatus, heating and cooking appliances, motors, batteries,

testing instruments and fittings. Under the first heading, the "Stannos" wiring system, which has attained such wide popularity, is, of course, a prominent feature, a large panel being wired with this material so as to show its capabilities. Of the telephone apparatus, which is made at Woolwich, besides domestic and inter-communication sets, there are long-distance telephones for exchange and railway use, and an all-metal cased central battery set, of which we give an illustration in fig. 208, on the opposite page. Water-tight and gas-tight telephones of exceptionally robust

any existing signal, consists of a small motor driving the signa arm through a train of gearing, so that the power required is ver small—about 30 watts—the operation of lowering the signal being spread over 4 or 5 seconds. When lowered, the signal arm is held down by an electromagnet which brings a pawl into gear with a large wheel forming part of the gearing, and the motor is cu out. When the signalman replaces his lever, the circuit of th magnet is opened, the wheel is unlocked, and the signal arm return to the danger position; the same thing happens if the batter

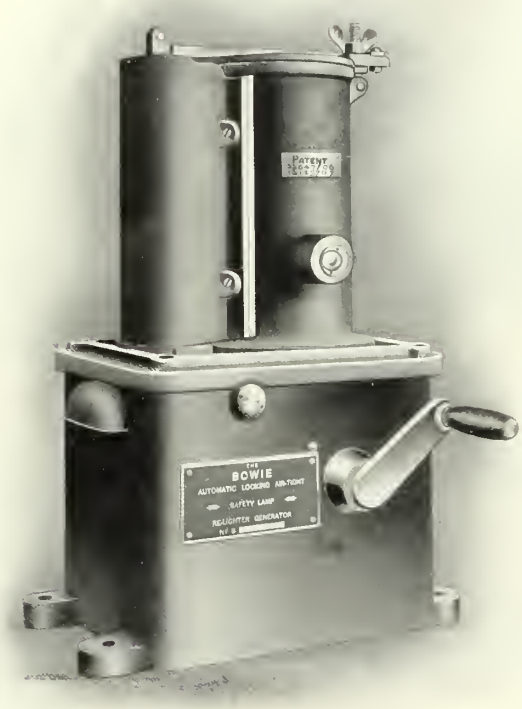


Fig. 204.—Bowie Safety-Lamp Relighter.

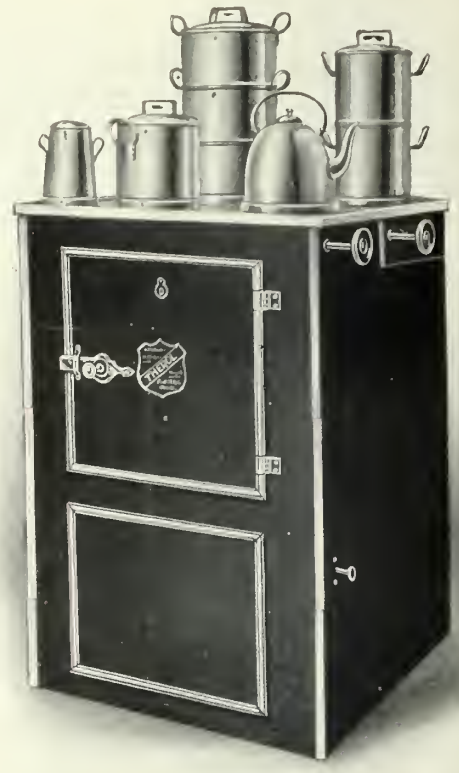


Fig. 205.—Therol Electric Cooker.

construction are also shown; these are suitable for collieries and similar places, and a special marine pattern, with loud-speaking trumpet dispensing with a separate receiver, is shown for use on board ship (fig. 210). The largest exhibit in this line is a "high-tension" cabinet, in which all the apparatus is most efficiently protected against the incursion of high-pressure current from transmission lines carried on the same poles as the telephone wires (fig. 209). Wheatstone transmitters and receivers driven by small electric motors instead of clockwork actuated by

circuit is opened by any means, so that any derangement of t apparatus always puts the signal at danger. In the act of returnin to this position, the mechanism raises the armature of the magn close to the poles, so that a long pull is not necessary when t signal is actuated again, and thus the magnet does not require large current to actuate it. As a battery of Siemens-Obach ce will work the mechanism twice an hour for 120 days of 24 hou

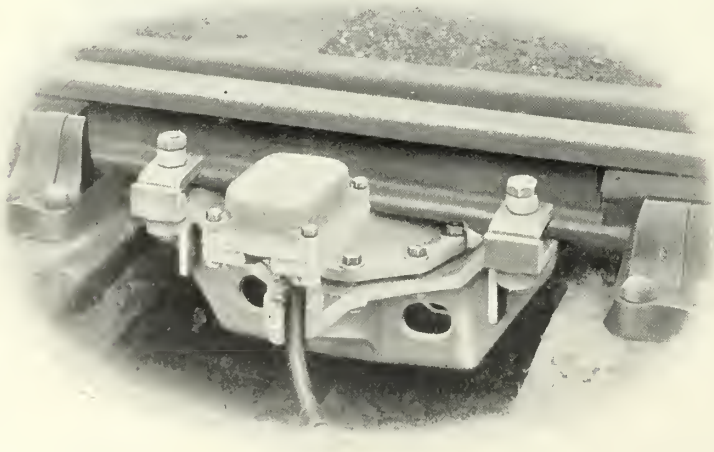


Fig. 206.—Siemens Mercury Treadle.



Fig. 207.—Standard Motor-Control Pillar.

springs or weights form a novel feature of the telegraph exhibit, being shown in operation; these are energised from the batteries used to feed the line circuits, and take from 5 to 7·5 watts at 30 volts, running under the control of a mechanical governor which ensures extremely steady speed.

Standing out prominently above the stand is a full-size railway signal, which is operated by a dozen dry cells under a new system, patented by the company; the apparatus, which can be applied to

each, without falling off more than 10 per cent., it will be seen th the cost of power is very small. A mercury contact treadle, us for actuating signals on the passage of a train over the line, exhibited, and is illustrated in fig. 206.

Amongst the domestic apparatus is a pumping system for count houses, in which each tap is furnished with an electric device whi starts the motor and pump whenever the tap is turned on, th providing a constant supply of water without necessitating t

se of a large storage tank at the top of the house. Another set, with which a tank is used, is fitted with an automatic float pparatus for controlling the motor, so as to maintain a supply of vater in the tank. A mining switch pillar for voltages up to 3,300, nd a current of 300 amperes, is exhibited: this is of the draw-out ype, so arranged that when the switch carriage is in the forward

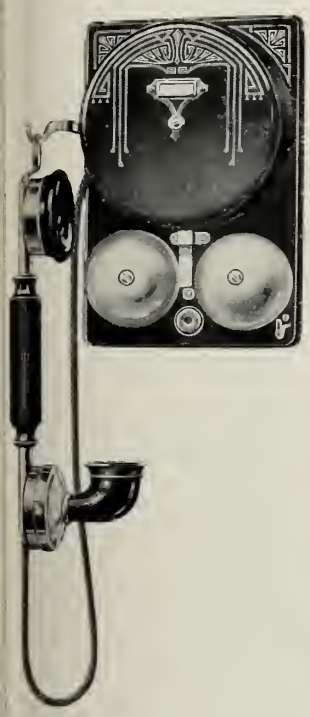


Fig. 208.—Metal-Cased Telephone.

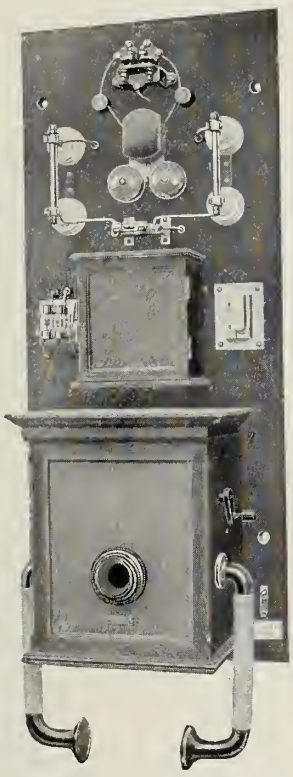


Fig. 209.—"High-Tension" Cabinet.

position, the switch is entirely dead, and a safety interlocking device prevents the switch from being put back unless it is in the off position, while the carriage cannot be withdrawn, until the same condition is fulfilled, and the oil tank and the cover cannot be removed until the carriage is drawn forward. The switch is of the free-handle type, so that it cannot be held in on an overload. Various combinations can be made in this class of apparatus, which is shown in fig. 211. An automatic starting switch is shown for a D.C. motor in which, after the main switch is closed, the resistance is cut out by steps under the control of a 'scape wheel and balance wheel. We illustrate in fig. 207 a standard motor control pillar with D.P. switch and fuses, starter and ammeter. A small loom motor, of the company's standard three-phase type, mounted with elastic suspension on a cradle, is another exhibit in this department.

Zed fuses are shown in operation, and the "Vortex" vacuum cleaner, which is operated by a central motor-driven plant, and is provided with a water supply pipe to carry the dust into the drains forms a popular attraction. This system can be fitted for almost any number of points, which are connected to the central plant by piping, and is in use in many large buildings in this country. A portable apparatus is also made. Non-encrusting zincs, primary cells, overhead line material, instruments and transformers are other items of this extremely diversified exhibit.

We gave particulars of the result of the Siemens lamp poster competition a few weeks ago, and last week the lamp and fittings exhibit by the Dalston works was reviewed. In view of the interest that the above competition evoked, we have succeeded in finding space to illustrate the prize-winning posters below. One—Little Bill—is really humorous, and is intended to be so; the other, that of the dread eclipse, is intended to be quite superior and impressively serious, but it may strike you either way—it all depends upon your point of view, and whether you are interested in another lamp or not. Contractors who want copies of these posters to display in their establishments will soon be able to have them attractively reproduced on thick card in several colours, varnished, eyeleted and strung



Fig. 210.—Loud-Speaking Marine Telephone.

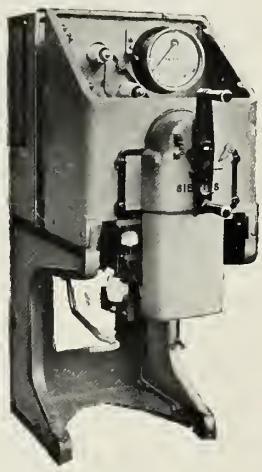


Fig. 211.—Mining Switch Pillar.





Figs. 212 and 213.—Prize-Winning Posters in the "Tantalum" Competition.

Bertram Thomas (22 and 39),

Worsley Street, Hulme, Manchester.

The stands occupied by this firm are filled with apparatus of a novel character, and containing mechanical devices and features which are of unusual interest.

An automatic battery regulator switch is shown, for keeping the voltage of supply from accumulators constant, or for operation from a distance; a similar but somewhat modified gear may be employed

for the voltage regulation of generators boosters, balancers, &c. The governor or voltmeter section works without the intervention of relays, and turns the operating current direct on to one or other of two solenoids, which, in their turn, move the main contact arm to cut cells into or out of circuit as required. The governor *makes* contact only, and the resulting current is broken in a magnetic field on special renewable carbon contacts placed on the battery switch.

The governor can be compounded to allow for drop of pressure in a feeder, which is very useful when the battery is placed at a distance from the distributing centre.

The regulating switch itself which carries the main current is arranged with either one or two main contact arms, according as the switch is required for discharge only, or for charge and discharge occurring at the same time. The contact arms pass

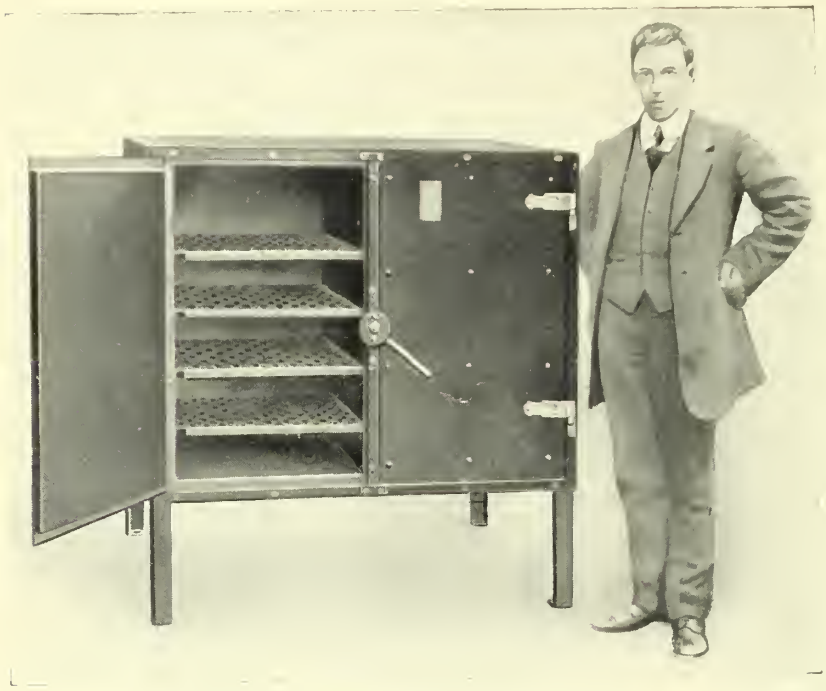


FIG. 214.—BERTRAM THOMAS ELECTRIC OVEN.

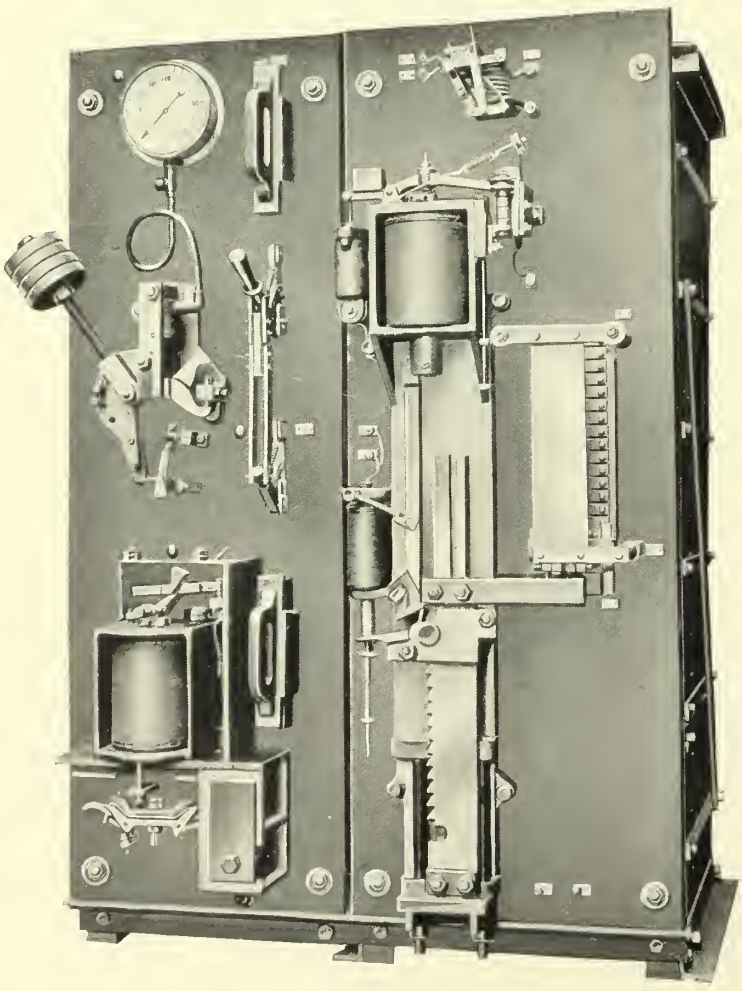


FIG. 215.—BERTRAM THOMAS THREE-PHASE 350-H.P. AUTOMATIC STARTER.

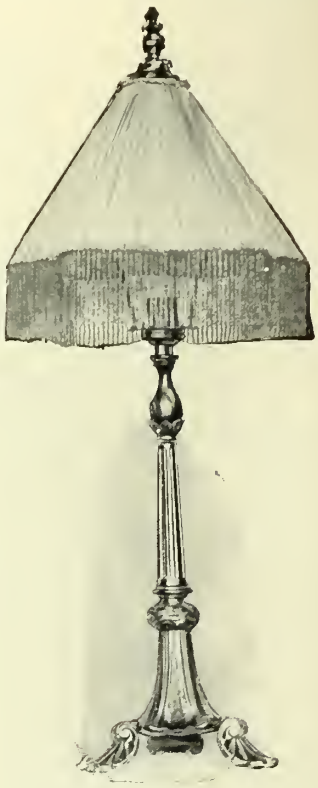


FIG. 216.—TABLE LAMP.

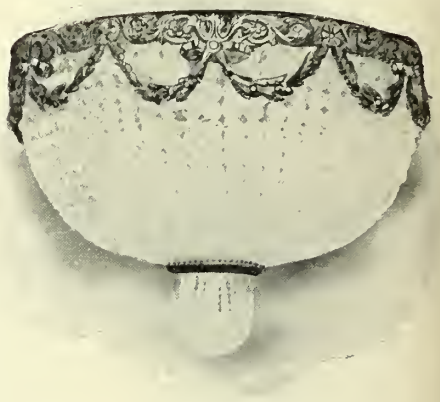


FIG. 217.—CRYSTAL CEILING FITTING.

FALK, STADELMANN FITTINGS (see next page).

from step to step by an instantaneous movement allowing no time for burning.

An interesting example of a 350-H.P. three-phas automatic starter is shown (fig. 215), embodying th firm's special features of quick movement from ste to step, and protection of the main contacts fro burning by means of well designed and carefull placed auxiliary contacts which take all sparking The moving arms carry contacts of the controlle finger type, and the process of starting consists of series of rapid movements from contact to contac the time taken to start up being determined by th length of time during which the contact arms ar allowed to dwell upon each step: this time is readil adjusted to suit the motor and its particular service.

These starters are used for automatically controllin motors driving air compressors, hydraulic accumu lators, pumps supplying or emptying tanks, &c., c for remote operation. In many cases, also, it is mo satisfactory to make the starting of motors aut matic rather than dependent upon the discretion of unskille attendants.

A panel is shown containing the necessary gear for controlling a air-compressor motor, and thereby maintaining the air pressu constant between certain limits, say, between 95 and 100 lb. Th comprises an air-pressure limit switch in which the air pressu acts directly upon a piston, and is balanced against weights

intain the desired air pressure and range. The forces actuating is switch are very powerful, and its operation is therefore very rtain. It opens or closes quick make and break switches, which erate a solenoid main switch, and thereafter set the automatic rting switch to work with its step-by-step action.

Direct-current auto-starters are shown of various sizes up to 0 H.P., as well as ratchet starting switches for hand operation th double-pole overload circuit-breaker and no-voltage release, d circuit-breakers of all sorts and sizes for hand operation or note control, and with or without time limit.

The "gold medal" cooking oven with patented internal air cirlation is shown at work, and an adjoining table is spread with e appetising results produced. The oven has an internal size of in. high × 18 in. deep and 15 in. wide, is heavily lagged so that outside is kept cool, and carries at the top a plate-warming closet d two hot plates for boiling or frying.

A large electric oven made by Mr. Thomas is illustrated in . 214 opposite.

Messrs. Falk, Stadelmann & Co., Ltd. (80),

83—87, *Farringdon Road, E.C.*

This company has, in effect, transported a portion of its new owrooms to Olympia, the stand containing a comprehensive hibit of fittings and accessories on showroom lines. The internal d external panels which form the walls of the room are utilised r a display of electric bells, telephones, &c., and bracket fittings, hile from the ceiling depend a variety of electroliers and pendants, ith concealed wiring as though installed on consumers' premises. nall tables and the floor itself provide support for table lamps and or standards, and the "Efesca" tungsten lamps pervade the ole exhibit, forming also a very striking sign on the facia.

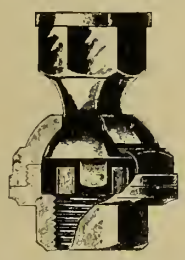


Fig. 218.—"Noturn" Ball Joint.



Fig. 219.—Pocket Fuse-wire Holder.

Some examples of the fittings are shown in the accompanying ustrations, page 618, representing a very handsome four-light ystal fitting (fig. 217), and a table standard in oxidised ver (fig. 216). The company also makes a speciality of eriod" fittings, which are designed to suit individual quirements. The "Efesca" flat wall switch which is exhibited a line of which the company is proud, and the neat little se carrier, which we illustrate in fig. 219—a device which ables a sufficient store of fuse-wire to be tidily kept at hand—is convenient little appliance for either consumer or wireman. ecial switches made to conform to the Home Office requirements e shown, the earthing connections and shock-proof features of ese being noteworthy. One bay of the stand, containing a show glassware, is illuminated with reflected light from above. Our her illustration, fig. 218, shows a patent "noturn" ball joint, hich is particularly useful for outside lamps, as it prevents the isting of the flex.

Messrs. Pirelli, Ltd. (172, 191),

45, *Basinghall Street, E.C.*

This well-known Italian firm is making a special display of ower, telegraph and telephone cables. The mains engineer will ew with great interest a large drum of 75,000-volt three-core ble which occupies a prominent position on the stand. This cable jute insulated, paper and lead-covered, and steel armoured, and e numerous other examples of the firm's work range through l grades down to fine silk-covered wire for delicate instrument ork. The company also specialises in rubber and ebonite goods, d substantial motor tires and a variety of ebonite telephone and her fittings bear witness to its activities in these directions.

The Pirelli Co. has several factories in Italy and other countries, d employs some 6,000 hands: a series of illuminated views will lp to impress the visitor with the wide scope of its operations.

The Earth-Driven Clock Co. (307),

11, *Bowling Green Street, Leicester.*

The energy driving the electric clock exhibited by this firm is rived from a zinc-carbon couple buried 3 or 4 ft. deep and about ft. apart in moist soil; in the Exhibition installation the earth ates are 90 yd. from the clock itself. The primary battery thus ranged provides about 1 volt p.d. at the clock terminals and sets a very small current through a many-turn winding on the "bob" of the pendulum. The motion of the latter reverses the direction of current flow at the end of each swing and thus enables the maintenance of its oscillations. The clock employed is of very simple and robust construction, and usually keeps correct time to within 1 minute in 12 months. It is not dear in initial cost, as compared with other high-class timepieces, and there is no reason why the clock should not run for years without attention providing the gears and contacts do not wear down.

Messrs. Dorman & Smith (59, 64),

Ordsal Electrical Works, Salford.

Photographs of some main generator control pillars and main switchboards, of which some 16 were supplied to the *Olympic* and *Titanic*—the largest steamships afloat—may be seen on this stand,

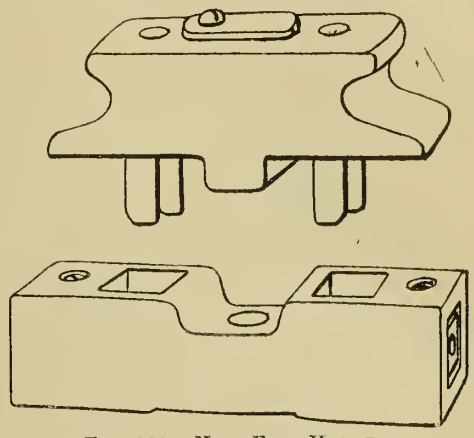


Fig. 220.—New Fuse-Holder.

as well as views of indicator pillars and voltmeter pillars. A new type of switch-fuse power boards, with bevelled tops, fitted with removable plates to facilitate wiring, is exhibited, as well as the

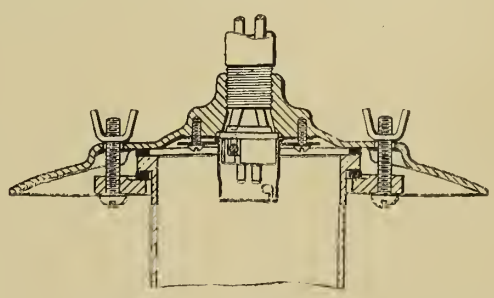


Fig. 221.—Section of Patent Easy Wiring Fitting.

firm's standard fittings for bulkhead lamps, lanterns, &c. A porcelain fuse holder designed to comply with the Home Office requirements, all the live metal parts being enclosed (fig. 220), and a new



Fig. 222.—Easy Wiring C.I. Well-glass Fitting.

fitting for easy wiring (fig. 222) are shown; it will be seen from the section of the latter (fig. 221), that the porcelain of the lamp-the holder is clamped tightly against the body of the shade, and conduit screws directly into the latter, making a watertight fitting.

Messrs. R. A. Lister & Co., Ltd. (11, 12),

Dursley, Glos.

This firm is making a special display of the "Bruston" patent automatic electric generating plants, which were fully described in our issue of July 14th last.

The generating plant is self-contained, consisting of engine, belt-driven dynamo, controller, &c., and a switch cabinet (in the small sizes) carries the switchboard and battery.

The exhibit includes a couple of these plants installed in a small engine room adjacent to a tastefully furnished apartment, which is equipped with electric light, and thus enables the firm to demonstrate the automatic features of the installation.

Messrs. A. P. Lundberg & Sons (90),

Pioneer Works, Liverpool Road, N.

No comprehensive reference to Messrs. Lundberg's exhibit can be attempted here; the number and ingenuity of their switch specialities have always been a source of wonder to us and others —and quite a good selection of these can be seen on the stand. We understand that Messrs. Lundberg's rate of output of new designs, improvements, &c., is as great as ever, and we had no difficulty in finding something new. Readers will be interested in a new pattern of 10-ampere metal-cased watertight push-and-pull switch (fig. 223) which has been supplied to the Admiralty. The box is of "Naval" brass, with lugs for fixing. Stuffing boxes are provided for the leads, the operating plunger passes through a similar box, and the screw-on cover has a soft metal packing ring. The inner end of the plunger is insulated by a porcelain reel from the contact parts of the switch. The most important feature of this accessory is its independent make and break, its action being quite unaffected by slow or uncertain operation of the plunger, or by

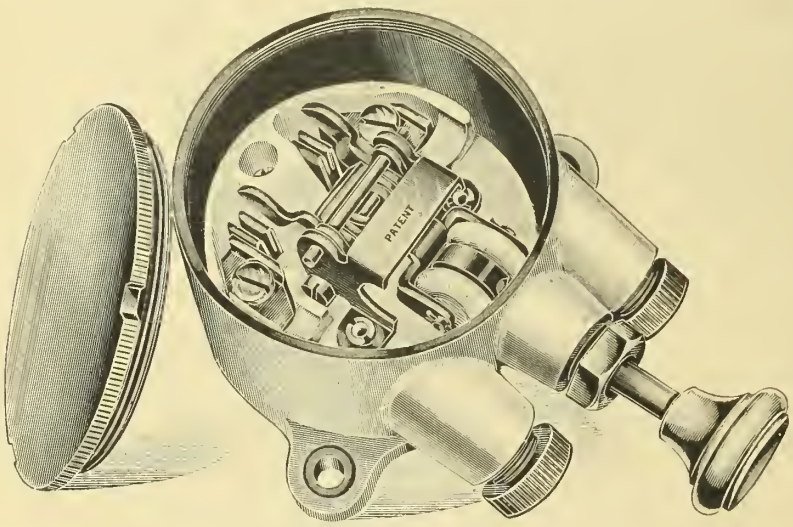


Fig. 223.—Watertight Push-and-Pull Switch.

the tightness of the packing around the latter. The special form of terminals, it will be noticed, allows of ease of wiring and security of connection.

A neat double-push type of flush switch, illustrated in fig. 224, is of interest. This shows a single-way type, but the same action can be applied to both the two-way and intermediate types as well. These switches are supplied in iron boxes.

We understand that several "Lektrik" plug connections for earthing, in line with Home Office requirements, are now available; and the fibre-disk, two and three-pin plugs for all

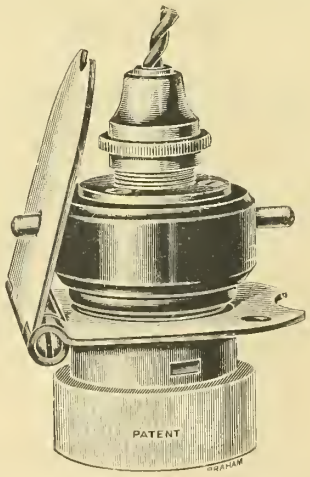


Fig. 225.—Safety Plug and Socket.

kinds of sockets are now provided with extra insulating mica bushes and washers, an improvement which has been patented. In fig. 225 we illustrate an ingenious plug connection suitable for places where hand lamps are used, or where accumulators have to be charged; it will be noticed that one of the side pins in the plug cap catches in a hole in the spring-hinged cover, which thus prevents the plug from being accidentally withdrawn.

In connection with the above, mention may be made of the combination switch and plug, fig. 226, which, where a D.C. supply is available, enables one either to burn a lamp or charge an accumulator with the lamp in series through the plug connection.

This, of course, is a general feature of the Lundberg switch arrangements; you can do almost anything with them, if you ask Messrs. Lundberg what to use and how to use it.

Sir Joseph Causton & Sons, Ltd. (300),

Birkbeck Street Works, Bethnal Green, E.

This exhibit includes a most artistic and effective variety advertising and display signs, ranging from small imitation flo signs to large polychrome disks and globes. A characteristic feat throughout is the uniform light distribution obtained from a sin carbon-filament lamp (16 c.p. in the small signs and 25 c.p. in larger equipments). The "flower" signs exhibited have ventila covers (to obviate any risk of cracked glasses), high efficiency tributing back reflectors and very effective stained-glass work. also notice a new screen design showing opaque lettering o silvered background by daylight and translucent mono or p

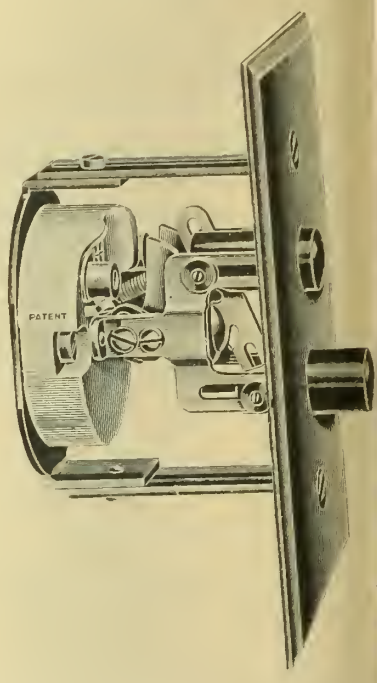


Fig. 224.—Double-Push Flush Switc

chrome lettering on an opaque background by light from the i lamp; here again the special reflector design gives very unif illumination from a single lamp.

The attention of every visitor, however, is riveted by the polychrome signs and decorative effects. These are attractive day and by night, and are equally applicable to every clas interior and exterior display. The effect produced is tha swirling streams of liquid or clouds of vapour in ever-chan soft and brilliant colours. The signs must be seen t appreciated.

We understand that the whole effect is mechanically produc the relative movement of a single carbon lamp (25 c.p.) and va colour plates used in conjunction with special reflectors and diffu media. The moving parts are actuated by a spring-motor run

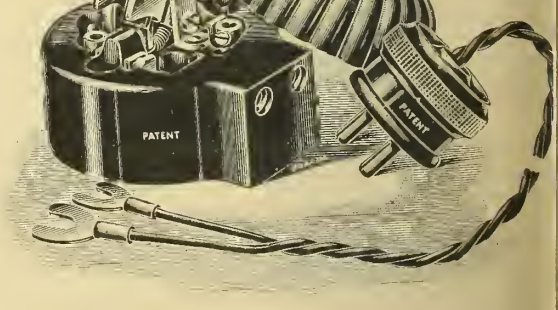


Fig. 226.—Combination Switch and Plug.

six hours on a single wind; there is no limit to the variet polychrome fittings which can be applied to the motor equipm so that the sign may be simply a charming riot of colour o same in conjunction with any flashing or permanent advertisin scenic effect. A wide range of signs and "attractions" is exhib and these we heartily commend to our readers' inspection.

Messrs. G. M. Boddy & Co. (297),

8, Leadenhall Street, E.C.

These well-known factors are exhibiting an interesting sele of miscellaneous fittings and accessories, in addition to a ran Tantalum and "Mazda" lamps, "Holophane" and "Weatherpr fittings for the same, and various electric radiators and convect

Messrs. H. R. Witting and K. and Th. Moller (325),

9, *Southampton Street, W.C.*

In the latest type of the Moller air filter—applicable to ventilating schemes or to the cleansing of air blown through electrical machinery for ventilating purposes—a number of independent "pockets" are employed in place of a continuous cloth (see fig. 227). A strong cotton material is used, with specially roughened surface: as fitted to the "pocket" frames it is nowhere in contact with metal, and no eyelet holes are required. The filter cloth can be easily and perfectly stretched over each frame, and each pocket

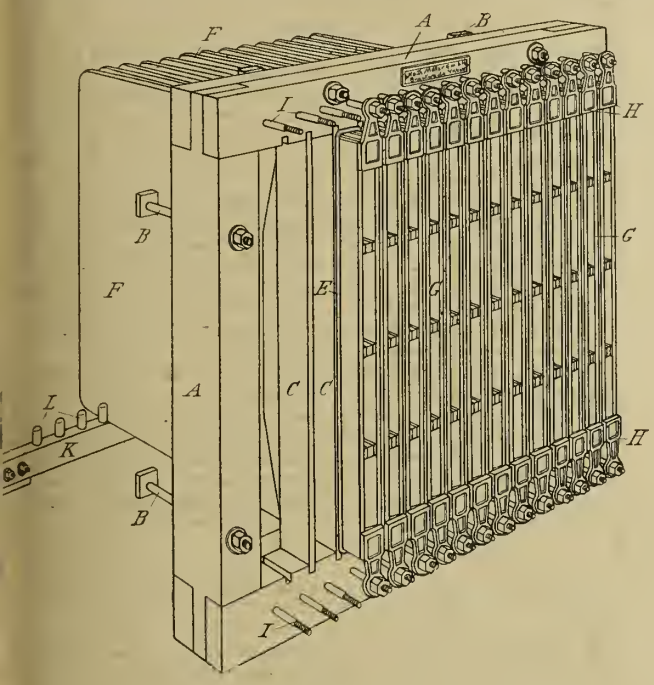


Fig. 227.

can be removed for cleaning (by benzine or, preferably, by a vacuum process), without at all interfering with the action of the filter as a whole. We are informed that 600 filters, of a total capacity exceeding six million cubic metres of air per hour, have already been supplied for use with turbo-generators; each standard "pocket" filters about 270 cb. ft. per min.

Side lines at this stand are various counting and recording movements by Roux & Co. and by K. Hardtmann.

Messrs. F. M. Russell & Co., Ltd. (320),

Junction Works, Willesden, N.W.

Besides its better known specialities such as the Follett Time Stamp, the Simplex Key Time Recorder, the Watchman's "Tell Tale" Recorder, and other time-recording instruments, this firm is exhibiting new or improved models of other apparatus of this class. The "Kosmoid" Signature Time Recorder is made in various patterns to suit different services, and avoids all possibility of error, wilful or accidental; the time of each employé's arrival and departure is shown against his own signature, so that only by forgery can the purpose of the machine be circumvented. The "Jurus" Lift Recorder charts the exact time and duration of every movement and stoppage of the cage, and is being widely used by London underground electric railways. A new Current and Brake Recorder, for use on electric railways and tramways, is now undergoing trial by the London, Brighton and South Coast electrified line, and we hope to publish a full description of it at a later date. The functions of the instrument are to record the distances travelled with and without current, and under braking respectively. These particulars are printed at the beginning and end of each journey on a loose driver's card; in conjunction with a bonus system, it is needless to say that the recorder brings about great economy in working. Other interesting instruments worthy of inspection are the "Jurus" Speed and Journey Recorder, applicable to any class of vehicle, and affording an indisputable record of its speed and distance performance, and the Ship Steerage Recorder, showing the time and duration of every rudder movement. Features of all the above recorders are their simplicity and durability.

Marconi's Wireless Telegraph Co., Ltd. (154, 246),

Watergate House, W.C.

This firm is exhibiting examples of its latest marine-type wireless telegraph equipment, in addition to an interesting selection of apparatus required for experimental and everyday work in radio-telegraphy. The Marconi Co.'s standard 1½-kw. ship station is still used on passenger liners of medium size, but whereas larger vessels have installed 3 or 5-kw. stations, there has lately grown up a wide demand for a smaller equipment suitable for small passenger boats, cargo vessels and destroyers. To meet this demand a ½-kw. station has been designed; the normal transmitting distance is 150 miles, but on favourable night trials messages have been dispatched as far as 500 miles from such an equipment. Visitors will notice that the ½-kw. set, unlike the 1½-kw. station, has no oil tanks for the transformer and condenser, and the amount of woodwork in the construction is reduced to an absolute minimum. The well-known magnetic detector is employed in all the ship stations, and in a very large number of land stations; some of the latter, however, are equipped with electrolytic or contact detectors.

Le Carbone (95),

17, *Water Lane, Great Tower Street, E.C.*

This exhibit is representative of the numerous carbon and other products associated with the Le Carbone, comprising dynamo and motor brushes in carbon, combined metal and carbon, gauze, anti-friction metal, &c., the Le Carbone pig-tail connection for brushes, carbon switch breaks, packing rings (for turbines), the Lacombe and Carbi primary cells, microphone carbons, &c.

We understand that the firm's carbon brushes are in use on the majority of British traction systems, and some of their "F" grade brushes on the Central London Railway have reached 35,000-50,000 miles' use, while some E 29 grade reached an average of 35,000 miles.

Messrs. Rose Bros. (328),

38, 39, *Beech Street, Barbican, E.C.*

A wide range of electrical accessories and novelties is shown at this stand. Special attention should be called to the "Comet" Schmidt dry battery; the three-cell type, for pocket flash lamps, &c., yields 0·25 ampere *continuously* for four hours—an excellent performance. The well-known "White Star" dry battery is supplied in various sizes suitable for ignition, bell and telephone work; the standard cell for bell work yields 12—15 amperes on short-circuit—an output indicative of very low internal resistance. The firm's "R.B." accumulators, of various sizes and patterns, are suitable for ignition and small lighting loads. Visitors should inspect the very wide range of pocket lamps and torches exhibited. We understand that Messrs. Rose Bros. have several important contracts pending for the further supply of portable accumulator lamp sets to police officers in various towns.

This firm holds the agency for the Compagnie F.A.C.'s portable and switchboard voltmeters and ammeters and combination voltmeters and centre-zero ammeters for charging sets and motor-car work, &c. The attention of motorists may be called to a novel design of car-lighting dynamo provided with a gyroscopic cut-out, which switches an auxiliary secondary battery in or out of circuit when the dynamo speed falls below or exceeds 1,500 r.p.m. respectively. We notice an exceptional variety of miniature metallic-filament lamps (¼—1 ampere), bells and bell switches, medical coils and massage sets, &c.

The Ronald Manufacturing Co. (248).

This firm makes a speciality of small accumulators and various accessory apparatus employing the latter (*e.g.*, portable hand lamps and miscellaneous lighting sets and accessories). A new type of lattice grid is employed in the construction of the plates, which are specially light and practically incapable of buckling; a special paste composition is forced into the grids by hydraulic pressure. The terminal lugs are burnt on to the plates, and a non-creeping amalgam is used in their stem; this appears to be highly effective. The polarity of the terminals is permanently indicated by coloured fibre washers. In the hand lamp sets sufficient acid is retained by a glass wool filling between the plates; these cells are only 10 per cent. less efficient than the "liquid" type, and are naturally non-spillable. We understand that the Ronald Co. has made probably the largest celluloid accumulator extant for exhibition work; unfortunately this cannot be shown at the present Exhibition, as it is charged. The company has also achieved some very striking and effective repairs on deteriorated cells of other makes.

Ship Carbons, Ltd. (58, 65),

67, *Aldersgate Street, E.C.*

The company specialises in carbon goods, and the well-known "Shipcarbon" brand is familiar to most of our readers.

The exhibit consists of a tasteful display of flame, open and enclosed arc carbons, brush carbons, coppered and plain, together with cinematograph, battery and other carbons for all purposes.

The Electric Home at Olympia.

In our reference last week to the Home in the gallery, we said that the supply for all purposes was taken from the small generating set and battery installed at the kitchen end. This is not the case. The lighting of the Home, and that alone, is done from this small plant, the general Olympia supply being drawn upon for the laundry, cooking and other such like purposes.

Exhibition Lectures.—To-day, Friday, at 8 p.m., Mr. R. Borlase Matthews will lecture on the Therol system of cooking, at the Electric Supply Companies' stand at the Olympia Electrical Exhibition.

CONTRACTS CLOSED.

(*Continued from page* 606.)

Wimbledon.—The Watch Committee reports having had under consideration the report of Mr. James Swinburne as to the system of fire-alarms most suitable for installation in the borough, and has come to the conclusion that, in accordance with his recommendation, the Siemens system of fire-alarms should be adopted for installation, subject to (1) Messrs. Siemens Bros. and Co., Ltd., agreeing to substitute secondary batteries for Daniell batteries without extra cost, and (2) a satisfactory arrangement being made with the Post Office London Telephone Service for the renting of their wires and the maintenance of the system.

Wrexham.—The T.C. has accepted the tender of the Lancashire Dynamo Co., Ltd., for a motor-driven booster, at £120 : that of Messrs. Whipp & Bourne for switchgear, at £84 ; that of Messrs. Hall & Pickles for 13 steel joists for the battery floor, at 7s. 9d. per cwt. for joints, and 8s. 6d. each end for cranking and drilling ; that of the British Reinforced Concrete Engineering Co. for electrically-welded fabric for the concrete floor : that of Messrs. Willans & Robinson for an automatic expansion gear for No. 3 engine, at £105 : and that of the Tudor Accumulator Co., Ltd., for a traction battery, at £475, and maintenance for 10 years at annual payments ranging from £42 to £30.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 13th. At 6.30 p.m. Visit to "The Model Engineer" Exhibition at the Royal Horticultural Hall, Westminster.

Northampton Institute Engineering Society.—Friday, October 13th. At 5.45 p.m. Presidential address by Dr. R. Mullineux Walmsley.

Faraday Society.—Tuesday, October 17th. At 8 p.m. At the Institution of Electrical Engineers. Adjourned discussion on "The 'Paragon' Electric Furnace and Recent Developments in Metallurgy," by Mr. J. Hardén ; "Progress in the Electrometallurgy of Iron and Steel," by Mr. D. F. Campbell ; and "The Hering 'Pinch Effect' Furnace," by Mr. E. Kilburn Scott.

Olympia Electrical Exhibition.—Saturday, October 21st. Closing day.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued :—

Drills for efficiency (1911-1912) will commence at Headquarters on Thursday, November 2nd, 1911, and Headquarters will be open as stated below from that date :—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Electricity in the Home.—As a souvenir of the Olympia Electrical Exhibition, the General Electric Co., Ltd., are presenting visitors with a very attractively got-up brochure, entitled "The Magic Wand of Science," in which they treat of the application of electricity in every-day life in quite an interesting way, the pictures being life-like representations of ironing by electricity, cooking by electricity, electricity in the breakfast and drawing-rooms, the vacuum cleaner at work, electricity in the bedroom and the nursery. At the end of the pamphlet (24 pages) is a simple, straightforward list of prices of electrical domestic appliances. It is intended that the brochure shall reach the public through the trade and central stations, as well as at the Exhibition, and quantities can be furnished to central station authorities who will undertake to distribute them.

Electrical Imports and Exports.—The official returns regarding foreign trade during the month of September show that the electrical goods imported were £125,428, or £53,532 less than in September, 1910, and machinery was £426,979, an increase of £82,331. In exports electrical goods figure at £209,332, a decrease of £222,357, as compared with September, 1910. The reason of this decrease is obvious when we remember that in the 1910 figure for the month, one special item of telegraph cable, &c., sent to the U.S.A., Philippines, Porto Rico, and Cuba was valued at £230,654. Machinery exported shows a fall of £350,799 for the month.

Wireless Signals from Lighthouses. — For the direction of ships by wireless telegraphy, Major von Salviati proposes, in cases of fog, to complete the indications given by the lighthouses on the Ahrenhold system by means of wireless signals. A signal will be made with each extinction of the light by the same clockwork which controls the former. The cost of this innovation is small, as are the working costs, for the giving of a short signal every five or ten minutes is all that is needed.—*E.T.Z.*

Copper.—Messrs. Merton's statistical circulars for mid-September and for the 30th of the same month give, as usual, a quantity of interesting details on the state of supplies of this metal. At mid-month the visible supplies were 68,177 tons, a drop of 25,784 tons as compared with last September, but an increase of 1,263 tons over the return for the end of August, 1911. This had, however, fallen by the end of September to 67,340 tons, the increase on the month being therefore only 326 tons. For mid-month the supplies to English ports from North America are average, from Spain and Portugal decidedly low, from Chile rather over the average, and from Australia just under it. Deliveries at 17,268 would indicate a rather dull market. Coming to the figures for September 30th, we find supplies from North America low, from Spain and Portugal practically just double the mid-monthly return and therefore low, from Chile low, and from Australia also a good deal under the average. The total deliveries, at 32,943 tons show a fulfilment of the indications of the mid-monthly return American supplies are still falling off, being down 1,919 tons on July, at 59,571 tons for end of August. Rotterdam stocks are down 400 tons since August, but Hamburg are estimated to be up 300 tons. The world's supply for the end of August is 126,485 tons, a drop of 3,030 tons on the preceding month. The average drop since May, 1910, when 178,593 tons were registered, has been 3,400 tons per month, a rate at which the present supplies will take considerable time to work off. English stocks (in port) fell 55 tons on the month (September) and those in French ports 74 tons and afloat 1,050 tons more were registered.

The slow, but fairly steady, reduction of visible supplies has apparently, encouraged the trust rumours, &c., judging by an article in the *Financial News* of October 10th. The writer therein says that London is indicated as the centre of the combination, the States being found unsuitable under an administration which has already instituted actions against several Trusts. Mr. Edmund Lou de Bestry, vice-president of the American Mining Congress is quoted as indicating London as the headquarters, and Baron Rothschild as the president. (It is pointed out that the use of Baron Rothschild's name in this connection is, no doubt, unauthorised.) This would, of course, be a try towards including the Rio Tinto in the organisation. The article goes on to point out that, at the present time, with other large producers coming in, the effect of the surplus on American copper shares is becoming marked. Arizona Commercial, Shannon, Boston and Corbin are quoted as down, and Colorado, Sioux Consolidated and Uncle Sam as dropping. One can hardly reconcile this with Trust rumours.

Electric Towage for the Panama Canal.—The Isthmian Canal Commission, Washington, D.C., has advertised for proposals for furnishing one electric towing locomotive, complete for the Gatun Locks, and 39 electric towing locomotives for towing ships through the locks of the Panama Canal. Four locomotives will be required to tow a vessel of moderate size—two ahead, one on either wall, towing, and two behind, trailing, to keep the vessel in the middle of the lock. The towing speed is 2 miles per hour. The electrical equipment of each locomotive is to consist of two traction motors and controllers. There are also to be a motor and controllers for operating a windlass for hauling in or paying out the tow-line under load, and a high-speed, motor-driven attachment for coiling the tow-line when out of service. The motors are to be three-phase, 25-cycle, 220-volt induction motors of the railway mill type, totally enclosed and moisture-proof.—*Electrical World.*

Scott's Old Boys.—This informal Society held its fifth reunion at Olympia on Saturday last, Mr. C. N. Russell presiding at the dinner. Although it had been suggested that visitors should be invited upon this occasion, the old traditions were maintained and only men who were in the Acton works in the eighties were present. The function was marked by a great display of enthusiasm. There are still a few of the old boys who are not in touch with the Society, and these are requested to communicate with Mr. H. Marryat, of 28, Hatton Garden.

The Electro-Harmonic Society.—The artists for next Friday's concert are as follows :—Vocalists—Mr. John Bardsley (tenor), and Mr. Graham Smart (bass-baritone) ; violoncello, Mr. W. H. Squire ; cornet solos, Master Shakespeare ; art humour, Mr. Ernest Mills : conjuror, Mr. Herbert J. Collings : humorous recitals and short stories, Mr. Charles Wreford ; sensation novel, Mr. Frederick Upton ; sketches at the piano, Mr. Harrison Hill. Mr. R. Kaye Gray will be the chairman. The list of dates for the season's concerts is given on page 591 of this issue.

Sewer Gas as a Motive Power.—Experiments are being carried out at the Parramatta sewage works on the utilisation of sewer gas for motive power. Gas is taken from the septic tank to a 2-H.P. gas engine coupled to a dynamo and used for illuminating the grounds. The quantity of gas generated per cb. ft. of sewage has not yet been ascertained with any degree of certainty, but there is no doubt that it is much superior to coal gas in point of cleanliness. Tests are also being made to ascertain the average calorific value of the gas. There seem to be commercial possibilities in the scheme and undoubted advantages from the health point of view, as it is obviously better to consume the gas than to allow it to escape into the atmosphere as is done at present.

Fatality. — A fatal accident occurred on Monday afternoon at Makin's paper mills, Disley, near Stockport. H. Viggars (18) was employed in fitting up electric light cables, and was threading one of the cables through the wall ; it is surmised that the wire was caught by the rotating machinery, and Viggars was dragged with the cable. Hearing a cry a man named

Simpson stopped the engine, and rushing to the spot found the deceased's foot, leg and arm torn off, and his head terribly mutilated. He died in a few minutes. Deceased was employed by a Manchester firm of electricians.

A Wireless Ship Compass.—A wireless compass is reported to have been devised by MM. Bellini and Tosi, Italian officers, and is shortly to be tested as to its ability to indicate the exact position of a ship travelling in time of fog. For this purpose special wireless signals will be transmitted from various parts of the French coast to ships equipped with the apparatus. Each of the signals from the different stations will be arranged in a different tune; and as the different tunes correspond with the letters of the alphabet, it is claimed that it is impossible to mistake the signals from one station for those from another. When set to receive a wireless signal the compass indicates automatically by a pointer the direction from which the signal emanates, so that the man at the compass is able, notwithstanding the thickest fog, to determine exactly the direction and situation of the various stations, and is consequently able to calculate where the ship is situated.

Appointments Vacant.—Assistant telegraph superintendent for the Great Indian Peninsula Railway (Rs. 500 per month): mechanical superintendent for the West Ham Corporation Electricity Works: station engineer and engineman for the Bradford Technical College extension: mains superintendent for the Perth Corporation Electricity Department; switchboard attendant for the Erith Council Electricity Department; assistant station superintendent for the Yorkshire Electric Power Co. (£156). See our advertisement pages to-day.

Institution and Lecture Notes.—Battersea Polytechnic.—The first of a special course of lectures on "Illuminating Engineering," by specialists, is to be delivered on Tuesday next, October 17th.

The Association of Engineers-in-Charge.—On Wednesday evening at St. Bride's Institute, E.C., Mr. W. H. Maw delivered his presidential address to the members of this Association.

Inquiry.—A correspondent inquires for the maker of the Sinclair insulator, labelled "The Only Way, G. & G."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Winchester T.C. has appointed Mr. R. Ayton as resident operating engineer at the electricity works.

On September 29th, at the Ilford Council Electricity Works, Mr. John A. Vice, engineer-in-charge, was presented by the staff with a silver cigarette case on his leaving to take up a similar position with the Lancashire Electric Power Co. at their Radcliffe power house.

Mr. Robert W. Willis, of Perth, has been appointed chief assistant electrical engineer to the Swindon Corporation.

The salary of Mr. H. P. Stokes, borough electrical engineer and tramways manager of the Ilkeston Corporation Tramways, has been increased by £15 per annum.

Mr. Mackenzie, the mechanical superintendent at West Ham generating station, has sent in his resignation.

In submitting the accounts of the electricity undertaking, the Battersea Electricity Committee drew the attention of the Council to the very satisfactory progress made during the year 1910-11 (the net profit advanced from £1,206 to £3,500), which it was of opinion was largely due to the services rendered by Mr. F. A. Bond, the electrical engineer. The Committee unanimously recommended that his salary be increased from £600 to £650 per annum, and this recommendation has been adopted by the Council.

Mr. Alex. C. Cramb, borough electrical engineer of Croydon, was married, on the 5th inst., to Miss Maud M. Hillier, daughter of Alderman T. Hillier, a member of the Croydon Corporation since 1883. The ceremony was attended by the Mayor and Mayoress (Alderman and Mrs. Trumble), Alderman D. B. Miller (chairman of the Lighting and Electricity Committee), the town clerk and many members of the Council and chief officials. A few days previously, Mr. Cramb received, at the hands of Mr. Burr (deputy electrical engineer), an inscribed silver salver from the staff of the electricity works. The Lighting and Electricity Committee presented a silver tea service, and the chief Corporation offices a case of table cutlery.

Mr. Lionel Andrew has resigned the position of chief assistant electrical engineer to the Stoke Newington B.C., which he has occupied for the past five years, in order to take up the post of managing director of the Coupé Co., London, who are supplying London with 6d. a mile taxicabs for private hire. Prior to his Stoke Newington appointment, Mr. Andrew was for two years shift engineer at the Fulham electricity works.

General.—The Winchester T.C. has appointed Messrs. Merz & McLellan, of Westminster, as consulting engineers to the electricity undertaking for five years.

The secretaryship of the Junior Institution of Engineers, rendered vacant by the resignation of Mr. Walter T. Dunn, after so lengthy a period of splendid service, has been filled by the appointment of Mr. A. Clifford Swales, engineering assistant to the city engineer of Leeds. Mr. Swales served two years of his articles under the late Mr. Thos. Hewson, city and waterworks engineer, of Leeds, completing his term under Mr. W. T. Lancashire, city engineer of Leeds. Apart from his experience in the city office, Mr. Swales was for some time engaged on the new Leighton Reservoir for the Leeds Corporation, at Masham, the holding capacity of which will be 1,136,000,000 gallons. He was for four years honorary secretary of the Yorkshire Association of the Institution of Civil Engineers, and was last year awarded a "Miller Prize" by the Institution of Civil Engineers for his thesis on "Cement and Concrete."

Mr. A. B. Mallinson has severed his connection with Messrs. Mather & Platt, Ltd., and joined the firm of Mallinson and Eckersley, Ltd., at Albert Saw Mills, Worsley Street, New Bailey Street, Salford. It is his intention also to continue (in a consulting capacity) his engineering work, making a speciality of the application of electricity to works of all descriptions, particularly textile mills, paper mills and collieries. Mr. Mallinson's connection with Messrs. Mather & Platt, Ltd., where he was joint manager of the electrical department, extended over a period of 14 years.

Mr. R. Borlase Matthews, Wh.Ex., informs us that he is relinquishing his present work as a consulting engineer, to become manager to Messrs. Ozonair, Ltd., 96, Victoria Street, Westminster, S.W.

Mr. Albert Vaux, of Clyde Engineering Works, Buitengracht Street, Cape Town, left on Saturday last by the *Edinburgh Castle* on his return to the Cape.

NEW COMPANIES REGISTERED.

Patent Brake Blocks, Ltd. (117,962).—This company was registered on October 6th, with a capital of £10,000 in £1 shares, to take over the business of Jones & Co., engineers, Padeswood, near Mold, and to purchase and place on the market a speciality in railway and tramway brake blocks, cast-iron chilled wheels, &c. The subscribers (with one share each) are:—G. C. Taylor, Ravenswear, Helsby, Chester, engineer; J. T. Morgans, The Mount, Mold, Flint, tinplate manufacturer; J. Owens, 20, Old Bank Buildings, Chester, accountant; W. Taylor, Padeswood, Flint, engineer; J. W. Taylor, Padeswood, Flint, engineer; C. O. Taylor, Padeswood, Flint, engineer; G. Beckett, 4, Old Wrexham Road, Chester, clerk. Minimum cash subscription £2,500. The number of directors is not to be less than three or more than five; the first are G. C. Taylor, J. T. Morgans and J. Owens; qualification, £200. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

Italian Concessions Syndicate, Ltd. (117,882).—This company was registered on October 2nd, with a capital of £5,000 in 4,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each, to acquire and deal in options, concessions or rights in connection with railways, tramways, electric power, land, buildings, factories, workshops and any real or personal property in Italy or elsewhere, and to adopt an agreement with Michael Palmer & Co., Ltd. The subscribers (with one preference share each) are:—J. A. Moir, "Craigleith," Hadley Road, New Barnet, secretary; F. A. Wallace, 16, Finsbury Road, Wood Green, N., accountant. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office, 3, Warwick Court, Holborn, W.C.

Scholey & Co., Ltd. (117,945).—This company was registered on October 5th, with a capital of £21,000 in 20,000 cumulative preference shares of £1 each and 20,000 ordinary shares of 1s. each, to carry on the business of manufacturers of and dealers in railway and tramway appliances, rolling stock, engines and machinery of all kinds, founders, electricians, railway and tramway contractors, &c., and to adopt an agreement with H. Scholey. The subscribers (with one preference share each) are:—F. S. Clark, 85, Gresham Street, E.C., solicitor; Catherine George, 85, Gresham Street, E.C., secretary. Private company. Table "A" mainly applies. Registered office, 151, Queen Victoria Street, E.C.

CITY NOTES.

The B.E.T. Proposed Rearrangement of Capital.

It is now announced that an extraordinary general meeting of the B.E.T. Co. will be held on the 17th inst. for the purpose of considering the scheme which was fully described in our issue of August 11th, as well as a memorandum by Mr. Garcke, which has been issued to the shareholders, commenting upon the alleged equity of the capital reconstruction scheme in general, and upon the disparity of profits in relation to the paid-up capital, perhaps, in particular. He attributes the latter to inadequate fares; but such an attribution or declaration is by no means a new feature of Mr. Garcke's views on the subject. Tramway service is cheap: but that is not the real reason of the present position of the B.E.T.

The transcending question of depreciation of assets is a matter which is usually inseparable from any scheme of rearrangement of capital. That there has been a very large depreciation of the paper assets of the B.E.T. seems to be undoubted; but Mr. Garcke states that the problem which arises therefrom can be discussed

better after the shareholders have dealt with the scheme under review, which is an assertion without reason, advanced with the hope of giving life to the somewhat ponderous and complicated scheme which has been formulated, and in which the shareholders are requested to concur at the meeting convened for the 17th inst.

This question of the values of assets should be carefully considered from every aspect before any scheme is submitted to the shareholders, and Mr. Garcke would, we think, be well advised to take a representative number of the preference and ordinary shareholders into the confidence of the directors before proceeding further with a scheme which has merited much dissatisfaction.

In our opinion, if the scheme be passed, the deferred shares are not likely to exceed scrap paper price, whilst the preferred ordinaries must wait long and patiently for the appearance of any sign of practical value.

Since writing the foregoing, our attention has been directed to a circular which has been issued to the shareholders of the B.E.T., signed on behalf of the Anglo-American Debenture Corporation, the Gas, Water and General Investment Trust, the Municipal Trust Co. and others, protesting against the adoption of Mr. Garcke's scheme. This circular seems to confirm the views to which we have just given expression, as well as those enunciated in our article on August 11th.

British Thomson-Houston Co., Ltd.

THE directors' report covering a period of 12 months from April 1st, 1910, to March 31st, 1911, reads as follows :—

Works at Rugby.—The buildings and machinery of the company have been maintained in first-class condition during the year. In last year's report it was stated that an extension to the main factory was then approaching completion, this extension being necessary to take care of the increase in the turbine business of the company ; also that another building was being enlarged. Both of these improvements have been completed during the year, and further extensions are under construction, the most important being a four-floor building to be utilised as a winding department, and a three-floor extension to the iron foundry. Other important extensions are now being considered in connection with the growth of the company's business. Notwithstanding the additional facilities the shops are full of work, and this should make a marked improvement in the company's progress. Up to November last the orders secured were below in value those secured during the corresponding period in the previous financial year, but soon thereafter they began to increase, and at the closing of the books on March 31st were largely in excess of those booked during the previous year, though this came too late to affect the present balance-sheet. This satisfactory rate of increase has continued during the current year.

Curtis Steam Turbines.—The turbine business of the company continues to show satisfactory results, and the largest number of turbines that the company has ever had on order are now in course of construction.

Metallic-Filament Lamps.—During the year ending March 31st the company expended a large amount in advertising the "Mazda" lamp. This has been justified by the rapid expansion of lamp sales. Here again, however, the expansion came too late to affect the present balance-sheet, although the expenditure was made during the financial year under review. As has been announced in the Press, a marked and most important advance has been made in lamp manufacture ; the company has secured the patents and processes for making pure drawn tungsten wire which is used for filaments, and replaces the old pressed tungsten filaments ; the new form of lamp being stronger during all stages of its life than any other tungsten lamp manufactured. In order to take care of the increasing lamp business, the company has acquired premises in Upper Thames Street (adjacent to Queen Street) and near the present offices, which new premises will be known as "Mazda House," and devoted to the sale of lamps and wiring supplies. At Manchester a similar step has been taken, with the same object in view.

Debenture Redemption.—Under the terms of the trust deed securing the issue of the company's debentures, the company had to pay to the trustees on February 28th last £3,339 to be applied by them in purchasing debentures in the market. Prior to the closing of the books, debentures of the par value of £3,339 were purchased, making the total par value of debentures retired to date £13,760. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, depreciation of shares held by the company, and other contingencies.

The balance-sheet shows a profit of £6,374 as the result of the year's working, after paying interest on debentures and loans, which the directors recommend should be appropriated as shown in the profit and loss account and balance-sheet. To depreciation of office furniture and store-room equipments, £628 ; to depreciation of apparatus, meters, supplies, &c., £5,343, leaving a balance of £403, which together with the previous year's balance makes a total amount to be carried forward of £3,002. The directors have decided hereafter, beginning with the current year, to close the books on December 31st instead of March 31st, so that the next balance-sheet will cover the company's operations for a period of nine months only. The retiring directors are Messrs. G. Franklin, J. F. Nauheim and E. Thurnauer, who, being eligible, offer themselves for re-election. The directors have thought it in the best interests of the company to elect Messrs. W. C. Lusk, manager of the company's export department, and H. N. Sporborg, chief engineer at the Rugby works, to seats on the board, and the shareholders will be asked to ratify their election.

Willans & Robinson, Ltd.

THE half-yearly meeting was held on Tuesday at the Cannon Street Hotel, E.C., Mr. J. C. Peache, M.I.C.E., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 577), said he wished first to refer to the recent lawsuit, which had been concluded at such a heavy cost to the company. At the time of the meeting in April last, the case was still in progress, and although it was briefly alluded to at that and at previous meetings, it would have been injudicious to enter into a discussion on the merits of the case, and, indeed, the law imposed strict limits as to the comments on a case *sub judice*. Those reasons for reticence were now removed, and the shareholders were entitled to receive a full explanation of the causes leading up to this heavy loss. The case arose out of contracts carried out by the Queen's Ferry works during the years 1907-8. A heavy claim for damages was made on account of alleged defective work. Repeated efforts were made to effect a settlement, but on each occasion the claims put forward were so much in excess of the merits of the case, that no reasonable settlement could be arrived at. When Mr. Mark Robinson, owing to ill-health, had suddenly to resign the chairmanship of the company in April, 1909, there were left outstanding three cases of dispute, in each of which legal proceedings against the company were pending. These he (the chairman) had to deal with, amongst a mass of other work, and though he succeeded in effecting a settlement of two out of three of these cases, both of which were of quite as serious a character as the case which, unfortunately, went to trial, all his efforts to arrive at a reasonable settlement of the latter case were unavailing. So lately as last September Mr. Anderson and himself made a final attempt to settle this case, and on that occasion offered exactly double the sum their legal advisers fixed as the limit of what it was wise to offer. Even then there was a hopelessly wide gap between the sum offered by them and that which the other side were willing to accept. It was easy to be wise after the event, and to see now that it would have been better to have paid the full sum demanded rather than let the case continue. That course, however, did not appear justifiable at the time, and in allowing the case to go on the board were acting in accordance with the unhesitating advice of their legal advisers. The whole of the £19,656 shown as outstanding at June 30th had since that date been paid, and, so far, it had not been found necessary to exercise the borrowing powers recently entrusted to the directors. There were certain features about this matter that the shareholders would do well to bear in mind. In the first place, it was not the outcome of any recent half-year, nor was it the outcome of the Rugby business. It had now been completely paid for and settled, and with it, the liabilities arising out of the Queen's Ferry business were at an end. The history of the company since 1904 had been marked by an almost continuous clearing off of old liabilities. That chapter was now closed, and even if at the present moment, there were no very evident signs of returning prosperity, yet the Rugby business at any rate now stood on its own merits. The Queen's Ferry works were still standing unoccupied and unsold. There were still several parties who had the purchase of these works under consideration, but he regretted there was nothing of a definite nature to report. Since the close of the half-year, the Thames Ditton works had been sold. The sum realised for them was less than that at which they stood in the balance-sheet. This was largely due to the great depreciation which had taken place in industrial property in this country in recent years, but it was considered advisable to accept the opportunity of effecting a sale rather than let it pass. Passing to the consideration of the result of the half-year's working at Rugby, the directors regretted that they had to report a loss for the half-year of £7,692. It was due entirely to the continued low scale of prices prevailing in the class of business in which the company was concerned. The general volume of such business was insufficient to fully occupy the whole of the manufacturers, and consequently there continued to be keen competition, and an unremunerative level of prices. Under Mr. Davenport's *régime*, some further economies had been effected. The full result of these was not shown in the figures for the past half-year, but would materialise in the accounts for subsequent half-years. The study of economy would continue to have the close attention of the board, but it would be misleading to suggest that any considerable further savings could be made. Orders must be obtained, and the work must be properly executed, and to achieve these objects, it was essential that a sufficient and highly-trained staff be maintained ; while rates, taxes, insurance and other items of that nature had a constant tendency to increase. It was to the furthering of the company's business that the energies of the managing director and staff were chiefly directed. Taking some of the principal figures on the balance-sheet on the asset side, it would be seen that substantial amounts had been written off development account and Diesel engine suspense account, and both of these items stood at materially lower figures than for the previous half-year. Debtor balances (£91,948) stood at much the same figure as for the previous half-year. The large amount of the outstanding debts was frequently the subject of comment from shareholders. As explained on several previous occasions, the business of the company lay largely with municipal and other public bodies whose custom was to spread payments over some l

ths after delivery. Nearly the whole of the items posing this sum of £91,948 were for goods sup- l to sound and reliable concerns of this description. total of cash in hand and investments, which should be con- ed together, showed no change from the previous six months' unts. On the liability side of the balance-sheet the amount to creditors showed an increase. This was almost entirely unted for by the indebtedness regarding the Queen's Ferry uit not discharged at June 30th, but since that date fully paid In considering this loss of between £7,000 and £8,000, it ld be borne in mind that it was the practice of the company rite off depreciation against the profit and loss account in tion to charging a further considerable sum for somewhat lar items direct against cost of production, and therefore not rately shown on the profit and loss account. The loss shown, efore, was to a great extent a book loss, and only to a small nt an actual cash loss, and although unsatisfactory, was not of ture to make any serious drain on the assets of the company. loss shown was less than that of either of the previous three years, and although there was no very evident sign of rning prosperity, yet there was some reason to hope that the er had at last been turned, and progress in future might not ownward but upward.

R. F. R. Davenport, the managing director, in seconding the ution, said he regretted to say that the infliction of low prices ieir particular trades remained as severe as ever, due primarily, urse, to the usual laws of supply and demand, and it was hard e any early improvement in that quarter. To illustrate this, ight say that an order was recently placed at about £4,000 for t similar to what some three years ago they obtained £9,000 for, rket difference of over 50 per cent. Financially speaking, the s they had been passing through had naturally been anxious but it was certainly gratifying that notwithstanding the y drains on their resources, due to trouble of past days, they never yet had to overdraw their banking account, or have irse to those borrowing powers which the shareholders tioned shortly after he joined the board, and which latter served good cash reserve. As one or two of their principal share- ers had well said at previous meetings, it was fruitless belittling enterprise at a time like this, and contrary to the true interests e company. He would like to endorse this, and remind share- ers that tempting as it was to all of them to criticise past ts, what they wanted, both as their fellow shareholders and tors, was the cordial support of their efforts to bring the con- into smoother water again. Signs were not wanting that even ig their rival competitors a spirit of friendly co-operation ed, and he was not without hope that results beneficial to all erned in this branch of engineering might yet mature. It seemed g also to make a passing reference to the prevailing labour st from which they at Rugby had not been entirely free. e threatened strikes in their own and kindred trades were far- ing in their effect, and reacted inevitably on the workers iselves, for the simple reason that they not only delayed pro- ive work, but operated against the spread of capital in the shape esh orders. This would appeal to them as shareholders, and, oped, would be better understood by the workers themselves as went on. The ground was now much cleared for their future ts, since, as the chairman had told them, they were at last rid ie many legal worries and embarrassments that had hung about company's path. They had at the present time in hand their share of what business was available, and that from the best of client, which indicated that the work they attempted to nglish was both appreciated and trustworthy. Every possible omy, both in production and organisation, continued to be ht after, and these should slowly but surely have good effect. r business friends and clients were entrusting them with large important work, and they felt confident that they could justify doing so. As an indication of their confidence, he might say their orders during the last three months showed a distinctly oving tendency.

ie report was adopted.

R. Dean proposed a vote of thanks to the chairman, directors staff.

L. Plunkett, in seconding the vote, said he thought it ought put on record that that was the first time for some years that report had been adopted unanimously and without any criticism. thought from what the chairman and Mr. Davenport had told that it was evident the company had got over the worst of ifficulties, and that although the rise at present was small and , it seemed to be sure, and it gave them every justification for ing forward to more prosperous times.

ie vote was carried with acclamation, and acknowledged by the rman.

German Electrical Companies.

Berlin Elektromobil Droschken Gesellschaft (Electric Cab which decided to go into liquidation some time ago, reports as the creditors have agreed to a reduction of £94,000 in the unt of their claims, the creditors' accounts now stand at only 000. At the recent meeting it was stated that it had been difficult to ascertain the value of the assets, including landed e in Halensee, buildings in Chausseestrasse, fleet of cabs, eries, &c. For weeks it had not been possible to obtain a single . The circle of interested parties was very small, and the few ons concerned sought to secure for themselves the most advan- ous prices by causing delays as long as possible. An agree- t had been reached with all the creditors, and the liquidators ess the hope that the liquidation will be brought to an end in a year.

The liquidator of the E. H. Geist Elektrizitats Gesellschaft, of Cologne-Zolestock, at the recent general meeting, announced that since the end of June the banking credit had increased, and the old banking debt had been reduced, thus showing that the situation had considerably improved. It had not been possible to sell the works in operation, and it was not to be assumed that success would be obtained in that direction. If the works were stopped the company would have no receipts, but would probably have large expenses for improvements, interest charges, increasing charges for redemption of loan, &c. An offer had been made to take over the works at a rental for a year certain, and the meeting authorised th liquidator to enter into an agreement for the purpose.

The report of the directors of the Kabelwerk Ryeydt, which deals with the financial year ended with June 30th, 1911, states that in general the company was not sufficiently employed. The sale prices for conducting material remained depressed, more so than the fall in raw materials, whilst at the same time, the large customers continued to hold back in the placing of orders. The accounts show profits of £39,600 on manufacturing, as compared with £38,800 in 1909-10. After meeting general expenses and providing £11,000 for depreciation, as against £10,000 in the preceding year, the balance-sheet exhibits a loss of £1,400, as contrasted with profits of £530 in 1909-10, on an ordinary share capital of £250,000. It is, therefore, again impossible to pay any dividend. The report adds that employment is normal at present, and by means of improvements in equipment a favourable result is expected for the current year.

Llanelly Electric Lighting and Traction Co., Ltd.

The fourth annual meeting took place on September 25th at 22A, Cannon Street, E.C., Mr. A. R. Holland presiding. The profit and loss account showed a credit balance of £57, which it was proposed to carry forward. The capital had been increased during the year to provide for improvements. The directors felt justified in paying an interim dividend on the preference shares for the half-year to June 30th. An issue of £50,000 5 per cent. debentures had been made in August, and in order to provide for increasing the plant at the power station they recommended that the nominal capital of the company be increased.

The Chairman said that the promise of success had been more than fulfilled. He attributed this fortunate condition to the skill and ability shown by the contractors and managers, Messrs. Balfour, Beatty & Co., Ltd. The whole of the streets of Llanelly were entirely lighted by electricity several days before the time provided for in the agreement, namely, the end of December last. The present machinery at the power station was already overloaded. Though an adequate amount of machinery had been provided, the growth had been so rapid that the directors thought it their duty to consider the extension of the plant.

At an extraordinary general meeting subsequently held it was decided to increase the capital by further 15,000 preference shares and 15,000 ordinary shares.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

British Columbia Electric Railway Co., Ltd.—Further issue of £600,000 4½ per cent. perpetual consolidated debenture stock.

The Committee have ordered the undermentioned securities to be quoted in the Official List :—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 40,370 5 per cent. cumulative preference shares of £5 each, fully-paid (Nos. 120,001 to 160,370).

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 7,761 to 7,910 and 8,111 to 8,160.

Anglo-American Telegraph Co., Ltd.—The resolutions passed at the meeting held on September 29th are to be submitted to an extraordinary general meeting on Monday, October 16th, for confirmation as special resolutions.

Oriental Telephone & Electric Co., Ltd.—The directors have declared the following interim dividends: 3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax and 3 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on 31st inst. The share transfer books will be closed from 12th to 25th inst.

Parsons Marine Steam Turbine Co.—The directors' report for the year ended June 30th, recommends a dividend at the rate of 10 per cent. per annum, tax free, of which an interim dividend of 5 per cent. for the six months to December 31st has been paid, and also a bonus of 2½ per cent., tax free, carrying forward £17,509.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year ending June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st. The transfer books will be closed from 18th to 31st inst.

Canada.—The Barcelona Traction, Light and Power Co., capitalised at $40,000,000, divided into 400,000 shares of $100 each, has received a Dominion charter giving it power to develop and sell electrical energy. The head office is at Toronto.

The Mexican (Midland) Light and Power Co., with a capital of $15,000,000. has received an Ontario charter giving the company power to carry on the business, outside Canada, of electric light, heat and power supply. These two big institutions will deal in foreign enterprises largely.

MARKET QUOTATIONS.

Wednesday, October 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£10 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c ,, Tube (brazed)	,,	9d.	..
c ,, ,, (solid drawn)	,,	7¾d.	..
c ,, Wire, basis	,,	6¾d.	¼d. dec.
c Copper Tubes (brazed)	,,	9¾d.	..
c ,, ,, (solid drawn)	,,	8¾d.	..
g ,, Bars (best selected)	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars	,,	£57 10	..
e ,, ,, Sheets	,,	£73 10	..
e ,, ,, Rods	,,	£60 10	..
e ,, ,, H.C. Wire	per lb.	7⅝d.	..
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	5/- to 7/-	..
h India-rubber, Para fine	,,	4/5½	4d. dec.
j Iron Pig (Cleveland warrants)	per ton	46/1½	7½d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£15 10	5s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	2/6 dec.
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£192 to £193	£10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/1	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£33	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

The course of the Stock Exchange markets is still sufficiently chequered to cause proprietors a certain amount of uneasiness in regard to their holdings in securities which are at all speculative. Although the political disturbances are supposed to be in the way of progress towards settlement, and though the singular Italian-Turkish war is declared to be no menace to the peace of Europe at large, anxiety and restlessness are prevalent in other directions. There can be no doubt that the fall of the past three months has caused grave inconvenience to capitalists large and small, and every other day brings its cloud of rumours telling of financial difficulties in various important quarters.

British Railway stocks are at the mercy of every seller who comes along, and the market is very backboneless. With the off-chance of a miners' strike, combined with the uncertainties respecting the findings of the Railway Commission, there is little disposition on the part of investors to open out fresh purchases. Moreover, traffics are none too good, and in spite of the strike decreases becoming gradually wiped out, there is not sufficient brightness in the situation to encourage speculation on the bull tack.

The Brighton Company's stock has been more particularl attacked during the past few days, having fallen to 93. Th price, it should be noticed, includes the full dividend in respec of the current year, which will become payable next January, an which is not likely to be less than 5 per cent., to be on the saf side. Even this prospect, however, does little to steady th market. Undergrounds have weakened with the steam stock Metropolitans and Districts both showing small losses. District were bid for at one time on the renewed attention directed t the stock on account of the publicity afforded to the opening o the moving platform, at Earl's Court, between the District Compan and the Piccadilly Railway. The price, however, on balanc shows ¼ fall, and the 6 per cent. Debenture stock fell a point to 14 The Central London and City and South London groups show n change, although the market in them—and more especially in th former—is a very tender one. Central London New 4½ per cen Preference stock, for which it may be recalled there was tremendous rush at the time it was offered, is quiet at 85 for th scrip, £75 paid, and there is a fair amount of business being don in it.

The feature in the Home Traction department is the big rise i British Electric Traction shares of both kinds. That thes advances should occur so shortly before a meeting at which th directors' scheme will be severely criticised is somewhat remark able, and rather suggests that one party or the other is endeavour ing to get hold of a line of shares, possibly for voting purpose Other Home Traction issues are mostly unchanged. Metropolita Electric Tramways Ordinary, however, eased off ½, although th company's 4½ per cent. Debenture put on a point, and Londo United Tramways Debenture went back to the same extent. Soutl Metropolitan Preference at 15s. are a good feature.

English Electricity Supply shares continue to droop, and fall are recorded in Bournemouth Second Preference, Charing Cros Preference, and Westminster Ordinary. The Preference shares o the last-named company are a trifle higher at 5½. The company extension of its works is proceeding apace, and it is thought tha completion will be reached somewhere about next June or July The company is doing most of the work itself, and is, of course spending a lot of money on the extension. Newcastle-on-Tyn shares at 4¼ are ⅛ higher, being the only issue in this section t show any improvement on the week. Amongst the prior-charg stocks Urban Debenture at 87½ is a point higher.

In the Telegraph market the principal feature has been a fresl outbreak of excitement in Marconi shares. On one day they wer whirled up from 44s. to 47s. 6d. bid, reverting later to 46s. 6d Most of the buying continues to come from Dublin. The Anglo American trio is unchanged, with the exception of ⅛ loss on th Deferred, reducing the price to 24¾. Great Northern is are a littl easier, and Globe Telegraph Ordinary drooped to 10¾, thus losing most of the improvement registered last week. West India an Panama shares are 1/16 higher.

The Stock Exchange learned with much regret of the death o Mr. William Seal, one of the oldest dealers in telegraph and tele phone shares. Mr. Seal had been a member of the House for 3 years, his membership dating back to 1876. It was partly due t his efforts, and to those of his firm, that this market, as a channe for investment, was kept prominently before the House.

National Telephone Deferred remains very firm, and there is good deal of business going on in the stock at between 119 and 12 though, with the public so shy of operating, speculation is checke by the general uncertainties prevailing elsewhere. New Yor Telephone Bonds are ¼ down to 103¼.

Mexican Light and Power Common, Preference and Bonds hav improved on the ready way in which the new President has been accepted, Monterey bonds rising a point for the same reason, and although reports are afloat as to some revolutionary raids in one o the provinces, the Stock Exchange treats this latter lightly. Mexico Tramway bonds of both classes are higher, although the company's Common shares are a point down. Rio Trams rose ¾ to 117¾. This company's 5 per cent. bonds appear to be the best secured in the Latin-Canadian division. They have a huge amount of ordinary capital and mortgage bonds behind them, on which dividends and interest are regularly met, and from the point of view of safety, the company's first mortgage bonds are probably, as we have just observed, the best in this section.

Madras Ordinary shares rose ¼, and there is more disposition to buy Indian shares in view of the probable stimulus to business that will be given to all the big Indian cities in connection with the Durbar celebrations. Calcutta Trams rose ⅛, but the Lighting shares are unaltered. British Columbia Deferred is up 1½, the Preferred Ordinary rose 1, and the 5 per cent. Preference ½, there being a steady demand for the company's stocks. Sao Paulo is also a very good market, with a rise of 4½ points. The shares have, of course, reached a price at which movements are almost necessarily large, because it takes so little buying or selling to affect the quotation substantially. Shawinigan Water Capital rose 2. West Kootenay Gold Bonds are again ½ up, and Montreal Light, Heat and Power gained 3. Northern Light and Power bonds are flat at 35.

Amongst manufacturing shares, the principal alteration is a rise of 5s. in General Electric Preference, which are being quietly bought in consequence of the success that is attending the sale of the company's metal-filament lamps. Willans & Robinson's Preference fell a similar amount, some of the holders trying to realise on account of the lamentable report upon which we commented last week. Castner-Kellner regained their slip-back, and the Debenture stock is 1 higher. The Electrical Exhibition at Olympia has had practically no effect upon the market, although the members who have attended it agree that the show is not only interesting, but very educational.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	7¼ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅛ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	7⅞ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 7⅞	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5	3⅝ — 4½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	— 3/16	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	3⅝ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12¼	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 8
County of London, Ord.	10	5	5	7⅜ — 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100⅛ —103⅛	..	4 7 0
Edmundson's, Ord.	5	Nil	Nil	½ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	5½	6	4⅛ — 5 xd	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛ xd	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	8½	9	6⅞ — 7⅜	..	6 2 0
Kensington & Knightsbridge, Ord	5	8	9	6⅜ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅛ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7½	6 — 6⅛	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 8½ % Deb.	100	8½	8½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98 xd	..	4 11 10
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½ xd	+1	5 1 8
Westminster, Ord.	5	10	10	7⅜ — 7⅞	— ⅛	6 7 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	+ ⅛	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	106 —109 xd	+1½	6 8 5
Do. 7 % Pref.	$100	7	7	118 —122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	92 — 95 xd	..	5 5 3
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86 — 88	+ ½	5 13 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	13/32 — 15/32	..	8 6 8
Kaministiquia Power, 5% G. Bs.	$500	5	5	101⅞—103½	..	4 16 7
Madras, Ord.	5	Nil	..	2⅝ — 3⅛	+ ¼	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4	86 — 88	+ ½	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+ ½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	+ ½	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	+1	5 8 8
Montreal, Lt., H. and Power	$100	6	7	170 —175	+3	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	34 — 56	—2	13 17 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	..	4 9 1
Shawinigan Water, Capital	$100	4	4	117 —119	+2	3 7 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	106 —108	+ ½	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7¼ — 7¾	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8	136 —138 xd	—1	5 15 11
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3⅜	3⅜	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111½—112½	..	5 6 8
Do. Def.	Do.	25/-	30/-	24½ — 25	— ⅛	6 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Cbili Telephone	5	8	7	6 15/16 — 7 31/32	..	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86½ — 88½ xd	..	4 10 5
Cuba Telegraph	10	6	6	10½ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanisb Telegrapb, Ord.	5	4	4	3⅜ — 4 xd	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8½ xd	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4¼	4¼	7¾ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½—101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 8½ % Pref. Stock	Do.	8½	8½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102½—104½	..	3 16 7
Eastern Extension	10	7	7	13⅜ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	100⅜—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegrapb and Trust	10	5⅞	5⅞	10½ — 11 xd	— ⅛	5 6 10
Do. 6 % Pref.	10	6	6	12⅞ — 13⅜	..	4 9 9
Great Northern Telegrapb	10	18	18	30¼ — 31½	— ¼	5 18 5
Indo-European Telegraph	25	13	13	56⅜ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	83 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	74 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	Nil	Nil	2¼ — 2⅜	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	29/32 — 31/32	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	118 —121	..	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 10⅛	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	95 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102⅜—103⅝	— ¼	4 6 9
Oriental Telep. and Elec.	1	8	8	1 1/16 — 1 1/16	..	4 14 10
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 1/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and Europcan Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5	9 — 9½ xd	..	4 4 3
Submarine Cables Trust	Cert.	6	6	133 —136	..	4 8 3
Telepbone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 7/16 — 7 7/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5½ — 5⅝	..	4 10 11
West Coast of Amcrica	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2 1/16 — 2 1/16	— 1/16	2 11 1
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅜ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13¼ — 13⅞	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	..	3 12
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otberwise stated, all shares aro fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 10th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1/4 — 3/8	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	77 — 81 xd	..	5 11 1
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 3/8 — 1 3/4	+ 1/16	Nil
Do. 6 % Pref.	10	3	1½	3 7/8 — 4 1/4	+ 3/8	3 10 7
Do. 5 % Deb.	100	5	5	90 — 93 xd	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1⅜	1½	28½ — 29½	..	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	3/8 — 7/16 xd	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3 — 3⅛	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	—1	5 6 8
Metropolitan Railway Consol.	100	1	1⅜	41 — 41½	— ¼	3 6 3
Do. Surplus Lands	100	2⅜	2⅜	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	88 — 90	—1	3 17 9
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	21¼ — 21⅞	— ¼	Nil
Do. 6 % Deb.	100	6	6	144 —146	—1	4 2 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5	5½	7/8 — 1	—1/32	5 10 0
Do. Def.	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	3/4 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100—102	+1	4 8 3
Do. 5 % Deb.	100	5	5	100—102 xd	..	4 18 0
Potteries, Ord.	1	2	2	7/32 — 1/4	..	..
Do. 5 % Pref.	1	5	5	1/4 — 5/32	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	5/8 — 7/8	+ 1/4	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1⅜ — 1⅝	..	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	Nil	1	57 — 59	..	1 13 11
Do. Power House Debs.	100	..	4	100 —102 xd	..	3 18 5
Yorksbire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5½	..	4 15 3
Do. 2nd Pref.	5	5	5	4 11/16 — 4 15/16	— 1/16	5 1 3
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	+ ½	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6 5/8 — 7⅛	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	+1½	5 10 4
Do. Pref. Ord.	100	6	6	121 —125	+1	4 16 0
Do. 5 % Pref.	100	5	5	108 —111	+ ½	4 10 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4⅞	4⅞	101½—103½	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5⅝ — 6⅜	+ ⅛	4 14 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/16 — 3/32	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 9/16 — 5 13/16	..	4 12 6
Do. 4 % Deb.	100	5	5	96 — 99	+1	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½—103½	+ ½	4 16 7
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	62 — 66	—1	7 11 6
La Plata Elec. Trms, Prf,	1	6	6	23/32 — 1 1/32 xd	..	5 16 4
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7	117 —119	—1	5 17 8
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	+1	5 0 0
Do. 6 % Bonds	100	6	6	98 —100	+1	6 0 0
Para Elec. Rlys. & Lt., Ord.	5	..	10	6⅜ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Pertb (W.A.) Elec. Tr., Ord.	1	2½	2½	1 3/8 — 1 5/16	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101⅛—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅞ — 5⅞	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	1	4¼	117½—118¼	+ ¾	3 16 1
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102¼	..	4 17 10
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½ xd	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	177½—180½	+ 1½	5 10 10
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	9 5/16 — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	5	6	5⅜ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½—107½	..	4 3 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	9/16 — 11/16	..	Nil
Do. 6 % Pref.	1	12	9	7 13/16 — 8 3/16	..	7 7 8
Babcock & Wilcox	1	24	26	5½ — 5⅝ xd	..	4 10 5
Do. Pref.	1	6	6	1 3/8 — 1 5/8 xd	..	4 0 0
B.I. & Helsby Cables	5	10	10	6½ — 7¼	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westingbouse, Pref.	3	Nil	Nil	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	58 — 61	+1	6 11 2
Do. 6 % Prior Lien	100	6	6	99 —101 xd	..	5 18 10
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9¼	..	7 13 10
Do. Pref.	5	5	5	4 5/8 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3½ — 3⅝	+ 1/16	4 16 7
Do. Deb.	100	4½	4½	104 —108	+1	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10
Dick, Kerr	1	6	5	13/16 — 15/16	..	5 6 8
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	2 — 2⅛	..	Nil
Do. fully paid	5	Nil	Nil	1¾ — 2¼	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	77 — 80 xd	..	6 5 0
Electric Construction	2	Nil	Nil	1/4 — 3/4	..	6 13 4
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8¾ — 9¼	+ ⅛	5 8 1
Do. Deb.	100	4	4	86 — 91 xd	..	4 7 11
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4¾	4¾	4 13/16 — 5 1/16	..	4 5 11
Do. Deb.	100	4¾	4¾	106¾—108½	..	4 2 11
India-Rubber, G. & T.	10	10	10	13¾ — 15¼	..	6 9 0
Do. Pref.	10	5	5	9¾ — 10¾	..	4 16 5
Telegraph Construction	12	17½	20	34½ — 36½	..	6 11 7
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	1/32 — 3/32	..	Nil
Do. Pref.	5	1½	Nil	1/4 — 3/4	— ⅛	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

ELECTRICAL ACCIDENTS IN MINES.

The year 1910 will be remembered in the annals of the mining industry as one in which the number of accidents was the highest on record; for the greatest single colliery disaster that ever occurred in Great Britain, namely, that at Hulton Colliery, which caused a loss of 344 lives; and also for the introduction of the Eight Hours Act which caused strikes in the North of England, and general dissatisfaction of both owners and workmen, owing to decreased earnings and increased costs.

As regards accidents, it is with regret that we notice from the reports of the H.M. Inspectors of Mines that no fewer than 20 persons were killed and 48 injured by the use of electricity in mines. This, at first sight, appears to be serious—and, in fact, is serious—but these casualties really form a very small proportion of the total number of accidents, the majority of which are due to "falls" of side and roof. This latter type of accident will probably never be completely eliminated, and there is every reason to think that the Eight Hours Act by causing the workmen to hurry over their work has largely contributed towards the increase; but with regard to the electrical accidents, the sad part of it is that most of them might easily have been prevented had the plant been properly installed and supervised.

Year after year the Inspectors report upon the trumpery way in which electrical plant is installed, and the careless manner in which it is worked and supervised, yet little improvement appears to take place, in spite of "special rules" for the installation and maintenance of electrical plant. We have reason to think, however, that mining engineers are now beginning to recognise that electricity cannot be done without, and that it pays to install high-class machinery, and to carefully attend to it after it is installed.

In No. 1 District (Scotland) five persons were killed by shock, whilst 12 were injured underground and two persons were injured on the surface. The first fatal accident caused the death of a motor attendant. "He was seen to have hold of one of the cables in the roadway close to his motor; and though a man close by offered to pull him off, he would not allow him to do so, but sent him away to have the current switched off. This man, however, was ignorant of how to switch off, nor was there anyone in the vicinity, except the deceased, with better knowledge. Another miner, hearing of the accident, got some india-rubber gloves, and went to the scene, but by that time the man was insensible. He was removed from contact and artificial respiration was tried for two hours, but without restoring consciousness." On examination it was found the cables contained a joint, and that one of the joints was insulated, or rather covered, as it could not be *insulated* by *waterproof tape only*, and the unfortunate man had caught hold of this faulty joint, and received the fatal shock in consequence. The system in use was three-phase at 500 volts, and the supply was obtained from a neighbouring colliery. The neutral point of the generator was earthed, and the deceased, therefore, would get a shock between one phase and earth—about 290 volts. Legal proceedings were taken against the manager for failing to see that Special Rule 11 was carried out, which provides that a "competent person shall be on duty at the mine"; but, after a long hearing, the Sheriff "found the charge not proven." Such is the law!

The second accident caused the death of a putter boy, who was seated close to a switch controlling the running of a coal conveyor at the time of the accident. The system of supply was three-phase at 500 volts, the neutral point being insulated, and the current was led to a triple-pole oil switch mounted on a wooden stand and fixed some 10 to 20 yards from the coal face. Between the switch and conveyor was a coil of cable which was payed out as the conveyor motor was moved forward with the advance of the coal face. From evidence given at the inquiry, it appeared that the conveyor had been stopped for some repairs, and during this period the boy had nothing to do. He seated himself by the switch, and when the attendant went to switch on the current after an interval of about a quarter of an hour, he was found to be dead, and there was no doubt that his death was due to electric shock. A piece of wire about 12 in. long was found hooked on to the side of the switch-box, and this wire had evidently, from its appearance (small globules of metal) carried current and been fused at some time or other. On top of the switch were several rows of terminals protected by a metal cover, but *between this cover* and the *switch top* on each side was a clear space of about ½ in. × 6 in. One of these terminals showed signs of arcing, as to a small piece of wire such as that found. This evidence, coupled with the fact that the switch was tested and examined and found to be in order, suggests that the boy had been amusing himself by thrusting the wire, which was found hooked to the side of the switch, underneath the cover through the clear space until he touched a live part, and thus was responsible for his own death. After the accident, the terminals were properly covered, as they ought to have been before they were allowed to go down the pit. Not to have them so was clearly a breach of the "Special Rules," and the manager ought to have been prosecuted for the omission. No one, of course, would ever expect that a boy would poke about with a piece of wire amongst the live terminals, and one might have thought that a cover to prevent anything from falling directly on to the terminals would be sufficient. It is, however, the unexpected that always happens, and it is the unexpected actions of pit boys that must be guarded against.

The third accident resulted in the death of a roadsman, who was actually engaged on the main haulage way in repairing the damage caused by a runaway hutch at the time of the accident. This main haulage way is level for about ¼ mile from the shaft bottom, but from that point it dips 1 in 7. The roof is supported by side props, with steel girder crowns. The runaway hutch was carrying timber in-bye and was in charge of two men. They seemed, however, to have spragged it poorly, with the result that it got out of control at the top of the dip. In running down the incline it displaced some props, bringing one of the steel girders down on to the cable. The flange of the girder *cut through the insulation* of the cable to the copper core, and deceased, in attempting to lift the girder in order to clear the roadway, received a fatal shock. The girder in the position in which it fell was not touching earth: it fell with one end on the cable, and the other on a wooden sleeper, so that it was practically insulated.

Current at this colliery is obtained from a power company as three-phase current at 400 volts. The neutral point of the system is connected to earth, and, therefore, deceased would receive a 230-volt shock.

"The damaged cable was an unarmoured bitumen insulated cable. There can be no doubt whatever that the conditions are precisely those in which mechanical protection is required for cables: a roof supported by girders and a fairly steep incline, with the constantly present possibility of a hutch or set of hutches getting out of control. Both the electricians at the pit and one of the owners agreed that the use of armoured cable is desirable in such cases."

Whilst an armoured cable *might* in this case have prevented the accident, we must not forget that several armoured cables have been *cut through*, and *might* have also been cut through in this case. A safer and cheaper plan is to put the cables unarmoured in *strong* wooden boxes, which it is practically impossible to break.

In the fourth the deceased was in charge of the running of a face-conveyor, and he was actually about to switch off current from the conveyor motor at the time of the accident.

"Current at this colliery is generated as three-phase current at 440 volts. It is used at this pressure chiefly for pumping and for driving coal conveyors. Armoured cables are used. At the gate-end switch, controlling the conveyor motor south of the shaft in the coking coal seam, there was at the time of the accident a short length of armoured cable connecting up a 400-volt-100-volt transformer, current at the lower pressure being used for lighting. The deceased was heard to groan when in the act of switching off the gate-end switch, and he was then seen to have his left hand on the lighting transformer. An effort was made to pull him off, but it was not for some few minutes afterwards that he was freed by the switching off of the current at a switch in series with the gate-end switch some 20 or 30 yards away.

"Examination of the lighting transformer showed that

the cable inside the case had become bared, and there is no doubt that contact between this bared part and the transformer case was the primary cause of the accident. In the ordinary way the transformer case would be connected to earth through the armouring of the incoming cables, but this connection (through a brass gland) *must have been a very poor one at the best*, and it had failed. It is probable that deceased placed his hand on the transformer cable in approaching the gate-end switch, and that in doing so he made contact between the bared cable and the transformer case and caused the armouring, which had been very poorly secured, to slip out of the brass leading-in gland. In this way the transformer case would be made 'live.' Deceased was standing on a wet iron plate at the time of the accident, and it is probably due to this fact that the 240-volt shock he received proved fatal. The neutral-point of the generator was connected to earth.

"This case indicates the uncertainty of depending upon a gland for an earth connection. It is better not to depend only upon a gland, but to connect in addition a short length of cable to the armouring of the incoming cable and to the body of the transformer by properly designed lug connections. No stress can possibly in these circumstances be taken by the earth connections, and this is as it should be. The earth circuit is frequently regarded as of no great importance, certainly of less importance than the main circuit. It is not, however, of *less* but of *greater importance*, for if the latter fails, it merely means the shutting down of the machine, whereas if the former fails it may result in a fatal accident. The transformer gland was *evidently not designed for the purpose for which it was used*, namely, as an earth connection to the cable armouring. It was probably intended merely as an oil-tight gland for the cable."

The italics are ours, and are sufficient to indicate that there was probably no one on the colliery who *understood* what an *earth* was, let alone how to couple it up properly.

Out of 12 non-fatal accidents, Mr. Walker describes four, the first of which caused a conveyor attendant's hand to be burned by a motor fuse which he had just replaced when he was switching on the current with the fuse exposed. "He should have had the cover of the fuse-box closed before switching on the current. To prevent an accident of this kind it is desirable to make the use of boxes compulsory with which the switch cannot be opened or closed unless the box is closed."

In the second a "coal-cutting machineman received a shock owing to the frame of the coal-cutter becoming live, although it was supposed to be earthed through an old cable and haulage rope to a plate sunk at the surface. On examination of the switch and connecting boxes, it was found that the vulcanised bitumen sheet below No. 2 phase block was charred at a point where the connection passes into the switch-box. This probably accounted for the discharge of electricity to the frame of the machine, but why with the frame earthed the man received a shock is not quite clear. It is possible the wires of the old haulage rope may have been broken inside it, and thus been of no use for the purpose for which it was used. Old haulage ropes are unsatisfactory on account of their liability to breakage, and should not be used for making earth connections. The earth connection is even more important than that for the supply current, as it is a question of fatal injury if the former is not in order, whereas with the latter it is only work that is interfered with.

"In this case a galvanometer test was applied between the current-carrying parts and the frame of the machine, to locate the fault on the machine, without success. This is not surprising, as such a test is of no value. For such tests an ohmmeter, giving not less than the working voltage, and preferably rather more, should always be used for this purpose. To do as was done in this case, as Mr. Nelson very aptly said in his remarks on this accident, is 'exactly like applying a test of 2-lb. pressure to a 200-lb. pressure boiler to find a small weep of leak.' This practice is common in Scotland, and I would, therefore, draw the attention of managers to the uselessness of it.

"The use of a galvanometer to test the continuity of the earth connections is right and proper, for if the test is satisfactory with a pressure of 4 volts, there is no doubt of a current at 500 volts pressure being dispersed. To quote Mr. Nelson again, in order to bring home to all co cerned that the application of a pressure of, say, 500 vol for this purpose is useless and misleading, he says, 'applyin 500 volts to test continuity is rather like testing an eggsh for a breaking stress with a 500-lb. weight.' If the co tinuity of a conductor is broken a high voltage may jum across, and a low voltage is required to indicate such defect."

In the third an "engineman's fingers on right hand we burned when he was taking out the switch in connectio with the leakage indicator. Owing to the switch being o of single-break type, and also to the fact that he was slow taking out the switch, arcing took place between the cart terminal and the main terminal. After the accident th switch was replaced by a larger and simultaneous-brea switch of the double-break type."

The fourth resulted in the "driver of a coal cutt receiving a shock from a 500-volt D.C. supply, and his han was burned. The machine was being started for the fir time; shortly after it began the electric current failed, th man made an inspection to discover what was wrong, an found there had been fusing at a junction box. In order ensure that all was dead, he sent one of the men assistin him to the main switch to switch off, but he appears to ha gone to the switch of another section by mistake, and wh the driver was working at the box he was burned, an received a slight shock. In fixing the cable in the junctio box *the ends did not meet*. The electrician *joined them a piece of fuse wire*, and it was this wire that fused. Th driver was attempting to fix this wire when the accide occurred. The electrician was very much to blame for doin as he did, and the driver should have gone himself an switched off. Such reprehensible conduct as the form was guilty of, is the cause of accidents, and it is fortuna that the driver did not receive a fatal shock."

The italics are ours, and these may be taken as typical the minor electrical accidents in mines; as a rule, th can all be traced to bad plant or workmanship. Fancy man—anywhere else except at a colliery—joining up cable with a bit of fuse wire. No wonder there a agitations against the use of electricity by the workme when this sort of thing is allowed to go on. Why was th man not prosecuted?

Mr. Walker also reports that no fewer than five perso were killed by being caught by the cutter bar of the b coal-cutting machines when operating them at the coal fa It is very satisfactory to note, however, that the make have devised a gear which will prevent the bar revolvin when it is not under-cutting, and, further, have promis not to send out a machine in future without this gear.

There were two fatal accidents in No. 2 District (Ne castle), but, unfortunately, no particulars are given. O occurred at the surface, and was "due to the curiosity of young man in charge of a motor, who opened the switchbo without authority." The box, of course, should have be made so that he could not open it. No one could very we take off the top cover of a steam valve to see what was insi it, and colliery switches should be built on the same line The other was underground, and due to a "connectio having been accidentally made on the surface between lighting system carrying current at 250 volts and telepho wires extending into the mine." It would be interesting know how this happened.

There was only one fatal underground accident in No. (Durham) District, and as this is peculiar, we extract M Nicholson's full report.

"It occurred at Auckland Park Colliery, and resulted the death of an engineman who was braking a hauler drive by a three-phase motor of 110 H.P., which received i current at 2,400 volts through an armoured three-core cabl The controller stood upon a wood floor, and was not metallic contact with the motor casing. The motor was on in contact with the hauling gear through the wheel gearin The framework of the switchboard, the controller casing, an the frame of the motor were earthed by a copper wire attache to a copper rod embedded in damp coke breeze. When his place of work, the engineman stood upon a dry wood floo and hence, if not in contact with any metal portion of th machinery, was fairly well insulated. At his left hand had the controller handle, on his right the haulage ge

lutch lever, and at his feet a pair of foot-step brake levers. The electrician had only left the engineman some two minutes previously, and was standing ten yards distant when e heard him shout 'Oh!' as the set was landing. He at nce ran towards him, and found him lying dead on the oor. The controller handle was found, on examination, o be in the 'off' position. Repeated and careful tests ailed to disclose any fault with the plant.

"An inquest was held by Mr. Coroner Proud on February 2th. The medical evidence, obtained partly from a *post-nortem* examination and partly by eliminating other possible auses of death, favoured the idea that death was brought bout by electric shock, but this was by no means considered o be conclusive, and Messrs. Bolckow, Vaughan & Co.'s hief electrical engineer, in his evidence, stated that on xamination he had found no leakage or defect, and considered ; absolutely impossible that the deceased could have received shock.

"The jury returned the following verdict: 'Shock from lectric current whilst following his employment, but there ;as no evidence to show how he came in contact with the lectric current.'

"After the inquest, feeling that the occurrence had not een satisfactorily explained, Mr. Nelson, H.M. Electrical nspector, on the invitation of Mr. Bain, made further nvestigation, and also conducted some resistance tests of the arious paths to earth, with interesting results. If there ;as a leakage at the controller at the time the engineman ad hold of the handle and had his foot on the brake, there ;ould be two paths to earth; one by the earth wire to the arth rod, and the other through the man's body and then hrough the brake strap to the hauler. It has been ex-lained that the incoming cable was armoured. With this ound earth Mr. Nelson showed that the haulage gear brake-ever footstep was in *better connection with earth* than the netal rod, to which the motor frame and the controller asing were connected. Hence it is possible, given a leakage it the right moment, that the man did get a shock. The eakage, if any, must have been the result of *momentary rcing* to the controller casing, but it must be said that *no vidence of this was found*. Since the accident the motor rame, controller case and switchboard frame have been con-ected by stranded wire of ample section to the armouring f the cable."

The italics are ours, and we believe Dr. Thornton has conclusively proved that arcing may take place in a closed controller or switch box, *without showing any sign* of having lone so, and hence this shows the necessity of careful and substantial design to ensure that arcing cannot possibly occur. It also shows the danger attached to high-pressure current, and the necessity of getting a good earth connection to the surface. It is of no use to get a good connection to earth in the pit, if there are one or two coal seams between it and the surface, which have such a high resistance that current cannot pass.

There was also a surface fatal accident which was "due to forgetfulness on the part of the deceased, who had been employed as a fitter on the works for some months. One of his duties each morning during the breakfast hour, when the machinery was standing, was to clean out and oil the (coke oven) stamping machine. This was operated by a three-phase motor, the current at 500 volts being obtained from three bare wires by rubbing contacts. Before going to the machine it was his duty, which he had regularly performed, to switch off the current. On this particular morning he was found by the stamping machine attendant lying on his machine. On going to the switch the attendant found it was on, and after pulling it off, the deceased was removed from the machine and artificial respiration tried for 1½ hours, but when a doctor arrived he pronounced life extinct. The switch was quite in order, and it can only be surmised that on that particular occasion the deceased had omitted to put the switch off, an act of forgetfulness which cost him his life."

There must, however, have been something else wrong, as if the machinery was standing, the starting switch should have been arranged to cut off the current entirely from the machine.

(*To be continued.*)

ELECTRICITY AND THE LAY PRESS.

By H. E. GOODY.

The relations which subsist between the electrical industry and the lay Press are curiously interesting, and the man who makes only a casual study of them is well repaid by the insight which he thereby gains into the petty purposes and trifling intrigues of daily journalism.

On the journalistic side, these relations seem to be tinged with a sort of vindictive ignorance, which has done incalculable harm in the way of prejudicing electricity in the public mind. Ignorance in regard to technical detail is, of course, expected of the newspapers; but there is no excuse for their habitual inaccuracy in electrical matters of general interest.

The general public are, of course, not in a position to check the statements of the Press in this connection; and even if the average man were sufficiently versed in electro-technics to perceive journalistic errors and evasions, he would probably keep his knowledge well under control, and subdue himself to that human and mysterious instinct which impels to a child-like trust in the printed word.

It is useless for the electrical profession to attempt to keep its own end up by means of articles in the electrical papers. The general public do not read trade papers; and, in any case, the letterpress of a technical journal is not sacrosanct. It is permitted for one to disbelieve it on the ground that it is obviously biased.

If anything effective in the way of neutralising the results of newspaper inaccuracies is to be done, it must be done in the newspapers themselves. You cannot successfully combat a definite newspaper untruth with a mild protest in an electrical paper. If the *Daily Wail* unjustly lays the blame of some awful disaster on the innocent electrical installation, then the *Daily Wail* must be made to withdraw its damaging statement, or, at any rate, an article contradicting the false report should be inserted in its columns.

So far, any reference to "gas" has been rather cleverly avoided; but no doubt the intelligent reader will have seen the drift of the writer's remarks. All those sly attacks on electricity, and those skilfully-worded innuendoes which are constantly appearing in the Press, are simply one phase of the losing battle which the gas interests are waging against the electrical industry.

It would be very instructive to get at the real explanation of the recent and widespread habit of blaming electricity for all the fires which occur on premises with an electric light or power supply. This is always done, except in cases where the true cause (usually totally unconnected with electricity) is so extremely obvious that it can neither be overlooked nor suppressed. The daily paper is the worst—indeed, apart from the gas journals, the only offender, and the ordinary untechnical man who falsely accuses electricity is simply making ignorant repetition of something he has seen in his morning paper.

But if the "man in the street" is innocent of everything but ignorance, the same cannot be said for the journalists who so constantly pen the false phrase: "It is supposed that the fire was due to the fusing of an electric wire." One likely explanation of this singularly unscrupulous journalism is that the reporters who "write up" fires are influenced by the gas interests.

All the available evidence gives good ground for the surmise. And, of course, it does not necessarily mean that reporters are given direct cash payments for their services in this connection. It may be that these inaccurate paragraphs, damaging to electricity, and therefore, by implication, helpful to gas, are simply the newspapers' method of gratefully and delicately recognising the generosity of the gas companies in the distribution of advertising contracts.

There is no need to give examples of the way in which newspapers father the most unlikely fires on electricity. To members of the electrical profession, this habit has been for some time a source of irritation, and the fact that these

untrue reports have not invariably received immediate contradiction in the journals which originated them is due, not to any doubt of the reality of the grievance, but mainly to a certain diffidence and dislike to controversy, which seem inherent in those who work with such a spiritual medium as electricity.

In rare cases, of course, the newspaper man is right in tracing a disaster to electricity; but as he always guesses the same way, it is obvious that he must sometimes guess right.

It would not be so bad if electricity were a likely cause of fire; there would then be some excuse for jumping to the conclusion that nearly all the fires on premises lighted by electricity were due to that illuminant. But no sane man who studies the characteristics of electricity, and who removes himself from the baneful influence of the papers, can dispute the proposition that, of all lighting and heating agents, electricity is certainly the least dangerous. Gas lighting, with its naked flame, high temperature, and extreme susceptibility to explosion, escapes newspaper censure altogether, and probably for the reason given.

We are fighting the gas interests, fighting them to the bitter end; but, thank heaven, we fight on the square. The gas companies have imported crooked and misleading methods into what promised to be a straight, sporting contest; and when the end comes they will suffer, not only defeat, which was inevitable from the first, but also humiliation, which might have been very easily avoided.

It is well known that coal-gas will asphyxiate anyone who breathes it to any considerable extent; it is not so well known that a financial interest in the exploitation of coal-gas induces asphyxiation of the moral sense. And yet it is a very justifiable inference from the conduct of the big gas corporations.

Sometimes the journalist, in his misguided efforts to prove the deceptively dangerous nature of electricity, arrives at conclusions which are both wrong and funny.

A halfpenny morning paper, some five or six years ago, reported a case in which a horse had been killed by stepping on a road grating charged with electricity. Up to this point there had been strict adherence to fact; but when it went on to remark that "it would require a great deal of electricity to cause the death of a robust carthorse, and it is supposed that the electric fluid, which emanated from a leaky circuit in the neighbourhood, must have been accumulating in the grating for many years, until at last there was a sufficient charge to bring about this regrettable accident" one simply had to drop the paper and laugh heartily at the egregious idiot who could put his pen to such rubbish.

Well, the end is approaching, and gas has very nearly had its day—or, should one say, its night? As a proof, one may point out that the gas companies, in spite of their extensive and almost hysterical advertising, direct and indirect, in the Press and in their own pamphlets, are rapidly losing ground to the electricity supply companies, who practically do no advertising at all. It is a clear case of winning entirely on merit.

Gas has long since given up the pretence of being fashionable (it is essentially a mid-Victorian product); it now claims to be safe, and to make its claim of any significance it must prove that electricity is dangerous. The contrast between the old aloofness and indifference to public opinion, and the modern and almost fawning attitude of the gas companies would be laughable if it were not so pathetic.

One seems to have heard somewhere that the electrical interests had formed a sort of joint publicity committee, whose duties consisted in advertising, in a general way, and without reference to any specific firm, the many advantages of electricity. If this committee has done any work, it has very carefully concealed the fact.

Perhaps one might suggest that this modest and retiring committee should leave ordinary advertising to individual firms, and give its whole time and attention to hunting up, tracing to their several origins, and effectively contradicting, the frequent inaccurate references to electricity in the daily Press.

A vigorously conducted campaign of this sort would do a tremendous lot of good to the industry; and it is to be presumed that that is what the committee is out for.

THE MUNICIPAL TRAMWAYS CONFERENCE.

Tramcar Meters.

(Abstract of Paper by R. G. Cunliffe and J. G. Cunliffe, *Manchester Corporation Tramways.)*

The result of a long series of investigations into the relationshi between energy consumption and maintenance costs, carried ou during the past few years at Manchester, has been to demonstrat clearly that in the case of certain wearing parts of the equipment in which the energy losses increase with wear, the economical li is determined by the energy loss rather than by the extent of th wear.

Thus the scheme of maintenance is largely settled by the energ losses, the methods employed at Manchester having been briefl referred to in the authors' paper presented at the Nottingham Co ference of the Association in September, 1908.

At that time the methods were still of too recent application t permit of results being given; but, in the three years which hav since elapsed, savings have been made which have proved the efficacy and vindicated the somewhat increased maintenance costs.

Curves A and B, fig. 1, show that the rate of energy consumptio commenced to fall from the time that the methods were applied i 1908, the saving increasing as the equipments were graduall brought to a state of increased efficiency.

The whole of the large increase in rate of energy consumptio prior to 1907 was not due to the increasing inefficiency of th equipments, as the proportion of large bogie cars in use was steadil increasing whilst the covering of cars was proceeding at a rapid rate but curve B shows that the units per ton-mile also increased to considerable extent, and the effect of increasing weight ought t have been to slightly diminish this, since weight added to a ca does not proportionately increase its rate of energy consumption, s that there was no doubt as to the importance of the increasin losses.

From curve C it is evident also that the mileage run wa increasing rapidly, and the transmission losses, being roughly pro portional to the square of the mileage, were becoming of relativel greater importance.

The actual saving effected is shown approximately by the shade area in curve A, and would have been greater but for the fact tha the proportion of bogie cars has continued to increase, as also ha the covering of existing cars, so that the average weight per car much in excess of the 1907 value, as is shown by curve D.

It is difficult to obtain an exact knowledge of either the valu of the saving effected or the cost of obtaining it, but, althoug the first cost of renewing faulty field coils, worn gearing, &c., an adopting a heavier gauge of trolley wire where necessary wa comparatively heavy, it has already been balanced by the saving i energy, which, in addition, is cumulative over a number of years during which the increase in maintenance charges will be ver slight. The lost mileage due to defective equipments has falle considerably from 1908 to 1910, and is still rapidly decreasing thu indicating the state of increased efficiency of the equipments.

On the whole, therefore, by keeping down the losses it is possibl to maintain the equipments in a better condition, with increase public safety and comfort, and, at the same time, to effect a saving but this necessitates as exact a knowledge as possible of the valu of the various losses, and one of the principal functions of th meters ought to be to supply this information. This, however, ca only be done by meters capable of giving absolute values.

Another of the most important functions of the meters is to affor a means of measuring the comparative care and skill exercised b the motormen in the handling of their controllers. This can onl be done, in the case of meters giving relative readings, on th assumption that every meter, working under similar general con ditions, has the same percentage error; an assumption of th accuracy of which no proof has as yet been offered.

In the present paper the authors have endeavoured to show, a fully as the limited space allows, the importance of absolute value and the possibilities of obtaining them, the scope and accuracy o the application of relative values, the behaviour of the meters unde working conditions, and the factors controlling their use an effectiveness as a means of reducing the consumption of energy.

The watt-hour meter survived its early failure, and, by continue improvement, has been able, in many cases, to hold its own against its rivals, of which the only important ones are the ampere-hou meter and the time-meter.

Electrical energy is a product of three components, viz.:— voltage, current and time, all of which, in traction work, are subject to simultaneous and rapid fluctuation over a wide range.

The three types of meter are contrasted in Table I:—

TABLE I.—Conditions Governing the Use of Meters as Energy Meters.

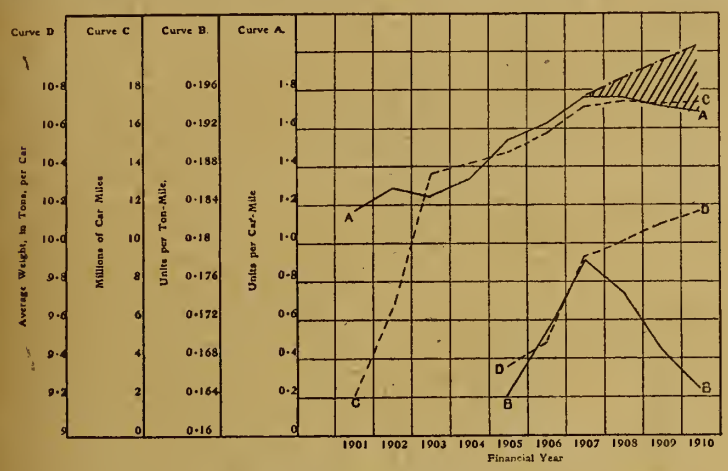
Type of meter	Energy components actually measured.	Components assumed to maintain a constant average value.	Remarks.
Watt-hour meter	All	Nil.	Theoretically complete
Ampere-hour meter	Current and time	Voltage	Partially complete
Time-meter ...	Time	Voltage and current	Incomplete

As an auxiliary meter the authors have developed a volt-hour meter, the readings of which, when divided by the time, give the average value of the fluctuating voltage along a route, and, in addition, have used graphical recording instruments and measuring instruments of many kinds for checking purposes.

If meters are to be expected to give absolute readings it is essential that they shall be capable of accurate operation under the actual working conditions, and, since it is useless to indulge in speculation as to the probability or otherwise of the truth of

Vibration reduces the friction, causing the meter to run slightly fast, but this is balanced by a slight retardation due to inertia effects.

Both ampere-hour and watt-hour meters have the great advantage that they are not called upon to operate with currents lower than 30 per cent. of the normal full load for which they are designed, thus avoiding the inaccuracies frequently encountered in these meters at light loads, and enabling full advantage to be taken of the flat part of the calibration curve



Curves: A, Units per car mile; B, Units per ton mile; C, Car mileage D, Average weight of car.

FIG. 1.—ENERGY STATISTICS; MANCHESTER TRAMWAYS.

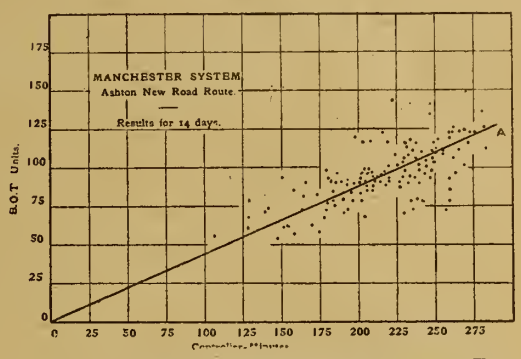


FIG. 2.—RELATION BETWEEN ENERGY AND TIME METER; POINTS REPRESENT RESULTS OBTAINED DAILY BY EACH DRIVER.

the assumptions made in Table I, great pains have been taken in checking the accuracy of the meters by actual measurement. This accuracy has been examined from the following standpoints, viz. :—

1. As a means of measuring the energy component or components which each meter is specially designed to measure.
2. As true energy meters having regard to the simultaneous and rapid fluctuation of the three components.
3. As true energy meters when assisted by an auxiliary meter.

The authors have employed several forms of time-meter, and have found the most successful to consist of a clock having a small electric motor of peculiar design in place of the mainspring, governing being obtained by means of a hair-spring and balance wheel, the motor providing the motive power and driving the clock when the current flows.

Experiments conducted with a contact maker rotating at a known constant speed, and completing the circuit for a predetermined part of each revolution, have shown the accuracy of the

Ampere-hour meters of both the mercury and commutator types, by various makers, have been tested and found to be capable of accurate operation within limits of 2½ per cent. over the whole of the working range, whilst, if accurate when installed, they have been found to be still accurate within 1 per cent. when tested after six months' continuous operation.

As the volt-hour meter is merely an ampere-hour meter designed for a very low current, and with a suitable series resistance in place of the shunt, its accuracy is that of the ampere-hour meter working at the most favourable parts of the load range.

Experiment shows that the average voltage on a route, as determined by the volt-hour meter, is practically independent of the car on which the volt-hour meter is installed, so that a single volt-hour meter will give the true average voltage for a route. Evidently, then :—

1. Every ampere-hour meter on the same route fails to register energy by the same definite percentage, and hence ampere-hour meters may be employed without correction for the purpose of

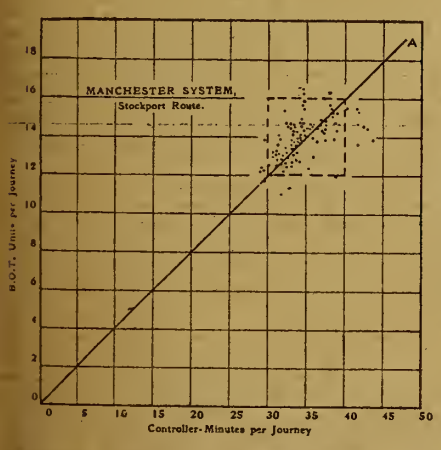


FIG. 3.—TYPICAL EXAMPLE OF SIMULTANEOUS RESULTS WITH ENERGY AND TIME METERS.

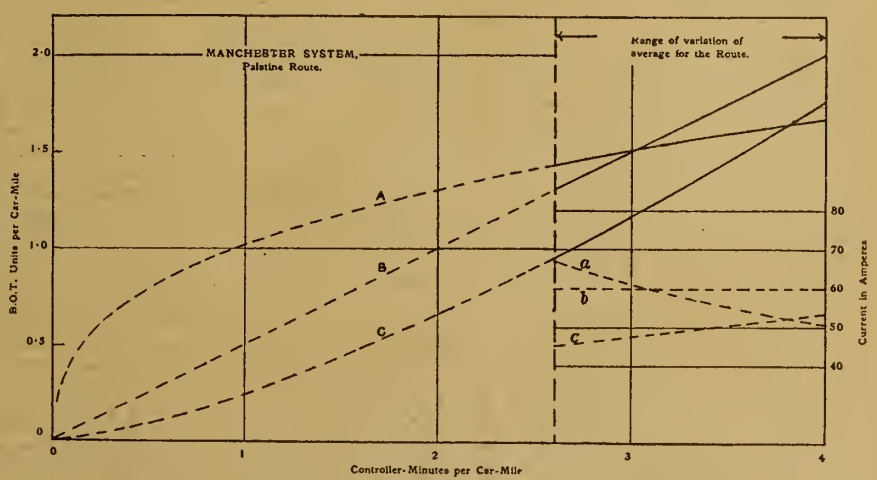


FIG. 4.—TYPICAL RELATIONSHIPS BETWEEN UNITS AND CONTROLLER-MINS. PER CAR MILE.

meter, at frequencies of operation corresponding to the quick handling of a controller, to be that inherent to clockwork generally, which, so far as meters are concerned, represents practical perfection.

Lord Kelvin* checked his most delicate current-measuring instruments by means of the copper voltameter, and the authors have made use of the same method in order to check the actual error of the ampere-hour meter when in operation on the car.

It is described in an appendix, and affords a means of measuring the ampere-hours to an accuracy of within half of 1 per cent.

Meters whose percentage error had been carefully determined in the test room were operated in series with the cell on service cars, and their error was found to be almost exactly as predetermined, showing that there was no appreciable error due to vibration and to the rapid fluctuation of the current.

This is of great importance and proves the test-room calibration to be reliable.

placing drivers or cars in their correct order of merit as regards consumption of energy, although such readings could not be accurately used to determine the percentage difference between the values of the various men or cars.

2. The readings of the ampere-hour meters, when corrected for the true average voltage, give the actual energy consumption. This correction need only be applied to average daily, weekly, or monthly values for either each separate car or for the whole route, as desired, in order to estimate the value of the line losses by comparison with the station meters, or to compare the consumptions of cars on different routes.

There is no direct method of checking the accuracy under service conditions of the watt-hour meter, but numerous readings have been taken of watt-hour meters operating in series with ampere-hour meters, checked by volt-hour meters, both of known accuracy, and it has been found that watt-hour meters do not work very accurately on a line with wide voltage variation.

In Manchester, owing to high-tension transmission to a network of over 20 sub-stations, each having a number of short, heavy, low-tension feeders, radiating in all directions, the voltage regulation

* "Electrolysis of Silver and Copper," *Phil. Mag.*, October, 1886.

is within 10 per cent., especially as every section is fed from the centre, and unusually heavy trolley wires are used and paralleled for mutual assistance.

The difference between the uncorrected ampere-hour meter readings and the watt-hour meter readings was found to be, within the limits of permissible error of the instruments, that due to the difference between the average line pressure and the 500 volts for which the ampere-hour meters are calibrated.

The Peel Green and Whitefield (Salford) route, of practically 22 miles per complete journey, was divided into several sections, according to the feeding system, and readings were taken over each section for four days, with the result that the watt-hour meter appeared to read high at the lower voltages, the error, as compared with the corrected ampere-hour meter, exceeding 10 per cent. on a 35 per cent. voltage variation.

In order to check this error under more favourable conditions, the instrument was taken to the Polygon Testing Department of the Manchester Electricity Works, where it was found the range of error may exceed 6 per cent. on a wide voltage variation, and under the more severe practical conditions, the fluctuations of current and voltage being simultaneous and rapid, this range was exceeded.

Evidently, if these results are typical of the watt-hour meter, it fails under the very conditions which would render its use desirable; and, whilst the above represent difficult conditions, they are, nevertheless, to be encountered on numerous tramways in this and other countries.

In the opinion of the authors, it is better that one such widely-fluctuating component, alone, should be measured by each meter, when there will be no mutual interference, and the whole attention of the designer can be concentrated on the already sufficiently-involved conditions.

If the time meter is to be of any use as a means of obtaining absolute values—*i.e.*, as an energy meter—there must be a direct proportionality between its readings and the energy consumption, whilst, if it is even to be used as a means of comparison between drivers or cars, there must still be some definite relationship, although it need not necessarily be a direct one.

In order to investigate this relationship, whole routes have been equipped with both energy meters and time meters, and the analysis of thousands of daily averages has proved that, for reasons discussed later, the time-meter cannot be made to give absolute values, and, further, that it cannot even be employed with fairness to the men, as a means of comparison between them, although the general tendency of a reduction in controller time is to cause a saving or energy.

Figs. 2 and 3 show typical cases taken from practice, and the whole of the points shown ought, if the meter is to be in itself of any value, to lie on, or reasonably close to, a straight line, such as O A or some other line, straight, or of continuous curvature.

The fact that they do not do so proves that there is no simple relationship between energy consumption and controller time, whilst this is further shown by a table giving the order of merit of a series of drivers, as determined respectively by energy and time meters.

The general tendency of a reduction in controller time to cause a reduction in the energy consumption is evident from the table, but, as is shown later, the energy saving is very indefinite, and actual harm may be caused if the process is carried too far.

Car meters are generally supposed to effect a saving in energy by promoting careful and skilful handling of the controller. They tend to prevent waste of energy by running with the brakes on, running on the resistance notches, approaching stopping places too rapidly, with consequent loss in braking, &c.

This increased care is what is really meant by the "moral effect" of meters, and in itself may result in fairly considerable economies, but skilful driving is a very different matter, and no amount of coercion, whether by meters or otherwise, can make a man drive skilfully if he does not know how to do so.

Numerous experiments have been carried out in Manchester with a view to determining the effect of various methods of driving, and, although the knowledge gained is by no means complete, many interesting results have been obtained. Whole routes have been equipped with both an energy and a time meter on each car, and separate daily records have been kept for every man and car. Further, in order to facilitate the investigation, Mr. McElroy arranged some time ago for each of the 20 cars on the Palatine route to be operated by the same two men working alternate weeks on early and late finish duty. This precaution has been of great utility, as it is found that two drivers, working under these conditions, can obtain very different results, although, when averaged over a month, the only variable is the method of driving.

Analysis of thousands of records shows the process of improvement to be extremely involved, new difficulties arising at all points in its study, but, although the complex conditions necessitate complex methods of investigation, the authors have endeavoured to explain the occurrences in as simple a way as possible (all mathematics required for the analysis of the results has, with this object, been placed in an appendix, and the data derived from its use alone given in the text).

It has been shown that there is no simple relationship between energy consumption and controller time, and various drivers can obtain the same value of units per car-mile with very different controller minutes per car-mile.

This is explained by the curves A, B and C in fig. 4, which illustrate various relationships between the two quantities. These are curves actually given by three men on the Palatine route with exactly similar cars.

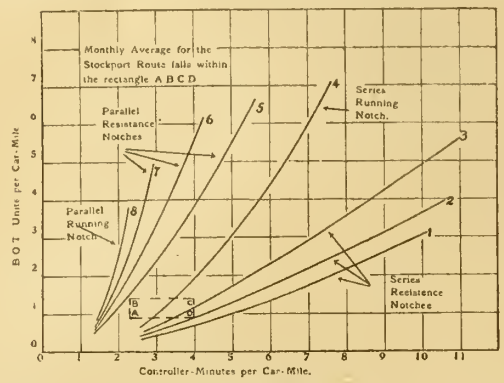


FIG. 5.—RELATIONSHIP BETWEEN UNITS AND CONTROLLER-MINS. PER CAR-MILE FOR A CAR EQUIPPED WITH 2-G.E. 52-27 H.P. MOTORS.

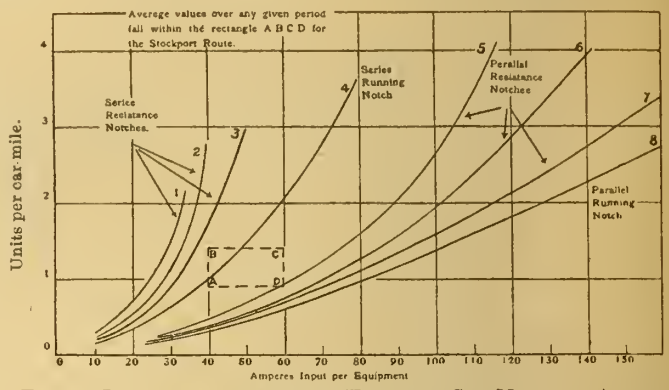


FIG. 6.—RELATIONSHIP BETWEEN UNITS PER CAR-MILE AND AMPERES INPUT PER EQUIPMENT, DERIVED FROM MOTOR CHARACTERISTICS, AND APPLIED TO A ROUTE WHERE SCHEDULE TIME IS EQUALLY DIVIDED BETWEEN CONTROLLER, COASTING AND STOPPING.

The working range is from 2·6 to 4 controller minutes per mile, as indicated, and it is evident that with the same value of the energy consumption these three men would have very different time meter readings. Thus, for example, at 1·6 units per car-mile, which is about the average monthly value for this route, the controller minutes per car-mile would be 3·2, 3·5 and 3·74 respectively.

This variety of possible curves is the real reason why the time meter does not classify either men or cars in the correct order of their energy consumption. There is a different curve for every man according to his method of driving, and the general tendency of the low time meter readings to indicate low rates of energy consumption, already referred to, is shown by the falling curves.

In the majority of cases it is found that a man keeps to a certain general method of driving, giving points lying fairly close to a smooth curve which can be drawn and analysed. This is invariably the case when the man covers a wide range of controller time per mile, the extreme upper and lower values lying on the curve whilst the points situated near the average value are clustered around the curve. It is men who maintain approximately the same value of controller time, from day to day, whose results do not give any curve, and they are few in number.

Fig. 5 shows the theoretical relationship for each controller notch, and every man must work up and down all these curves and from one to another, remaining on particular curves for different proportions of the time according to his method of driving; and when it is considered that each of the daily averages, from which the actual curves in fig. 4 are built up, is compounded of a great number of such instantaneous values covering the whole range of fig. 5, the complexity referred to is obvious, especially as each of these daily averages may fall anywhere within the rectangle of A, B, C, D, which represents their working range.

The shapes of the curves in fig. 4 afford an indication of the general methods of driving by which they have been obtained.

Figs. 6 and 7 show the great economy of parallel, as compared with series operation, and, again, every driver must traverse each of these curves and move about from one to another in obtaining his daily average result. The relatively heavy losses on the resistance notches are obvious, and, together with the increased torque per ampere obtained, as shown in fig. 8, at higher currents, indicate the desirability of getting on to the running notches as quickly as possible consistent with the comfort of the passengers, which latter consideration may be trusted to restrain the drivers, owing to fear of complaints, from too quick starting.

The economy af parallel running is shown in Table II, which gives the average results of a series of observations taken on the Palatine route.

The route was divided into three sections corresponding to city, urban and suburban traffic, this being rendered possible by other routes branching off at two places such that each section was of nearly equal length, the minimum being over two miles.

Skilled observers, stationed at each sectional boundary, took the readings of time-meter, energy-meter, and time as each car arrived, and all meters were fitted with tenths dials in order to permit of the accurate reading of small quantities.

Hundreds of journeys were checked on different days in different months and the average values determined.

It is evident that series operation entails a comparatively long use of the controller, a comparatively low average time-rate of

nergy consumption as shown by the units per controller-minute, nd a high distance-rate of consumption as shown by the units er car-mile.

TABLE II.

Section.	Units per car-mile.	Controller minutes per car-mile.	Units per controller minute.	Average speed (miles per hour).	Remarks.
All Saints' to town, return	2·26	5·28	0·429	5·39	Heavy city route. All series running, very frequent stops.
All Saints' to Birch Villa and back	1·99	3·35	0·592	8·52	Urban route. Frequent stops. Mainly mixed series and parallel running.
Birch Villa to terminus and back	1·395	2·99	0·467	10·9	Suburban route. Good opportunity for parallel running.

Parallel running, on the other hand, necessitates a greatly reduced use of the controller, a slightly greater time-rate, and a much smaller distance-rate of consumption, and it is in this listance-rate, the units per car-mile, that economies are to be effected.

Returning to the curves in fig. 4, it would appear that the use of the controller is mainly series in curve A, mixed in curve B, and parallel in curve C.

The characteristic upward tendency is shown in curve C, which s evidently a much purer curve than the other two, where there is a greater proportion of mixed driving.

If the installation of meters becomes general, the station engineer is threatened with a reduction of revenue in much the

Table II shows the predominating influence of "Type of Route, the values given in the city part being much higher than for pure series running on account of the great number of stops, and the authors are of opinion that it is not possible to effect much saving on such routes, as there is practically only one way in which a man can drive, his whole attention being taken up in getting his car along at all.

Low line pressure, due to bad feeding arrangements, compels the driver to remain longer on the controller in order to maintain a given schedule, but the average demand is reduced in practically the same proportion, so that the effect is to alter the relationship between energy consumption and controller time without materially increasing the former.

It is very difficult, therefore, to make a fair comparison between drivers or cars on different routes; and in a city like Manchester, where large numbers of part-day cars are run at the rush hours, separate comparisons must be made even between cars on the same routes.

One result of the installation of car meters is to call attention to the great importance of brake setting, and, however careful the supervision, cases of tight brakes are very common, causing great waste of energy. This difficulty is being met by the use of brake gear fitted with a conical drum, giving a large initial movement of slack chain and brake blocks with a leverage gradually increasing to a maximum when the block is on the wheel. This permits of an increased clearance between the blocks and the tires.

In order to facilitate correct reading of the meters by unskilled men, the dials ought invariably to be of the cyclometer type with spring figures, and a tenths dial ought to be provided, the figures being painted red, whilst the other dials bear figures in black.

Clock face dials invariably lead to confusion, and in the case of cyclometer dials without spring figures, it is possible to have two figures, each half exposed, when a driver is being relieved, with the result that each driver takes the figure most favourable to himself, and, as this generally occurs at the units dial, one unit is lost. If a tenths dial is provided, an error of reading in the last figure will be unimportant, whilst the other figures can always be corrected by a comparison of meter cards.

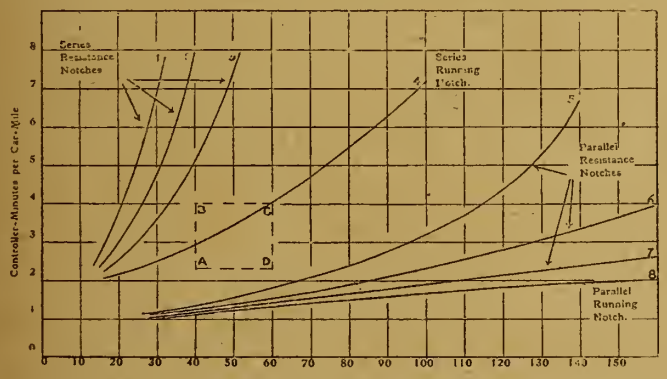


Fig. 7.—Relationship between Controller-Mins. per Car-Mile and Amperes Input, for the Case given in Fig. 6.

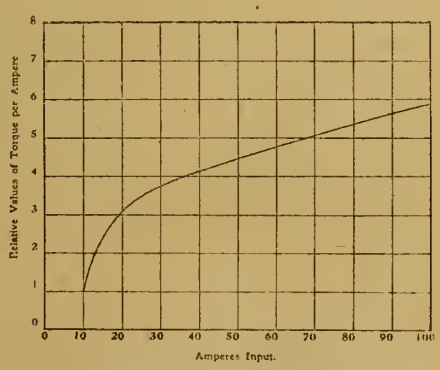


Fig. 8.—Relative Values of Torque per Ampere, for Series Traction Motors.

same way, though not to the same extent, as that caused by the advent of the metallic-filament lamp, with the added disadvantage that the increased economy will not bring him an increase in the number of his connections in the shape of cars, since the schedule adopted is fixed by other than energy considerations.

It is of interest to consider the probable effect of this saving on the maximum demand, as there appears to be every probability of traction energy charges in the future being based upon a maximum-demand rate.

The current taken by a car is proportional to the average energy demand of the car in units per controller-minute.

It is evident that, as the controller-time diminishes, *i.e.*, as improvement continues, the average demand increases for a driver working along curve A (fig. 4) remains constant for curve B, and diminishes for curve C.

In the case of curve A, however, it will be observed that the proportionate increase of average demand, as measured by current, is small compared with the reduction in the time during which the demand continues, and hence, owing to the lesser probability of many cars simultaneously requiring a supply of energy, the station maximum demand would be reduced even if every driver worked along the curve A.

As a matter of fact, however, it is observed that any marked improvement in driving is effected, not by working lower down a given curve, whether A, B or C, but by falling bodily on to a lower curve and consuming less energy at very similar values of the controller-time, and this, if it became general, would proportionately reduce the maximum demand.

The ideal method of driving, as regards energy consumption, would be to get fairly quickly into parallel, remaining there at full speed until approaching a stopping place, then to switch off at such a distance that the car would just come to rest without application of the brakes; but this long coasting would be wasteful of time and is prevented by the fixed schedule time, which is important in so far that it hinders the men in obtaining the best results and should be taken into consideration in comparing the records of men on different routes.

An analysis of the schedule recently compiled by Mr. Goodyer shows that, on 19 systems which have furnished complete replies, the average saving by the use of meters amounts to £22·66 per meter per annum.

The authors have had an opportunity of verifying the saving effected at Bury: a reduction of 21·79 per cent. was made in the energy consumption corresponding to a saving of £41·6 per meter per annum.

It is quite out of the question to expect such results on large city tramways, owing to the limitations which have already been described, and to others which indirectly complicate matters; but, although comparatively little can be done in the driving, there is no reason why the full saving resulting from efficient equipments should not be realised, and so, in the case of such undertakings, the absolute values become proportionately of greater importance.

The use of meters has already been widely discussed, and the methods adopted must depend largely upon local conditions, so that no useful purpose can be served by a detailed description of the Manchester methods.

As a general principle, however, the methods ought to be designed to exert a continual pressure on the men, as otherwise their improvement will not only gradually cease, but they will actually slip back into the old values.

It has been found profitable in Manchester to fix a limiting value, slightly better than that obtained by the best driver for each route, and to encourage the men to aim at reaching that value.

The authors are satisfied that:—

1. The ampere-hour meter can, with proper supervision, be made to operate with an accuracy of within 1 per cent.

2. If percentage differences between the results of various men are required the corrected values must be used.

3. The watt-hour meter, owing to its greater complexity, more fragile construction, &c., is not so desirable an instrument as is the corrected ampere-hour meter.

4. The time meter cannot be trusted to measure energy within 10 per cent., and should only be employed in conjunction with the

energy meter for purposes of investigation, in which connection it is very valuable.

5. The volt-hour meter ought to be employed on all tramway undertakings for the purpose of measuring average voltages.

6. On small undertakings with light traffic approximately equal savings may be effected in the driving and in the detection of faulty equipments, but, as the congestion increases, the state of the equipments becomes of increasing importance, more especially as regards the feeding and distributing system where the losses are a fraction of the total energy consumption, and do not merely affect the consumption of individual cars.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,149. "Automatic sectioning means for limiting accidental interruptions of current supply in central stations." E. Brandenburg. (Convention date, October 10th, 1910, Belgium.) September 25th. (Complete.)

21,164. "Circuits for automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) September 25th. (Complete.)

21,165. "Cord weights of telephone switchboards or the like." Siemens Bros. & Co., Ltd., and E. A. Laidlaw. September 25th. (Complete.)

21,168. "Electrical plug switches." J. Y. W. MacAlister. September 25th.

21,178. "Receiving instruments for electrical signalling systems." E. I. Everett. September 25th.

21,196. "Method of mounting electric resistance nets and coils." H. H. Broughton. September 26th.

21,215. "Automatic regulation of variable-speed dynamo." E. P. Prior and A. G. Prior. September 26th.

21,259. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparatus Fabrick E. Zwietusch & Co., G.m.b.H., Germany.) September 26th.

21,260. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparatus Fabrick E. Zwietuch & Co., G.m.b.H., Germany.) September 26th.

21,286. "Electric walking sticks." M. H. Goldstone. September 27th.

21,290. "Electric heating apparatus." R. K. Hearn. September 27th.

21,313. "Combination for jointing or coupling together incandescent electric lampholder parts." J. Moon. September 27th.

21,321. "Means of and methods for changing the frequency of alternating currents." A. M. Taylor. September 27th.

21,322. "Power and electrical installation of power-propelled vehicles." F. W. Lanchester. September 27th.

21,331. "Manufacture of insulated electric leads or cables." F. H. Broomfield and E. H. Tawn. September 27th.

21,351. "Hand combination telephonic instruments." E. A. Graham. September 27th. (Complete.)

21,402. "Selective electric signalling systems." C. M. Jacobs and G. H. Crook. September 28th.

21,403. "Devices for applying electric, galvanic, magnetic, or the like energy to the human body." E. S. Johnson. September 28th.

21,419. "Plug and socket or other connections for electric circuits." J. Lucas and F. Jenkins. September 28th.

21,441. "Electrical ignition apparatus for internal combustion engines." A. H. Midgley and C. A. Vandervell. September 28th.

21,456. "Fire alarm telegraph systems." A. C. Brown. September 29th.

21,462. "Radioactive accumulator." C. Abel-Musgrave. September 29th.

21,475. "Magneto." A. C. Saunders. September 29th.

21,489. "Dynamo-electric machines." Hon. Sir C. A. Parsons and A. H. Law. September 29th.

21,495. "Electric switches." H. Lucas and O. Lucas. September 29th.

21,496. "Dynamo-electric machines." Hon. Sir C. A. Parsons and A. H. Law. September 29th. (Complete.)

21,501. "Electric-current circuit-breakers more particularly for use in connection with tramway and railway systems." P. M. Levy and H. T. George. September 29th.

21,542. "Lightning and high-tension protector for use in connection with telephone, telegraph, electric lighting and power conductors and apparatus." R. McLean. September 30th.

21,593. "Production of copper by electrolysis." R. Douvreleur. September 30th.

21,597. "Electrically-heated flat-irons." T. McClelland, Jun. September 30th.

21,600. "Apparatus for the purification of electrolytic gases." A. E. Knowles. (Divided Application on 27,264, November 23rd, 1910). September 30th.

21,613. "Dynamo-electric machines." J. D. Walford. September 30th.

21,616. "Sparking plug for internal-combustion engines." H. E. Mills. September 30th. (Complete.)

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Electric Switch adapted to come into Operation when Currents have Reached their Predetermined Value. R. Venner and R. C. Griesbach. 14,471. June 15th. (December 15th, 1910.)

Signalling Systems. British Thomson-Houston Co. (General Electric Co.) 18,868. August 10th.

Electromagnetic Devices for Controlling Electric Switches or the like. British Thomson-Houston Co. and Wedmore. 20,852. September 7th.

Methods of and Means for Discharging Electric Accumulators or Secondary Batteries. A. M. Taylor. 20,906. September 8th.

Means for Mounting Conductors on Electric Railways. J. H. Mawe 20,917. September 8th.

Rotary Transformers for Converting Alternating into Direct Curre L. R. Aubert and A. E. F. Ferrand. 20,948. September 8th.

Electricity Meters According to the Ferraris Principle. M. Strel 21,240. September 12th. (September 10th, 1909.)

Wireless Telegraphy and Apparatus therefor. J. Sacek. 21,3 September 13th.

Detachable Heater for Electric Cooking Utensils and such like. J. C. Macdonogh. 21,557. September 16th.

Apparatus for Sterilising Liquids by Ultra-Violet Rays. A. H. Helbron and M. von Recklinghausen. 23,078. October 5th.

X-Ray Frames. R. P. J. Willis. (Granger.) 23,658. October 12th.

Variable Electric Air Condensers. B. F. Sobotka. 24,916. October 27t

Enumeration of Telephone Calls. S. D Williams. 25,700. November 5

Electric Switches. M. J. Railing and C. C. Garrard. 26,009. November 9

Polyphase Electric Commutator Motors. J. Gray. (Latour.) 26,1 November 9th.

Secondary Batteries. C. Inrig and Gavan Inrig, Ltd. 28,755. December 1

Electric Illuminating Signs. W. W. Arnold. 29,452. December 19th.

Joints for Telegraph, Telephone, Electric Transmission Poles and T like. H. J. Johnson. 30,047. December 28th.

Supports for Electric Incandescent Lamp Filaments. British Thom Houston Co. (General Electric Co.) 30,323. December 30th.

1911.

Thermal Switch Mechanism for Electrically Heated Appliances, parti larly for Kettles. G. H. Collins and H. F. Collins. 1,900. January 2

Electric Heaters or Convectors. J. E. Pownall. 6,374. March 14th.

Processes of Preparing Filaments for Electric Incandescent La W. G. Housekeeper. 17,480. August 1st. (August 5th, 1910.)

Supports for Electric Incandescent Lamp Filaments. A. S. Knight. 17, August 4th. (August 6th, 1910.)

Manufacture of Electric Incandescent Lamps. H. G. Moller. 1, (June 17th, 1910.) January 16th.

Electric Regulating Arrangements. W. E. Lake. (United States Li and Heating Co.) 9,363. April 15th.

Device for Welding the Metal Filaments of Electric Incandesc Lamps. E. Majert and W. Gladitz. 12,104. May 19th.

Electric Condensers. Aktieselskabet Hovlands Radiotelegraf. 12,976. 30th. (June 1st, 1910.)

Safety Device for Controls for Electric Motors. J. Woodford. 15, July 3rd.

Revenue Charges on the German Electri Industry.—The Hansa Bund has just published tables respect the public legal charges imposed upon the German electr industry since 1900. The following are the results recorded:—

	Paid-up share capital.	Percentage dividends.	Charges in p cent. of th dividends pa
1900 ...	£3,219,500	3·764	13·5
1901 ...	5,994,500	5·996	22·8
1902 ...	6,044,500	5·062	29·0
1903 ...	6,044,500	6·164	26·8
1904 ...	6,044,500	8·319	18·47
1905 ...	7,215,750	12·604	14·40
1906 ...	7,215,750	13·953	16·30
1907 ...	7,215,750	13·948	19·08
1908 ...	7,692,500	13·353	25·40
1909 ...	7,742,500	13·093	30·41

It will be seen that the public burdens imposed on the compa have risen from 13·5 per cent. of the dividends paid in 190 30·41 per cent. in 1909. In addition, the companies made volun contributions to benevolent funds amounting to 2·2 per cent. of dividends paid in 1900, 8·3 per cent. in 1901, 8 per cent. in 1 6 per cent. in 1903. 7 per cent. in 1904, 7·2 per cent. in 1905, per cent. in 1906, 7·8 per cent. in 1907, 10·2 per cent. in 1908, 8·9 per cent. in 1909. The tabular statement, naturally, does take into consideration the additional financial burdens which v placed upon the electrical industry by the Imperial scheme financial reform which was adopted late in 1909. The percent dividends on the paid-up capital appear to be higher than actual results during the past few years, and must be accepted v a certain amount of reserve.

Fixation of Nitrogen in Norway and Austria.—German newspapers announce that an important alteratio impending in the organisation of the Norwegian nitrate undertak which were constituted in equal shares by the Badische Anilin Sodafabrik, of Ludwigshaven, and the Norsk Hydro-Elekt Kvaelstof Aktieselskab, of Christiania. Both groups are in cour reaching an agreement whereby the majority of the shares in the j Norwegian undertakings shall pass into the possession of the N Co., and the management would then be concentrated in the la The German group will remain interested to the extent of £250 in the nitrogen works, the capital of which will now be subs tially French. The large works near Rjukanfoss are being exten

A syndicate, which is headed by Giovanni Zentini, of R projects the erection of a nitrogen of lime works in the Va Daone, South Tyrol, by the utilisation of the water power of Chiese. The power to be used amounts to 24,000 H.P., and expenditure on the works is estimated at £250,000. No object to the scheme were raised at the recent official inquiry into matter. The consumption of nitrogen of lime in Austria-Hung which has hitherto been obtained almost exclusively from Norwegian works of the Badische Anilin und Sodafabrik Notodden-Svalgfess, reaches about 15,000 tons per annum.

THE
ELECTRICAL REVIEW.

VOL. LXIX. OCTOBER 20, 1911. No. 1,769.

ELECTRICAL REVIEW.

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'HE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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heques and Postal Orders (on Chief Office, London) to be made payable to . H. ALABASTER, 4, Ludgate Hill. E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE EMPLOYERS' PARLIAMENTARY COUNCIL.

RECENT events in the labour world have shown that just as it is necessary for Trade Unions to combine, so it is essential for employers to put their heads together for the protection of their common interests. We are, therefore, glad to notice that the Employers' Parliamentary Council is about to direct its energies to obtaining such a modification of the law as will prevent useless labour disputes. The settlement of the Irish Railway Strike *on the employers' terms* shows what can be done by a little firmness. The directors had but little support from the Government, but they were backed by public opinion; the strikers, on the other hand, were backed by the Amalgamated Society of Railway Servants. To judge from the result of the strike, railway directors need not in future have much fear of any such *vis a tergo*. The reputation of the officials of this august body has not been enhanced by the ignominious part which they have played. It will be said, of course, that Ireland has taught England a lesson; and that, if the directors of our railways had only held out in August, victory would have been theirs. The circumstances, however, were widely different. At the time when the famous "24 hours telegram" was sent, affairs concerning Morocco were in a ticklish condition. In consenting to meet the Trade Union representatives in Conference with Cabinet Ministers, it has been suggested that the directors conceded the principle of recognition up to a point. But it appears that Sir Guy Granet and Mr. Claughton met the Union representatives at the request of the Government. When giving evidence before the Royal Commission, Sir Guy was asked by Mr. Henderson whether this did not amount to recognition. He replied, "No. Here was a case in which, under very special circumstances, to which I am not permitted to allude, but which are not likely to recur, and at the earnest solicitation of the Government as a special case, we were authorised to meet the representatives of the unions."

What were the "special circumstances?" The strike came to an end on Sunday, August 20th, the terms of settlement being announced in the Press on the following day. On August 19th the following passage appeared in the *Times* under the heading, "The Franco-German Negotiations."

> There are reasons for believing that one of the considerations which influenced the German Foreign Secretary in suspending the negotiations was a desire to wait and see the development and the effects of the English Labour trouble. The sense of British support in accordance with treaty engagements and British interests has greatly strengthened the French position from the beginning, and the German statesman, who is known to be very imperfectly acquainted with British affairs, may easily have imagined that something was to be made out of the present situation in England.

Does not this note give us some clue to the "special circumstances" to which His Majesty's Government would not allow Sir Guy Granet to allude? Was not the prospect of a European war, a "special circumstance" which was not likely to recur?

Having regard to these considerations, it may be assumed that if there had been no war cloud on the horizon, the

English directors would have been before and not behind their Irish colleagues. In fighting to a finish they would have met with the approval of the nation at large.

The whole trend of public opinion appears to favour the course which the Employers' Parliamentary Council is about to adopt. It would endeavour to secure a modification of the law with regard to picketing. "Peaceful picketing" was the Parliamentary method of persuasion which made these disastrous strikes possible.

The Trades Disputes Act, 1906, was forced through Parliament, because it was said to represent "the will of the people." It was for that reason that men of wide knowledge and experience allowed it to be placed on the Statute Book. But there were statesmen among them who did not assent to the measure without a word of warning. Conspicuous among them was Lord Halsbury, who said :—

> This is a Bill for the purpose of legalising tyranny ; for the purpose of taking people outside the ordinary Courts of Law. I do not want to be a prophet of evil, but I cannot help saying that this Bill is likely to produce commercial distress, and extremely likely to produce the sort of warfare in an intense degree which appears to be contemplated it may produce. It may be also that it will drive justice from her seat. I do not want to be a prophet of evil ; I dare say that, notwithstanding such a Bill, we may recover ourselves, but I believe it will be after much suffering and much injury. It may also take us a long time to recover. I believe in my conscience that if Parliament passes the Bill, it will strike a serious blow against the spirit of freedom which has hitherto reigned throughout our laws.

If the statesman is he who looks five or six years ahead, may not those who assented to this measure have done so in order to give the people a salutary lesson? We have already had some of the "suffering" and "much injury." Picketing is a species of mob law. Was it not wise to show people the danger of being ruled by the mob?

In embarking upon its course, we doubt not that the Employers' Parliamentary Council will enlist the sympathy and support of the silent ones among the people who can think for themselves. Those who are concerned with the electrical world have their own troubles to contend with, but they are bound to share the larger trouble foreshadowed by a general strike.

The loyalty which employers in "our own trade" have shown towards one another in the past gives earnest that those of them who take an active interest in politics would form a useful sub-committee in the general committee of the Employers' Parliamentary Council.

The B.E.A.M.A.

The inauguration of the regenerated National Electrical Manufacturers' Association under its new title—the British Electrical and Allied Manufacturers' Association (Incorporated)—which was celebrated by the customary dinner on Thursday last week, is an event which must be regarded as one of the first importance to the electrical industry in this country. It is true that the parent Association existed for some eight or nine years without accomplishing any very notable achievements, except in matters of detail, and without leaving any very marked impression upon the surface of the industry ; but its ineffectiveness was no doubt due largely to deficiency of means and lack of adequate support—for many of the most important manufacturing concerns stood aloof from it, and without their co-operation it was impossible to carry out any considerable programme for the benefit of the electrical industries. The new organisation, however, has been established upon a wider basis ; the subscriptions have been very materially increased, efforts are being made to include as members all the large firms coming within the scope of the Association's Articles, and a new scheme of administration and organisation is about to be put in force.

The Association, therefore, sets forth upon its new career with, it is to be hoped, vastly improved prospects of doing good work on behalf of its members, and great potentialities for the development of the British electrical and allied industries on sounder and saner lines than they have hitherto followed. In giving it cordial send-off, the chairman, Mr. Ferranti—whose presen at the dinner as President of the Institution of Electri Engineers may be considered as conferring upon Association the blessing of the Institution—referred characteristically plain terms to the absurdity of the c throat price competition which has so long been in vog and welcomed the prospect of co-operation due to the effo of the Association. It was generally anticipated, we belie that in his response to the toast of "The Association," chairman, Mr. Nalder, would unfold to his expect audience some outline of the policy and plans of the n body, but this assumption proved unfounded ; only Mr. Nalder, but Mr. Anderson and Mr. Hirst, who follow later, refrained most carefully from revealing the concr intentions of the Council. Abstract declarations determination to do great things for the allied industi there were in plenty, but nothing definite. The gene impression left upon our minds, however, may be stat viz. :—That the Council, while explicitly repudiating a intention of dabbling in fiscal questions, intends to ex its influence towards inducing purchasers of plant to pl their orders with British manufacturers, and to mitigate far as possible the severity of competition at present p vailing amongst the latter. These are most commenda objects—they are identical, in fact, with the policy that have advocated in these pages for many years, and theref command our most cordial approval and support. Our o regret is that no information was given as to the ways a means to be adopted by the Council. In the meantime, must congratulate the Association upon its auspicious auguration, and for the rest—in the words of one of speakers at the dinner—we must "Wait and see."

Conciliation in Trade Disputes.

In pursuance of an attempt to c unrest in the labour world, the Gove ment has decided to form a panel conciliation, from amongst whom a few are to be cho to advise with the Board of Trade when occasion ari The list includes 13 representatives of employers, and like number of persons representing the men. All workman representatives, without a single exception, trade union officials, while the employers are chairmen, of employers' associations. Sir G. R. Askwith, of Board of Trade, is to preside over the new body, whic to be styled the "Industrial Council."

We have had too much experience in recent years of tr union men and methods to hail this new creation with mu enthusiasm. Like every other conciliation board ever invent its decrees will have no sanction. The union leaders on one hand, and the masters in a particular industry on other, may consent to abide by any judgment pronounce but the men cannot, by any means known to the law, compelled to act in accordance with an unfavourable awa Nor is it certain that the labour representatives on t Council represent anyone but themselves. They are the not as delegates, but in their individual capacity. Fina almost before the ink was dry on the agreement un which this Council is constituted, the labour leaders h begun to "crab it." Thus Mr. Appleton, secretary of General Federation of Trade Unions, writes :—

> I fear that it would tend greatly to cause delay in the settlem of disputes, and that is all against the interests of the workm since it enables the employer to provide means to checkmate workman's weapon of a strike.

In expressing the fear that the workman might deprived of the strike as a weapon, Mr. Appleton di attention to the reason why conciliation has proved to of little use in the past. It is interesting to notice that birth of this conciliation board coincides with the death another :—

> After an existence of over 20 years, during which period it settled scores of disputes between employers and employed, North-East Coast Marine Engineers' Conciliation Board has b dissolved. The jurisdiction of the board extended from Blyth Whitby. One by one the employers' associations have sece from the board, until at its last meeting the men's representati only were present, and the board was declared to be at an end.

HE ELECTRICAL CONGRESS AT TURIN.

order to cover as wide a field of investigation as possible, e sittings of the Congress took place simultaneously in ven divisions or sections, whose deliberations were directed indicated by the following headings :—

Section I.—Electrical machinery and transformers.
Section II.—Central stations and cables.
Section III.—Instruments and insulation.
Section IV.—Electric lighting and heating.
Section V.—Electric traction.
Section VI.—Telegraphy and telephony.
Section VII.—Accumulators and electrochemistry.
Section VIII.—Taxation and legislation affecting the electrical industry.

On the first day, September 11th, in the first Section, of. Silvanus P. Thompson read a paper entitled "A Report Motor-Generators, Converters and Rectifiers." This port treats of (*a*) motor-generators with two field-magnet stems and two armatures ; (*b*) motor-generators with one gnet and two armatures ; (*c*) motor-generators with one gnet and one armature with two independent windings ;) rotary converters ; (*e*) cascade converters, *i.e.*, an induction motor and a continuous-current generator, interconnected ctrically, as well as mechanically ; (*f*) revolving field ernators ; (*g*) rectifiers ; (*h*) frequency changers ; (*i*) ase-shifters ; and (*k*) auto-converters, having split poles, or o pole-pieces to each pole of the armature winding, which ter machines are the most recent type of converting chine, and are used (1) as step-down continuous-current verters ; (2) as voltage regulators ; (3) to convert from iable current at constant voltage to constant current hin a limited range ; and (4) as rotary converters afford- regulation of the continuous voltage without affecting power-factor on the alternating side. This paper fines itself to a description of the machines in each ss.

On the same day, in the absence of Mr. Hallo, his paper "Cascade Converters" was read by Dr. Feldmann. In s paper, after comparing the most important qualities of cade converters with those of motor-generators and ary converters, the conclusion is come to that, while the ciency of cascade converters and single-armature converters practically the same, the first named are more suited for iliary poles than the latter, and do not present the same ficulties of commutation, when regulation of voltage is cted on the continuous-current side.

In the same Section, on September 15th, Monsieur rouez (Paris) read his paper on "Polyphase Motors h Collectors," with special reference to Latour's patent, roducing a subsidiary transformer for phase regulation.

A paper by Signor Sarli dealt with variable-speed three-se motors, with special reference to the driving of rolling ls and paper making ; after describing the various ways of ling with loads involving the problems presented by this s of machinery, the author concludes that three-phase tors with collectors are suited for small powers, while ge outputs, such as rolling mills, necessitate the employ- at of the cascade system. In the most recent arrange- at this consists of a principal motor driving a variable- ed machine, which returns the energy either in the form mechanical energy on the shaft of the principal motor, or trical energy to the supply.

M. Boucherot's paper, read on September 12th, in tion I, introduced a gratifying discussion. It was headed Electromagnetic Phenomena Resulting from the Sudden ort-Circuit of an Alternator." This paper was specially cted to the difficulties incidental to the construction and ulation of turbo-alternators, and contained numerous nulæ for ascertaining the currents and electro-motive es to be dealt with.

In Section II, on the first day (September 11th), Mr. chio, chief electrical engineer to the New York Edison , read his paper on "The Selection of the Transmission Distributing Voltage, and the Design of Switchboards Sub-Stations in Large Electric Installations, Taking Account both Economy in First Cost and Continuity Service." This paper has some very clearly set-out tables of costs, and appears, on the whole, to favour extra-high-tension transmission. There are also a number of illustrations of E.H.T. arrangements and appliances, and excellently classified particulars of working of various E.H.T. transmission lines in the United States. For high altitudes, says the author, corona effect will limit the voltage to about 100,000 volts ; but, for more favourable conditions, 140,000-volt transmissions are being put into operation.

In the same Section (II) on the 11th, M. Grosselin read his contribution on the problem of underground cables connected to aerial transmission lines. He noted that whereas 60,000 volts on the Continent and 110,000 volts in the United States were employed on transmission lines, cables were not, so far, in use at a greater pressure than 40,000 volts alternating, or 50,000 continuous. The Compagnie Lorraine d'Electricité, however, would shortly have one of 65,000 volts in operation. The question resolved itself into one of testing. In France and England test presssures were as high as two to three times the working pressure. The paper concluded with some notes on precautions against atmospheric discharge, and the change of impedance at the point of junction between the aerial and subterranean cables.

Other representative papers in this Section down for the same day, but apparently not read, were M. E. Ragonot's on "Automatic Cut-outs" (a comprehensive description with moral relating to extinction of the arc in oil) and Mr. Hayes's "Commercial Electrical Apparatus for 100,000 volts Service," a description of E.H.T. fittings, with some useful comments and interesting figures. We note that one branch of the transmission line from Niagara Falls extends to 304·45 miles. On this line 100,000 volts is employed. For voltages of 100,000 and above, the author considers the usual petticoat type of insulator mounted on a pin, and provided with a blade type disconnecting switch, as unsatisfactory for mechanical reasons.

Contributed to the same Section (II) was Herr E. Huber-Stockar's paper on aluminium conductors. This is a careful consideration of the advantages of aluminium over copper, the principal one being in cost. The author concludes that the simultaneous use of aluminium and copper conductors in one installation does not involve a lack of homogeneity prejudicial to working ; that the use of aluminium conductors admits of considerable economy, except in house-wiring ; that aluminium is not economical for small wires (telephone and telegraph), or applicable for bare conductors in conduits, owing to chemical action.

M. J. L. Routin's paper on "Governing on Electrical Generating Sets" works out in favour of an auxiliary motor in combination with a special arrangement of solenoids.

M. Etienne de Fodor contributed a paper on "Refuse Destructors Combined with Electric Generating Stations." He noted that comparative tables of results obtained were difficult to obtain, owing to the use of coal and refuse-fired boilers simultaneously. England and her Colonies have adopted this combination to a much greater extent than other countries. The question is, of course, further complicated by the consideration that the disposal of rubbish must, to a great extent, be unremunerative work.

In Section III, on the first day, SS. Barbagelata and Emanueli presented their paper on "Measurements of Precision" involving the opposition of alternating currents, a comprehensive *résumé* of the instruments belonging to this class, with remarks upon their accuracy.

Prof. Dina followed with his "Measurement of Insulation Resistance of Alternating-Current Installations." The author's method is to interpose two voltmeters between the poles of the circuit and earth and estimate the results by geometrical figures. The paper goes into the question of type of voltmeters, capacity, and the application of the system to single-phase and three-phase current. This paper was not discussed, and was followed by that of Prof. Riccardo Arno on "Volt-Ampere-meters" and their use with wattmeters to ascertain power factor and apparent watts, both on lighting and power circuits. There was no discussion.

On September 12th Mr. A. E. Kennelly read his paper on the "Rotating Electric-Current Field," an investigation based on Galileo Ferrari's experiment of 1889.

Prof. Vladimir Karapetoff's "Some Practical Calculations of Electro-Static Fields, with reference to the avoidance of Corona in H.T. Transmission Work," was read by

Vice-President Dina, and was followed (September 13th) by Dr. Sharp's paper on "Electricity Meters." This goes into the question of watt meters with respect to accuracy, and has some mention of demand indicators. The vexed question of commercial accuracy is touched upon, and various precautionary measures are noted. M. A. Durand read a paper on the same subject. Some interesting comparative tables are given, from which it appears that, in Europe, England and France have the most accurate meters. Various causes of inaccuracy are treated of, and it is a thoroughly practical paper.

On September 15th M. Faccioli gave a *résumé* of Dr. Steinmetz's paper, "The Nature of Transients in Electrical Engineering." By "transients" the author indicates the temporary phenomena which manifest themselves during the change of conditions in a circuit when the magnetic energy and the dielectric energy vary in adapting themselves to the new conditions of the circuit. Equations and rules are given for the determination of the extent of these surges, with a view to safe-guarding against their effect. This paper was well received and discussed.

On the same day Sr. Guglielmo Neuhaus read his paper on "Safety Relays," describing an apparatus for cutting off a broken conductor from the supply, at the network end, as well as at the station end. This depends on an electro-magnet, energised from the line, holding up a weighted lever which drops when the circuit is interrupted.

Another paper in this Section (III), which time did not permit of reading, was Mr. G. Faccioli's "High-Tension Switching Phenomena." This is a valuable and practical paper describing experiments made on an American high-tension transmission line (Shoshone-Boulder of the Central Colorado Power Co. at 95,000 volts, 60 cycles) with a number of oscillograms taken on the L.T. side of the transformers, illustrating the effects produced. On the H.T. side choke coils and spark-gaps were used to estimate the extreme values of the E.M.F. waves.

Mr. E. E. F. Creighton's paper on "Circuit-Protecting Apparatus in America," gives a clear account of a variety of appliances for the protection of electrical conductors from lightning effect and internal waves and surges, breakage, &c.

Another paper on "Prevention of Effects of Internal Surges due to the Action of Interrupters," was that by Sr. Alberto Dina, in the same Section. The author describes a method depending on the insertion of a resistance.

Mr. C. O. Mailloux's paper on "A Method of Determining a Constant Current Producing the same Heating Effect as a Variable Current," is a description of a development of the graphical method of Dr. Fleming.

(*To be continued.*)

LEGAL.

Automatic Telephone Patent.—Petition for Extension.

On Friday last, Mr. Justice Parker had before him in the Chancery Division of the High Court an application in the matter of a petition to extend the term of a patent granted to one Thompson, in 1898, for automatic telephones.

Mr. T. Terrell, K.C., who, with Mr. Courtney Terrell, represented the petitioners, the Automatic Electric Co., said that he was instructed to ask for leave to amend the petition. He brought the matter before the Vacation Court on September 27th, when Mr. Justice Lush extended the time for the delivery of the petitioners' documents, fixed to be delivered at a certain date, but the application for liberty to amend, he directed, should be made to the judge who would hear the petition.

Opposition to the amendment was raised by the Western Electric Co., who were represented by Mr. Astbury, K.C., and Mr. Gray; Messrs. Siemens Bros., for whom Mr. Walter, K.C., appeared; and another electrical company, which was represented by Mr. Gray alone. The petitioners were an American company, and the information for lodging the petition was sent over from Chicago. The lawyers in Chicago did not seem to have known the requirements of the English Courts with regard to petitions for extension of time, and it was now thought necessary to amend by giving particulars of the devolution of title, and by stating the interest in dealings with certain foreign patents facts that had been omitted from the original petition. There were undoubtedly certain imperfections in the way the petition was originally drafted, and which were discovered after investigations by junior counsel, who had gone over to Chicago during the vacation for the purpose of investigating the documer over there. The nature of the proposed amendments were n counsel submitted, such as would prejudice his opponents, as th were simply in the nature of further and better particulars matters already stated in the petition. The petitioners owne large number of patents, but the petition only related to "calling" device. The opponents asked for particulars, allegi that the terms of certain agreements were not disclosed, and by amendments what the petitioners proposed to do was to set out th agreements which related to the title and dealings with the fore patents.

Mr. Astbury, on behalf of the Western Electric Co., said th view was that this was not a *bona fide* petition. They thought t large remuneration and profits were made by the petitioning co pany owing to this patent having been licensed first by one comp and then by another.

Mr. Justice Parker suggested that leave should be given amend, reserving all questions of costs and without prejudice to respondents at the hearing raising the question of *bona fides*.

Mr. Astbury had no objection so long as his Lordship reser to himself the power to refuse the petition on the ground that only reason set out in the original petition for the extension of t was bad. He suggested, however, that the question of whether not amendments should be made, should be reserved until hearing.

His Lordship thought it was only fair that all questions sho be left open, as the respondents had raised the question of *b fides*.

Mr. Astbury said their view was that the petitioners had not closed the large profits that had been made by the selling working of foreign patents.

Mr. Terrell said that, of course, when the petition was fra they did not know the real facts. It was now that they k them, and they desired to amend so as to put them fully before Court.

Mr. Astbury said the petition stated that certain docum were in existence; now the nature of these documents had bec known, the petitioners desired to amend to get over certain ob tions. He submitted it was now the respondents' time to say the petitioners had not proved their good faith.

Mr. Walter took the same view as Mr. Astbury.

His Lordship said that he would allow the petitioners to am as asked, reserving all questions of costs, and the amendments to be without prejudice to any objection that might be raised at hearing on the ground that the petition was not so framed a allow of the amendments in question being made.

Workmen's Compensation Act: Lift Accident Claim

An exceptional case under the Workmen's Compensation Act decided in the City of London Court on Monday, before his Ho Judge Lumley Smith, K.C., in which Elizabeth Russell, 10, Me Road, Finsbury Park, the widow of an unestablished elect mechanic lately employed in the Telegraph Department of General Post Office, claimed £300 against the Postmaster-Ge for damages for the death of her husband, who was crushe death in an accident in connection with one of the lifts in the Post Office buildings. Mr. Morle, instructed by Messrs. Cham Smith & Co., appeared for the applicant, and Mr. H. E. Galla from the Solicitors' Department of the General Post Office, re sented the Postmaster-General. It seemed that Russell employed to put right some defect on one of the lift bells, and on March 22nd one of the charwomen told him she had dropp lavatory key. She asked him to look for it, and he did so, step inside the well of the lift, where the key had gone. There he crushed to death by the down-coming lift weights; hence widow's claim.

Francis Pickett, the lift attendant, said he brought lift down in answer to a ring of the bell. Before the acci he spoke to Russell about the lost key, and he never though would get inside the well enclosure to look for it. Even he (as liftman) had never done so during the five years he had been liftman. A key had never been lost before in the well enclo and it was really nobody's duty to get it out. One of the inst tions to liftmen was:—"Liftmen are not allowed to get on to underneath a lift or allow any person to work on to underneath while the lift is working." He allowed the deceas have the key leading to the enclosure because he was an experie man, but he never thought he would get inside.

For the defence, James Fraser, one of the engineers at Central Telegraph Office, said that the deceased had no busine get in the enclosure of the well space. Only on rare occas would he go there in the course of his work. The lift was u the control of H.M. Office of Works.

Judge Lumley Smith, K.C.: Would it be necessary for s one to go to H.M. Office of Works before this key could be got It must be somebody's duty to get it out.

Witness said that the chief liftman should have been spoke and the lift stopped by the Office of Works men. It was Russell's duty to look for the lost key.

Mr. Gallaher urged that the plaintiff could not rec because the deceased was not acting within the scope of his emp ment in looking for the key, and cited many cases in support o submission. Russell's voluntary act of good nature had ca his death. The Postmaster-General had felt very great symp for the widow, and he had granted her £25 from a special fun

Mr. Morle said the Post Office had behaved extremely towards the widow, who had been taken into the service.

Judge Lumley Smith said in his view the case was rathe

the line amongst all those which had been cited, but, on the whole, he thought plaintiff was entitled to recover the £300 claimed. It was in the interests of the employer that someone should pick up the lost key, and it was nobody's duty to do it. The case came within the scope of the Act. The Court of Appeal might upset it. Judgment for the plaintiff with costs.

Mr. Gallaher asked for a stay of execution, as the Postmaster-General would have to consult the law officers with a view to appealing. They paid the £25 on the assumption that they were not liable for anything. But they would not ask to have that taken off the £300.

The Judge was sure the Post Office would do what was right.

Tramway Accident Claim.

Sheriff Armour Hannay heard evidence at Cupar in an action by a Methil butcher against the Wemyss and District Tramway Co., Ltd., for £300 in respect of personal injuries and damage to a horse and van, as the result of a collision. The pursuer alleged that the tramway line at the point where the accident took place was in such a state that he could not get off the line, consequent on the wheels of his van skidding, the rails being higher than the roadway, and that the car which ran him down was driven carelessly, and at an excessive rate. The company denied the allegations, and contended that the rails were in perfect order. The hearing was adjourned.

G. Straus & Co., Ltd., *v.* S. G. Cozens.

In the City of London Court on Friday, before his Honour Judge Lumley Smith, K.C., a claim was made by plaintiffs, of 211, Upper Thames Street, against defendant, of 63, Queen Victoria Street, to recover the sum of £3 14s. 1d. balance of account for electric cable supplied.

Mr. H. Strouts, plaintiffs' solicitor, said the dispute had arisen in consequence of a mistake on the part of the plaintiffs' traveller.

Mr. Good, defendant's solicitor, said the plaintiffs had made a mistake, and they must suffer by it.

Mr. Henry J. Wright, plaintiffs' traveller, stated that on May 9th he called on the defendant, having been asked to give a quotation for some 37/16 electric cable. He quoted for the cable the price of £131 12s. per mile, instead of which it should have been £231 12s. per mile. The order was given later in the day, and the goods dispatched. A corrected invoice was sent to the defendant the same day, showing the error which had been made. He knew that the defendant was in urgent need of the cable, and that it fluctuated according to the movements on the Rubber Market. He did not think there had been many fluctuations during the past year.

Mr. Good: The boom was on at the time in rubber. Is the price of that cable now only £150?—The witness said it was not.

Mr. Good stated that the defendant bought 65 yards of the cable and the plaintiffs claimed £8 11s. 7d. It should have been £4 17s. 6d. at the £131 12s. rate. Defendant had sent a cheque for the smaller sum and now objected to the plaintiffs seeking to take advantage of the error.

One of the plaintiffs' clerks said they wrote to the defendant and explained to him that the £231 charge was a reasonable price.

Defendant said they had agreed to sell at a certain price and they were bound by it.

The Judge: I think so too. You cannot quote a price and then say you meant to charge a good deal more, unless the thing is absurd on the face of it. Defendant's manager said they carried on a very large business, and they fixed the cable as soon as they got it. The judge said the plaintiffs must stand by their own blunders, and judgment must be given for the defendant with costs. If a man agreed to sell a thing for £1 he could not afterwards charge £3 for it.

Electric Lamp Thefts.

At the Central Criminal Court on Friday, before the Recorder (Sir Forrest Fulton, K.C.), James William Waite and Thomas Powell, surrendered to their bail and pleaded guilty to a charge of stealing a number of metal-filament lamps, the property of Messrs. Siemens Bros. Dynamo Works, Ltd. The defendants were also charged with conspiring together to defraud the prosecutors of their goods. Mr. R. D. Muir and Mr. Adrian Clark appeared for the prosecution; Waite was defended by Mr. Curtis Bennett, and Powell by Mr. Purcell. For the prosecution, Mr. Muir stated that Messrs. Siemens Bros. had a depôt at 39, Upper Thames Street, E.C., where the defendant Waite was employed as a counterman at 32s. 6d. a week. The defendant Powell was a dealer in electrical fittings, and an electrical engineer, and had been a customer of the prosecutors, from whom he purchased lamps and other electrical appliances. The allegation of the prosecution was that Waite, having control of a stock of tantalum lamps, under colour of exchanging defective lamps with Powell, handed him over new and valuable lamps, and covered up the deficiency which would thus have arisen, by means of false entries. In his books the defendant Waite made it appear that defective lamps had been exchanged for Messrs. A. How & Co., of High Street, Leytonstone, and Messrs. Defries & Co., Ltd., of Houndsditch. As a matter of fact, no such transactions took place. Last February the prosecutors found that lamps were missing, and a monthly check was instituted. After a few months, however, it was found that some hundreds of lamps were missing from the stock. As a result, a daily check was instituted, but towards the end of August and the beginning of September some lamps were missed. When spoken to on the matter, Waite said that he gave the lamps to Powell in order to do him a good turn, and booked them out to other firms. He also admitted that he had given Powell new lamps in exchange for burnt-out ones. Waite was given into custody, and the same day Powell came to the prosecutors' premises. He was then told of the statements made by Waite, and denied them. At that time Powell was carrying some lamps which he wanted exchanged, and most of them were burnt out.

The Recorder sentenced Powell to nine months' imprisonment, and postponed sentence on Waite until the next sessions.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Bakefern" writes: "I should be greatly obliged if you would let me know through your legal column (1) whether purchasers can be called upon to prove damages sustained by late delivery before the contractors are compelled to pay same. I believe it has been laid down that a penalty cannot be enforced, and I cannot myself see the difference between paying a penalty and paying a sum of money and calling it damages when no damage has been suffered. In a recent contract where I looked like being a little behind, I mentioned to the purchaser that perhaps he would not be ready, and he said it did not matter whether he was or not, I should have to pay the damages if I were late. Further, (2) could damages be claimed for withdrawing a tender without its being proved that any damage had been suffered? Suppose, for instance, what had been offered was not what was specified, and the price was higher than that from other people who were offering the correct thing, clearly no damage would have been inflicted on the prospective purchaser, and, under these circumstances, could he make the contractor pay? In speaking of damages for withdrawing a tender, of course I mean where the conditions of tendering specify that damages shall be paid for doing so."

*** A certain vagueness of expression makes it difficult to answer these queries. The first question appears to resolve itself into this: Suppose A is under contract to deliver goods to B by a certain time, subject to penalties for delay. A orders the goods from C, putting C under contract to deliver in time. C makes default, by reason of which B does not get the goods in time. Although B makes no claim against A, can A still claim against C? The answer is in the negative. A penalty will only be enforced in a case where damages are incapable of estimation; and on the facts stated by "Bakefern" the party who employed the contractor is apparently willing to waive the question of damages. But if he enforces, or may hereafter enforce his claim for damages, then A might be entitled to an indemnity.

With regard to the second question, it is clear that a tender cannot be withdrawn after acceptance without risk of there being a claim for damages. As a general rule it would be the duty of the person inviting tenders to minimise the damage by obtaining another tender. The measure of damage would then be the difference between the two tenders. In the case suggested it is conceived that there would really be no contract and no valid tender, because to supply "barley" when "wheat" is asked for is no fulfilment of a contract. The parties would not be (as the lawyers say) *ad idem*.

Free Wiring of Small Dwellings.—The question of the lighting of small dwellings or flats recently formed the subject of a lecture by Mr. E. Wickander at the Royal Machine Construction School at Cologne. The author stated that many supply authorities, recognising that numerous tenants are unable to incur the expense of wiring, have themselves undertaken to defray part or the whole of the cost for the purpose of securing additional revenue, this being particularly the case with companies. As instances of the practice are cited the electricity works at Strassburg, Gotha, the Westphalian Co. of Hagen, Treves, Munich, Genoa, Christiania and Gothenburg. At Strassburg the installations have been carried out, free of charge, to the tenants, and 6,200 dwellings have been wired in 1½ years, these yielding an additional income of at least £3,100 per annum. The system in force at the Gothenburg city works consists in the supply of current for one year free of charge. It was introduced in 1909, and although the city only has a population of 165,000 persons, there are now 8,000 consumers, or as many as in towns with three times the population. The principle adopted at Gothenburg is for the tenant to defray the cost of wiring, whilst the supply works furnish current free up to the amount of the cost of installation, but not for any longer period than one year. The results, however, are not so satisfactory as when the supply authority pays the expenses.

A VISIT TO VERITYS.

There is a tendency among us to regard the aggressive new-comer as being in a more fortunate position than the man who, having been on the ground many years, is hedged around by custom and tradition. True, he may be free of certain handicaps that are sometimes met with where old firms have adhered slavishly to old ways, and buoyancy of spirit, modern equipment, and freedom for enterprise may to some extent serve where experience, connection, and reputation are assets as yet unobtained. Most of us occasionally meet with those who appear to look upon the term "old" as a synonym of "fossilised," and the expression often so glibly used as the result of observation of one isolated incident concerning which we know but half, has, in nine cases out of ten, no truth in it at all. We have in the engineering world to-day many fine old businesses which were established by individuals who lived the strenuous life—even in the "good old times"—when they were putting in the foundations of a great undertaking. They have become known in every quarter of the globe, and their names are household words among us at home still. Wherein are they the worse for age? The pioneers who established them are no more, and the responsibility has fallen upon their descendants, or they have become limited liability companies. Herein we may have strength or weakness according to the circumstances. When principals no longer display a business zeal and affairs are allowed to drift into incompetent and less interested hands, or where sons devote their attention more to the turf or to the hounds than to the business which gave them their social position, small wonder is it if once proud names become among quondam industrial compeers a by-word and a reproach. The business may live a lingering sort of death held together by its old connections, and then there comes the inevitable reduction of capital, the reconstruction and reorganisation, and new blood is brought in to endeavour to rehabilitate the concern, but a good business name once lost is hard to recover. This work of rehabilitation is a thankless, and often a hopeless sort of task, and well-known names are doomed to disappear—we recall some whose fate this has been after a hundred years' existence; the attempt to rouse oneself and get into the modern run of things, building new works and so forth, has been made too late.



Messrs. Veritys' New Showrooms:
A View of the Eighteenth Century Room as seen from the Oak Room.

But this is only part of the story, and there is not the same need to dwell upon it now as was once the case, for there are many masters' sons in business to-day who are every whit as live and enterprising as their fathers were, as well as being more scientifically trained and commercially educated. The imperative necessity for modernisation in old factories has been fairly generally recognised, and some of these to-day are running efficiently and economically with the added advantage of a world-wide reputation which naturally has taken years to secure.

There is something interesting and attractive about the restless activities, and abundant life and energy, as well as the plain and hopeful speech, of the new-comer who, admitting that things are not what they were and that fortunes are not now so easily made, desires to get together a business, make money, and incidentally leave a name to industrial posterity. But while this is all exactly as it should be, the onlooker, if he be a man who has sufficiently studied the business game, will not be so absorbed in the contemplation of youth that he cannot feel an even greater satisfaction as he surveys an old-time business catching on year by year the new spirit and adapting itself to new situations as they arise. We venerate the old, but the combination of accumulated experience of industry and trade, knowledge of men and their idiosyncracies and the exercise of diplomacy in dealing with them, and a connection which is so firmly rooted at home and abroad that all the assaults of a twentieth century competition make no impression upon it, only add admiration to our veneration. We recognise that in these times it is fatal to depend too much upon an honoured name, but we confess to the pleasure that it has sometimes given us when conversing with employes of firms of long standing and renown to hear them speak with glowing pride about "our good old name," "our world-wide reputation," immediately proceeding to enter into details of modern enterprise and activity, demonstrating that though time has brought great change it has not brought decay. It may be that the reader will wonder to what all this cogitation is leading him. As a matter of fact, we have been led to make these casual reflections by recalling old names and firms to mind, contemplating their present doings and looking backward at what we have seen of rise and fall in a not more than ordinarily lengthy experience of the electrical and engineering industry. The incident which must be blamed for this indulgence in the reflective mood was conversation and observation in some premises a little off the Strand where an old print of the building as it was, say, 80 or 90 years ago, appealed to our literary instincts because of wielders of the pen whose haunts were thereabouts when journalism and literature were more attractive, because less commercial than now. To fall from the sublimer sphere to the matter of fact, let us say that the premises were those in King Street bearing the name of Verity. The aforesaid print shows the old original "Verity" shop where the gas fittings business

had its birth, now close upon 90 years ago. But there is not much of the old building remaining to-day. Contiguous premises were absorbed by the voracious Verity of



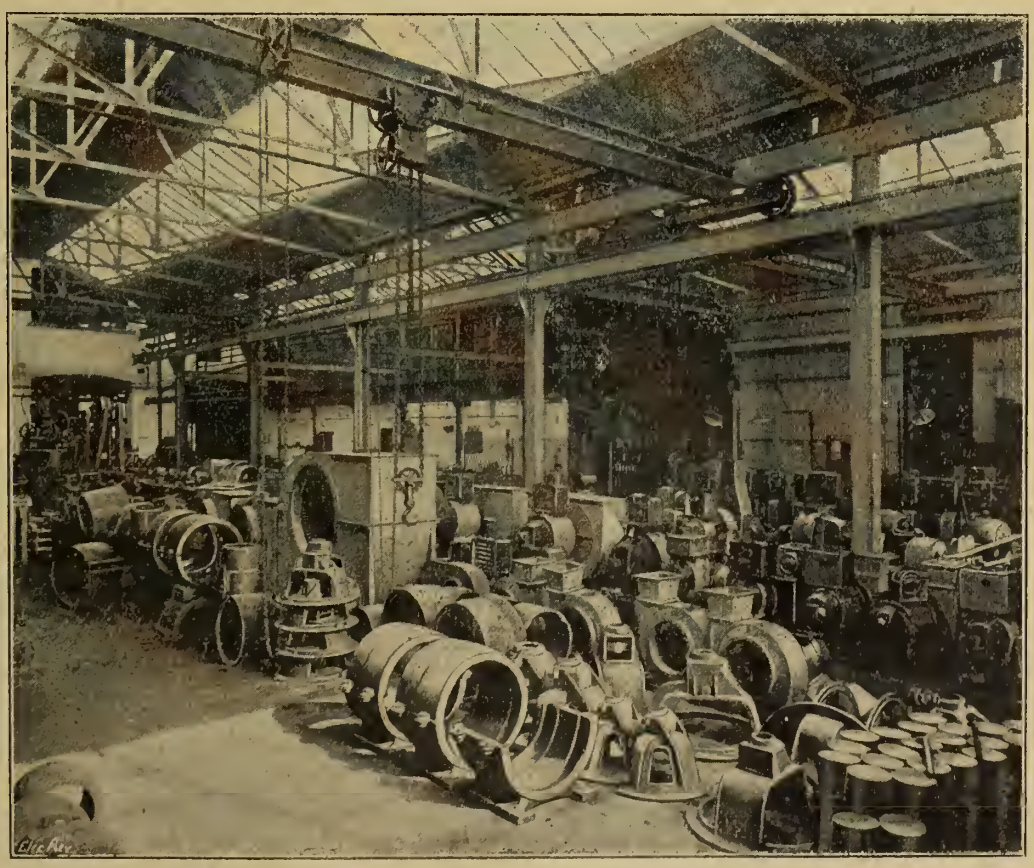
Veritys' New Electric Heating and Cooking Showrooms.

former days as business requirements compelled, so that the frontage is wider now, and inside the building during the last few months there has been a complete turning upside down and inside out, and the old rooms redolent of memory have had to give way before the pressing commercial necessities of 1911.

In many of its departments the electrical industry generally shows signs of increasing business, and a visit to these West End premises with their accommodation for counter trade, their special department laid out to educate the public itself up to the virtue of electric heating and cooking, and their admirably-appointed periodised show-rooms, all indicate that Messrs. Veritys are enjoying a good share of the improvement.

We have said repeatedly that electrical firms who in these days adopt a really enlightened foreign trade policy are bound to be rewarded, and if we were to refer merely to this particular aspect of Veritys' business, we should have to feel that it was the adoption of an aggressive foreign policy which had led to the necessity for both the large outlay at the Covent Garden premises and for the extensions to the Aston Works, which we illustrate in one of the accompanying photographs. The chairman of the company is a widely-travelled man, and in recent years he has conducted a personal investigation of electrical affairs in Canada, in India, in Russia, and we know not where—we are not sure whether he has been so far as the Antipodes. It is an instance of the success following the going out of the right man, armed with his own full authority and freedom to negotiate, and possessed with credentials giving him an *entrée* into useful circles. How far peregrinations of this kind have been responsible for a recent signal success in Ceylon against very keen Continental and American competition, we are not able to say, but the fact remains that the firm has just booked for Ceylon a contract to the value of £10,000 for electric fans, fittings, motors and other material.

Close upon 30 years ago an advertisement appeared in the Telegraphic Journal and Electrical Review, as we then called ourselves, to the effect that B. Verity & Sons, King Street, Covent Garden (only address), were designers and manufacturers of electric light fittings, that their showrooms were lighted by the Edison incandescent electric light, and that at the 1882 Crystal Palace International Electric



The Latest Addition to the Works at Aston.

Exhibition they were awarded the only prize medal for electroliers and other appointments for incandescent electric lighting. The firm of that day devoted itself to a speciality—electrical illumination; but the great strides that have been made by the electrical industry have led to other departments being opened and extended as occasion demanded, dealing with motors up to 100 H.P., electrical ventilation, controller gear, arc lamps, and last, but not least, electrical heating and cooking. Their three-volume catalogue shows how wide a field they cover, and is itself widely used both at home and abroad.

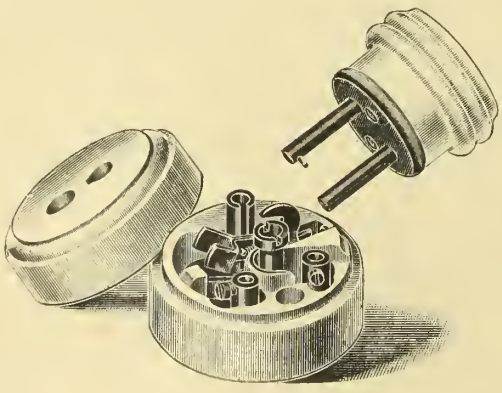
We gave a fully-illustrated description of the Aston Works, showing the manufacture of motors, switches, arc lamps, fittings, switchboards, &c., in our issues of March 2nd and 9th, 1906. It is interesting to note that this year the firm celebrates the 21st year of its removal of manufacturing operations from London to Birmingham. Since that change took place the progress made in electric heating and cooking, electric signs, electric fans, electric motor applications and other such lines has made new demands upon manufacturing capacity. In one of our photographs we show a collection of the heating and cooking apparatus that is now on show at Covent Garden. To a large extent pictures of this kind must be allowed to speak for themselves.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Switch-Plug.

Messrs. Julius Sax & Co., Ltd., of 24A, High Street, New Oxford Street, W.C., have just introduced a combined switch-plug which offers a ready means of complying with the regulations requiring plug connections to be independently switch controlled on the live side of the connector.

It will be seen from our view, that the arrangement consists of a china base with cover, containing a quick-break switch, the movement of which is controlled by a small pin projecting sideways from the tip of one of the plugs; the inserting of the plugs in the sockets pushes the switch "on," while on withdrawing the



plug, the small pin referred to catches in a hooked projection on the switch arm and pulls it off at the same time—a spring movement giving a quick-break. With this arrangement it is obviously impossible to insert the plug into "live" terminals as the switching-on action does not occur until the plug is pushed home; similarly the sockets are "dead" before the plug can be withdrawn. The device is well-made and is as easily wired as an ordinary plug.

Foster Contactless Electric Bell.

Having marketed a small transformer for ringing electric bells from the public A.C. supply, the Foster Engineering Co., Ltd., of Wimbledon, have gone one better, in devising an alternating-current electric bell without a make-and-break. The mechanism is similar to that of the ordinary trembler bell, with the difference above-mentioned: the armature, however, is stiffly supported, so as to have a natural period corresponding with that of the supply current, and carries a clapper on a flexible stem, the result being that the bell is caused to ring by the alternations of the current. The bell may be operated in series with a lamp, or off a transformer, or may be wound for direct connection to the lighting circuit. It is an ingenious device, and should prove popular.

BUSINESS NOTES.

The Mazda Lamp.—A new and attractive showcard has just been issued by the British Thomson-Houston Co., Ltd., with the intention of giving fresh impetus to the demand for the "Mazda" lamp, with drawn-wire filament, the mechanical strength of which is graphically demonstrated by the centre



illustration. A brawny arm with clenched hand is seen striking a "Mazda" lamp. The force of the blow sets the lamp swinging in mid-air—with the filament intact. Other features of the new showcard are several well displayed catch-words. We understand that the black and white reproduction herewith gives no idea of the actual effect as the circle in the centre is a vivid red.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—56-page catalogue (No. 8) containing brief descriptions, numerous illustrations, and particulars of prices of a variety of colliery accessories, including standard pattern magneto call telephones, portable and watertight telephones, switches, relays, mine exploders, miners' lamps, weatherproof bell and pushes, batteries, wires, insulators, lamps, carbons, cluster fittings, watertight lighting fittings, ironclad switches and fuse boards, steel conduit, &c.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—List No. 328, of 32 pages, illustrating various designs of "Aureola" luminous radiators and convectors ranging from the simple two-lamp iron-frame radiator to the antique copper and polished brass frame radiator of more ornate character. Among the latter we observe one with gilt brass frame, with cast enrichment and brass curtain. A novelty—as it strikes us—is a radiator in wrought-iron frame, double encased, with polished copper reflector, with a fire-screen giving the effect of a coal fire.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street Street, Dalston, N.E.—The firm announce a new departure in connection with the pushing of their "Onewatt" battery lamps. They are now supplying showcards which can be purchased by contractors in quantities, and on which one of each type of "Onewatt" battery lamp is mounted. These are, of course, supplied to contractors at prices embodying the discount allowed to the trade. The card is printed in red and blue, and is mounted on stiff board which is cut away in order to effect a secure fastening for the lamps, and is eyeletted and strung for suspension purposes. On the back of the showcard are printed full particulars of the types of lamps which can be obtained, together with the voltages and candle powers in which they are supplied. The various types of lamp and prices are clearly shown, and contractors may find the cards to be business-bringers if suitably displayed in their windows.

We have received a framed reproduction of a series of interesting sketches by Mr. McBean on "Making the 'Onewatt' Lamp." They depict the processes entirely from the humorous point of view, and in the main are quite successful in getting home on the points claimed in favour of the lamps.

Messrs. Hans Renold, Ltd., Progress Works, Brook Street, Manchester.—New illustrated pamphlet of eight pages relating to Renold driving chains applied to governors and valve gear. Copies can be obtained on application.

The Knapp Electric and Novelty Co., 511, West Fifty-first Street, New York.—Catalogue No. 22 containing illustrated particulars and prices of a number of miniature models of electric motors, dynamos, battery fans, magnetos, electric trains, &c.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—New catalogue of 30 pages (No. F3) containing excellently printed illustrations and prices of many designs of electric light fittings (electroliers, cord pendants, rise-and-fall pendants, ceiling fittings, wall brackets, standards and hall lanterns). A number of hand-wrought luminous radiators and cast-iron watertight fittings are also included.

Book Notices.—"The Mathematical Theory of Electricity and Magnetism." By J. H. Jeans. 1911. Cambridge: The University Press. Price 15s. net.

"Electric Traction for Railway Trains." By Edward P. Burch. 1911. London: Hill Publishing Co. Price 21s. net.

"*Boletin* de Ingenieros." Vol. II, No. 1. September, 1911. Mexico: Secretaria de Guerray y Marina.

"Il Nuovo Cimento." September, 1911. Pisa: Stabilimento Tipo, Toscano.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University." Vol. III, Nos. 4, 5 and 6. Kyoto, Japan: The College.

"The Post Office Electrical Engineers' Journal." Vol. 4, Part 3. October, 1911. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"The Steam Turbine: The Rede Lecture, 1911." By Sir Chas. A. Parsons, K.C.B. 1911. London: Cambridge University Press. Price 1s. 6d. net.

"The Physical Review." Vol. XXXIV, No. 3. September, 1911. Lancaster, Pa.: The *Review* Offices.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXIII, No. 10. October, 1911. Baltimore, Md.: The Society. Price 35 cents.

"The Law Relating to Engineering." By L. W. J. Costello. 1911. London: The Society of Engineers. Price 5s.

"An Elementary Course on Applied Electricity and Magnetism." By Daniel H. Ogley. London: Longmans, Green & Co. 1911. Price 2s. 6d. net.

Trade Announcements.—For the convenience of their customers throughout Scotland, the Western Electric Co., Ltd., have opened a branch office in Glasgow at 49, West Campbell Street, where their representative, Mr. Malcolm Breingan (late of the General Electric Co.), will give personal attention to all inquiries for cables, telephones, and electrical supplies. Demands will be met from stock. Telegraphic address, "Microphone, Glasgow"; telephone, No. 1999 Central.

In consequence of the re-numbering of Tothill Street, the address of Messrs. Ledward & Beckett, Ltd., will in future be 33, Tothill Street, S.W.

Mr. T. Wray has removed his business, as electrical engineer, from Petergate, James Street, to 3, Cheltenham Crescent, Harrogate.

Messrs. Mayne & Sons, electrical engineers, of Station Approach, Beaconsfield (Bucks.), have opened a branch business at 5, Market Street, Maidenhead.

Messrs. Haslam & Schontheil, Ltd., of 11, Windsor Place, Cardiff, have been appointed selling agents in South Wales and Monmouthshire for Messrs. E. Bennis & Co., Ltd., of Little Hulton.

Owing to rapid extension of business the Silent Electric Clock Co., of 192, Goswell Road, E.C., have, for the second time within 12 months, had to enlarge their premises. They have just fitted up additional office accommodation and a new large showroom, where they will welcome visitors who wish to inspect the details of their "G. B. Bowell" silent electric clocks.

Mr. F. Peake Sexton has removed to 48, London Road, Kingston-on-Thames, owing to increased business. The business will be carried on as Tameso Co., electrical contractors and scientific advisers.

The British Thomson-Houston Co., Ltd., are removing their Leeds office from Greek Street Chambers to Standard Buildings, City Square. The telephone number is unchanged, namely, "3241 Central."

Cab Tire Sheathing.—In a letter received too late for our "Correspondence" columns, referring to the mention of cab tire sheathed cable in a letter signed by "An Electrician" in our last issue, Mr. J. H. C. Brooking, manager of the St. Helens Cable and Rubber Co., Ltd., points out that the writer is wrong in stating that this cable, in the kindred forms of hard cord and metallic-braided flexible, has been in use for seven or eight years. There is a considerable difference between cab tire sheathing and the protection of the flexibles mentioned, as in fact there is between this class of cable and any other in use; and while he does not wish to make comparisons with what are really useful types of cables in certain situations, Mr. Brooking desires us to insert this correction to our contributor's statement, lest his company's patent cab tire sheathed cables should be confused with other types of protected cables.

"Twingrip" Lampholder.—We are informed that this lampholder, designed to prevent short-circuiting of the flexible cord where it enters the cord grip, is shown on the stand of the Edison & Swan United Electric Light Co., Ltd., at Olympia.

Bankruptcy Proceedings.—C. F. Lindop, electrician, 16, Moss Lane, Aintree, Liverpool, late 62, Dale Street, Liverpool.—The adjourned public examination took place on Monday last at Liverpool. The Official Receiver said that since the last hearing of the case he had had an opportunity of seeing a number of vouchers for payments which were in the hands of the Receiver for the debenture-holders, and so far as he was concerned, the examination might now be closed. Mr. Garner Smith, for creditors, said he had nothing further to ask. Mr. Madden, barrister, also present for creditors, had nothing to ask. Mr. Gething, barrister for the debtor, asked that the examination be closed, and this was sanctioned by the Registrar.

Metallic-Filament Lamps—Price Reduction.—The interesting announcement has just been made by the General Electric Co., Ltd., makers of the Osram lamp, that the prices of H.V. Osram lamps are now reduced from 3s. 9d. and 4s. respectively to 3s. This reduction, we are informed, is not in any sense indicative of an existing or impending war of prices; it has been made deliberately, with the co-operation of the various other firms which are licensees of the General Electric Co., or with which that company has a patent understanding, because the initial difficulties experienced in the manufacture of high-voltage lamps, with their necessarily delicate filaments and larger bulbs, and the high percentage of breakages in the process, have been to a large extent overcome, and thus the reduction has been made possible by an actual decrease in the cost of production. The lower cost will prove of material assistance to the electrical industry in its fight with the gas mantle, and the makers hope to benefit also by the increased demand resulting therefrom.

Simultaneously we have been notified of corresponding reductions by Messrs. Krupka & Jacoby in the list prices of their Graetzin lamps (200-260 volts, 3s.; 100-135 volts, 2s. 6d.); the Edison and Swan United Electric Light Co., Ltd. (do., do.), who are also introducing 12-watt 100-130-volt and 24-watt 200-260-volt lamps at slightly higher prices: Messrs. Drake & Gorham, Ltd., Osram lamps as above (and a 20-watt 16-C.P. lamp for 200-260 volts); Messrs. G. M. Boddy & Co., Mazda drawn-wire lamps (prices as above); and Messrs. Siemens Bros. Dynamo Works, Ltd., "Onewatt" drawn tungsten lamps (prices as above). The last-named firm inform us also that the H.V. tantalum lamps are reduced to 3s. each (in ordinary bulbs), and that the sale of both these and the tungsten lamps is steadily increasing.

Dissolutions and Liquidations.—Auto-Controller and Switch Co., Simplex Works, Vienna Road, Bermondsey, London, S.E.—The partnership between Walter Robbins Cherry and John Bush has been dissolved. The business of the Auto-Controller and Switch Co., including the manufacture of Fluxite soldering paste, is being carried on by Mr. W. R. Cherry alone, under the old name and at the same address.

Davis Electrical Co., Ltd. (in liquidation).—A meeting of creditors will be held at Armfield's Hotel, South Place, E.C., on October 23rd.

Animatophone Syndicate, Ltd.—A petition for winding up this company, presented by Peto & Radford, Ltd., and E. T. Heron and Co. (publishers), is to be heard on October 24th.

Doncaster Electrical Co., Ltd.—A meeting of creditors was called for October 16th, at Doncaster.

Fire.—The premises of Messrs. Parsons Bros., electrical engineers and ironmongers, 34, Eastgate Street, Gloucester, were, on 1st inst., destroyed by fire.

LIGHTING and POWER NOTES.

Australia.—The North Sydney (N.S.W.) Electric Lighting Bill is to be introduced into the Legislative Council at an early date; the Bill is on the same lines as the Balmain Council's Bill, which gives the Council power to enter into arrangements with a supply company if necessary.

The Perth (W.A.) City Council is endeavouring to secure the services of Mr. H. R. Forbes Mackay (Sydney) to report on the proposed purchase of the Perth Gas Co.; two reports on the matter have already been obtained.

A preliminary report has been received by the Tasmanian Minister of Mines, showing that 5,000 H.P. could be disposed of at North-East Dundas for mining purposes, and that this could be developed with the local water power.

Bampton (Devon).—A largely-attended meeting was recently held to ascertain the feeling of the inhabitants regarding an electric light scheme. Mr. Steele attended on behalf of the consulting engineers, Messrs. J. and W. Purves, and explained the details of a scheme estimated to cost £1,700, divided into ordinary shares of £1 each. It was considered that the present was an opportune time for the introduction of an electric light scheme, seeing that they would not meet with any opposition from a gas company, as in some towns. As there are no gas works in the town, it is predicted that the growth of the undertaking would be rapid and remunerative. The meeting heartily approved of the electric light scheme being introduced, and elected a committee to promote the same.

Bangor.—The City Council has decided to spend £500 upon a further extension of the electricity mains and services, and proposes applying to the L.G.B. for sanction to borrow the money.

Batley.—The T.C. has decided to ascertain the number of probable consumers of current in the Staincliffe boundary district, with the view of extending the mains and feeders there. The estimated cost is £1,700.

Birmingham.—The Electric Supply Committee has decided to acquire a site of 17 acres for another generating station. It is stated that the Committee intends to erect a H.T. power station, with an up-to-date equipment, at a cost estimated at nearly a quarter of a million sterling.

Bradford.—The annual report of the Corporation Electricity Committee, which has just been issued, shows that output and revenue have continued to increase, whilst the working expenses per unit sold show a decrease, and the net profits an increase. The latter, for the financial year ending March 31st last, amounted to £8,979. The total revenue exceeded that of the previous year by over £3,000, this being due, no doubt, to the policy of the Committee in reducing charges, thereby bringing about a greater demand and a larger output. The increased output in connection with the bulk supply during the 12 months ended June 30th, 1911, though not so great as in the year previous, reached the substantial figure of 540,628 units. The output to the smaller power consumers, however, has increased by 527,845 units. The new rateable value system of charging for current supplied to private houses has proved popular, over 40 per cent. of such consumers having now adopted this system. The total number of consumers at the end of June had increased from 2,701 to 3,052, being an increase of 13 per cent. Altogether 351 new consumers had been obtained—the largest yet recorded in one year.

Cheltenham.—The T.C. has authorised application to be made to the B. of T. for an order to amend the Cheltenham Electric Lighting Orders of 1890, 1899 and 1900, by extending the area for the supply of electricity to the parishes of Leckhampton, Swindon, Prestbury, Badgeworth, Shurdington and Up Hatherley, in the Cheltenham Rural District, and to Bishops Cleeve, Southam, Brockhampton and Woodmancote, in the Winchcombe Rural District. It was stated that the undertaking had gradually progressed, and from having only 101 consumers, had now 1,401. The increases in the number during the last two years had been greater than ever before, viz., 147 last year and 153 the year before.

Clevedon.—A company has been formed for the purpose of providing an electricity supply for the town, and shares to the value of over £6,000 have already been taken up.

Continental Notes.—France.—A new company has lately been formed at Douai (Nord), with a capital of £5,000, and the title La Compagnie Electrique du Canton de Marquion (Pas-de-Calais), to undertake the supply of electrical energy for lighting and power purposes to a number of villages in the Marquion district.

The establishment of generating stations at the mines in the Pas-de-Calais district is on the increase and extending to other Northern mining districts. Those mines using coke furnace gas, or that derived from inferior coal, are able to generate current at a cheap rate and to profitably distribute it, after having appropriated the energy needed for their working, at times when there is the least call for it at the mines. Among the mines which are active in this new departure are the Lens Colliery, which has founded the Société Electrique du Nord; the Béthune Colliery, whose offshoot is the Société Arthésienne d'Eclairage et de Distribution; the Bruay Colliery, which has launched the Société Beithunoise. These electrical societies have come to an understanding as to the sharing of the supply area, and the current which they are about to generate will presently be distributed at 26,000 volts, and afterwards at 45,000 volts throughout the departments of the Pas-de-Calais, the Nord, and as far as those of the Aisne and the Somme. The character of the equipment of the several mines' generating stations is shown by the following details:—That at the Bruay Colliery comprises two turbo-generators, of a capacity of 1,000 KW. at 5,000 volts. The Ligny-les-Aire station has a group of high-pressure Zoelly turbo-generators of 900 KW., distributing current to the transmission lines at a pressure of 5,000 volts. The Lens Colliery has already at work a group of turbo-generators of an average capacity of 5,250 KW. The Courrières Mines has completed the installation of a turbo-alternator of 1,000-KW. capacity. Calculations recently made show that the power available for the working of the mines represents on an average 3,130 H.P. per 1,000 tons extracted, as contrasted with 2,950 H.P. in 1909.

Bosnia.—The Austrian Finance Ministry has approved of the plans of an electric light and power station at Bihaé, and the constructive works will be undertaken forthwith by the firm of Janesch & Schnell, the equipment and starting of the undertaking being entrusted to the A.E.G. Union of Vienna. The cost, estimated at over 300,000 kr., has been advanced to the local authorities by the Agrar und Kommerzial Bank of Sarajevo.

Devizes.—At the last meeting of the T.C. a scheme for extending the area of supply for electric lighting in the neighbourhood was adopted. Starting in 1895 with 101 customers, an average of about 90 a year, it was stated, had been added.

Dundee.—The Convener of the Corporation Police Committee states that great progress is being made in the lighting of common stairs by electricity, and that there are now between 1,500 and 1,600 electric lights in use.

Fleetwood.—The Fleetwood Council is making every endeavour to popularise the use of electric current; it has just opened an electrical exhibition in Lord Street, where there are on view the latest appliances and all manner of electrical fittings.

Frome.—At the meeting of the U.D.C. the General Purposes Committee reported that they had passed plans for extensions of the electricity works. The contractors are Messrs Edmundson.

Glasgow.—The City Watching and Lighting Committee recommends that 100 electric lamps be obtained for use by the police, and that the electrical engineer be requested to have switchboard and motor-generator for charging the lamps installed at the Central Police Chambers at a cost of £90. Hitherto oil lamps have been used.

The new electric passenger lifts installed in the Corporation principal public library, which was recently opened, are of the full automatic push button type, with electro-mechanical gate locks, a range of push buttons in the car, and call pushes at each of the six landings. The lifts have been installed by Messrs John Bennie, Ltd., Glasgow, who are at present fitting one of the lifts into Windsor Castle.

Gosport.—Independent electrical installations are to be provided by the Government for the Royal Clarence Victuallin Yard and the new Magazine Works at Bedenham.

Hartshead.—At the monthly meeting of the Halifax R.D.C., held at Halifax, an agreement was signed between the Council and the Yorkshire Electric Power Co. to supply 50 lamps for lighting the streets of Hartshead with electricity. The work to be proceeded with as soon as possible.

Japan.—The Municipal Electric Bureau of Tokio has announced a scheme for the installation of a million electric lamps in the Japanese capital. According to the proposal, the work is to be completed within two years, the cost being estimated at £2,000,000.

Liverpool.—During the present year the demand for electrical energy for power purposes has steadily increased in Liverpool, and 305 motors, &c. (equal to about 1,300 H.P.) have been connected to the public supply mains, while the current supplied for this purpose exceeded by more than 30 per cent. the sales of the previous year. There are now about 8,230 consumers connected to the mains. The area of supply has been increased in many districts by extensions of the distributing mains, the whole of the work being carried out by the staff and employés of the department. In this connection, an important feature has been the supply of the garden city estate at Wavertree, where 8 dwelling houses have already been connected, with a prospective total of about 1,800 houses.

It was reported by Mr. H. Gobie (chief engineer) at the meeting of the Workhouse Committee on October 12th, that during the past year the electrical plant of the Brownlow Hill Workhouse has worked so satisfactorily that the total annual cost, including £700 for interest and repayment of loan, had only amounted to £1,698, compared with the sum of £3,291, which would have been charged by the Corporation if the supply had been obtained from the municipal mains at a flat rate of 2½d. per unit. In 1907-8, the cost of generating 316,000 units was £1,075 or ·813d. per unit, and last year the cost was £998 for generating 329,000 units, or ·725d. per unit. In fours years the coal consumption had been reduced by 1 lb. per unit, equal to a saving of 147 tons per year for electric light and power purposes, while in the same period the maintenance cost had advanced only £12.

London.—Bethnal Green.—The Electricity Committee has recommended that Mr. J. F. C. Snell be appointed to advise in regard to the proposed scheme of electricity supply, at an inclusive fee of 200 guineas.

Newport (Mon.).—The T.C. proposes to ask the L.G.B. for sanction to borrow £5,000 in order to provide motors for hire and hire-purchase in the town, and for the purpose of wiring approved premises, and the Electricity Committee has been ordered to take the necessary steps in the matter.

Portsmouth.—The E.L. Committee of the T.C. has decided to extend the cables so as to supply current to Weingarten's factory at All Saints, and to install seven 1,000-C.P. flame arc lamps along the tramway route. The lighting mains are also to be extended in the Goldsmith Avenue district, where houses below £30 annual value are now being wired owing to the economy of the metal-filament lamp.

Quarndon.—The Derby T.C. is making efforts to have the electric supply extended to this village by means of overhead wires carried through the fields at the rear of the houses, and, providing no obstacles are put in the way by the P.C., the scheme will go through. The main object is to give a supply to Kedleston Hall, as Lord Scarsdale desires to do away with his private plant. Other influential residents have promised to take current, and it only rests with the P.C. to extend its support, and, if possible, to have the village lit by electricity.

Southampton.—The Electricity Committee of the T.C. has recommended that the price of current for ordinary lighting be reduced from 3½d. to 3d. per unit as from the December readings.

Stoke-on-Trent.—The T.C. has received the sanction of the L.G.B. to practically all the loans asked for in connection with the £60,000 electricity scheme.

Stourport.—The B. of T. has deferred the question of revoking the E.L. order until the end of the year. The Kidderminster E.L. Co., which is the holder of the order, is taking steps to carry it out, the U.D.C. having granted concessions with regard to the use of overhead wires.

Swindon.—For some considerable time extensions have been proceeding at Swindon electricity works, and further plant is now to be installed, the electrical engineer's estimate for which is as follows: One 250-KW. Diesel engine, £8,320; fuel tank, £100; road tank, £50; foundations, £300; piping, &c., £300; switchgear, £200; contingencies, £320—total, £5,600. Some discussion took place at the T.C., relative to the purchase of the Diesel oil engine, some of the members preferring a steam turbine set, but eventually it was decided to install a Diesel set. The electrical engineer's judgment was that, from both engineering and financial standpoints, Diesel oil engines, as distinct from steam turbine engines, were a sound proposition.

Swinton and Pendlebury.—The U.D.C. has instructed the resident engineer to submit a scheme for the supply of electricity in the area bounded by Partington Lane, Worsley Road and Moorside Road, together with an estimate of the capital cost.

Teignmouth.—A special meeting of the Urban Council has been held to consider a letter from Dr. Purves regarding the electric lighting order which he proposes to promote this autumn. Dr. Purves wrote that if the suggestions contained in his letter were approved, the Council would lay the necessary mains and distribute and sell the electricity in Teignmouth, a business that could easily be carried on by the present gas department. The only capital outlay for the Council would be upon the mains, as he would provide all the capital for the generating station and destructor. The letter was discussed in Committee, after which it was resolved that, having carefully considered the matter and being unable to accept Dr. Purves's figures, it declined the offer contained, as even assuming his figures to be correct, the Council considered that the proposed undertaking could not result in anything but a serious loss to the ratepayers of the town. The clerk was instructed to proceed, as agreed upon at the last meeting of the Council.

Wakefield.—The T.C. has received the sanction of the L.G.B. to a loan of £4,500 for mains, £540 for transformers, and £500 for sub-stations.

Wednesbury.—On Wednesday, last week, a L.G.B. inquiry was held respecting an application by the Corporation for sanction to borrow £4,997 for the purposes of the electricity undertaking. Mr. Fennell (borough electrical engineer) stated that the success of the undertaking dated from the time the Corporation ceased to buy its electricity in bulk and put down its own plant. Prior to the putting down of its own plant, he added, it was losing annually a sum equivalent to a rate of 2½d. in the £.

Whitehaven.—The T.C. has received a letter from the electrical contractors of the town objecting to a form of specification for wiring that was being sent out by the electrical engineer, which, they contend, is an interference with their business. The T.C. has referred the matter to the Water and Lighting Committee for consideration.

TRAMWAY and RAILWAY NOTES.

Australia.—In connection with the report of the Royal Commission favouring the electrification of the Melbourne Suburban Railways, it is further recommended that the State should purchase the rights in the existing metropolitan tramways, and that pending the creation of the proposed Greater Melbourne Council, a municipal tramway trust should be formed to run the tramways. The Greater Melbourne Council, we may add, proposes to incorporate 19 outlying and adjoining municipal areas with Melbourne, for administrative purposes and for the control of the public utility services.

Colwyn Bay.—At the meeting of the U.D.C. on October 10th, the clerk drew attention to the notice given by the Llandudno and Colwyn Bay Tramway Co. of its intention to apply to the B. of T. for an extension by two years of the period during which it may construct the remainder of the "Railway No. 7" at Colwyn Bay. The only portion of No. 7 railway not yet constructed, he explained, was a length of about 24 yards from the present terminus at the top of Station Road in the direction of Old Colwyn. There was another railway, No. 8, authorised, extending further in the direction of Old Colwyn, but the period covered by the B. of T. order in respect of it had not yet expired. It was questionable whether any opposition to the present application would serve a useful purpose. It was decided, as a protest, to ask the B. of T. to grant the extension for one year only.

Continental Notes.—AUSTRIA.—It was mentioned a few weeks ago that the Vienna Traffic Commission proposed to invite offers in connection with the projected conversion of the Vienna City Railway to electric traction. It is now announced that the seven large banks in that city, in association with the local A.E.G.-Union Co. and the Austrian Siemens-Schuckert Works and their German friends, have offered to enter into negotiations with the Traffic Commission in regard to the matter, and it is assumed that the Austrian Brown, Boveri & Co. will also join the group in order to exclude competition between the firms in question. The expenditure on the transformation would be so considerable as to preclude one bank from financing the enterprise, and this explains the co-operation of the seven leading banks in Vienna. On the other hand, a French syndicate, headed by the Omnium Lyonnais, is also taking an interest in the matter, and a firm at Prague is likewise concerned in the question.

A preliminary concession has lately been granted in respect of a projected narrow-gauge electric railway between Orlau and Kapaniny, Austrian Silesia.

GERMANY.—It is stated that as a result of the experience gained this year in the working of the main line on the trial section between Dessau and Bitterfeld, the Prussian State Railway authorities are now proceeding to convert to electric traction the connecting lines between Bitterfeld, Leipzig and Halle, and between Dessau and Magdeburg. A beginning has already been made with the extension of the Muldenstein power station, which is situated in the Bitterfeld lignite district, and from which the railway is supplied with H.T. alternating current. Two steam turbines, each of from 5,000 to 7,500 H.P., have been ordered from a Berlin firm, and it is expected that the total length of 93 miles of railway will be operated by means of electric locomotives in about a year from the present time.

It is reported in well-informed circles in Berlin that as the preliminary labours in connection with the proposed transformation of the Berlin City Railway to electric traction have been completed, the practical work may be expected to be put in hand in the near future. It is proposed to erect a power station in association with a lignite mine in Saxony, the energy being transmitted over the long distance to Berlin.

The narrow-gauge railway running between Bremen and Tarmstedt is to be converted to electric driving. Negotiations for the alteration of the concession are under way, and as the Bremen Senate and the Government President at Stade are in favour of the project, little doubt of its realisation may be entertained. The capital required, about 1,500,000 marks, is said to be available.

RUSSIA.—Good progress is being made with the electrification of the horse tramways in Odessa; the power station and three sub-stations have already been completed, and 16 miles of electric tramways are now open for traffic.

ITALY.—Official sanction has been accorded to the application by the Société Anonyme Les Tramways de Palermo for leave to construct and work a tramway network at Palermo.—*Giornale dei Lavori Pubblici.*

Darlington.—The B. of T. has granted the T.C. an extension of time until October 24th, 1913, for completing the tramway extensions to Haughton.

Dewsbury.—At a joint meeting of the Parliamentary and Electricity and Tramways Committees it was decided, by a small majority, to recommend the Council to apply for a prov. order authorising the construction of a tramway along Willans Road, Moorlands Road and Staincliffe Road, to the Butcher's Arms.

Dundee.—Mr. Peter Fisher, the manager of the Corporation Tramways, has issued an interesting report on the effects of changes in the fares, which were remodelled about six months ago. At that time a general fare of 1d. all the way from the centre of the city to the suburbs was adopted. This involved the cutting down of some of the ½d. stages, and these stages were generally fixed at 880 yds. The estimates for the current year provide for a reduction in the receipts by £2,200, as compared with the previous year's working, but the actual result of the first four months' working under the new conditions showed a drop of only £289, instead of £730, as estimated. That the change of fares was popular with the public was evidenced by the increase in the number of passengers carried, which was 44,608 greater than the number for the same period of last year. Comparatively few tramway systems, Mr. Fisher states, had adopted ½d. fares over the whole of their lines such as had been done in Dundee, and 60 Corporation tramway undertakings in Britain did not have ½d. fares on any part of their system. Twelve systems on which ½d. fares were adopted did not pay their way. Regarding a suggestion that the Dundee 1d. maximum fare provided too generous conditions for those who resided near the extreme ends of the routes, Mr. Fisher points out that such fares encourage building at the outskirts, and enable the working classes to visit the country in a convenient and cheap fashion.

Glasgow.—The recent Conference of the members of the Municipal Tramways Association at Glasgow, and the civic hospitality extended to the representatives, was the subject of a rather heated discussion in the local T.C., when Mr. Lyon put a question to the convener of the Tramways Committee, bearing on the lavish hospitality afforded to the Association during its recent visit. Mr. Nelson explained that the Association consisted not only of tramway managers, but representatives from the leading municipalities in the kingdom. The arrangements were carried out on lines similar to those which obtained in other municipalities, and were made by the Sub-Committee. Mr. P. S. Stewart inquired if the Sub-Committee had been consulted in connection with five different functions given to the Association, and contended that Mr. Dalrymple was the whole Committee. Mr. Stewart threatened to have the standing orders suspended to open up the whole question, but was ruled out of order, and the discussion was closed.

At a later stage of the same meeting, Mr. Lyon asked for information as to when the Tramways Committee would report upon the remit from the T.C. in connection with the blind people travelling free upon the tramway cars. The sub-convener of the Tramways Committee replied that the requirements of every blind applicant in the city for tramway service were inquired into by arrangement with the Tramways Committee, and every applicant was supplied with an adequate supply of tokens.

The question of giving two present ½d. car stages for one ½d. has been discussed by the T.C. on a proposal to that effect by Bailie M'Mullan, who, in moving the proposition, expressed the opinion that not one member of the Corporation, from experience, would say that the two-stage fare had not been a success, and he questioned very much if they had lost any money at all, because they had had an increase of customers. He was convinced that the scheme would prove as successful as the two-stage one. Bailie Alstan thought the Committee should not be called upon to introduce innovations till May 31st, when the progress of the two-stage experiment would be reported upon. A direct negative was moved by Bailie Russell, the convener of the Tramways Committee, who promised, on behalf of the Committee, a full report at the end of May. The Lord Provost, having expressed the opinion that in future two of the present ½d. stages would be given for one ½d., recommended the withdrawal of the amendment on the ground that no harm would be done in the Committee reporting on the whole question. This was agreed to.

The T.C. has been recommended to pay £10,000 towards the cost of the construction of new bridges to carry the Corporation tramways over the Forth and Clyde Canal within the burgh of Clydebank, the authorities of the latter burgh to pay any additional costs which might be incurred.

Gosport.—The U.D.C. has decided to oppose the application of the Portsmouth Tramways for an order amending the route of the proposed tramways from Privett Road to Lee.

Hazel Grove and Bramhall.—The U.D.C. has decided to lease the tramways to the Stockport T.C. until 1926, at an annual rent of £645.

Leith.—The Sub-Committee of the Corporation Tramways Committee is considering a proposed extension, and has asked for a conference with the Edinburgh T.C., in view of the routes proposed for the railless trolley system in that city.

Liverpool.—Evidence of the continued prosperity of the Corporation electric tramways department was given at the last meeting for the municipal year of the Tramways Committee on Thursday, October 12th. Sir Chas. Petrie (chairman) in his review, said the nine months of the year had created another record. Passengers numbered 95,773,341, an increase of 2,266,686, or 2·4 per cent.; mileage was 9,235,431, an increase of 107,856, or 1·2 per cent.; receipts were £446,779, an increase of £13,616, or 3·1 per cent.; and the receipts per car-mile were 11·61d., an increase of ·22d. In the engineering department of the tramways a staff of about 370 men had been employed throughout the year at the Lambeth Road works. Fifteen new cars of the standard type will have been completed by the end of the year, making the total number of cars in service 561; of these 54 are first-class cars. During the year 88 cars were fitted with new running gear, making a total of 470 cars so equipped.

A memorial was submitted to the Committee from residents in Edge Lane and district, praying that electric cars should be laid in Edge Lane as soon as possible. It was announced that the Committee had authorised the city engineer to proceed with the construction of this section, and the lines will be laid at an early date.

Peru.—The concession for the construction and working of an electric tramway in Arequipa has been transferred from the Crédito Urbano de Arequipa (now in liquidation) to the Compania Anonima de Tranvia Electrico de Arequipa. The latter is allowed four months in which to draw up plans for the execution of the work.—*Board of Trade Journal.*

South Africa.—The Pretoria T.C. has decided to expend £48,000 on the extension of its tramway system; it is also intended to install a 1,000-KW. steam-driven generator, with boiler plant, &c.

Stockport.—The Corporation Tramways Committee has decided, subject to the consent of the T.C., to seek Parliamentary powers, in conjunction with Hazel Grove U.D.C., to run railless trolley cars from Marple to Stockport.

Widnes.—The following resolution was submitted at the last meeting of the T.C. on Tuesday, October 10th, by Councillor Lewis: "That, having regard to the success attending the introduction of motor-'buses into the borough and the probable requirement of further provision to meet the public need in this respect, it be an instruction to the Committee to obtain expert advice on the practicability of an electric traction system of transit within the borough and the probable cost of installing and equipping such a system and maintaining and working the same." It was pointed out that the Committee was making inquiries into the question of electric tramways, and the subject was adjourned for two months, when it is hoped a report will be ready.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephone Patent.—An application is being made to the High Courts for the prolongation of the Strowger patent No. 809, of January 1898, for an automatic telephone system, on the ground that the inventor has not received an adequate financial return. The British patent is owned by the British Insulated and Helsby Cables, Ltd.

Hythe.—As the result of the interview between the Mayor of Hythe and the Post Office officials in London, the latter have agreed to lay the 64 wires mentioned in our last issue, underground in the High Street, thus removing the grievance of the T.C. The change will be made when the Post Office takes over the telephone system, and in the meantime the service will not be interfered with.

London and the Continent.—Experiments on telephonic communication between London and Basle, through Paris and Belfort—a distance of over 620 miles—have been carried out recently, with excellent results, thanks to the new loaded cable. Communication has also been effected with Amsterdam and several German cities.

Lundy Island Isolated.—For some weeks past Lundy Island, one of the most important signalling stations on our coasts, has been isolated, through a break in the cable connecting it to the mainland.

Night Letter Telegrams.—The German Government has introduced letter telegrams, which may be sent between 7 p.m. and midnight, to be delivered by the first mail in the morning, at a cost of one pfennig (⅛d.) per word, the minimum number being 50, or, say, 6d. per message. If this plan were adopted here, we should have traffic on the lines, charged at one-fourth of the usual day rate, to be worked by operators on night duty, receiving higher pay, and working under more expensive conditions. The fact that the lines would be more fully utilised does not enter, for the revenue from the telegraphs does not cover working costs, let alone the capital charges.

Wireless Telegraph Patents.—We have received a letter from Messrs. Siemens Bros. & Co., Ltd., referring to a circular issued by Marconi's Wireless Telegraph Co., Ltd., in which the statement was made that "every wireless telegraphic installation, if it have any practical value, is an infringement of the Marconi patent." Messrs. Siemens Bros. state that the "singing spark" (Telefunken) system, of which they hold the exclusive rights in this country, has been proved in many installations all over the world to be capable of dealing with practical modern requirements, and they quote the opinion of Mr. W. R. Bousfield, K.C., and Mr. G. H. Hume, K.C., to the effect that the Telefunken arrangements in no way infringe the Marconi patent, No. 7,777 of 1900. They are therefore prepared to indemnify their customers against any action for infringement in respect of wireless telegraph installations supplied by them, and have decided to commence an action against the Marconi Co. for infringement of certain Telefunken patents, of which they are the assignees.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—October 28th. Gas-raising and by-product recovery plant, one 1000-H.P. gas engine, and one 750-KW. E.H.T. generator, for the Corporation. See "Official Notices" October 13th.

Australia.—WESTERN AUSTRALIA.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

November 29th.—One portable hand-driven desiccating plant, and binders, sleeves, tapes and copper wire, for the P.M.G.'s Department. See "Official Notices" October 13th.

NEW SOUTH WALES.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 15th.—Telephone cords and ear-pieces, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M.G. See "Official Notices" October 6th.

November 22nd.—Cable for the P.M.G.'s Department. See "Official Notices" September 29th.

VICTORIA.—November 28th. Ebonite earpieces, calculagraphs and insulators for the P.M.G. See "Official Notices" October 6th.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone materials for the P.M.G.'s Department. See "Official Notices" to-day.

Belgium.—November 6th. The municipal authorities of Loochristi (Flanders) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Bradford.—November 11th. Stores for a year for the Tramway Department. Tramway Offices, 7, Hall Ings rnable deposit of £1 1s.).

Canada.—Lethbridge.—November 24th. Municipality. er station equipment comprising boilers, economiser, steam o-generator, condenser and sub-station equipment; 10 per cent. sit with tender. Plans, &c., from A. Reid, superintendent neer, Lethbridge.

Dublin.—November 9th. The Corporation is inviting ers for electrically-driven centrifugal pumps for the Ringsend ping station. Specifications, &c., from the City Engineer, n Hall, Dublin, or J. S. Alford, Esq., The Sanctuary, minster, London, S.W., on payment of a deposit of £5 5s. rnable).

vember 6th.—General stores for a year, for the Dublin United ways Co., Ltd. See "Official Notices" October 13th.

Edmonton.—October 25th. Installation of eight tele- e instruments and line wires, also the overhauling of existing anges at Chase Farm Schools, Enfield, for the Edmonton dians. Specifications from the consulting engineers, Messrs. & Hawes, Caxton House, S.W. (deposit £1).

Great Western Railway.—November 7th. Stores for r. See "Official Notices" October 6th.

Hungary.—Tenders have recently been invited by the cipal authorities of Felsoor for the establishment of a central ric lighting station in the town.

London.—L.C.C.—October 24th. Sub-station plant and inery. See "Official Notices" September 15th.

vember 6th.—Stores for a year. See "Official Notices" to-day.

Norway.—November 1st. Norwegian State Telegraph rtment. 200,000 insulators (No. 2). Tenders, marked "Anbud isolatorer Nr. 2," to the "Telegrafdirektörens kontor," tiania. Local representation by a resident agent is required. py of the specification (in Norwegian), together with a ng, may be seen by British makers at the Commercial igence Branch of the Board of Trade, London, E.C.

uary, 1912.—Norwegian Army Authorities. New field tele- s for the Norwegian infantry; 100 sets. Tenderers must h to the Military Authorities at Christiania, two sets of atus with description and other details. Local representation esident agent is required.—*Board of Trade Journal.*

e State Railway Administration at Elfkarleby are prepared to ler proposals for the supply and erection of turbines at the State electric station. Tenders must be forwarded on or December 1st.

Radcliffe.—November 7th. Two 300-kw. rotary con- s and transformers, and E.H.T. switchgear for the U.D.C. Official Notices" to-day.

Rochdale.—Installation of electric lighting at Smith Baths. Particulars from P. W. Hathaway, A.R.I.B.A., Town Rochdale.

Sheffield.—November 13th. One 5,500-kw. steam e, condensing plant, pumps, pipework, &c., and alternator citer, for the Corporation. See "Official Notices" October 13th.

Siam.—December 30th. Tenders are invited for five cally-driven centrifugal pumps for the waterworks at ok. Particulars, Local Sanitary Department, Bangkok.

South Africa.—November 22nd. Posts and Telegraph tment. Tenders for power-generating plant, consisting of generator, accumulators, switchboard, &c. Forms of tender pecifications from either District Stores Clerk, G.P.O., nesburg, or Controller of Stores, G.P.O., Capetown.

Spain.—November 16th. The Colonial Section of the Ministry of State in Madrid is inviting tenders for the and establishment of a wireless telegraphy station on the of Fernando Po.

municipal authorities of Malgrat (province of Barcelona) ast invited tenders for the concession for the electric lighting town during a period of 10 years.

Swinton.—200-k.v.a. single-phase alternator, superheater, and induced-draught fans for the Council. See "Official " October 6th.

Tiro.—October 21st. Installation of private internal me system, at the new offices, for Cornwall C.C. Clerk of rks.

Woodbridge.—October 23rd. Electric light installation in spital blocks at the Kingston Lane Hospital, Hillingdon, ge, for the Joint Hospital Board. Specification, &c., at the f C. Woodbridge, Clerk to the Board, 38, High Street, ge.

CLOSED.

Australia.—According to the *Australian Mining Standard*, the Gawler (South Australia) T.C. recently accepted the following tenders in connection with its electrical installation :—

W. McLean & Co.—72-B.H.P. Gardner gas engine, £703; dynamo and sundries, £740; service meters, £154; aluminium cables, £225.
Warburton, Franki & Co.—Set of accumulators, £397.
British General Electric Co.—Transformers, £131; switches and instruments, £85.
Siemens Bros. Dynamo Works, Ltd.—Switches and fuses, £12.
Kynoch, Ltd.—Gas producer, £177.

According to the *Australian Mining and Engineering Review*, the Goulburn (Victoria) Shire Council has accepted the following tenders in connection with the electric lighting and power scheme for the town of Nagambie :—

R. Hornsby & Sons.—66-H.P. suction gas plant, £735.
N. Guthridge, Ltd.—Generator, booster and motor, £250.
Warburton, Franki & Co.—Switchboard, £94.
Noyes Bros. (Melbourne) Pty., Ltd.—Copper cables.
L.-R., G.-P. and Telegraph Works Co., Ltd.—Fuse-boxes and meters.

Tenders have also been accepted for a 540-A.H. storage battery, at £445, and metallic-filament lamps, at £14.

Batley.—The T.C. has accepted the tenders of Messrs. Crawshaw & Warburton, the Howley Park Coal Co., the Soothill Wood Colliery Co., Messrs. J. Critchley & Sons, Ltd., and the White Lee Colliery Co., for coal and slack for the electricity works.

Belfast.—The tender of Messrs. Craig & Paton, Gret Victoria, for the installation of conductors and equipment for light and power purposes at the new abattoir, has been accepted, at £505.

Bury (Lancs.).—The T.C. has accepted the tender of the Switchgear Co., of Salford, for two regulating switches for the battery.

Dundee.—The offer of Messrs. Lowdon Bros., Dundee, for the electric lighting and power distribution system at the new engineering laboratories at University College, has been accepted.

Harwich.—Messrs. Mann, Egerton & Co., of Ipswich, have secured the contract for the electrical installation at the new picture palace to be erected at Harwich.

London.—L.C.C.—The Fire Brigade Committee received the following tenders for an electrically-driven motor turntable long ladder :—

Cedes Electric Traction, Ltd. .. £1,137, plus £198 for spare wheels, &c.
J. Morris & Sons, Ltd. .. .. £1,380, " £215 " "

The Cedes Co.'s tender has been accepted, and the sub-contractors are Messrs. Johnson & Phillips, Ltd., for the chassis with wheel motors, and the Tudor Accumulator Co., for batteries.

Shoreditch.—The B.C. has accepted the tender of Messrs. Pooley & Austin, at £60, for the supply of a motor-generator for cinematograph purposes, to be installed at Hoxton Baths. The other tenders were : Union Electric Co., £59, who refused to incur any penalty for non-delivery to time; and the Electric Construction Co., £66 10s.

Lowestoft.—The T.C. has accepted the tender of Hadfield's Steel Foundry, Ltd., for four sets of tramway points, at £49 10s.

Morecambe.—The Tramways Committee has provisionally accepted the tender of Mr. W. J. Pearce, for doubling the track from Lord Street to Bare.

Pembroke (Co. Dublin).—The U.D.C. has placed an order with Messrs. Ed. Bennis & Co., Ltd., for two of their independent elevators for the electricity works, one to serve a single Lancashire boiler, and the other to feed two. The Council has also ordered six hatchway frames with removable doors through which the coal will be fed into the storage bunkers.

Portsmouth.—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., Ltd., for low-tension rubber-insulated cables, at £222.

Sunderland.—At a meeting of the T.C. on the 11th inst. the Electricity and Lighting Committee recommended that the following tenders be accepted :—

Ferranti, Ltd.—Meters.
British Insulated and Helsby Cables Co.—250 house service fuse boxes.
J. Grabham, Sunderland.—Painting work at Hylton Road and Dunning Street works.
Sunderland Forge and Engineering Co.—Supply and fixing of a new half-coupling in connection with the removal of the No. 8 Dynamo from Dunning Street to Hylton Road.

The report was accepted.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Messrs. F. W. Smith & Co., at £38, for the erection of an overhead line for the supply of electricity to the Swinton Industrial Schools.

Watford.—The U.D.C. has decided to renew for a year the contracts with Messrs. W. Cory & Son, Ltd., and Messrs E. Foster & Co. for coal for the electricity works. The U.D.C. has also accepted the tender of the Clay Cross Co. for a suction pipe for the turbo-condenser, at £67.

TRADE STATISTICS OF SWEDEN.

The following figures show the imports of electrical and similar goods into Sweden during the year 1909, and are taken from the official statistics which have recently been issued; the figures for 1908 are given for purposes of comparison, and notes of any increases or decreases have been added.

	1908. Kronor.	1909. Kronor.	Increase or decrease. Kronor.
Electric meters.—			
From Germany	564,000	102,000	—162,000
,, Great Britain ...	19,000	30,000	— 19,000
,, Other countries ...	4,000	3,000	1,000
Total ...	617,000	435,000	—182,000
Electric incandescent lamps.—			
From Germany	267,000	402,000	+ 135,000
,, Great Britain ...	3,000	—	3,000
,, Other countries ...	11,000	12,000	+ 1,000
Total ...	281,000	414,000	+ 133,000
Dynamos and parts thereof.—			
From Germany	266,000	132,000	— 134,000
,, Great Britain ...	4,000	1,000	— 3,000
,, Switzerland ...	57,000	127,000	+ 70,000
,, Austria	—	16,000	+ 16,000
,, Other countries ...	12,000	17,000	+ 5,000
Total ...	339,000	293,000	— 46,000
Electric motors and parts thereof.			
From Germany	485,000	378,000	—107,000
,, Great Britain ...	35,000	19,000	— 16,000
,, Switzerland ...	12,000	127,000	+ 115,000
,, United States ...	16,000	15,000	— 1,000
,, Other countries ...	18,000	14,000	— 4,000
Total ...	566,000	553,000	— 13,000
Transformers and parts thereof.			
From Germany	187,000	238,000	+ 51,000
,, Great Britain ...	1,000	1,000	
,, Switzerland ...	15,000		— 15,000
,, Austria	—	115,000	+ 115,000
,, Other countries ...	—	3,000	+ 3,000
Total ...	203,000	357,000	+ 154,000
Telephone apparatus.—			
From Germany	15,000	12,000	— 3,000
,, Great Britain ...	1,000	1,000	—
,, Other countries ...	3,000	1,000	— 2,000
Total ...	19,000	14,000	— 5,000
Telegraph apparatus.—			
From Denmark	3,000	5,000	+ 2,000
,, Germany	4,000	1,000	— 3,000
,, Great Britain ...	1,000	1,000	—
Total ...	8,000	7,000	1,000
Gas motors.—			
From Germany	249,000	102,000	—147,000
,, Great Britain ...	45,000	23,000	— 22,000
,, United States ...	5,000	41,000	+ 36,000
,, Other countries ...	9,000	3,000	— 6,000
Total ...	308,000	169,000	—139,000
Petroleum and benzine motors.—			
From Germany	45,000	63,000	+ 18,000
,, Denmark	12,000	26,000	+ 14,000
,, Great Britain ...	47,000	7,000	— 40,000
,, France	30,000	10,000	— 20,000
,, United States ...	99,000	74,000	— 25,000
,, Other countries ...	16,000	23,000	+ 7,000
Total ...	249,000	203,000	— 46,000
Turbines.—			
From Norway	2,000	111,000	+ 109,000
,, Germany	6,000	3,000	— 3,000
,, Great Britain ...	24,000	—	— 24,000
,, Switzerland ...	29,000	—	— 29,000
Total ...	61,000	114,000	+ 53,000
Accumulators.—			
From Germany	627,000	477,000	—150,000
,, Great Britain ...	6,000	7,000	+ 1,000
,, Other countries ...	6,000	2,000	— 4,000
Total ...	639,000	486,000	—153,000
Rheostats.—			
From Germany	866,000	689,000	—17
,, Great Britain ...	14,000	10,000	—
,, Switzerland ...	123,000	42,000	8
,, Other countries ...	16,000	15,000	—
Total ...	1,019,000	756,000	—26
Elevators.—			
From Germany	61,000	81,000	+ 2
,, Holland		99,000	+ 9
,, Great Britain ...	43,000	1,000	
,, Other countries ...	13,000	14,000	+
Total ...	117,000	198,000	+
Cranes.—			
From Germany	245,000	134,000	1
,, Great Britain ...	136,000	56,000	
,, United States ...	100,000	10,000	—
,, Other countries ...	39,000	25,000	
Total ...	520,000	225,000	— 2
Copper wire, twisted, and cable not insulated.			
From Germany	76,000	117,000	+
,, Great Britain ...	21,000		—
,, Other countries ...	10,000	—	—
Total ...	107,000	117,000	+
Copper wire covered with textiles.—			
From Germany	8,000	6,000	
,, Other countries ...	3,000	1,000	—
Total ...	11,000	7,000	—
Copper wire covered with rubber.—			
From Germany	12,000	5,000	—
,, Other countries ...	—	1,000	+
Total ...	12,000	6,000	—
Electric cables covered with lead.—			
From Germany	2,774,000	2,767,000	—
,, Holland	44,000	43,000	—
,, Great Britain ...	188,000	251,000	+
,, Other countries ...	67,000	7,000	—
Total ...	3,073,000	3,068,000	—
Copper wire otherwise insulated.—			
From Germany	356,000	252,000	—
,, Great Britain ...	65,000	15,000	—
,, Other countries ...	3,000	1,000	—
Total ...	424,000	268,000	—
Other electric cable.—			
From Germany	192,000	226,000	+
,, Great Britain ...	3,000	3,000	
,, Other countries ...	1,000	2,000	+
Total ...	196,000	231,000	+
Steam turbines.—			
From Germany	18,000	64,000	+
,, Great Britain ...	64,000	7,000	—
,, Switzerland ...	54,000	319,000	+
,, Other countries ...	23,000	3,000	—
Total ...	159,000	393,000	+
Steam boilers.—			
From Germany	87,000	115,000	+
,, Great Britain ...	147,000	75,000	—
,, Other countries ...	35,000	19,000	—
Total ...	269,000	209,000	—

Krone = 1s. 1½d.

Electricity in Mines.—We read in the *Time* the Mining Association of Great Britain met on 13th London, to discuss the provisions of the Mines Regulat which relate to the use of electricity in mines. "The ow opposed to the compulsory provision of certain expens cautions which, they contend, would be no more effective tha much less costly. They are of opinion that some of the co precautions must inevitably come out of the wages of the was resolved to submit certain amendments to the H Commons on the report stage."

FORTHCOMING EVENTS.

o-Harmonic Society.—Friday, October 20th. At 8 p.m. At the King's all, Holborn Restaurant. Smoking concert.

ia Electrical Exhibition.—Saturday, October 21st. Closing day.

tion of Engineers and Shipbuilders in Scotland.—Tuesday, October 24th. At p.m. At the Rankine Hall, Glasgow. Presidential address by Mr. E. all-Brown.

al Society.—Friday, October 27th. At 5 p.m. At the Imperial College f Science, South Kensington. Papers on "Further Observations on the fterglow of Electric Discharge and Kindred Phenomena," by the Hon. . J. Strutt; and "Homogeneous Fluorescent X-Radiation of a Second eries," by Prof. C. G. Barkla and Mr. J. Nicol.

ation of Electrical Engineers (Manchester Local Section).—Friday, October 7th. At 7.30 p.m. At the University, Manchester. Address by Mr. W. ramp.

ation of Engineers-in-Charge.—Saturday, October 28th. At 6.30 p.m. At iverpool Street Hotel. Social. Ladies' night.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

following orders are issued:—

ls for efficiency (1911-1912) will commence at Headquarters on Thursday, November 2nd, 1911, and Headquarters will be open as stated below from that date:—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

ritish Electrical and Allied Manufacturers' Asso-on (Incorporated) Inaugural Dinner.—On Thursday last the reorganisation of the "National Electrical Manufacturers' iation" was celebrated by a dinner at the Hotel Cecil, at which were some 250 guests. Mr. S. Z. de Ferranti, President of nstitution of Electrical Engineers, occupied the chair, and oposing "The Association," claimed to be an old manufacturer, garded himself as an outsider in this case, and could therefore hings which otherwise he could not. Since he had become dent of the Institution, the fact had forced itself upon his tion that the electrical industry was not as prosperous as it d be. This was partly due to the impression that there were gent interests in the industry, but that was a mistaken view. country depended upon its manufactures, and it was beneficial e country that its manufacturers should be prosperous, other-they could not make progress. It was vital to the buyer that nanufacturer should be prosperous. There must be more ion sense amongst the manufacturers; what was the use of g each other for an apparent good that never came? Let know each other as good friends. This dinner was ost happy occurrence, and nothing but good could to the manufacturers, buyers and users of elec-machinery from their working together with goodwill. had been too much competition in pure *price*; what was ed was reasonable competition in price, but keen competition cellence. Then England would lead the world in electrical factures, and he looked to the Association to do everything le towards that end.

Nalder, Chairman of the Association, in response, thanked Mr. nti most emphatically for the sound commonsense and good e which he had given them. The Association, he said, had been istence for eight or nine years, operating on a modest scale, and one some good and useful work. It had certainly brought etitors together. Manufacturers had been "pestered" in the by local exhibitions, but had taken the matter into their own and held three exhibitions, of which the last would be the successful. Recognising the necessity of expansion, the iation had recast its articles and reorganised its mechanism; r subscriptions were necessary, and the Council was sure that uld be able to show good results for the money. "The trend odern commerce was to temper competition by conference," they would only pull together the result would be to their tage.

A. Bruce Anderson, in proposing "The Industry," emphasised nportance of the occasion. The Empire had to live by its tries, of which the electrical industry was second to none. If they did not work together, they would not achieve ss. Let them give the manufacturer his due; they were all s as well as sellers, but he would for the moment distinguish takers from the users of machinery, for amongst the latter some who declared that they would not buy from bers of the Association, but would buy abroad. He ot complain of the power to buy abroad, but he asked such nsider where this policy would lead to. For what purpose ey buy plant?—to light our houses, carry our workmen, &c. process of buying in a market where they could not sell could go on indefinitely. Electricity suppliers valued the manu-rers' power load; the manufacturers would increase it if they could. Shareholders were deeply interested in British manufacturers' progress; employés were *vitally* interested, and in effect they were all employés. The electrical industry was one and indivisible, and there was no real distinction between buyer and seller. He hoped to see an association representing the whole of British industry. The Manufacturers' Association had created an organisation for putting to them certain things; let them remember that the manufacturer was their fellow-creature and their fellow-countryman, and not buy abroad if they could help it. If work was going abroad—and it was going abroad—while British workmen stood idle, it was a shameful fact. By strengthening the manufacturer they strengthened the industry, and in turn the country. They best helped themselves who helped one another, and that was the spirit in which the Council meant to go forward. Mr. James Swinburne, in reply, paid a tribute to Mr. Ferranti, and pointed out that the harm done by legislation to the electrical industry was not a thing of the past, but an active agency of the present. He adduced the attitude of Parliamentary Committees towards industrial proposals, and their utter indifference towards the welfare of the community—if there was any possibility of making a profit, it must be squashed, and every possible hindrance must be placed in the way of the promoters. All ought to do their best to alter public opinion on these matters. The British workman himself should be educated; for he thought there was only a certain amount of work in the world, and therefore it must be done slowly lest it be used up. Again, he thought nine-tenths of the fruit of his labour went into the pockets of "the idle rich," whoever they might be; and thirdly, he had a curious conception of the State as a wealthy body with unlimited powers. His hearers themselves might with advantage study the science of Economics, which was of vital importance to the industry and to the welfare of the whole country.

Mr. Swinburne further recommended the classification of catalogues, which at present were of the most diversified sizes and shapes, and most inconvenient to handle. It was impossible to file them or arrange them to advantage. If the manufacturers would try and realise what the consulting engineers had to do with catalogues, they might standardise them.

Mr. Hugo Hirst proposed "The Guests," and said that if the efforts of the Association were rewarded with only 50 per cent. of what was aimed at, they were well worth making. In this or any other State, the Government never did anything except under the pressure of public opinion; this Association was formed, knowing what was required, to influence public opinion, and thus to obtain the measures desired. They were not promoting trusts or cartels—they were doing a national duty in promoting the welfare of one of their most important industries. The wealth of the Empire consisted in what it could produce daily; therefore let them go about their work with the lofty spirit indicated by those who had already spoken. Some of the grievances from which they suffered were due to their own fault. If this Association were a success, they could achieve some of the results that would accrue from that policy which he was known to favour, which, however, was not an item in the Association's programme. They suffered from foreign competition; one reason was that they did not consider sufficiently the home middleman. Rushing to the public at low prices, they left no room for the distributor, and drove him into the hands of the foreigner; he would like to supply British-made goods, but had not the opportunity, and had to buy foreign goods, sold at dumping prices. If they could regulate the selling prices to the public, and standardise certain lines, leaving a sufficient margin for the middleman, they would reduce foreign imports and increase the number of their allies. The Post Office bought exclusively British-made goods where possible, and was no loser thereby. Australia had offered preference, which had been increased through the efforts of Capt. Collins. Major O'Meara, in reply, speaking as a buyer, expressed his gratitude to the manufacturers for their efficient assistance. He hoped the Association would prove successful in its objects. Capt. Collins (secretary to the Commonwealth of Australia in Great Britain), also replying, referred to the constantly increasing applications of electricity as exemplified at Olympia, and said they should lose no time in establishing an Imperial system of wireless communication. They in Australia were anxious to promote British enterprise in every way, and he noted with satisfaction the improvement in electrical trade with Australia.

Mr. B. Longbottom, proposing the health of "The Chairman," eulogised his services to the electrical industry; the toast was drunk with musical honours, and Mr. Ferranti, in the course of a brief reply, said that if he could be of even a little assistance to them he would be amply repaid, and he wished them and their endeavours every success.

Exhibition.—An engineering and machinery exhibition is being arranged for at Olympia next year (October 4th to 26th), and the whole of the hall, except the part under the gallery, will be reserved for machinery to be shown in motion.

Advertising at Olympia.—An exceptionally "taking" advertising scheme was carried out by Messrs. Magic Appliances, Ltd., on Saturday last. In addition to occupying the whole of the front page of the *Daily Mail* with a display of the "Magic" suction cleaner, the firm engaged a bevy of smart housemaids to perambulate the promenade in front of the main entrance of the Exhibition, each armed with a Magic cleaner. Naturally the animated advertisement attracted universal attention, and the firm are to be congratulated upon their unique and effective methods of securing the utmost publicity.

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Section).—On Friday next the 1911-12 session opens at the Physical Laboratory of the University, Manchester, with an address by Mr. W. Cramp (chairman). The programme of the meetings thereafter is as follows:—

Tuesday, November 7th.—R. Roberts: "The Mechanical Design of Direct-Current Turbo-Generators."
November 15th.—Joint meeting with the Liverpool Engineering Society, at Liverpool.
Prof. E. W. Marchant. "The Function of the Laboratory in the Training of an Engineer."
November 28th.—R. Rankin: "Automatic Reversible Battery Boosters."
December 12th.—Miles Walker and H. D. Symons: "Heat Conductivity in Electrical Machinery."
January 16th.—Karl Baumann: "Recent Developments in Turbine Practice."
January 27th.—Meeting with the Manchester Association of Engineers. (By invitation.)
Cecil Myers: "Electrical Furnaces."
February 13th.—Fred. S. Sells: "Specifications."
February 23rd.—Annual Dinner.
February 27th.—J. Lustgarten: "High-Tension Porcelain Insulators."
March 12th.—F. W. Carter: "The Mechanics of Electric Train Movement."
March 26th.—Prof. A. Schwartz and R. G. Cunliffe: "The Corrugation of Rails."
April 16th.—J. F. Crowley: "Recent Developments in the Application of Electricity in Textile Factories."
April 30th.—Annual general meeting. Lecture by Dr. R. Thury.

On October 6th, Mr. F. H. Taylor delivered the second of his popular lectures on "Recent Developments in Electric Lighting," at the Willesden Polytechnic. He also dealt with electric heating and cooking, and many of the well-known apparatus were shown, their construction being explained. It was suggested that the Willesden District Council should arrange with Mr. Taylor to give similar lectures in various parts of the borough to educate the public concerning the advantages of electric lighting and heating, and Councillor Harvey promised to bring the matter forward.

I.E.E. (Manchester Students).—The opening meeting of the Students' Section takes place on Tuesday, October 31st, at the Manchester School of Technology, when Mr. J. F. C. Snell will deliver an address, in which will be included, amongst other things, a lantern description of one of the modern power stations in South America for which he has been responsible. Mr. W. Cramp will preside.

The first of the special series of 12 lectures on "Illumination," arranged to take place at Battersea Polytechnic, was delivered by Prof. J. T. Morris on Tuesday, October 17th, the subject being incandescent lamps.

It Certainly Should be.—"The practice must be stopped, if possible," observed the Stipendiary Magistrate at the Manchester City Police Court, on Friday last, in imposing a fine of 5s. and costs in three cases where the defendants were charged with spitting on tramcars, contrary to the by-law.

Electric Police Lamps for Glasgow.—The Police Committee of Glasgow T.C. has decided to replace constables' oil lamps with electric torches, and 100 torches are to be obtained, while the electrical engineer is to have a charging switchboard and motor installed at the police headquarters, at an estimated cost of £90.

The U.S. Electric Lamp Combine Dissolved.—The *Evening Standard* of October 13th states that "the United States District Court has decided the suit against the electric companies brought in March last in favour of the Government, and orders the dissolution of the National Electric Lamp Co. and 35 subsidiary companies. The decree is a sweeping one, and restores the conditions which prevailed before the trust agreement was entered into. The defendants had announced their willingness to plead guilty, and accept the mercy of the Court."

Reuter in a Washington dispatch says that the Attorney-General says that this decision has established precedents of great value to the Government in its prosecutions under the Anti-Trust Law.

The above appears to bear on the prospects of the leasing of the British cables, and placing them all under one control, being adjudged illegal.

Inquiry.—A correspondent asks for information as to the Paragon pump, name of makers, &c.

The Continental Glow Lamp Industry.—At the recent meeting, in Berlin, of the German and Austrian cartel of carbon glow lamp manufacturers, the situation of the industry, more particularly with regard to the competition of the metal-filament lamp manufacturers, was exhaustively discussed. It was eventually decided to maintain the union until April, 1912. The cartel agreement lapses in 1913.

Manchester Wiremen's Demands.—The electrical wiremen employed in the building trade in Manchester, who are reported to number 500, on Thursday night last week determined to demand an increase of wages. At present the men are receiving 8½d. an hour, and they are intent on having 9½d.

Secret Commissions and Bribery Prevention League, Inc.—A public conference will be held at the Mansion House, London, on Tuesday, October 24th, at 3.30 p.m., to further the efforts of the League in making known the Prevention of Corruption Act 1906, and in enforcing its provisions, the Lord Mayor presiding. Mr. E. B. Ellington, president of the Institution of Mechanical Engineers, has written to the Secretary of the League, saying that "the most important point of all is to foster a strong public opinion in favour of honest dealing, and the passing of the Prevention of Corruption Act in 1906 is a very useful expression such public opinion. I should not be disposed to place mu reliance on the Act itself."

Football: The Davis Challenge Cup.—We are asl to state that the General Electric Co.'s Athletic Club cordi invites application from football clubs in the electrical trade (n league) London and district, to enter for the above cup. Furt particulars can be obtained from the secretaries of the cl Messrs. H. Chard and J. Peters, 67, Queen Victoria Street, Lond E.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with technical or the commercial side of the profession and indus also electric tramway and railway officials, to keep readers of Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. W. Wood, of Le has been appointed switchboard attendant, and Mr. T. Smith Wakefield, junior mains assistant, at the Dewsbury Electri Works.

Mr. E. E. Hamar, shift engineer with the Kent Electric Po Co., has been presented with a marble timepiece by the staff employés on the occasion of his marriage.

The Southampton T.C. has decided to increase the salary Mr. H. L. Mills, assistant borough electrical engineer, from £ to £260 per annum, rising by annual increments of £10 to £30 annum.

Mr. Alfred E. Ricketts, sub-station superintendent of Po Borough Council electricity department, was married to Margaret Anderson, on 14th inst., at Plimsoll Street Presbyte Church, Poplar. Mr. Ricketts was formerly in the employmer Messrs. Cowans, Ltd., of Manchester.

The Electrical Committee of the Bristol T.C. has decided tha from March 25th last all premiums received with impro entering the electricity works shall be retained by the Corpora and that in lieu of the fees being divided between the Corpor and the engineer, the latter's salary shall be increased by £100 annum. The average received in fees during the past 10 year the engineer has been £102 per annum.

Tramway Officials.—The Bournemouth T.C. appointed Mr. F. Wiltshire as second shift engineer on the t way staff.

General.—Mr. Alfred H. Gibbings, who for so n years was well known in connection with public electrical su and tramway undertakings in this country, and whose large jected electric power scheme in Scotland was rendered impossib Clause 23 of the Electric Lighting (Consolidation) Act, 1909 launched out in another field, where, from what one hears c business possibilities, he should meet with success. He has op business at Buenos Ayres as Alfred H. Gibbings y Cia. as elect engineers, and he is also associated with the firm of Scott & H (recently Alejandro Hume, Scott & Hume) in a partnership arr ment. The firm of Alfred H. Gibbings & Cia. are represe Messrs. J. H. Howden & Co., Ltd., Messrs. Ernest Scott & Mour Ltd., Mr. Bertram Thomas, Messrs. Drake & Gorham, Ltd., Mc Nalder Bros. & Thompson, Ltd., the Bastian Meter Co., Ltd., Messrs. Boothroyd & Co., Ltd., of Liverpool. The firm of Scot Hume has been connected with railway enterprise in Arge since 1867, and in conjunction with Messrs. John Meiggs, Sons & Co., of London, financed and constr 540 miles of narrow-gauge railway for the Santa Fé Provi Government. Later the firms jointly constructed and equi 125 miles of the Central Cordoba Railway, 521 miles of Central Northern, 412 miles of the Central Entre Rios, 125 miles of the Bahia Blanca and North-Western Rail up to the end of 1892. Afterwards the firm entered a working agreement with Messrs. Pauling & Co., Ltd., which recently terminated on the death of Mr. Alexander Hume. A extensive experience such as this, placed in conjunction wit Gibbings's extended electrical knowledge, should be of great in negotiating and executing contracts. Mr. Gibbings's friends in this country will no doubt join with us in wishing h large measure of success in his new sphere of activity.

According to the American *Electrical Review and Western trician*, on September 28th, Mr. Samuel Insull, president o Commonwealth Edison Co., gave a dinner in honour of Mr. S. Ferranti, President of the I.E.E. On the following day lunc was given in honour of Mr. Ferranti by the officers of the Ame Institute of Electrical Engineers, at the Engineers' Club, New Other English electrical men present included Mr. Arthur W and Mr. C. H. Merz.

Mr. J. W. Meares, electrical adviser to the Indian Govern left this country for India on the 19th inst., on the P. & O. ste *Morea*.

Mr. R. B. Coney, superintendent of the electrical departme Uttoxeter for the North Staffs. Railway Co., has been presente the Stoke-on-Trent headquarters' staff with a silver cigar-ca a mark of esteem.

We announced last week that Messrs. Ozonair, Ltd., had appo Mr. R. Borlase Matthews, Wh.-Ex., to the position of man This is in consequence of the extension of their bus Mr. Edward L. Joseph, managing director, will still contin give the same personal attention to the business.

Ald. Geo. Weeks, head of the firm of G. Weeks & Son, electrical contractors, High Street, Bromley (Kent), is mayor-elect for the borough.

Obituary.—Sir Wm. Crossley.—We regret to record the death of Sir William Crossley, Bart., which occurred on October 12th at Manchester, at the age of 67 years. Sir William was one of the founders of the well-known gas engine firm of Crossley Bros., Ltd., the other being his brother, the late F. W. Crossley. He was also one of the original directors of the Manchester Ship Canal. The deceased gentleman was made a Baronet in 1909. In politics he was a Liberal, being elected M.P. for Altrincham Division in 1906 and in 1910 : at the second election of the latter year he was defeated. He took a deep interest in movements for the amelioration of the lot of the sick and poor ; for these his generosity often took a substantial form. To a consumptive sanatorium scheme alone he devoted no less than £70,000. The funeral took place at Bowden on Monday.

We regret to record the death of Mr. Edward Pyke, J.P., of Preston and Merton Bank, Southport, whose remains were interred at the Preston Cemetery on Friday last. Deceased was Preston's oldest magistrate, and he was a director of the National Electric Supply Co.

NEW COMPANIES REGISTERED.

Reno, Ltd. (117,987).—This company was registered on October 9th, with a capital of £5,000 in £1 shares (1,000 5 per cent. cumulative preference), to take over the business carried on by the Reno Electric Stairways and Conveyors, Ltd., of Eagle Wharf Road, Hoxton. The subscribers (with one share each) are :—H. C. Walker, 33, Wickham Road, Brockley, S.E., engineer; W. H. Aston, 46, Eagle Wharf Road, Hoxton, N., engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. C. Walker, W. H. Aston and H. Harmsworth. Registered office, Falmouth Road, S.E.

Long & Crawford, Ltd. (118,040).—This company was registered on October 12th, with a capital of £1,000 in £1 shares, to carry on the business of electrical engineers and contractors, dealers in electrical and mechanical apparatus, machines and accessories, &c. The subscribers (with one share each) are :—E. Long, 7, Birchdale Drive, Romiley, Chester, electrical and mechanical engineer; R. Crawford, Milton, Bearsden, Glasgow, electrical and mechanical engineer. Private company. The number of directors is not to be less than two or more than three; the first are E. Long and R. Crawford; qualification, £100. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Leominster Electric Supply Co., Ltd. (118,025).—This company was registered on October 11th, with a capital of £4,000 in 2,000 ordinary shares of £1 each, and 400 5 per cent. cumulative preference shares of £5 each, to carry on the business indicated by the title. The subscribers (with one share each) are :—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer ; S. Williams, All Saints House, The Exchange, Bristol, solicitor. Private company. The number of directors is not to be more than five. J. H. Edwards is the first managing director; qualification, 50 ordinary shares. Registered by Seymour Williams & Co., 38, Parliament Street, S.W.

Winscombe Electric Light and Power Co., Ltd. (118,016).—This company was registered on October 10th, with a capital of £2,000 in £1 shares, to carry on at Winscombe and elsewhere in Somerset the business of an electric supply company in all its branches. The subscribers (with 100 shares each) are :—J. W. Bobbett, Goathurst, Winscombe, gentleman; J. E. Counsell, Longfield, Winscombe, gentleman; W. Yatman, The Hall, Winscombe, gentleman; J. Grubb, The Down, Winscombe, gentleman; H. W. Thompson, Coombe House, Winscombe, gentleman; W. Reed, Hale House, Winscombe, gentleman; T. Carwardine, Berrymead, Winscombe, gentleman. Minimum cash subscription, £1,000. The number of directors is not to be less than four or more than six; the first are J. W. Bobbett, J. E. Counsell, W. Yatman, J. Grubb, H. W. Thompson and W. Reed; qualification, £100. Registered office, Longfield, Winscombe, Somerset.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Church Stretton Electric Supply Co., Ltd. (80,857).—Deed of further charge dated August 19th, but executed on September 14th, 1911, to secure £75, charged on freehold land at Crossways, Church Stretton. Holder: E. Bond, 43, Thurloe Square, S.W.

Bray, Markham & Reiss, Ltd. (74,871).—Return dated August 2nd, filed August 28th, 1911. Capital 20,000 in £1 shares. 8,000 shares taken up. £8,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Allgemeine Elektrizitäts Gesellschaft.

The accounts of this company for 1910-11, after deducting working expenses, taxes, interest on loans, and provision for depreciation which is not specifically mentioned, show net profits exclusively from manufacturing and sales amounting to £1,107,000, as compared with £921,000 in 1909-10. It is proposed to pay a dividend of 14 per cent. on share capital of £5,000,000, and 7 per cent. on the new shares of £1,500,000 which are entitled to participate as from January 1st, 1911. In addition to the provision made for depreciation according to the custom hitherto, it is intended to add £118,000 to the reserve fund and devote £37,500 as reserve for the extension of the business premises. The issue of new shares of nominally £500,000, yielded a premium of £431,000 to the legal reserve fund, which, including the before-stated allocation of £118,000, becomes increased to £2,436,000. The turnover in the first two months of the new financial year and the orders on hand exceed those prevailing at the corresponding time in 1910. The dividend of 14 per cent. contrasts with a similar rate in 1909-10, 13 per cent. in 1908-9, and 12 per cent. in each of the two preceding years. It is now proposed to make a fresh issue of capital by the emission of a new loan of £1,500,000, which is required owing to the extension of business. The loans according to the previous balance-sheet amounted to £2,547,000, and the fresh issue will raise the total share and loan capital to about £10,500,000.

City Electric Light Co., Ltd. (Brisbane).

The directors' report for the half-year ended July 31st, 1911, states that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal replacement and contingencies account, there remains a credit balance of £4,954, which, with the balance brought forward from last half-year, makes a sum of £7,133 to be disposed of. It is recommended that a dividend be paid of 3 per cent. on the preference shares and of 5 per cent. on the fully-paid ordinary shares, and of 5 per cent. on the contributing shares in proportion to the amount paid up thereon. The directors also recommend the payment of a bonus of 1¼ per cent. on the fully-paid ordinary shares and of 1¼ per cent. on the contributing shares in proportion to the amount paid up thereon. The payment of the above-mentioned dividend and bonus, together with the dividend duty, will absorb £5,222, leaving a balance of £1,911 to be carried forward. Part of the plant for the new waterside power house in William Street has been delivered and erected, part also of the plant from Ann Street has been removed to William Street. This has enabled electricity to be generated and supplied from that station, thus freeing further plant in Ann Street which will be removed to William Street in due course. The meeting of the company was held on September 12th.

Ferranti, Ltd.

The directors report that, for the year to June 30th, 1911, the profit on trading was £49,074, and, after crediting discounts, interest and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, bad debts, and directors' and trustees' fees, there remains a balance of £22,045, which has been applied as follows : Interest on prior lien debentures, £806 ; interest on first mortgage debenture stock, £5,000 ; interest on bank loan, £1,073 ; amount charged in respect of depreciation, £10,000 ; prior lien debentures redemption account, £1,000 ; leaving a balance of £4,166. The amount at credit at June 30th, 1910, was £1,162, making £5,327, which the directors recommend should be carried forward to the current year. The results for the year again show an improvement over those for the previous year. The depreciation allowance has been further increased from £7,500 to £10,000, and the amount of £1,000 has been charged against profits in respect of prior lien debentures redemption account.

Anglo-American Telegraph Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Monday at Winchester House, E.C., Mr. F. A. Bevan presiding.

The Chairman, in moving a resolution confirming the resolutions passed at the extraordinary general meeting on September 29th for leasing the company to the Western Union Telegraph Co., said that since they met, the shareholders of the Western Union Co. had held a meeting on the other side of the Atlantic, and had confirmed the agreement by a very large majority. A three-fifths majority was required, but out of 900,000 votes 770,000 or 780,000 were polled in favour of the agreement.

Sir Gerald Fitzgerald seconded the resolution, which was carried unanimously.

Mr. Channen said that subject, he supposed, to the sanction of the Court, the affairs of the company were now happily settled for 99 years ; but there was one point on which he desired to invite the earnest consideration of the board. For years the company had had divided interests, which periodically arose between the preferred and the deferred shareholders, and it occurred to him that the present was an opportune time to get rid of those difficulties entirely. The deferred shareholders had the right to participate equally with the preferred in the capital assets in the event of liquidation. It was true that owing to the lease such a thing as liquidation was, they hoped and believed, shelved for all time—certainly for 99 years ; and though the risk of dissension between the "A" and "B" shareholders was more remote than hitherto, he would like to see it entirely removed, and he thought it ought not to be a very difficult matter to give them one uniform stock. If they were to reduce the capital of seven millions down to £5,250,000, they would be able to give to each holder of £100 6 per cent. preference stock £120 of the new 5 per cent. guaranteed stock, and to each holder of £100 deferred stock £30 of the same stock. The security now was the lease and the guarantee of £262,500 which came in

annually. It took £210,000 to pay the "B," or the preferred interest, and the other £52,500 to pay 1½ per cent. on the deferred. If the lease was broken under the Sherman Act, the present preferences to the "B" stock would not be very much in case of default, because it was extremely unlikely that the default would stop short at the £210,000. He submitted that the deferred holders should have the same stock as the preferred, and they would then be conceding their chance of an equal distribution of assets in the event of liquidation. There was another point in favour of having a uniform stock. Originally they had one stock, and it was thought wise to give the holders an opportunity of splitting their holding into 6 per cent. preferred and deferred stock. The preferred stock holders got a preference over the deferred of 6 per cent., and the deferred stock holders took the reversion. Under this guarantee the deferred holder lost his right to his reversion because the amount of his interest was limited. It seemed, therefore, reasonable and right that the preferred holder should relinquish his claim to preference, and that the deferred holder should relinquish his claim to an equal distribution of the assets in the event of liquidation. He asked the board to complete their work by making all the shareholders equal, and so bury the bone of contention between them.

Mr. Fry said that speaking both as an ordinary and deferred shareholder, he suggested that they had better leave well alone. They were, he thought, going rather too quickly in asking the directors to immediately consider some scheme for altering their existing stocks. During the last 12 months the company had gone through very critical times, and he would suggest that at any rate they should leave matters where they stood for 12 months and see how the new lease worked.

The Chairman remarked that he was sure Mr. Channen would not expect him to at once give a definite opinion upon the proposal he had made. *Prima facie*, it seemed a very reasonable proposition, and one which he (the chairman) thought the directors should consider, but as Mr. Fry had said, the matter had come upon them unexpectedly, and naturally they must take some little time to consider it, especially as they must ascertain, if possible, what the wishes of the deferred shareholders would be—so very much depended upon them. They had equal rights with the preferred in case of liquidation, and it was rather a strong thing to ask them to give up that right. However, if the proposal could be carried through, personally, he thought it would be rather a desirable arrangement, but the shareholders might depend upon it that the board would not do anything in a hurry and without carefully considering the whole matter, and on a future occasion he would let them know how they entertained the proposal.

A vote of thanks to the chairman for presiding terminated the proceedings.

Direct United States Cable Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Tuesday at Winchester House, Old Broad Street, E.C., Mr. E. M. Underdown, K.C., presiding.

The Chairman, in proposing the confirmation of the resolutions adopted at the meeting held on September 29th for the purpose of leasing the company to the Western Union Telegraph Co., said he had no further information to give the shareholders than that which he gave them upon that occasion. He had only to add that the shareholders of the Western Union Co. in America, representing considerably over two-thirds of the capital stock of the company, had, by written consent, ratified and approved the agreement, and that the shareholders of the Anglo-American Telegraph Co. had also not only unanimously approved the agreement, but had confirmed their approval. He had no doubt that the views of the shareholders of the Direct United States Co. also remained unchanged, and that they would agree with the board that it was in the best interests of the company that they should confirm the resolutions for adopting the agreement, and making the amendments in the articles of association consequent thereon.

Sir James Pender, Bart., seconded the resolution.

Mr. Alldred said he understood the chairman at the last meeting to say that the board intended to pay quarterly dividends at the rate of 4 per cent., and that possibly at the end of the year the distribution might be made up to 5 per cent. He wished to know whether it was proposed to pay the dividends in future free of income-tax.

The Chairman replied that under the agreement they were restricted from paying more than a 5 per cent. dividend, and therefore they must always make their distributions subject to income-tax.

The resolution was then carried unanimously, and the proceedings terminated with a vote of thanks to the chairman and directors for the way in which they had conducted the negotiations for the lease.

Cuba Submarine Telegraph Co., Ltd.—The report for the half-year ended June 30th, 1911, states that the total receipts of the six months were £20,774, while the expenses amounted to £6,456, leaving a balance of £14,319, to which has been added £7,276 brought forward from last account, giving a total of £21,594 to be dealt with. The sum of £2,500 has been placed to reserve against loss on investments, and £4,000 added to the reserve fund, which now stands at £124,000. The dividend on the preference shares will absorb £3,000, and leave £12,094, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free from income-tax, the balance, £7,294, being carried forward. The cables continued in good working order throughout the half-year.

Stock Exchange Notices.—The Committee has (1) appointed special settling days as under :—

Monday, October 30th.—Rio de Janeiro Tramway, Light and Power Co. Ltd.—Further issue of 62,500 shares of $100 each.

Tuesday, October 31st.—Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 62,500 shares of $100 each.

Thursday, November 2nd.—Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 1,250 shares of $100 each.

Welsbach Light Co., Ltd.—262,000 shares of £1 each, fully paid (Nos. 1 to 262,000).

Friday, November 3rd.—Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 23,750 shares of $100 each.

And (2) ordered the undermentioned securities to be quoted in the Official List :—

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 62,500 shares of $100; 62,500 shares of $100; 1,250 shares of $100; and 23,750 shares of $100 each.

Welsbach Light Co., Ltd.—262,000 shares of £1 each, fully paid (Nos. 1 to 262,000).

Application has been made to the Committee to allow the following securities to be quoted in the Official List :—

Sao Paulo Tramway, Light and Power Co., Ltd.—£300,000 5 per cent. perpetual consolidated debenture stock (renewed application).

Marconi's Wireless Telegraph Co., Ltd.—A circular issued to the shareholders states that a considerable development is taking place in all parts of the world in the use of wireless telegraphy, to which recent events are adding a further impetus. In order to be able to cope with the business in hand, and to be able to take full advantage of pending negotiations of an important nature, the directors have resolved to call extraordinary general meetings for October 25th and November 9th, for the purpose of passing a special resolution to increase the company's capital by 250,000 £1 ordinary shares. These will be issued on such terms and conditions as the directors think fit, such shares to rank *pari passu* in all respects with the existing 500,000 ordinary shares of £1 each.

The *Financial News* states that the Marconi Co. has secured the control, and will in future direct, the management of the Russian Co. of Wireless Telegraphy and Telephony of St. Petersburg. Mr. Adrian Simpson, of the Marconi Co. of London, has been appointed managing director, and is about to proceed to St. Petersburg to assume control. Russian Government contracts for wireless telegraphy provide that all material to be supplied shall be manufactured in Russia. In these conditions the Russian Co. of Wireless Telegraphy and Telephony secures the bulk of all the Russian Government business, which is very considerable. The company has very large orders in hand and considerable business in prospect. Under the agreements entered into the Russian company obtains a licence for the Marconi patents for Russia.

Cape Electric Tramways Co., Ltd.—The directors' report for the year ended June 30th, 1911, as abstracted in the *Times*, states that the profit, after providing for debenture interest and redemption of debentures, and taking into account the balance brought forward, amounts to £28,855. From this sum the reserve fund has been credited with £8,000, leaving £20,855. It is proposed to recommend a dividend on account of the earnings for the past year of 2½ per cent., tax free, on the ordinary shares. This will absorb £12,281, and the balance of £8,574 it is proposed to carry forward. During the past year the tramways carried in Cape Town 13,318,110 passengers, the receipts being £131,702, as against 12,207,739 passengers, with receipts of £119,936, for the year 1909-10. In Port Elizabeth 3,363,099 passengers were carried, the receipts being £35,632, against 3,102,286 and £32,883 respectively for 1909-10. The improved conditions of general business which were manifested last year have continued, and there is every reason to look forward to further improvement in this direction

Direct United States Cable Co., Ltd.—The board announces an interim dividend of 2s. per share, together with a bonus of 6d. per share, less income-tax, being at the rate of 5 per cent. per annum for the quarter ending September 30th.

Brisbane Electric Tramways Investment, Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum, free of income-tax, on the ordinary shares for the past half-year.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the quarter ending the 31st inst.

Anglo-Portuguese Telephone Co., Ltd.—The directors announce an interim dividend at the rate of 3 per cent., free of income-tax, on account of the year ending December 31st, 1911.

Anglo-Argentine Tramways Co., Ltd.—The directors recommend an interim dividend of 4s. per share, being at the rate of 8 per cent. per annum, less income-tax, on the £2,500,000 ordinary share capital for the half-year ended June 30th, 1911.

Stothert & Pitt, Ltd.—On page 577 of our issue of October 6th we printed the dividend on the ordinary shares in this company incorrectly. We should have stated it as 5 per cent., not 3 per cent. per annum.

(*Continued on page 670*)



SUPPLEMENT.

SOME OF THE EXHIBITS AT OLYMPIA.—V.

(The figures in parentheses are the numbers of the stands.)

The Coventry Chain Co., Ltd. (251),

Spon End, Coventry.

The general principles and advantages of the "Coventry" chain aring are too well known to need repetition. A number of thin, rd steel, toothed links, provided with dead hard bushes, are pinned gether to form a flexible, internally toothed band of width depend- on the running speed and power transmitted (see fig. 228). The th are so designed as ays to mesh perfectly th the gear wheels con- cted by the chain. ndard pitches up to in. are now available, d a linear velocity of 00 ft. per min. may be ained. The present ex- bit includes various mples and illustra- ns of the application of oventry" chains. A o-stage speed reduction r is shown with the ver removed; the ain runs in oil, and overall efficiency ft to shaft of 98 per t. is guaranteed. Up 5½/1 speed reduction n be effected per r of gear wheels, and the makers supply a four-stage gear box ing 80/1 speed ratio between the initial and final shafts. Visitors uld carefully inspect the 32/1 reduction box exhibited as applied the starting of large motors, &c. (a pawl release gear uncoupling starter at a predetermined speed). The "Coventry" shock fluctuating drive, and not only smooth out the varying torque, but also reduce the shocks on the driving chain.

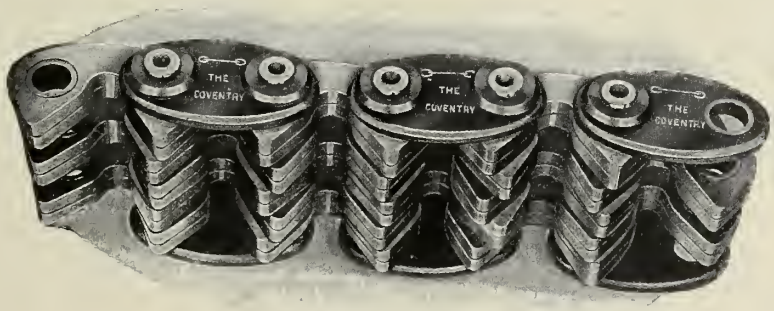


Fig. 228.—Coventry Chain.

The Felt and Tarrant Manufacturing Co. (299),

Kingsway, W.C.

The scope and simplicity of the "Comptometer" calculating machine must be seen to be appreciated. This instrument is already widely used by a great variety of British trading and manufacturing firms; its manipulation consists in the successive depression of one or more, at a time, of the bank of keys according to very simple rules. The result of the calculation is indicated along the front of the machine; no paper or ribbon, &c., is required. The total weight of the machine is 15 lb. The machine adds, subtracts, multiplies and divides any quantities occurring in finance, trading or manufacture. The most sceptical observer can-



Fig. 229.—The "Comptometer."

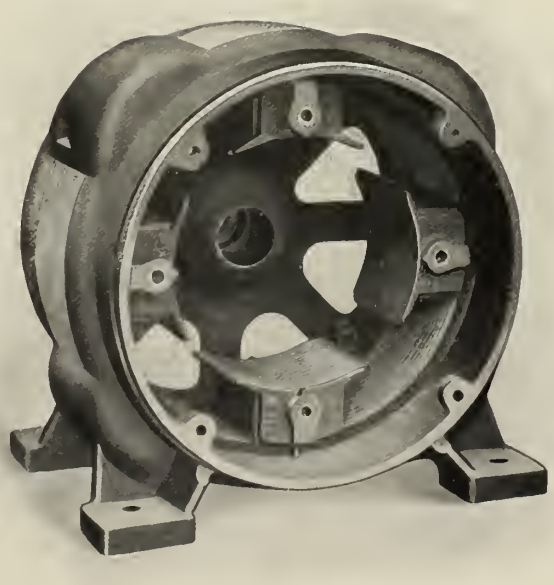


Fig. 230.—Carcass of "J.-L." Motor.

sorption wheel consists of an inner hub, keyed to the driving or ven shaft, and an outer chain wheel connected to the inner boss ough suitable helical springs; these wheels are applicable to any not but be impressed by the convenience and speed of the "Comptometer": as a single instance of its results—7 cwt. 1 qr. 4 lb. at 16s. 9d. per cwt. = £6 2s. 0½d., in *three seconds.*

The J.-L. Manufacturing Co. and Gwynnes, Ltd.,

Southall and Hammersmith.

The J.-L. Co. are exhibiting interesting examples of their laminated field motors, special features of which are the laminated yoke field circuit (see fig. 230, page 655), the double carbon brush-holder, and the lightness and compactness of the design as a whole (30 per cent. saving in copper weight is claimed). The machines have low temperature rise, high efficiency and overload capacity, wide speed range by field control, and sparkless commutation up to 50 per cent. overload, without the use of interpoles or other commutating devices. Various housings from "open" to "weather-proof" types are supplied, and fan ventilation is fitted when necessary.

The now familiar Macdonald submersible motor is shown in submersed operation at this stand. For full particulars of this machine we may refer readers to our issue of March 24th, 1911. It will be remembered that the motor is of the squirrel-cage induction type, the stator winding being perfectly waterproof, and the rotor bars being bare, but offering between no two points a greater P.D. than 1·5 volts (so that no electrolysis of the water occurs). Heating, naturally, offers no difficulties in this type of motor, the many applications of which will at once occur to readers.

Messrs. Alexander Wright & Co., Ltd. (237),

Westminster.

This exhibit is of considerable scientific interest, including as it does a National Physical Laboratory standard photometer, provided with a bench and scale designed by Simmance & Abady to N.P.L.

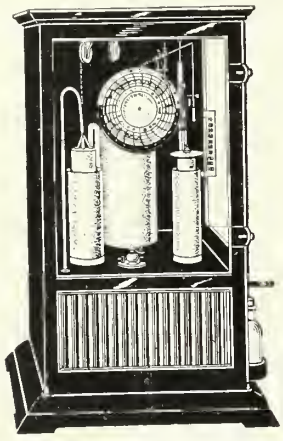


FIG. 231.—SIMMANCE-ABADY CO_2 RECORDER.

requirements, and the lamp rotator designed by Mr. C. C. Paterson, of the N.P.L.; Simmance-Abady direct-reading portable photometers for street tests, &c.; a variety of recorders for combustion, draught, pressure and vacuum; recording water-meters, also calorimeters and thermometers—the stand being, in fact, illustrative of the scientific methods which the central-station engineer may and ought to adopt with a view to obtaining the best results from the installations under his control.

Of the numerous interesting items, we single out for referen the Roland Wild calorimeter, shown in fig. 232, consisting of combustion chamber (in which the fuel sample and sodium peroxi are placed), suspended from the cover by a conduit, which furnished with a valve. A copper water vessel is provided ins an outer vessel, heavily nickelled, forming an air jacket, whi

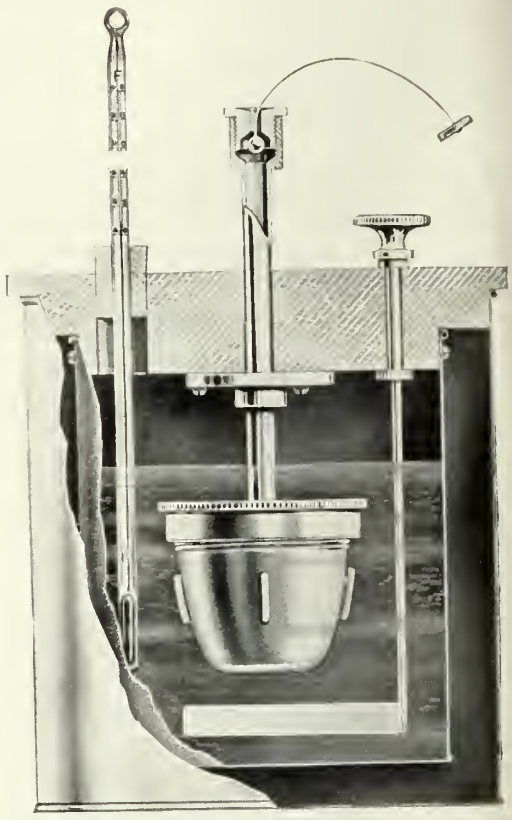


FIG. 232.—ROLAND WILD CALORIMETER.

prevents radiation and absorption and renders the temperature of the water a true guide to the heat given off by the fuel. suitable thermometer and a stirrer are also provided. Ignitior obtained by introducing a small piece of nickel wire, heated redness, into the crucible, through the valve in the conduit, means for electrical ignition and mechanical stirring can be fit The apparatus is an up-to-date low-pressure bomb calorime

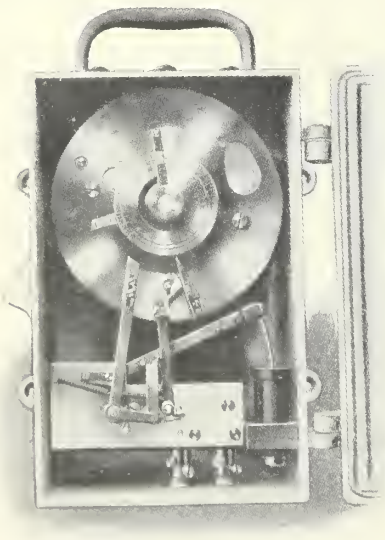


FIG. 233.—"B" TYPE VENNER TIME SWITCH.

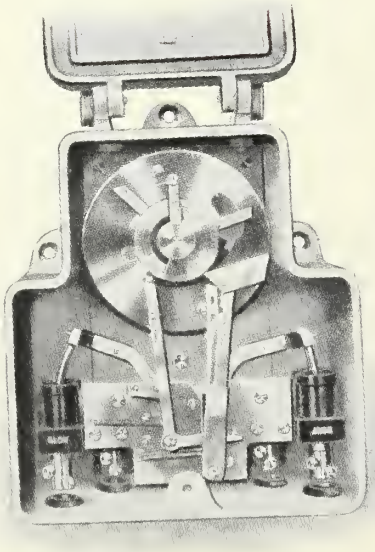


FIG. 234.—"DB" TYPE VENNER TIME SWITCH.

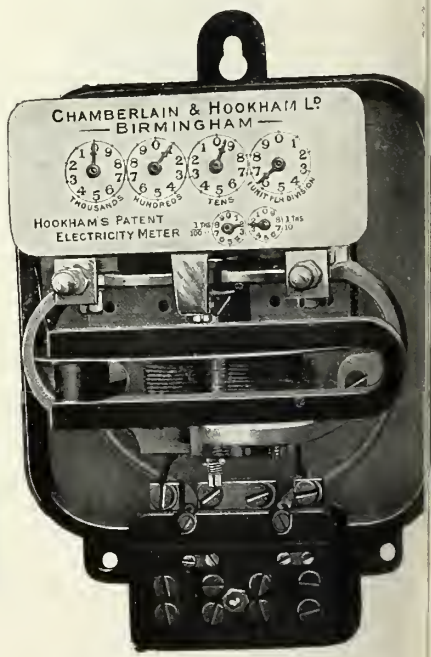


FIG. 235.—HOOKHAM SINGLE-PHASE METER.

suitable for rapid testing, and giving results within 1 per cent accuracy.

The Simmance-Abady CO_2 recorder, with a disk chart, show fig. 231, is of course familiar to many engineers, both in this cou and abroad. This apparatus is supplied with either 24-hour

drum charts, or a 60-day roll similar to a tape machine, and mbined with a draught recorder.

A new "Precision" water meter is shown, for which great sim-icity and accuracy are claimed. As regards the latter usually batable attribute of water meters, we understand that a National ysical Laboratory test showed an error of less than 1 per cent. he meter is fitted with the "Yorke" weir, the flow of liquid over hich enables the rate per hour to be ascertained—the mechanism r recording this automatically, consisting of a float, with clock-iven drum and charts. Various capacity meters are obtainable, om 30,000 lb. to 300,000 lb. per hour, and owing to the absence working parts, the maintenance costs are negligible.

Messrs. Venner & Co. (156, 157),

6, Old Queen Street, S.W.

Messrs. Venner's exhibit makes up in interest what it lacks in riety. Most attractive to the average exhibition tourist would , no doubt, the series of Credenda picture signs inside the room hich is provided on this stand.

These are in daylight-coloured pictures—actually copies of some the artistic posters which have been introduced by our railways—tlined with numerous small glass balls, on the Venner patent inciple, which has been described in our pages. When illumi-ted from behind at night by a few glow lamps, brilliant outlines e obtained, giving a most attractive effect to what would dinarily be in darkness.

The flexibility of this system is demonstrated by a sign showing orang outang in skeleton form; minute beads can be used, and us the smallest detail can be emphasised.

Turning from signs to switches, the range of Venner time itches will attract the central station engineer, as also a simple rrent limiter and some motor-driven flashers for illuminated sign ork; as regards the latter, a special quick-break switch is provided, ith a view to obtaining efficient working.

We illustrate in figs. 233 and 234 the B type time switch for ntrolling two-rate meters, street and staircase lighting, &c., and he D B type for combined arc and incandescent street lighting. he former is for use where the current does not exceed 1½ amperes 250 volts; it is fitted with a well made clock and simple switch hich will close the circuit for any time from 15 mins. to 21 hours. latinum contacts are employed, and selective switching can be ranged.

The D B type is for changing over 250-volt circuits carrying up 15 amperes on the first circuit and 5 amperes on the second, with .c., or double this amount with A.C.

Of course, Messrs. Venner make a great variety of these switches

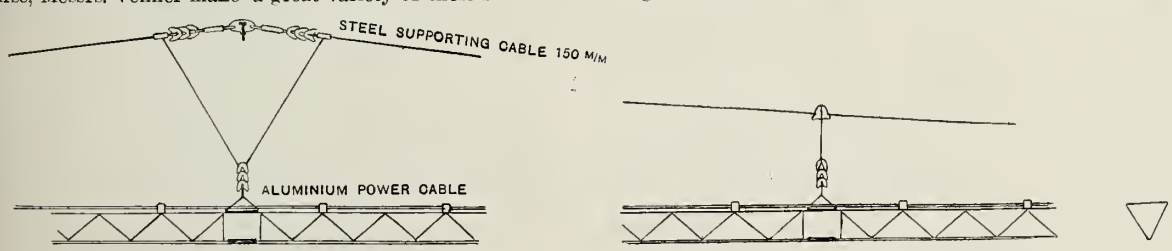


Fig. 238.—Paul Semi-Rigid Contact Line for Single-Phase Traction; Laing, Wharton's Exhibit.

or all purposes, and one feature of the exhibit is a "restricted hour pply" time-switch for up to 300 amperes at 500 volts. Turning



Fig. 239.—100,000-volt Testing Transformer; Laing, Wharton's Exhibit.

rom switches to meters, a selection of the well-known Chamberlain nd Hookham standard A.C. and D.C. instruments are shown.

These cover a wide field of usefulness, and include both watt-hour and ampere-hour D.C. meters, also tramcar meters; attachments for the two-rate system of charging, and the Lackie maximum demand indicator in combination with the firm's meters; also prepayment meters for either 1s. or 1d. in the slot, or for foreign currency. We illustrate in fig. 235 a Hookham single-phase meter of the induction motor type for currents up to 100 amperes,

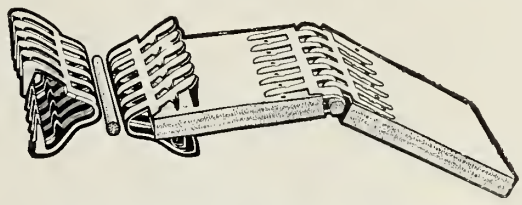


Fig. 236.—"Alligator" Flexible Joint.



Fig. 237.—"Turtle" Belt-Fastener.

pressures up to 600 volts, and frequencies of 25 to 125 cycles per sec. We should mention that the firms exhibiting are Venner Time Switches, Ltd., the Credenda Signs Co., of Birmingham, and Messrs. Chamberlain & Hookham, Ltd., of Birmingham, for all of whom Messrs. Venner & Co., are the agents.

Messrs. J. B. Stone & Co. (230),

135, Finsbury Pavement, E.C.

This firm are showing a collection of their special tools and machinery of interest to the electrical and kindred trades. A full range of "Fox" universal trimmers of the latest design, some of the self-contained type mounted on their own standards, others being compact for screwing to a joiner's bench; these embody a number of improvements. A special feature on the stand is the belt-fastener exhibit. The original "Peerless" belt-lacing machines were followed by the flexible steel lacing with a pinless hinge, and now, last of all, the firm have introduced the patent "Alligator" flexible and detachable steel lacing (fig. 236). The "Alligator" joint ensures quick contact with the pulley, whether the belt is run with either or both sides in service, and as the lacing engages both sides of the belt alike, the strain is thrown in a direct line with the pull, making a joint which is easy on the belt, and which, applied according to directions, will stand any strain put on a belt under any conditions of drive. For both the flexible and "Alligator" steel lacing no sort of equipment is requisite. The "Turtle" belt-fastener (fig. 237) is perhaps more simple to handle than either the flexible or the "Alligator," and has particular advantages to the practical man. Messrs. J. B. Stone & Co. have tried to satisfy by demonstration all opinions in respect of the vexed question of belt fastening. They are also showing their "Stephenson's" bar belt dressing; their easy car pushers, which will work on any track; tally meters (a measuring instrument primarily, perhaps, designed for indicating at a glance the output from planing machines, but applicable to a variety of purposes); the swing cut-off saw gauge, for securing absolute adjustment of the timber on the saw table, thus avoiding waste. Other special lines are their band saw filer, and the "Universal" ratchet.

Messrs. Laing, Wharton, Ltd. (56, 67),

7, Great Newport Street, W.C.

In an earlier notice of Messrs. Laing, Wharton's exhibit, when it was incomplete, we referred to the 100,000-volt testing transformer, which has since been erected over the stand and now provides a popular attraction for the passer-by when its crackling discharges are in progress.

The transformer, shown in fig. 239, weighs 1½ tons, and contains 1½ tons of oil; it is of 50-KW. capacity and is intended for testing high-voltage transformers. On the stand it is arranged to discharge at 50,000 volts over two bottle insulators to an earth plate, and is supplied on the L.T. side with 220-volt 50-period single-phase

current through an oil circuit-breaker, and an ordinary S.P. circuit-breaker and fuses (in a locked case) in series.

An exhibit of considerable interest to the railway man is a section of the Paul patent semi-rigid aerial conductor, shown in fig. 238, which is built up of half-round iron sections with a lower steel contact strip and an aluminium power cable over the triangular

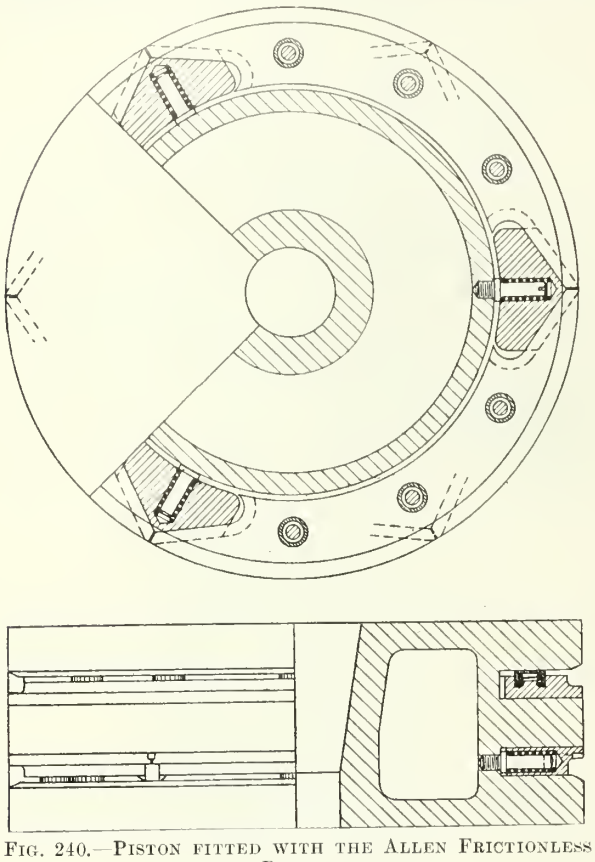


Fig. 240.—Piston fitted with the Allen Frictionless Rings.

construction. The latter is built up in lengths with special joints between them which allow for end movement due to temperature, &c., and suspended by a steel carrying cable suitably insulated. This is one of six experimental systems now under trial on the Midi Railway of France, as a preliminary to electrification with single-

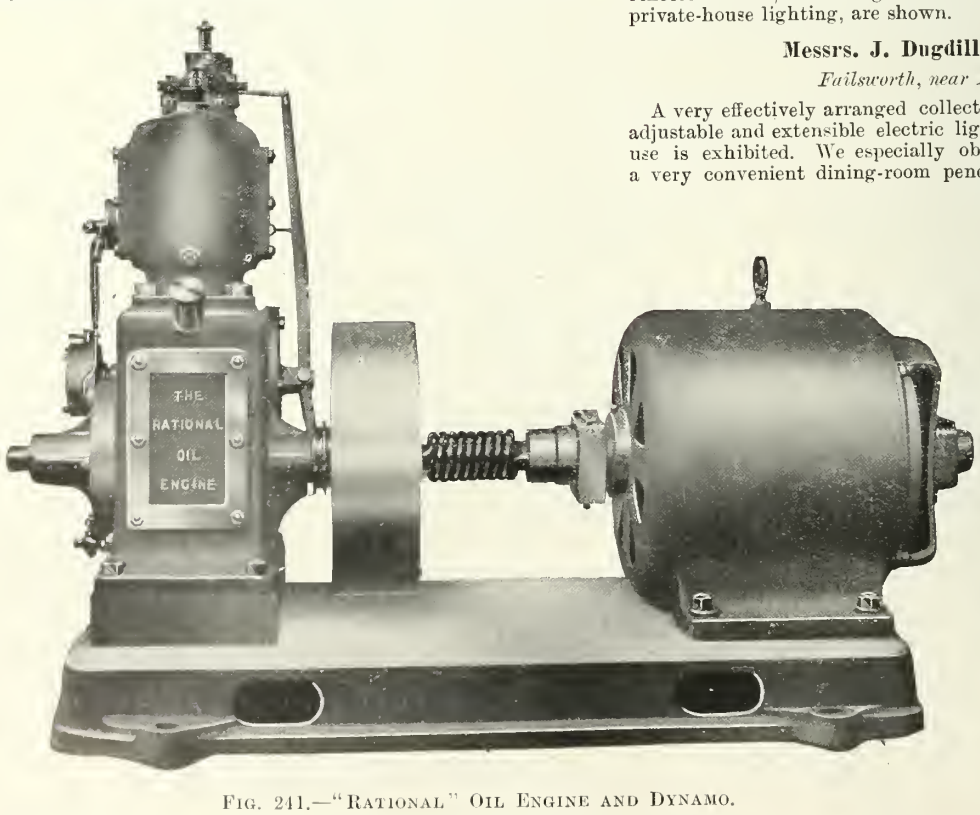


Fig. 241.—"Rational" Oil Engine and Dynamo.

phase current at 12,000 volts. Overhead collecting gear for the same line is shown, and a new patent acetylene welding system for welding copper bonds to steel rails *in situ*. This system is considerably cheaper than any other yet introduced; two men can weld six bonds per hour without interfering in any way with traffic, and a specimen bond is on view at the stand.

Another novelty which has been added within the last last f days is the Arnold patent time switch with double contacts. T has been specially designed for street lighting work, as, for instan switching lamps on at dusk and switching a proportion out at m night, and the remainder at dawn. The switch is simply ma only one spring being included in its construction.

Messrs. Allen & Simmonds, Ltd. (229), *Reading.*

The feature of this exhibit is the Allen patent frictionless pist ring, the arrangement of which can be better understood by ref ence to fig. 240.

A piston fitted with two rings is shown; each ring is divid into three segments, and a spring-controlled block at each joi forces the rings outwards against the cylinder walls. The up and lower rings break joint as shown by the dotted lines. It w be noted that the rings are of special section, and that steam pas freely along one side and behind the rings; the object of t arrangement is to secure a steam-tight joint on one side of ea piston ring, and to give the rings a floating action controlled o by the springs behind the joints.

We understand that these rings have been widely tested in bo marine and land engines, including gas engines, and have giv great satisfaction.

In the case of a Belliss compound engine at the Chester Corpo tion electricity works which was fitted with the Allen rings recent test showed a saving of 14 per cent. in the steam consum tion, as compared with two years previously when the engine w working with the ordinary piston rings fitted by the builders.

The Heatly-Gresham Engineering Co., Ltd. (175), *Gresham Iron Works, Letchworth.*

On this stand are shown a number of the "Rational" patent engines, most of them direct coupled to Mawdsley or Sieme dynamos, and ranging from 3 to 6 B.H.P.; two of these are of t vertical and two of the horizontal type, besides a vertical eng driving a Worthington pump. We illustrate in fig. 241 one of electric generating sets with vertical engine; the latter has advantages of extreme simplicity and accessibility; the pist connecting rod and cam shaft can all be removed without taki off the cylinder, and the governing is very simple and sensiti The firm's own patent vaporiser is used, which causes no deposit the cylinder or gumming of the piston rings, and these engines be run continuously on electric ignition without attention. T engine can be started on paraffin, without petrol, the lubricatio automatic, and the oil consumption is stated to be 0·85 to 0·9 p per B.H.P.-hour.

Messrs. Holophane, Ltd. (199, 216), 12, *Carteret Street, S.W.*

The company makes a good display of the well-known Holopha glassware, the shades being adapted for various distributions required by the user. Attractive-looking Holophane spheres a reflector bowls, and a great variety of smaller reflectors private-house lighting, are shown.

Messrs. J. Dugdill & Co. (238), *Failsworth, near Manchester.*

A very effectively arranged collection of the firm's well-kno adjustable and extensible electric light fittings for many classes use is exhibited. We especially observed a mirror light fitti a very convenient dining-room pendant, and various desk, ta and piano standar which can be put in almost any position. new and special featu is an application of t system to picture ligh ing, which has be shown during the p week or so.

Haydn Harrison (309), 11, *Victoria Street, S.*

Mr. Haydn Harris has confined his exhib to the latest develo ments in connecti with his street lighti business, the prese magnitude of which evidenced by the i posing list of towns which he has carri out the conversion gas to electric str lamps. The gracef tungsten lanterns e ployed, instead of gas in place of arc lamps, a very noticeable (fig. 24 by the careful placing of the lamps beneath a specially design enamelled reflector, the excellent efficiency of 1·5 effective C.P. watt is secured. Over 900 arc lamps have already been replaced these fittings. With reference to side street and other branches exterior lighting, Mr. Harrison is exhibiting special lantern a reflector designs which have been widely adopted.

The Johnson-Billington A.C. watt-hour meters (fig. 242) shown of an entirely new type, in which permanent braking magnets, d the ageing errors attributable to the latter, are avoided by the of A.C. electromagnets. These meters start on 2 or 3 watts load size), and their characteristic curve is linear from $\frac{1}{100}$ full load wards on both inductive and non-inductive circuits; at full loads

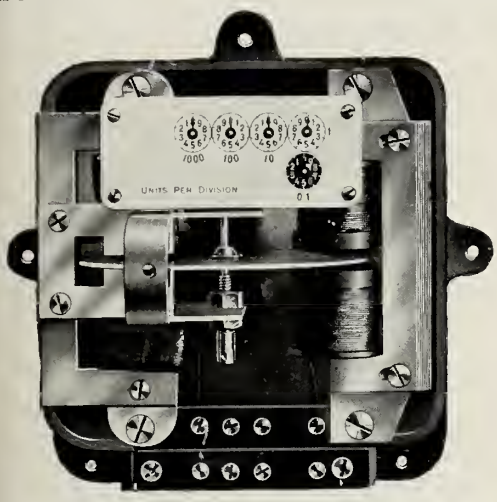


Fig. 242.—Johnson-Billington A.C. Watt-hour Meter.

armature speed is exceptionally low. The winding of the brake gnet is in series with the shunt field coils, and perfect tempera-re correction is claimed.

There are many other interesting features in this exhibit, such time switches, automatically changing the operating period in



Fig. 243.—Harrison Tungsten Lamp Fitting.

ccordance with the season, automatic "half-night" switches, auto-atic control switches for series-parallel groups of tungsten lanterns, nd circuit-breakers with inverse thermal time-limit release.

Messrs. W. T. Nicholson & Clipper Co., Ltd. (234),

King Street, Salford.

This exhibit has as its outstanding feature the "Klincha" tool nd patent belt-fasteners; the "Clipper" belt tools and hooks are lso shown.

Messrs. Wallach Bros., Ltd. (28, 33),

Royal London House, Finsbury Square, E.C.

A feature which has excited a good deal of interest at this stand has been a line of high-speed portable electric drilling machines for attaching to existing lighting circuits, and many orders for these have been booked during the Exhibition. The windings of the machines are such that speed regulation is obtained according to the size of drill used. The special construction of the motors obviates



Fig. 244.—The "Daisy" Vacuum Cleaner.

the necessity for overload cut-out—that is, if the drill stops dead in going through a hole, no immediate burning-out of the motor occurs.

Another very popular line on this stand is the "Daisy" electrically driven vacuum cleaner. Models for domestic service fitted to lamp sockets in private houses are supplied, weighing 90 lb, and measuring 32 in. high × 16 in. deep × 18 in. wide. A large size (model "E"), which we illustrate, fig. 244, is specially intended for service in hotels, factories or warehouses. It weighs 119 lb. and measures 36 in. × 16 in. deep × 20 in. wide. A third line to which attention may be called is a new asbestos-packed cock, which can be repacked whilst the boiler is under steam. Many other of the firm's well-known manufactures, such as engineering tools and sundries, are, of course, exhibited, india-rubber gloves being included among them.

Messrs. Escaré & Denelle, Ltd. (145, 166),

129, *Wardour Steeet, London, W.*

There are a number of excellent displays of electric light fittings in the Exhibition building, but that of Messrs. Escaré & Denelle fastens the visitor's attention first by the fact that workshop



Fig. 245.—Georgian Candle Bracket.

operations are demonstrated in actual progress. Several of the firm's expert metal workers are engaged in embellishing brass work from the casting. "Live" exhibits always compel the interest of the average mortal. This stand is not only alive in the sense that

we have mentioned, but the fittings and objects shown are themselves quite eloquent in the appeal made by their artistic qualities. The high-class character of the exhibit may be gathered when it is

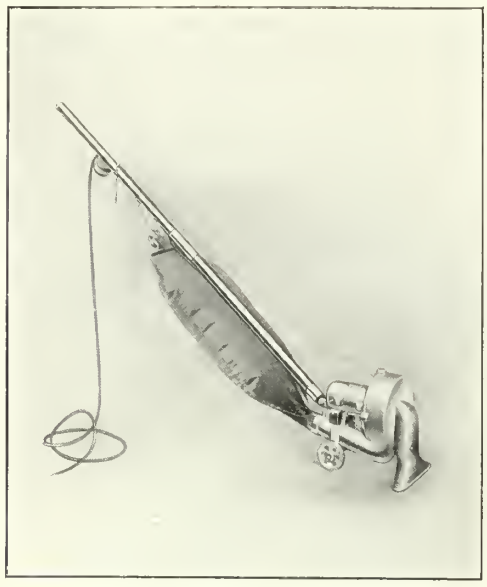
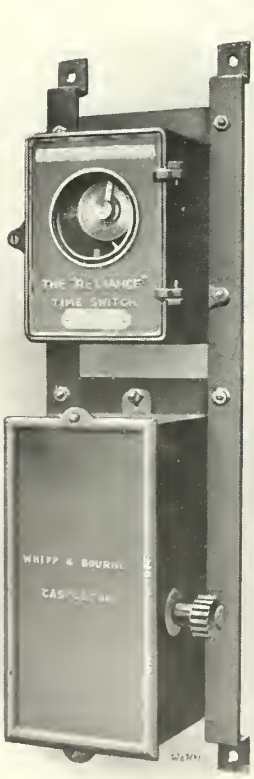
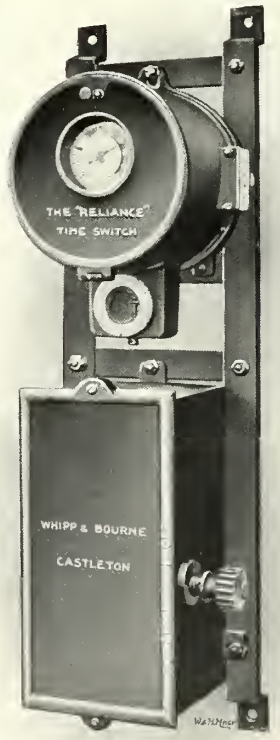


Fig. 246.—The "Magic" Suction Cleaner.

mentioned that there are displayed some fine reproductions made in oxidised silver and gilt for the Government authorities for Holyrood Palace, also an example of fittings made for King George's dressing room at Buckingham Palace. Among other features brought to our notice was a new system of picture lighting which, by a particular arrangement of lenses, obviates streaky rays and also increases the illuminating effect so that the light extends right to the bottom of the picture. The illustration shown in fig. 245 represents a rich Georgian wall light of registered design. Messrs. Escaré & Denelle, of course, specialise also in bell and switch plates and general metal work in all styles, as well as in carved wood fittings.





Figs. 248 and 249.—"Reliance" Time Switches: Whipp & Bourne's Exhibit.

Magic Appliances, Ltd. (17, 44),
6, Farringdon Avenue, E.C.

This exhibit consists of the "Magic" suction cleaner, which is made at Witton, near Birmingham, and is an extremely neat and handy device. As shown in the illustration above, fig. 246, it is of the portable self-contained type, and is operated by a connection to an ordinary lampholder or wall-socket; it is made for D.C. and A.C. circuits of all voltages from 100 to 250 volts, and is very small and light, weighing less than 10 lb. The case is of aluminium, and contains four members—the suction intake, the fan box, the motor and the exhaust duct; the motor is mounted horizontally, with provision for self-lubrication, and drives a disk turbine fan giving an air-current of large volume. The case is carried on rubber-tired wheels with ball bearings, and the handle is pivoted, so that the machine always maintains the proper position without effort on

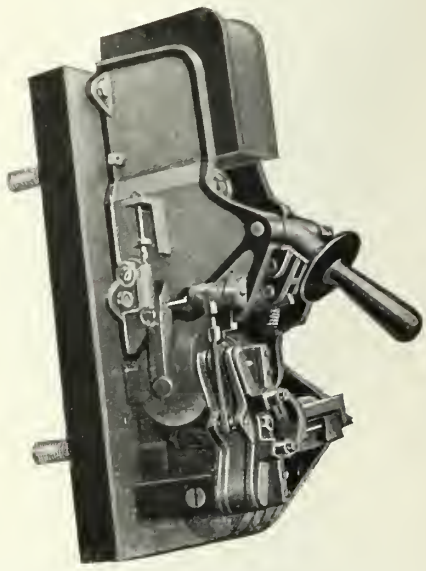


Fig. 247.—Whipp & Bourne's Reverse-Current Circuit Breaker.

the part of the operator. The dust bag offers a large filtering surface, retaining all dust, while allowing the air to escape freely. A switch on the handle controls the motor, and the flexible cord has a plug connection at the motor end as well as at the other end. A variety of attachments, to enable the cleaner to be used in all situations, including extension hose and handle for cleaning walls, cornices, &c., and for utilising the machine as a blower instead of an exhauster, is provided with the cleaner. Judging from the interest displayed in the device by the cluster of visitors round the stand, the cleaner is likely to become a popular item of the domestic *ménage*.

Messrs. Whipp & Bourne (183),
Castleton, Lancs.

The switch productions of Messrs. Whipp & Bourne are probably not so well known as they deserve to be, in view of the excellent features which are embodied in their construction generally.

The exhibit includes a great variety of switches, fuses, resistances, &c., and of particular interest to engineers who are developing a "restricted hour" supply are the "Reliance" time-switch arrangements of this firm, consisting of either a pendulum or lever escapment clock, in conjunction with an enclosed loose handle switch—the function of the time switch being solely to make a shunt circuit to open the main switch. The clock switch does not break any circuit, and this eliminates contact trouble. We illustrate in figs. 248 & 249 switches of the lever escapement and pendulum escapement types respectively, and these are made standard for capacities between 10 and 200 amperes for 440 volts. The switches can also be combined with overload loose handle circuit-breakers. Fig. 247 is one of the firm's overload and reverse-current circuit-breakers of the "loose handle" and magnetic blow-out type, constructed in standard sizes between 25 and 2,500 amperes, examples of which can be seen in operation on the stand. In connection with the time limit a calibration scale is provided, varying from 5 seconds to 5 minutes, and should the limit period not be used, the switch will reset itself, giving the full time again.

The feature of the reverse-current breaker, however, is its ability to operate with a reduced bus-bar pressure. Even if the pressure is reduced to only 5 per cent. of normal, the current will only be

e-third full load current of the breaker. It is impossible for the verse breaker to open circuit with an overload or short-circuit in e forward direction. The power operating the reverse-current p increases as the current rises in the reverse direction, and as e trip is electrical, no resetting is required after operation.
These circuit-breakers are supplied with all the usual operating vices, and a typical Admiralty D.P. breaker interlocked with an ualising switch is shown on the stand.

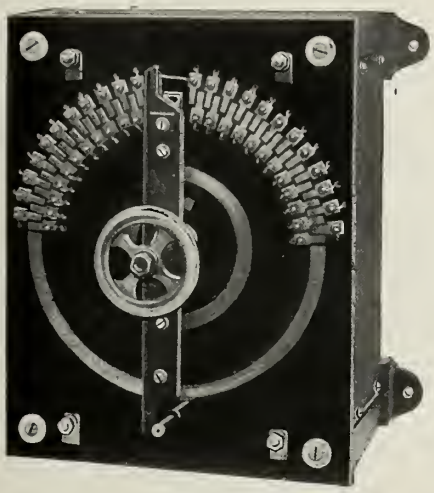


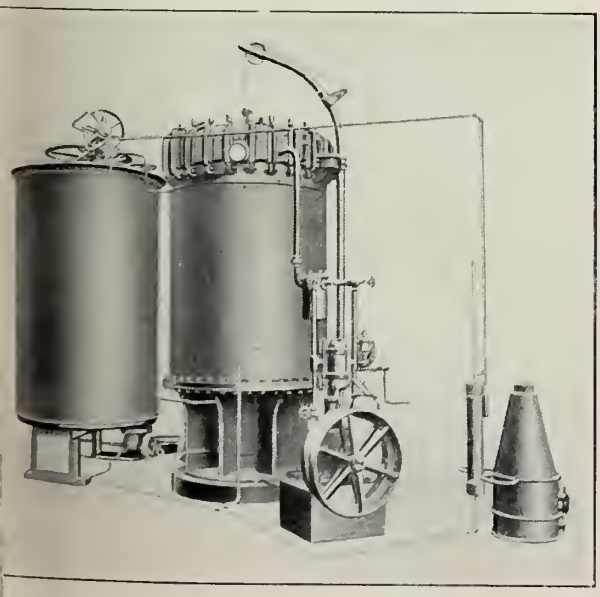
Fig. 250.—"Reliance" Rheostat.

The firm specialises in electrically controlled switchgear, and amples of its remote-controlled circuit-breakers for motors, nerators, &c., and built-up control units are on view.
These, it may be added, are of metal and mica construction roughout, in sheet-steel waterproof cases, and have, in one form other, been used in practically all our latest battleships. Another ature of the exhibit is the "Reliance" rheostat for switchboard ork, as illustrated in fig. 250, for dynamo voltage and motor speed ntrol.
The resistances consist of Eureka wire wound on asbestos-covered eel tubes carried in porcelain blocks; the contact connections are otected by porcelain beads. The contacts vary in number from on the 300-watt size to 40 on sizes above 2,000 watts capacity.

Messrs. Pinchin, Johnson & Co., Ltd., (155),

26, *Beris Marks, E.C.*

On this stand is shown a practical illustration of the uses of the andard insulating varnishes and compounds. Examples of armare and field coils are shown, loaned or supplied by customers of e firm.
Special attention is called to the use of the Standard insuting varnishes and compounds in connection with the mainnance and repair of electrical machinery. The windings of achines periodically coated with a suitable varnish will be kept a constant state of efficiency, any fear of breakdown through



ig. 251.—Impregnating Plant, with Pump and Compressor.

ie penetration of moisture or lubricating oil being reduced to a inimum. Another interesting feature of the exhibit is the acuum drying and impregnating apparatus, which is shown on e stand. By means of this plant the windings of electrical machinery can be treated under vacuum, and subsequently under pressure, with compound or varnish, ensuring complete elimination of moisture and thorough waterproofing of the windings. We illustrate in fig. 251 a complete dry insulating plant, 5 ft. diameter × 8 ft. deep, for both solid compound and liquid varnishes, with vacuum pump and air compressor and steam heater to work at 200 lb. pressure.

Messrs. Schäffer & Budenberg, Ltd. (21, 40),

77A, *Queen Victoria Street, London, E.C.*

This firm has a large exhibit of its well-known pressure and vacuum gauges and other instruments, covering a wide range of measurements, as well as boiler fittings of all kinds. An electrical distance thermometer of the resistance type, with direct-reading dial, and a switchboard enabling any number of stations to be connected and rapidly tested, is shown, and the Bayer patent steam meter, which records on a chart the weight of steam per second passing through a pipe, as well as the pressure in the pipe at each instant, forms another interesting item. The Bayer meter consists essentially of a disk suspended in a conical passage, so designed that the disk always moves to a position where the difference of pressures above and below it balances a constant force due to a counterweight; the velocity of the steam passing the disk is thus maintained constant by increasing the area of the annular space surrounding the disk, and under this condition the weight of steam per second at constant pressure is proportional to the area of the opening. The pressure chart enables the user to apply the necessary corrections for changes in the steam pressure.

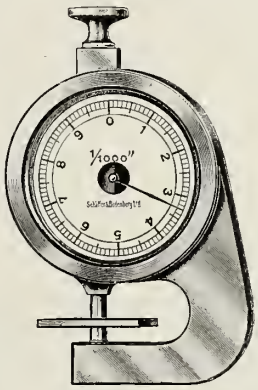


Fig. 252.—"Auto" Caliper.

A series of automatic micrometer calipers, which give direct readings on a dial, is worthy of notice; these are made for a variety of purposes, and for various ranges. We illustrate (fig. 252) one graduated in $\frac{1}{1000}$ in. and intended for indicating the thickness of paper, sheet metal, &c. The jaws are normally held apart by a spring; the substance to be measured is placed between them and the plunger pressed down, when the reading is at once given on the dial, and as the instrument can be used with one hand, it is much more convenient to manipulate than the screw type.

Dowsing Radiant Heat Co., Ltd. (161).

105, *Great Portland Street, W.*

The Dowsing exhibit undoubtedly does the firm credit. It makes its appeal to several distinct classes; to the ladies who want a substantial and serviceable line of electric stove or other cooking

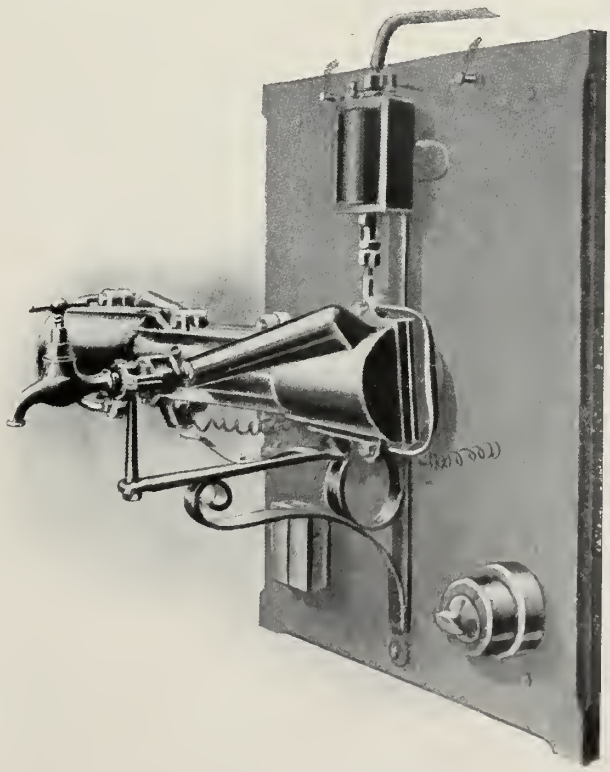


Fig. 253.—"Nogier" Water Steriliser.

device; to the Mary Anns or Sarahs who are troubled with household work, and to the mistresses who are troubled by them; also to the medical men of London, amongst whom a further interest has been stimulated in the medical applications of electricity,

Even here the variety of the appeal does not end, for the deputations from public authorities will not have failed to take special note of the plant shown for the sterilisation of water supply. Taking the stand, then, in the order indicated above—we find, first, a useful display of three heat electric cookers, and "Kensington" electric ranges, concerning which we may be able to say more in a later issue. Then we have, of course, kettles, irons, and general electric heating and cooking apparatus. The radiator in its various designs of luminous and combined luminous and convector patterns is strongly and warmly in evidence, while the maid-of-all-work reclines in leisure in the enjoyment of a grateless, ashless, smoke-free existence, with half her occupation gone.

The familiar "Solarium," or electric sun bath—a small one in folding oak with enamelled iron lining for home use; the hair



Fig. 254.—Westinghouse Cooper-Hewitt Co.'s "Silica" Lamp, Type Z 2.

dryer and the vibrator; and the seven-purposes-in-one "Multostat" which has been appreciated by medical men as a most serviceable line—all these lead us down to the "Nogier" equipment for the sterilisation of water by ultra-violet rays. Two or three years ago Drs. Courmont and Nogier, in a communication to the French Academy of Sciences, showed that water, however impure bacteriologically, could be thoroughly sterilised by the ultra-violet rays given out by

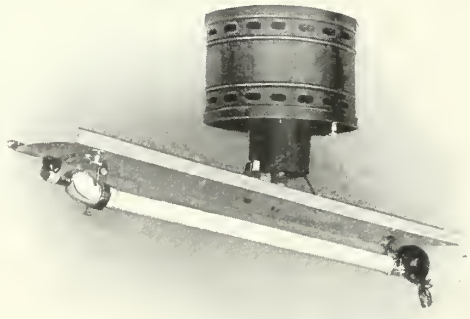


Fig. 255.—Cooper-Hewitt a.c. Lamp.

a mercury quartz lamp, provided that the water was not muddy or thick. In the "Nogier" steriliser it has been demonstrated that the microbe-spores themselves are completely destroyed. The water undergoes no chemical change, and it contains neither ozone nor oxygenated water, nor any added substance, the sterilisation being purely physical. The apparatus exhibited (fig. 253, p. 661) is for household purposes, and is composed of a metallic covering in bronze, nickelled inside and out, in which is placed a mercury-vapour quartz lamp. The yield of the household apparatus amounts to 220 to 330 gallons per hour. If the apparatus be used by surgeons, who especially require sterilised water for operation purposes, the delivery of water can be specially regulated.

The apparatus is supplied mounted on a marble slab which can be fixed to the wall by screws, and it carries a connecting joint for the inlet of water and terminals to which the conducting wires are to be fitted. It is only necessary to turn the switch and gently till the lamp to light it. With the household apparatus there are supplied: the sterilising cylinder, the quartz lamp, th automatic tap, a resistance, and a D.P. switch, all fixed on th marble slab.

The Westinghouse Cooper-Hewitt Co., Ltd. (82), 151-2, *Great Saffron Hill, E.C.*

The singularly diversified uses of the mercury-vapour arc a well exemplified by this exhibit, which shows its application lighting (including printing and photography), the rectification alternating currents, and the sterilisation of water—three us which on the face have absolutely no relationship. Under the fir heading, in addition to the well-known Cooper-Hewitt lamps wit long glass tubes, the Westinghouse "Silica" lamp is shown. W

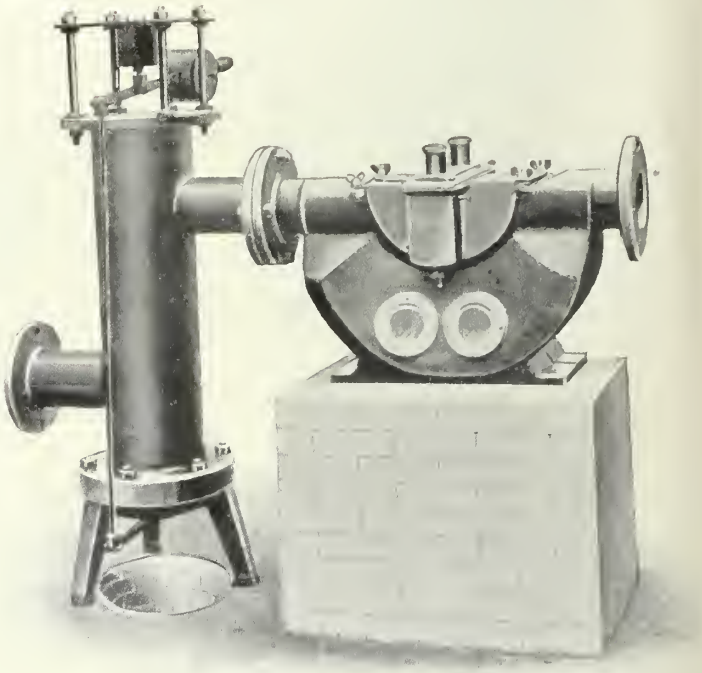


Fig. 256.—Westinghouse Water Steriliser.

illustrate one of these, type Z 2, rated at 3,000 C.P., and takin 3½ amperes at 200-250 volts (fig. 254). The incandescent mercu vapour is enclosed in a quartz tube, which is automatically tilt to start the arc, and thereafter needs no attention. The me hemispherical C.P. is stated to be 3,600 C.P., at a power consumpti

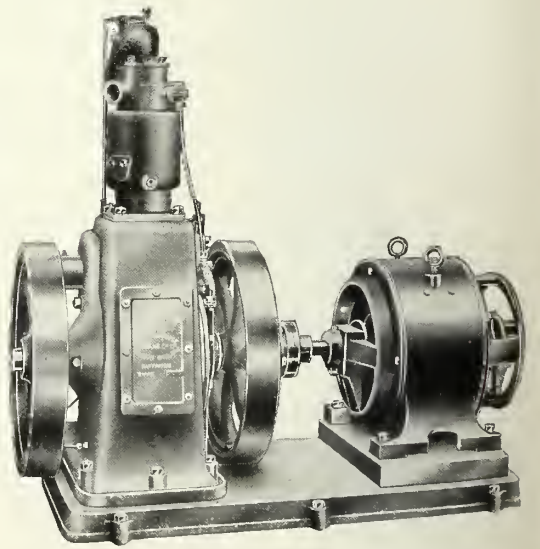


Fig. 257.—"Cross" 10-H.P. Oil Engine Set.

of 0·22 watt per candle, and the maximum is 5,000 C.P. over a rang of 20° on either side of the vertical. A minimum life of 1,0 hours is guaranteed, but the average life of the burner is 2,0 to 3,000 hours. Large numbers of lamps of this type, including th 800-C.P. pattern taking 1½ amperes, are in use in this country.

The Cooper-Hewitt lamp is not capable of burning on alterna ing currents, but this difficulty is overcome by the apparentl paradoxical device of feeding it through a mercury-vapour con verter. A lamp of this kind is shown in fig. 255; unlike the D. lamp, it requires no separate inductance in series with it, so tha

A.C. lamp, it is stated, is actually more efficient than the . lamp.

Experiments have been in progress for a long period with a view normalising the colour of the light emitted by the mercury- pour lamp—a difficult problem; all attempts to obtain this ult by intermixture of other elements inside the tube have herto failed. but the device of employing a fluorescent medium a reflector to convert a proportion of the rays from short to

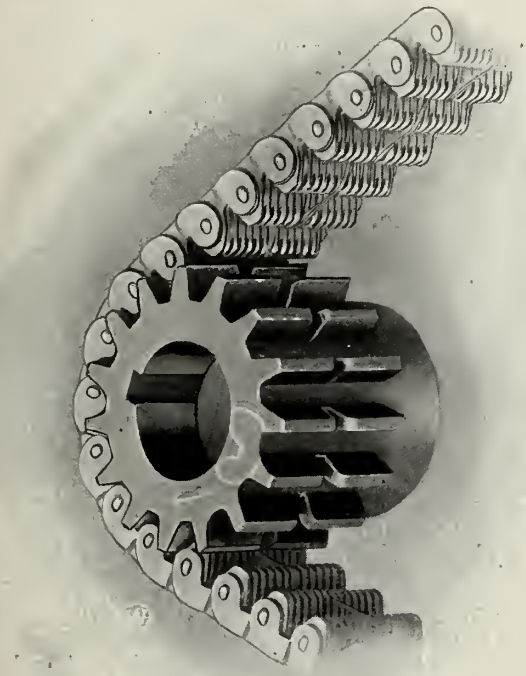


Fig. 258.—Westinghouse-Morse Chain Drive.

nger wave-lengths has been perseveringly developed, and a lamp exhibited, fitted with one of these reflectors, which gives a light normal white colour. We understand that the life of the uorescent material, which formerly was too short for com- ercial use, is now at least 1,000 hours, and the active surface is sily renewed. The importance of this improvement can hardly

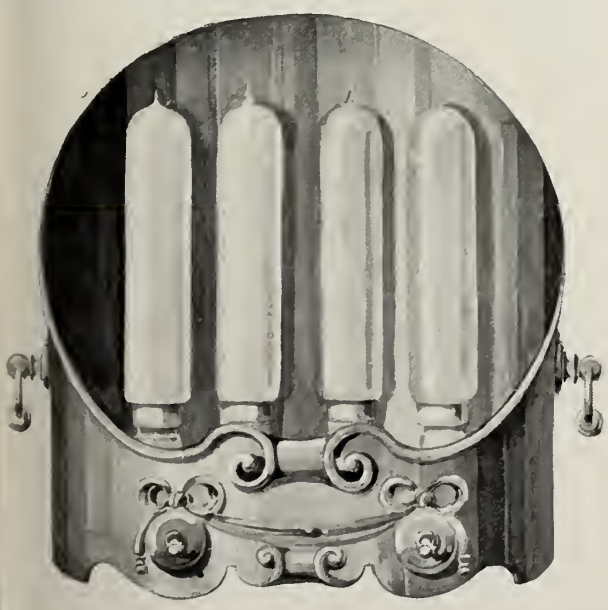


Fig. 259.—Emanuel Radiator.

e over-estimated, as it renders this extremely economical illu- ninant (·33 watt per C.P., or ·45 watt per spherical C.P.) applicable o very many uses for which it was formerly unsuitable. The ppearance of the lamp is similar to that of fig. 255, but with a semi- ylindrical reflector.

The mercury-vapour converter is exhibited in a form parti- ularly developed for the operation of projection arc lamps from .C. circuits; this apparatus is entirely automatic, starting up the moment the A.C. switch is closed, and the carbons are brought together; for an output of 60 amperes at 60 volts, two 30-ampere units are used in parallel, and these are so arranged with cross-wound inductance coils that neither unit can be overloaded. For



Fig. 260.—Cast Pendant Fitting.



Fig. 261.—Newel Post Fitting.

Emanuel Fittings (see page 664).

bioscope use, the apparatus, which is practically fool-proof, is admirably adapted.

Another feature of the stand is the Westinghouse water steriliser, working with ultra-violet light from the Silica lamp. The apparatus shown is capable of dealing with 600 cb. metres of water in 24 hours, using 26 watt-hours per $m.^3$, and is similar to apparatus in operation at Marseilles and Maromme for public water supply. The manner in which the sterilisation is effected has already been explained in our pages. Various other uses of the mercury-vapour arc—for photo-printing, portraiture, &c.—are exemplified in the exhibit.

The Westinghouse Brake Co., Ltd. (6),

82, *York Road, King's Cross, N.*

The principal exhibit of this company is a 10-H.P. "Cross" oil engine, coupled to a 5-KW. dynamo on a common bed-plate, and supplying current to other apparatus on the stand. This engine is made by the company for outputs from 5 to 50 H.P., with one, two or four cylinders, according to size, and runs on paraffin costing 2½d. per gallon, of which it consumes ·7 lb. per H.P.-hour; but the makers inform us that it can be arranged to burn anything in reason. The engine is of the vertical single-acting four-cycle type, and the fuel sprayed into the combustion chamber is ignited by the heat of compression. An interesting feature is an annular pocket near the combustion chamber into which air is compressed and cut off before the piston reaches the end of its stroke; ignition follows, and the piston, moving down again, opens this pocket, releasing the charge of heated compressed air, which mingles with the burning fuel, and ensures complete combustion. An exceptionally clean exhaust results, besides increased economy, and there is no deposit of carbon on the valves and cylinder.

The governor varies the stroke of the feed pump to suit the load, so that no explosions are missed altogether, but the strength of the explosion is varied. No carburetter or vaporiser is required, and no sparking plug. Double check valves are used on both the suction and the delivery side of the fuel pump; automatic lubrication by a rotary oil pump is provided, and the engine is of simple and substantial construction.

Another important exhibit is a variety of Westinghouse-Morse silent high-speed rocker-joint chain drives; similar drives have been made for powers ranging from ¼ to 1,000 H.P., and

part of a 130-H.P. drive is actually shown. These chains are so constructed that the wearing parts, of hardened steel, roll upon one another instead of rubbing, thus reducing friction and increasing the life of the chain. Fig. 258 (opposite) admirably shows the appearance of the chain and pinion, and the method by which the former is kept in position by guiding links running in a groove on the pinion. It is claimed that the efficiency of these drives in actual working is over 98 per cent.

Messrs. A. Emanuel & Sons, Ltd. (195, 220).

7-13, George Street, Manchester Square, London, W.

Messrs. Emanuel are displaying a great variety of manufactures for electric lighting and other purposes. Their electric light fittings, which include examples of many designs and finishes, are very effectively arranged, and bearing in mind their specialised experience in all classes of art metal work one is not surprised at the beauty of some of the specimens shown, whether in hand-hammered or cast work. We illustrate a newel post fitting (fig. 261) and a cast pendant fitting (fig. 260) (which is not so ordinary as it may appear to be) as representative of this department of the firm's business. Other exhibits that should be mentioned to indicate the field prepared for on this stand are picture lighting, reflector fittings, 'shoplite" fittings, outside lanterns for metal-filament lamps, the 'Kwik-fix" ceiling rose, and "Ennyvolt" bells, of which we have already given descriptions in our pages. In fig. 259 we show a luminous radiator with metal work of a quite unique design.

The Efandem Co., Ltd. (4),

244/246A, Corporation Street, Birmingham.

On this stand, considering its dimensions, there is, perhaps, as great a variety of electrical manufactures as on any stand in the building. Of course, as our readers have already been made aware, the line upon which the firm has been particularly concentrating attention of late has been the wholesale manufacture of pocket lamps (cases, batteries and all complete), and while there is a very imposing representation made of these, one has only to spend a few minutes on the stand to discover quite a number of other lines of equal interest. Since the intentions of the firm were announced, they have been inundated with orders for pocket lamps and batteries; not only has the home demand been large, but in the Colonies there is a strong evidence of the preference that exists for a British article. The works production for the season was sold in

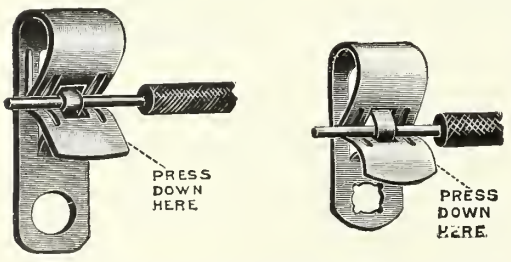


Fig. 262.—The T.E.C. Spring Terminal.

advance. The "T.E.C." dry cells, batteries and refills for these pocket lamps, and generally for portable lamps, are a new line made on a new principle. The "T.E.C." is a jelly cell, not a plaster one, and the firm claims to be able to make it in England at competitive prices against Continental competition. All the batteries in the lamps are fitted with the special T.E.C. patent spring terminal shown in fig. 262, which facilitate rapid connection, obviate the tendency to short-circuits, and eliminate the possibility of faulty or loose connections and of wires breaking off. In a fully illustrated circular the firm shows that the connections are applicable to all sorts of electrical apparatus, coils, bells, telephone, telegraph and measuring instruments, ignition batteries, &c. Three other matters call for mention. First, there is shown prominently within the range of vision a section of "Universal" sign and illumination material and accessories therefor; it is very effective, and particulars may be available later. Secondly, but perhaps as prominently as anything else, there is a speciality which has not only interested the outsider, but has received the attention of a number of the best known firms exhibiting in the same building. We refer to the magazine screw-driving attachment for sensitive drills. This is a new device of great ingenuity for driving wood screws quickly and without injuring the heads, and is equally suitable for flat or round heads. For cabinet makers, manufacturers of electrical apparatus and all who require to drive a large number of screws into similar class work, we can readily believe that this tool will save its cost in a very short time. It drives screws into hard wood, easily and quickly, without previous drilling. One tool will do the work of several hands and practically makes screwing as cheap as nailing. The tool is entirely self-contained. It is instantly attached to the machine, in the same manner as an ordinary drill. It is self-feeding; the operator merely puts a number of screws in the hopper, which automatically separates them, and supplies the screws singly as required, and as quickly as ever necessary. The tension adjustment is exceedingly simple and positive. Screws can be driven in hard wood as easily as in soft wood. The tool accommodates itself to the inaccuracies which occur in ordinary screws. Any faulty screws, such as, for example, a screw having no slot the head, can be instantly discharged from the driving noz It is made in three sizes. Lastly we may refer to an article whi can shriek for itself, a motor-driven siren—indeed, we believe t in the early days of the Exhibition it so signally succeeded demonstrating its ability to summon all and sundry from far a near that it has since had to be asked to keep quiet and g others a chance. This it has courteously done—nevertheless, it well able to speak for itself when required.

The Armorduct Manufacturing Co., Ltd. (120, 121, 138, 13

Farringdon Avenue, E.C.

A very attractive exhibit has been arranged by this compa considerable care having evidently been expended upon its prepa tion and arrangement. Naturally, the "Armorduct" steel c duit system occupies the premier position, both light and hea



Fig. 263.—"Therma" Kettle.



Fig. 264.—"Therma" Iron

gauge conduit being shown, in various forms, and complete sets connecting pieces, outlet fittings, and other accessories are played. A special feature is the "Armorduct" universal knock box, which is now made with ready-screwed sockets, as recen described and illustrated in our "New Devices" column. Wat tight fittings for a variety of purposes are also shown, toget with wires and cables of all kinds, the "Gral" metallic-filam lamps and electric fans.

A spiral of "Armorduct" steel conduit, bent cold, serves illustrate the toughness and sound jointing of the tube. A pat adjustable fittings box, draw-in boxes made watertight w

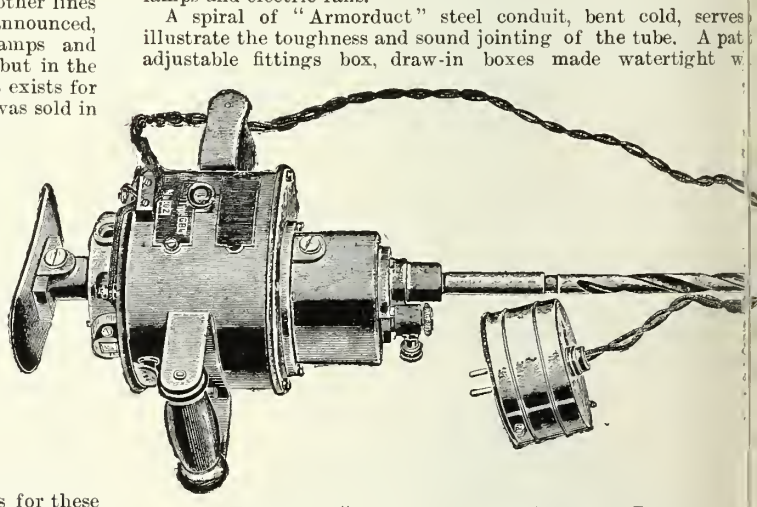


Fig. 265.—"Little Hustler" Breast Drill.

"Electrokit," and a series of new multiple junction boxes all c for special notice.

The "Therma" heating and cooking apparatus is well rep sented, including all kinds of self-contained cooking utensils; illustrate in fig. 263 an electric kettle, and in fig. 264 a domestic ir which is particularly recommended by several central stati authorities on account of its reliability—all the "Therm apparatus being made with a view to excellence of quality rat than low prime cost.

The "Little-Hustler" electric drill, and other electrical operated tools, are also shown; we give in fig. 265 an illustration the breast drill.

The National Telewriter Co., Ltd. (269),

20, Bucklersbury, E.C.

Various important simplifications and improvements are inc porated in the latest models of the "Telewriter" exhibited at t stand. A private wire type "Telewriter" sends and receiv messages to and from Stand 146, and visitors can themselves t the convenience of use and accuracy of reproduction of the inst ment. A significant development is the establishment of "Te writer" exchanges in the City and West End. These employ P Office lines, by permission of the Postmaster-General, and th utility will be greatly enhanced as the number of subscribers present about 150) increases. The exchanges are connected to t Central Telegraph Office at St. Martin's-le-Grand, and subscrib can therefore send and receive telegrams by "Telewriter." T time thus saved (15—30 min. per message) is often of vital impo ance in business transactions. We are informed that about 4 private-wire "Telewriters" are now in use in London, some of th instruments being used as shop-window advertising media.

Messrs. Parmiter, Hope & Sugden (81, 91),

Hulme Electrical Works, Manchester.

t is claimed that "Hope's Bimetal Fuse-wire," which was first oduced to the general public at Olympia, at the stand of Messrs. miter, Hope & Sugden, can be arranged to blow with certainty hin 5 per cent. of its rated limit—improving, in fact, on the uracy of many electromagnetic circuit breakers.

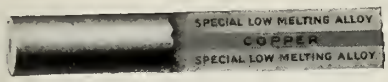


Fig. 266.—Hope's Bimetal Fuse-Wire.

As shown by fig. 266, the bimetal fuse consists of a copper wire rounded by a patent lead-alloy; the gauge of the core is so sen that the copper will fuse at a certain current after a desired e, and an appropriate* amount of soft metal is then forced on he core by a process exactly similar to that employed in lead-athing electric cables. The fuse, as so constructed, combines advantages of tin and copper fuses without the grave defects of ner. The sheathing, being almost pure lead, is acid-proof, and irely protects the copper from corrosion.

While the fuse is comparatively cool, the greater part of the rent traverses the copper core, but as the latter heats, a greater

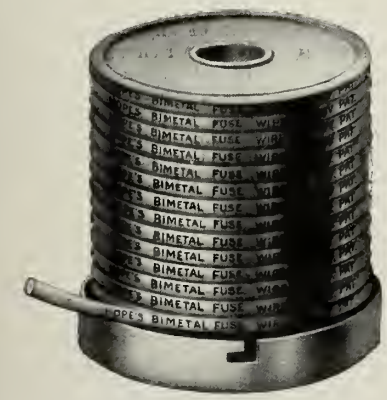


Fig. 267.—Reel of Fuse Wire.

rcentage of the current flows through the sheath. When the mperature of the latter reaches 180° C., which does not occur till e load is over 95 per cent. of the fusing current, the soft metal vering melts, and, running away, leaves the whole load on the ntral section of the copper core, which at once glows and fuses. is important to note that the soft metal does not volatilise cept on the heaviest short circuits (about 20 times full load), d that the fusing of the copper core makes far less "splash" an would that of a plain copper fuse of equal capacity.

A bimetal fuse will carry from 90 per cent. to 98 per cent. of its sing current indefinitely; for short periods, varying inversely ith the overload, it will carry from six to ten times its fusing rrent, a property which is especially valuable in motor and arc mp circuits. The resistance of the compound fuse wire is much ss than that of the equivalent plain fuse wire, hence the C^2R sses are proportionately lower, and, apart from the higher ficiency of the fuse, there is no danger of overheated fuse andles. (A plain copper fuse, blowing at 100 amperes, has 20 mes as great a loss as the equivalent bimetal fuse.) The actual lowing of the fuse being entirely confined to the copper wire, ight local variations in the composition of the outer alloy are nimportant, and the effect of vibration is nil.

The accuracy with which these fuses blow at the predetermined rrent offers great prospects of at last realising a definite rating or fuses. The present system of rating by the "continuous carry-ng capacity" is absolutely indeterminate, but the fusing current s, with the bimetal fuse, practically a physical constant of each ize, or, to allow for differences in local cooling facilities, it is, erhaps, better to say that the ratio—

$$\frac{\text{Continuous rating in air, } 4\tfrac{1}{2}\text{-in. break}}{\text{Blowing current in air, } 4\tfrac{1}{2}\text{-in. break}}$$

s practically constant, and usually ranges from 90 per cent. to 5 per cent.

At present bimetal fuses are available in five sizes, blowing espectively at 15, 25, 50, 75 and 100 amperes. A 7 or 8-amperc blowing current) fuse is in course of development. All sizes are old in 1-lb. tins arranged on the novel plan shown in fig. 267, he reel being normally protected by a bayonet cap.

* Determined by the required time lag and voltage drop per inch of fuse.

Hope's bimetal fuses can be used in any holder, but, to avoid the disadvantages of many holders now in use, while securing the advantages of parallel fuses and the peculiar merits of the bimetal fuse, Mr. Hope recommends his "Honeycomb" fuse holder (which is also on demonstration at Olympia).

Corresponding to the copper core of bimetal fuse wires, there are in this a number of "through strands" of copper wire connected in parallel and of such a gauge as to blow when traversed by a predetermined current for a specified time. Corresponding to the outer soft sheathing, there is now a central "fusible tin band" soldered to two copper leads which, when the holder is wired, are looped in from the ends and connected in parallel with the "through strands."

The general arrangement of the holder—with its outer fibre case and hand guards, its fire-proof lining and baffle plates carrying the connecting end plates (electrically continuous with the contact blocks), and its corrugated, hollow porcelain fuse carrier—is clearly shown in fig. 268. The component parts are excellently illustrated by fig. 269, and the manner of wiring is shown in fig. 268.

At normal load the bulk of the current passes *via* the "through strands"—the line of least resistance—but as the load increases more and more current is shunted through the "fusible tin band" till this melts (usually at the soldered joints), thus throwing the whole load on to the copper through-fuses, which at once blow. On heavy overloads a considerable amount of copper vapour is thus rapidly generated, but is cooled by the restricted passages or "cells" through which it is compelled to pass. On reaching the baffle plates (3, fig. 268), the copper vapour is thrown back into the central chamber of the porcelain holder and there remains (this action occurring at *both* ends of the fuse) long enough to condense; practically no vapour escapes into the open air. As the result of their quiet action and deposition of all copper



Fig. 268.—Construction of Honeycomb Fuse-Holder.

within the central passage, these fuse-holders withstand repeated short circuits. Even on battery short circuits their action is safe and reliable, and has a definite time element (depending on the design of the tin band).

The re-wiring of a Honeycomb fuse is very readily effected, through-strand-wire and fusible tin bands (with connectors attached) being supplied ready for use. Three types of holder, each in five sizes, are at present made, to suit fusing currents of 20-120, 100-250, 200-350, 300-500 and 450-650 amperes respectively. Fusible tin bands are provided in four capacities; the overall size of the bands

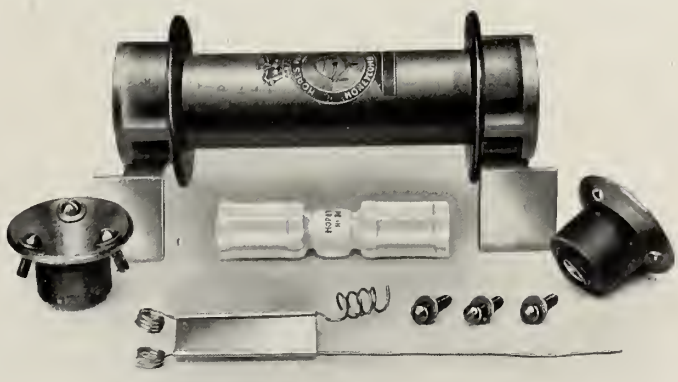


Fig. 269.—Component Parts of Honeycomb Fuse-Holder.

in each set is constant, but those of smaller capacity are punched with suitable holes to reduce their effective section.

Though inferior to bimetal fuse wire, both in accuracy and efficiency, the honeycomb-fuse, properly wired, will blow with less than 25 per cent. overload, and has a considerably lower C^2R loss than the equivalent plain copper fuse. The fuse has a heavy temporary overload capacity, but the fusible tin band provides a definite and regulable time element. Recent tests by Mr. S. L.

Pearce (Manchester Corporation electrical engineer), fully justify the claims made for the new fuse and its carrier.

While we have concentrated our attention upon these novel devices, we must add that the firm have in addition a comprehensive exhibit of their ironclad switches and switch-fuses of various types, Hope's patent "Start-run" switch-fuse for starting A.C. motors,

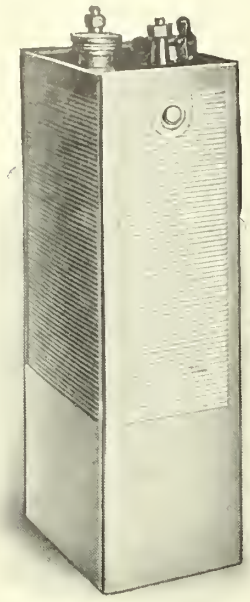


Fig. 270.—Complete Cell, Type A 6.

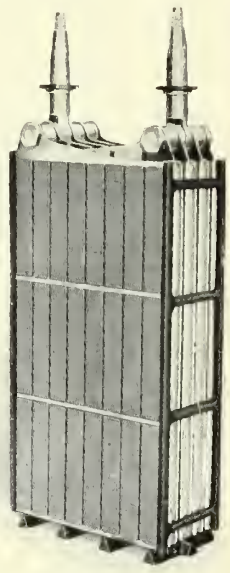


Fig. 271.—Plates Assembled.



Fig. 272.—Cell with Cover Removed.

The Edison Alkaline Accumulator.

mining switches, distribution boards, &c., which are well worthy of inspection.

The Edison Manufacturing Co., Ltd. (253, 254),

Edison Works, Willesden Junction, N.W.

The Edison alkaline storage battery has chosen this appropriate occasion for its reappearance in this country, and an extremely interesting exhibit of its various forms and component parts is on view. As we remarked on its earlier presentation, this cell affords a striking example of the application of engineering science to the solution of an exceedingly difficult problem, and it is impossible to examine its construction without a feeling of admiration for the skill and ingenuity with which it has been designed. We understand that it is the product not of one, but of a large number of brains, in an establishment where adverse criticism, if well founded, is as handsomely rewarded as constructive suggestions are, so that, as far as possible, every contingency has been foreseen and provided against.

The withdrawal of the cell after its extended demonstration in 1903 is explained on the ground that "it is an Edison policy that no new product shall be publicly exploited till it has been thoroughly tried out in a practical way outside the laboratory." This hardly seems convincing, for the battery was thoroughly "exploited" years ago; it is stated that weaknesses were found in the first two types, while the third showed too great a loss of capacity in three years' use, and no doubt to these defects must be ascribed the withdrawal. Now, however, we are assured that the performance of the new Type A battery has satisfied even Mr. Edison, and it will at once appear upon the market here—it is already on sale in the United States.

Eager, as we confess ourselves to be, to see the electric automobile assuming its rightful place as *the* ideal means of road locomotion—whether for pleasure or profit—we welcome the Edison battery as offering new possibilities. It is claimed that it weighs about half as much, and occupies only three-quarters as much space as a lead battery, while it has a vastly greater life; it can be charged quickly, left discharged or overcharged without injury. It contains no acid, cannot sulphate or buckle, cannot lose its active material, stands vibration with impunity, and grows in capacity when put in service; and its maintenance in good order is a simple matter. The makers offer to guarantee at least 90 per cent. rated capacity after three years' service in a delivery wagon.

Against these advantages, most of which, we believe, are fully justified, must be set the lower energy efficiency of the Edison cell and its higher cost. As regards the former, it must be pointed out that the cost of energy is not a determining factor in the question under present conditions, and the higher initial cost must be considered with due regard to the life and maintenance of the battery. In fact, we believe that efficiency and initial cost are minor matters compared with reliability, quickness of charging, long life and simplicity of handling. No other battery need be displaced by the Edison, for we look to it to create a new demand.

We described the construction of the cell on the previous occasion pretty fully; we need, therefore, only recapitulate the details here, by way of reminder. The positive (nickel) plate consists of perforated steel tubes, heavily nickel plated, and filled with alternate layers of nickel hydroxide and pure metallic nickel in exceedingly thin flakes (substituted for the graphite used in the earlier cells to give conductivity); the negative (iron) plate is grid of nickel-plated steel, holding rectangular perforated st pockets filled with powdered iron oxide. The plates are separat by "hard rubber" (ebonite) strips from one another, and by she and racks from the nickelled-steel container into which they close fit. The joints of the container and the cover are welded.

The cover is provided with stuffi boxes for the terminals, a device f separating spray from the escapi gas when charging, and an openi for filling the cell, covered with water-tight cap. The connectio are made with coned lugs fitting the taper terminal posts. The volta of the cell during discharge 1·2 volts, and a pressure of 1·85 vol per cell is required during chargin We give a number of illustratio showing the type A cell, the plat &c., from which the construction the cell can be readily understood.

Richard Pape, Ltd. (196, 219),

Belvedere, Kent.

This firm is showing the "For patent accumulator, of which it the sole manufacturer; the interes ing characteristics of these cells ha been described in our pages, a various types are shown suitable f ignition and lighting purposes. speciality of considerable interest the Pape safety lamp designed f use in mines (for rescue work ships' bunkers and magazine &c., or anywhere where hard usa is experienced. The lamp ca is of stout aluminium in o piece, surmounted by a lanter and contains a "Fors" accum lator giving 4 C.P. (in two 2-C.P. bulbs) for 9 or 10 hou By unscrewing one milled nut, the lantern can be lifted and the accumulator removed for recharging. The lamp is a

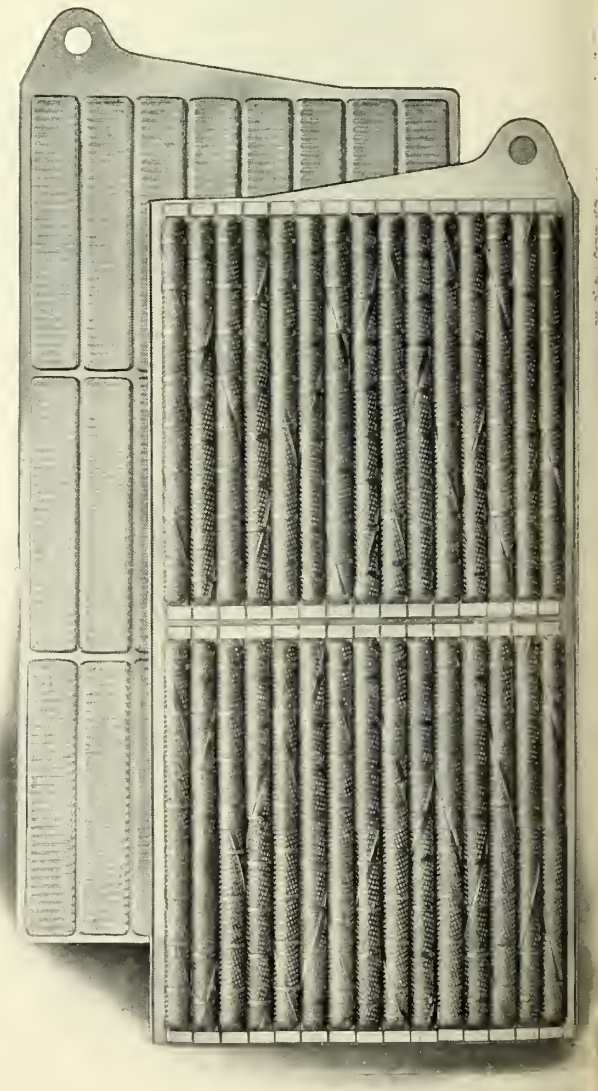


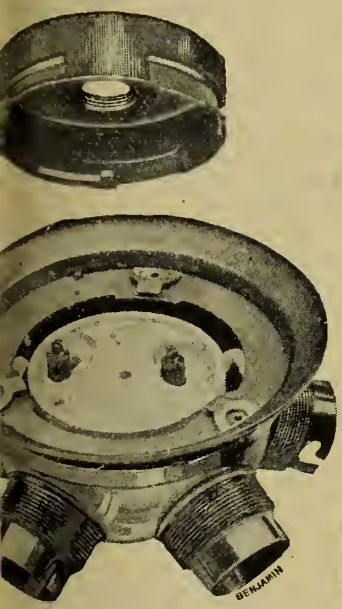
Fig. 273.—Positive and Negative Plates of the Edison Ce

two bulbs ensure against total extinction of light; it ½ lb. only, is 11 in. high and remarkably simple and construction.

The Benjamin Electric, Ltd. (151),

117, *Victoria Street, London, S.W.*

ture at this stand is the Benjamin wireless cluster princh they have applied to many kinds of fittings for ceiling pendant fittings, Holophane arcs, carriage lighting, marine de lighting, &c. The complete range is particularised, s are given, in their new green booklet. In fig 274 we illusre-light wireless cluster body parallel connected, showing



G. 274.—Five-light Cluster Fitting.



Fig. 275.—Twin Lampholder.



Fig. 276.—"Benco" Lampholder.



Fig. 277.—Friction Screw-driver.

minals and detachable base. Another speciality is a range window lighting and show-case reflectors. "Benco" ampholders and adaptors are likewise exhibited. They are d for either indoor or outdoor work, adaptable for use on ltage circuits, with lamps of high candle-power in onettings, conduit work, for outlining buildings and train or service. The interiors are made in two pieces of vitreous covered by a metal casing. The terminals and conducting re enclosed and insulated from the outside casing, and no g wire is necessary. Fig. 276 shows the holder equipped with , and 275 the twin holder. We understand that the Benjamin drive screw driver (fig. 277) has proved a great attraction the run of the exhibition.

Messrs. J. H. Tucker & Co. (78, 94),

Birmingham and London.

rs. Tucker's exhibit consists of examples of their numerous specialities, switch and distribution boards, &c., and includes ensive display of ironclad D.P. and T.P. switches and fuses for 12 to 350 amperes per way, the fuses being of either the in replacement or asbestos covered type; ironclad switches so shown with interlocked covers, which cannot be opened the switch is in the "off" position. A fine range of knife es of up to 1,200-ampere capacity and of handle-type fuses in r sizes is shown, also two private plant switchboards with and spring contact switches, N.C.S. regulators, and the usual ments. Messrs. Tucker are, perhaps, better known for their switches and fittings, and in this direction their exhibit intumbler switches of all kinds, wall plates, wall plugs of the tight and hand-shield patterns, bell pushes to match tumbler aes, &c., and, in fact, switch accessories of all kinds.

Messrs. Simmonds Bros., Ltd. (160),

Newton Street, High Holborn, W.C.

e well-known "Niphan" couplings and plugs, for use in conon with flexible cable, for portable electrical installations, are n on this stand. The system deals with anything from 5 to mperes at 500 volts, and has been very extensively adopted in ions where unskilled labour conditions have to be met. A t addition to this system is a 5-ampere combined switch and Both sockets and plugs are supplied with a third earthing nal if required.

Messrs. Longstreths, Ltd. (167),

190, *Queen's Road, Battersea, S.W.*

The firm are exhibiting their Lithanode cells for house, shop, garage, ship lighting, &c., and emphasise the construction merits of their battery plates by means of short-circuit tests of two 100-ampere-hour cells having a normal discharge rate of 10 or 12 amperes. These have been subjected to short-circuit discharges of 600 or 700 amperes two or three times daily since the Exhibition opened, without detrimental effect.

Messrs. Longstreths claim that they are the only people giving a guarantee against buckling with their battery plates, in which, we may add, the pellets of active material are enclosed in a lead frame, formed by pouring the lead in a molten state round the pellets, and taking advantage of the shrinkage which occurs while it is solidifying.

The firm are now developing the Lithanode cell in larger sizes, and typical examples are shown.

Other smaller but no less interesting exhibits are unspillable cells for ignition and similar work: these are used in the numerous portable lamps for which the firm are noted, and one interesting application, we may mention, is a combination medical battery for cautery and searchlight work, weighing under 10 lb., in which a series-parallel combination of the two cells used, by means of a neat automatic commutator switch and regulating resistance on the lid, allows of 10 ampere-hours capacity for lighting, or double that amount for the cautery. As the cells are detachable, a spare one can be kept to insert on emergency.

The Sun Electrical Co., Ltd. (101, 111),

118, 120, *Charing Cross Road, London, W.C.*

One of the most prominent features of this stand is the Kalkos system of wiring, which, it is claimed, is entirely free from all condensation troubles. It consists in the main of tinned brass tubes, which are socketed and soldered to tinned brass boxes. The Kalkos box is screwed internally and provided with an adjustment ring. the switch is watertight and the dolly automatically earthed. The

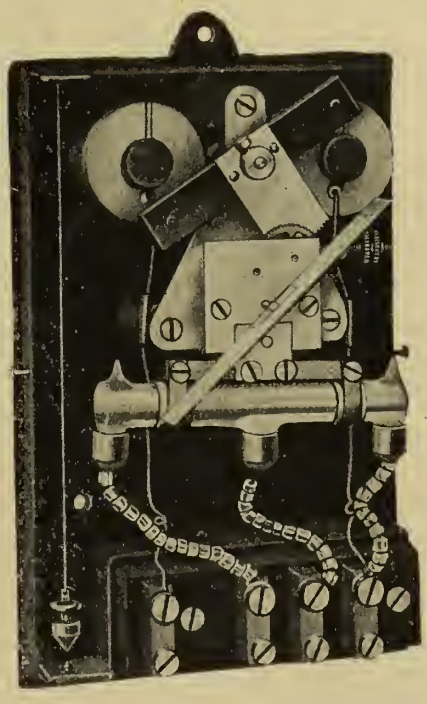


Fig. 278.—Mercury Type D.C. Flasher.

system can be used for both twin and concentric wiring, and the same boxes, accessories, &c., are used for flush, semi-flush and surface work. A new type of box has been designed for use with standard steel and iron conduit. The "Sunlite" reflectors are also

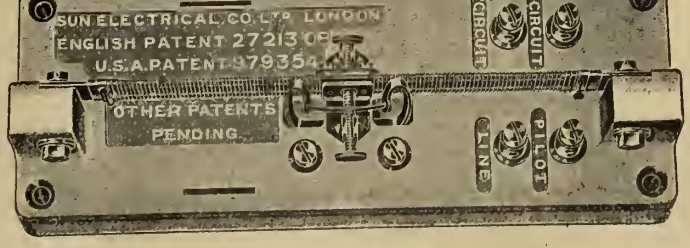


Fig. 279.—Quick-break Thermo-blink Flasher.

exhibited for a variety of purposes, especially for shop-window lighting; they are made to suit the standard sizes of lamps of various makes, and produce a brilliant effect, with high efficiency. Many types of signs are shown, including the kaleidoscope sign with its varied rich colour effects, and signs with opal relief letters.

The latter is a most economical means of obtaining the maximum effect at a minimum expenditure of power, one 16-c.p. metal-filament lamp being sufficient for each letter up to 8 in. high. On the facias are shown different types of wood letter signs in block, fancy and script characters. These are operated by various flashing effects, giving an idea of what can be done in this direction. One sign is flashed on letter-by-letter, and followed by a script lamp-by-lamp lighting effect. Another sign is operated by several of the new two-way quick-break "thermo-blinks," causing an ever-changing colour effect to take place on the sign; although various colour changes are made, the sign itself is always illuminated. Another sign embodies the trade mark of the S.E. Co., in which the rays of the sun are represented by small lamps radiating from the centre and operated by a motor flasher.

The Sun Electrical Co. have specialised in flashers, and their types now include the single thermo-blink flasher, two-way thermo-blink flashers, magnetically-operated mercury flashers (one and two-way) and motor flashers. All these are suitable for operating on either alternating or direct current. A large range of electric light accessories, cables, instruments, telephones, electric bells and indicators, electric fans, arc lamps, electric radiators and heating and cooking apparatus of all kinds are shown. A mysterious hand knocking the "Flexalite" candle-lamp to and fro without affecting its brilliance forms a striking feature of the exhibit.

Messrs. Wm. Geipel & Co. (204, 211),

Vulcan Works, St. Thomas Street, S.E.

Messrs. Geipel's exhibit is a comprehensive one embracing carbons, insulators, time-switches, cables, tapes, steam traps, &c., all of more or less interest to the engineer.

The firm are sole agents for the Henrion carbon specialities, which include arc carbons of many kinds and several hundred patterns of dynamo brushes—both graphitic and non-graphitic.

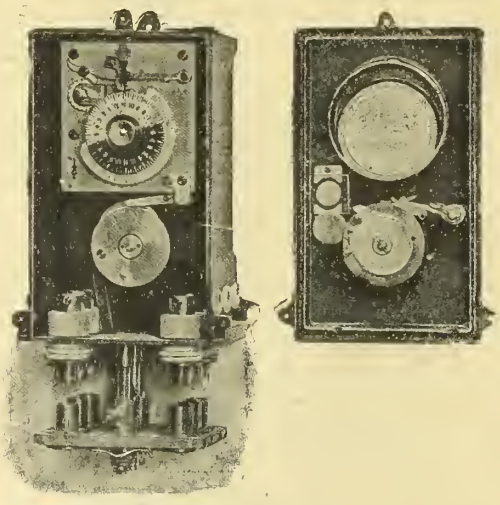


Fig. 280.—Showing Mechanism of the "Arbiter" Time Switch.

A special feature is a display of the Locke h.t. pin and suspension type insulators; one of the latter, comprising six units, is typical of many thousands in use in America on 110,000-volt transmissions.

The exhibit also includes, in the switch section, hand-operated and automatic motor controllers and rheostats; two types of time



Fig. 281.—"Opus" Time Switch.



Fig. 282.—Interior, "Opus" d.p. Change-over Switch.

switch, viz., the "Arbiter," intended for use with "restricted hour" supply, and the "Opus," for the automatic switching "on" and "off" of street lamps, &c., over 100 of the latter type being in use in Manchester at the present time.

In connection with transmission work, a variety of cables, including the "Firmacit" type, with an acid-resisting cove overhead aerial work, aluminium conductors, and the well Okonite and Manson tapes, &c., will be found on the stand.

Messrs. Jas. Gordon & Co. (188),

Knightrider Street, E.C.

This firm has an interesting exhibit of specialities hydraulic and steam power user. These include a 70-b.h.p wheel for 100-ft. head and 900 r.p.m., fitted with oil and tight ball bearings, and a spear nozzle regulator with hand

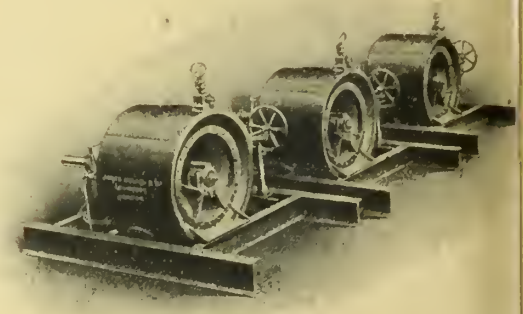


Fig. 283.—Horizontal Shaft Cased Turbines.

also a vertical shaft Samson type turbine for 30-ft. head, 40 b.h.p.

A Gordon patent sectional superheater will catch the eye steam user; this is constructed throughout of mild ste headers being rectangular in section of rolled steel ¾-in. thi the tubes solid drawn of 9 w.g. thickness.

The tubes are fitted in groups of three, with flange plates to the headers by set screws.

Any section of tubes can be removed in quick time and v interfering with any large joint or brickwork, and the open the header blanked off until the section can be reinserted.

In connection with this may be mentioned Gordon's pate way valve for use with the superheater, and which, while ac a stop-valve, can be adjusted by a hand lever, so as to div steam either through the superheater or direct to the range, or in varying proportions in both directions at once.

This is a simplification of the usual arrangements inv several valves and pipe connections.

Another exhibit worth noting is a 900-b.h.p. Davy patent co which is reversible and constructed of metal throughout.

London and Rugby Engineering Co., Ltd. (23, 38

10, *Bush Lane, London, E.C.*

A display of the Rugby incandescent electric lamps is here the lamps ranging from 2½ c.p. in the low voltage to 300 the high voltage; a new price-list of these has been issu show-case illustrates the various steps in the manufacture lamps. Small transformers are also present here.

The Synchronome Co. (223),

32—34, *Clerkenwell Road, E.C.*

The exhibit of the Synchronome Co. is a demonstration of m methods of securing and distributing uniform and accurate In addition to their usual display of electric clocks suitab schools and colleges, asylums and hospitals, offices and work institutions of all kinds, a very fine precision regulator or nomical clock, which is claimed to be one of the most ac timekeepers ever made, is exhibited. The pendulum is impell the "Synchronome" self-winding and switching action a underneath the bob, and the escapement deals in an entirely or manner with causes of irregularity which are usually negl such as the circular and barometric errors. We understan this instrument will be much in evidence before the le societies this season as a contribution to the science of acc time measurement.

Abbey Electric Co. (5),

17, *Victoria Street, S.W.*

The firm are exhibiting their "Abbey" arc lamps, of the enc flame and long-burning triple carbon patterns, also choking and accessories for use in connection with them. The "Ab lamp, which has already been referred to in our pages, em many interesting features.

The Skefko Ball Bearing Co., Ltd. (257),

Carlton House, Lower Regent Street, S.W.

The high-class ball bearings made by this company have described in our pages, and are here represented by a varie patterns suitable for electrical and other high-speed machi Radial, thrust and double-thrust bearings, with automatic a ment, and so assembled that they cannot be put out of adjust in the operation of fixing them in position, are shown.

The British Electric Transformer Co., Ltd. (30, 31),
Hayes, Middlesex.

This company is exhibiting a 100-KW. "Berry" transformer orking in series with a 10-KW. transformer, and controlled by tomatic switchgear on the well-known Berry series system, hich reduces light-load losses; when the load is within the rating the small transformer, the large one is practically idle, but when e load increases beyond this limit, the small one is short-circuited both sides, and the large one takes the load. The gear now hibited has been greatly improved by the substitution of an oil- vitch for the air-break switch formerly used to short-circuit the imary of the small transformer; this has made the switch work ore quietly and with a very short movement, and has enabled e operation of the gear to be made more directly positive than rmerly. The apparatus is shown in operation on a bank of lamps. n interesting arrangement of fuses in conjunction with a relay rms part of the switchgear, which ensures that if the small trans- rmer breaks down, the load shall be transferred entirely to the rge one. An oil-cooled three-phase transformer with a neat rrangement for the tapping terminals is also shown.

The company installed four transformers—two of 250 KW., and vo of 75 KW.—for the supply of the Exhibition; as already entioned, these convert from the two-phase supply of the Hammersmith Corporation to three-phase current, which is ltimately fed to a rotary converter. These transformers are in he model sub-station, and practically all the power used in the xhibition passes through them.

The Imperial Lighting Co. (233),
157, *Blackfriars Road, S.E.*

The electrical illumination of the front of Olympia was carried ut by this firm, and a description of the work has already ppeared in our pages. On the stand inside the building a great ariety of illuminating strips is shown—one of these being the same ype as that used at the White City, where it has been immersed in ater for 3½ years without deterioration. Letter signs built up f 1-C.P. 14-volt carbon lamps, and of 2½-C.P. 14-volt metallic amps—taking 3 watts each in either case—are exhibited, with arious other signs and devices.

Motor-flashers are a speciality of the firm, and are made to any equirements; theatre stage lighting is also one of their special ines, and they show a liquid dimmer, a stage box with aluminium lugs, batten winches, bunch lights and arc projectors, &c. The "Knoxem" fire bell is another noteworthy item shown at the tand.

The Phillips Commutator Grinder Co., Ltd. (7),
27, *Walbrook, E.C.*

This exhibit consists primarily of the well-known Phillips commutator grinder, shown in operation; this device has attained so wide a popularity that, like good wine, it needs no recommendation.

Messrs. R. Hornsby & Sons, Ltd. (9),
Grantham.

This exhibit consists of up-to-date examples of the firm's internal combustion engines, running on suction gas, petroleum and petrol, and designed for direct coupling to dynamos, in connection with which they are shown in operation.

Medway's Safety Lift Co. (171, 192),
10, *Bush Lane, E.C.*

The feature of this stand is an electric passenger lift running up to the level of the gallery, fitted with the firm's lift gear and patent push button and car switch control. A variety of other electrical lift apparatus is also shown.

The Bastian Meter Co., Ltd. (173, 190),
Bartholomew Works, Kentish Town, N.W.

The company are showing their electrolytic meters in various standard patterns, including a new one reading to 500 units, for use on circuits where supply is given on the contract system. A portable sub-meter for heating circuits is also shown; this is intended to enable extra heating circuits to be dispensed with, the heating apparatus being coupled to the lighting circuit through this meter, which is so designed as to be unspillable, and is provided with a seal on the refilling device.

Messrs. G. W. Goodchild & Partner (237A),
30-32, *Farringdon Road, E.C.*

This exhibit consists of a machine tools, small tools, gauges, &c., including the products of Messrs. Ludwig Löwe & Co., of Berlin, for whom the firm are the sole British agents. A useful three-way lathe-tool holder of novel design is shown, and the "D. W. F." ball-bearings—for which the firm are wholesale agents—with a double row of balls, and made in various sizes and patterns, are items worthy of special mention.

Consolidated Pneumatic Tool Co., Ltd. (50, 73),
Palace Chambers, Westminster.

The company's stand is, as usual on occasions such as these, an object lesson in the use of portable electrically-driven tools, and more particularly of drilling apparatus, which will be found in considerable variety.

Messrs. W. C. Tackley & Co., Ltd. (286),
30, *Blythe Road, W.*

This firm is exhibiting fittings and metallic-filament lamps; but by far the most interesting exhibit is the multi-colour switch. According to the number of lamp circuits arranged in the box of an ordinary mono or poly-chrome transparent sign, a number of hard steel contacts are placed symmetrically round a circle. Connection between corresponding (diametrically opposite), contacts is made by a switch arm moved smartly forward 4 to 15 times per minute by a simple ratchet gear. The latter is actuated by a specially robust mechanical clockwork running seven hours per wind. The flasher is obviously independent of line voltage; the standard type carries 10 amperes. The contacts are easily renewable, and between them the switch arm is carried by rollers on an outer brass rail ring. Any selection and combination of colours can be arranged in the various lamp circuits, to the number of which there is no limit. One set of lamps is connected before the last is completely dulled, and a beautiful variety of monochrome and rainbow effects can be arranged; from 240 to 1,000 changes per hour are usual. Deterioration of the contacts is very gradual, and there are, of course, no electrical losses in the apparatus.

The Morgan Crucible Co., Ltd. (144),
Battersea Works, S.W.

The exhibit of this company consists of the well-known "Morganite" plumbago brushes in their various types, "Battersea" carbon brushes, carbon gland rings for turbines, and lightning-arrester resistances, with all of which our readers are familiar.

The gland rings have proved highly successful in solving the difficult problem of packing turbine shafts, and are in great demand. The "Morganite" brushes, which are not subjected to a high temperature in the process of manufacture, have a very low coefficient of friction, beside which metal tops and flexibles can be embedded in the brushes so as to secure perfect electrical connection, and the resistance of the brush in the peripheral direction can be 7 or 8 times as much as in the radial direction, thus aiding commutation.

The Dussek Bitumen Co. (242),
Deptford, S.E.

The Dussek Co. are well known for their "Trinidite" insulating box compound, which can be seen on their stand, together with various other specialities in oils, grease, paint, &c.

Messrs. L. Weil and Reinhardt (224),
Mannheim.

This firm, whose sole agents in this country are Messrs. O. Rühl, Ltd., 77, City Road, E.C., makes a speciality of cable troughing, which is shown in various sizes on the stand.

This troughing is made of wrought-iron, hot rolled and tarred inside and out; it is made in semi-circular halves intended to fit closely round the cable and replace, if necessary, the ordinary armour sheathing provided on cables. The halves of the troughing are fastened together by clamps and cotters—two or three to the yard run—and are suitable for cables of diameters between 1½ in. and 4¾ in.

National Machine Recorder Co. (326),
64th and States Streets, Chicago.

All interested in machine shop and general manufacturing economy should inspect the ingenious recorder exhibited on this stand. The standard machine has 50 pencils side by side recording on a paper drum driven by a reliable clock. Each pencil is electrically controlled, and each machine or tool (whether a lathe, planer or wire-braiding machine, &c.) is provided with an appropriate contact device placed beyond tampering by the workman. When, and only when, the machine or tool is in proper production, the recorder contact is closed and the corresponding tracing pencil is deflected to register production on the recorder sheet. An integrating device shows the total time which each tool is in production, and to control the use of lathes, &c., which may work at various speeds, an adjustable time switch is provided. This is set to the time which may justifiably be spent upon a given piece of work, and when the tool is stationary or when the permissible "piece time" is exceeded, the recording pencil returns to non-production. A wide variety of switches, capable of infinite extension, covers every possible class of producing machinery, and the whole equipment affords a most valuable control over shop efficiency while greatly facilitating the computation of wages, bonuses, and piece-work rates. The recorder affords an indisputable record of the working of every power appliance in a works, is fair to both master and man, and costs about ½d. per day per machine to operate.

Messrs. D. H. Bonnella & Son, Ltd. (198, 217),
60, *Mortimer Street, Cavendish Square, W.*

The firm specialises in the hundred and one small sundries required in electric lighting and bell work, a feature of the stand being the display of electrical accessories for motor-car work.

In passing we may mention metal switch plates in attractive designs, also similar plates in non-inflammable imitation ivory; celluloid tokens for tramways; bells and indicators for hotel use, and bell pushes in great variety; connectors for railway and ship work; hand lamps; the Ampere cell, &c.

An attractive centre piece in this stand is the firm's illuminated table cloth with the special switches and fittings designed for use in

connection with it; it may be mentioned that the firm's Shadoless candle lamps are now provided with Osram filaments.

The "M. S." metal lamps, for which Messrs. Bonnella are agents, are shown, as well as samples of Terroid wiring, which is intended to meet the demand for metal-sheathed cable created by the introduction of certain special wiring systems, but has the advantage that no special fittings are required; the Terroid system employs an ordinary insulated cable with a bare outer wire, attached throughout its length by small wire binders, and the firm have the sole agency for this system.

In motor-car accessories, the firm's electric head lights, motor horns, direction indicators, &c., make an attractive display; they are now producing electrical goods to harmonise with almost any kind of interior furnishing in motor work, and are fitting Holophane globes, &c.

Messrs. Sessions & Sons, Ltd. (321).

Gloucester.

This firm is showing samples of enamelled and plain slate and Sicilian and Dove marbles, as supplied for switchboard panels and similar work. The marbles are very handsome, and well worth careful inspection.

Messrs. J. W. & C. J. Phillips (3),

23, *College Hill, Cannon Street, E.C.*

This exhibit consists entirely of examples of the well-known "Bristol" recording instruments for steam, vacuum and water pressure, electric pressure, current and power, and temperature. The last named are of two kinds—thermometers and pyrometers—and, like the others, record on flat circular charts.

Union Cable Co., Ltd. (181, 182).

Eagle Wharf Road, N.

The company's stand is near the main entrance, surmounted by its well-known five-section cable trade mark. The exhibit comprises specimens of cable for all classes of work. Prominent are a number of samples of power cables supplied to collieries; a '75 × '75 × '2 power cable with '3 7/18 pilots, for the Dundee Corporation; a 7/14 concentric paper and lead-covered 30,000-volt cable; and an 800-pair air-space lead-covered telephone cable.

Mention may also be made of a series of joint boxes for telephone work, also of joint boxes, cable-terminal boxes, &c., for power work. The company will shortly be manufacturing its specialities at Dagenham, where a new works covering some 10 acres is in course of construction.

"Lea" Recorder Co. (289),

28, *Deansgate, Manchester.*

The latest model of the Lea Recorder is on view at the above stand, in addition to one of the standard recorders and a large variety of weir plates, specimen charts, and so on. The integrating recorder consists essentially of a standard recorder with an extended pen shaft, the latter being controlled by a slotted drum gear-driven from the tank float. On this shaft extension there is mounted a recording or counting gear train driven by a toothed drum, rotated at constant speed by an eight-day clock. The toothed drum is cut away helically, so that according to the flow through the weir and the resulting lateral position of the counting gear box, the driving wheel of the counting train engages during no part, some part or the whole part of the revolution of the clock-driven drum. The integrator, of necessity, gives highly accurate results (which can, of course, be checked at leisure by planimetering the time-flow chart). The latest improvement in the integrator consists in the placing of the clock below the toothed drum and directly geared to the latter; this arrangement is simpler and yields better results than the earlier designs. By using a wooden or leaden tank and hard lead or glass weir plates, the "Lea" recorder can be used for recording the flow of acids and other corrosive liquids.

Exhibition Competitions.

To-morrow—the closing day of the Exhibition—is also the closing day of popular competition No. 2 (Parts I and II) arranged by the electric supply companies. Competitors in Part I have to select from the exhibits in the hall what they consider to be the best and most economical equipment, not costing more than £25, for an electric kitchen sufficient to provide a specified menu for a small dinner party. A description has to be prepared by the competitor in his own words, and on a plan the writer must indicate how he would dispose the apparatus in a kitchen which at present has an ordinary cooking range. The prizes offered are (1) the electric cooking apparatus selected in the description submitted; (2) electric cooking apparatus to the value of £10; (3) a reduction of £5 from the winner's next quarterly bill for electricity. Twelve other prizes consist of electric grillers, hot-plates, toasters, &c.

For Part II there has to be written a description of the apparatus chosen in Part I showing knowledge acquired as to method of construction, the operations of which the apparatus is capable, and the electricity consumed in various operations. The prizes here again are to take the form of apparatus (£10 and £5), and a reduction of 5os. in electricity bills, with a dozen others in the form of egg-boilers, hot-water jugs, cigar lighters, &c.

The particulars as to conditions can be obtained at the supply company's stand, or from Mr. F. J. Walker, at 19, Carnaby Street, Golden Square, W.

An Explanation.—In our issue of October 6th, p. 559, the exigences of space compelled us to publish an electric pocket lamp in close proximity to a Pope electric lamp, and we learn that in consequence Pope's Electric Lamp Co., of Hythe Road, Wimbledon, have been simply inundated with inquiries for pocket flash lamps. In their interests and at their request we desire to point out that Pope's Co. do not make these articles at all, but confine themselves to the manufacture of carbon and metal-filament electric lamps. When we repeat that Messrs. W. and R. Jacobs, of 39c, King William Street, E.C., *do* make these pocket flash lamps and are not the manufacturers of the Pope electric lamps, we think that the interests of all parties have been properly met.

CITY NOTES.

(*Continued from page* 654.)

British Electric Traction Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Tuesday, in the large hall of the Cannon Street Hotel, Mr. E. Garcke presiding, for the purpose of considering the much-discussed scheme for the sub-division and rearrangement of the company's capital.

The Chairman, in his opening speech, said that for the convenience of the shareholders the directors had made two departures from the customary procedure. They had issued full particulars of their proposals more than two months in advance of the general meeting at which they were to be discussed and voted upon, so as to allow shareholders time to obtain information and to fully consider the matter. The other departure was that, with the concurrence of the board, he had issued what was in the nature of a speech ten days in advance of the meeting. Whatever the views of the shareholders might be as to the merits or otherwise of the scheme which the directors proposed for their acceptance, he felt sure it would be admitted that the directors had put the scheme fairly before the shareholders, and that they had made an earnest endeavour to minimise the difficulties of the shareholders in deciding this question. The board were very desirous to maintain this attitude of fairness to all sections of the proprietary throughout the remainder of the proceedings, and he was most anxious that the meeting should be conducted with the strictest impartiality. For the reasons set out in the memorandum he had issued, the directors felt that something ought to be done to adjust the altered relations between the two classes of shareholders which had been produced by the unfortunate circumstance that their profits were insufficient to pay the full preference dividend. The directors, having given the whole position their most careful consideration, were of opinion that the scheme which had been formulated was the right solution. Having come to this decision, they felt it their duty to strongly advise the shareholders to accept their proposals. Complaint had been made that the scheme was complicated, but it must be remembered that the problem which had to be solved was a complicated one, and they could make the scheme less complicated only by ignoring some of the factors of the situation. Having stated his views on the subject pretty fully in the memorandum, which he had no doubt they had received, it would be unnecessary for him to occupy much of their time, as the opposite views of the preference and ordinary shareholders had been expressed by representative shareholders of each class, and the directors were in the fortunate position of hearing the strongest arguments in favour of the scheme stated by their opponents, for the arguments against the scheme which had been advanced by preference shareholders went to answer the objections to the scheme which had been urged by ordinary shareholders, and, on the other hand, the objections to the scheme which the ordinary shareholders felt were an answer to those preference shareholders who were of opinion that the scheme unduly favoured the ordinary shareholders. In the memorandum he had explained the present position in regard to the profits of the company and also the reasons why the profits were small in relation to the paid-up capital, but while they spoke of the smallness of their profits it was only right that they should clearly understand that they were small only in relation to the paid-up capital, and the point he would like to emphasise was that in this respect they were no worse off, but, on the contrary, they stood a little better than the average electrical undertakings in this country of the same class. In order to clearly understand the position of the company he would like them to fix in their minds certain figures mentioned in his memorandum. He there explained that their organisation consisted of 57 companies, with an aggregate capital of over £12,000,000 sterling. On that capital of £12,000,000 they earned last year net profit to the amount of over £622,000, representing an all-round average return of about 5 per cent., but of these profits only about £400,000 were distributed in interest and dividends, and £221,000 were applied to reserve funds or carried forward, so that the average net returns to the investors in these companies was 3¼ per cent. There was no denying that this return was low, but that was not the point they had to discuss that day. The business of the meeting was not to discuss the causes of the insufficiency of profits, or even the means of alleviating it, but to discuss the question of altering the existing relations between the two classes of shares, so as to overcome difficulties which that insufficiency of profits had produced. Of the capital of £12,000,000 represented by the companies in their

organisation, the British Electric Traction Co. held a little over £5,000,000, on which it received about £134,000 in interest and dividends last year. The percentage of profit on their £5,000,000 was a little less than the percentage of profit earned by the Associated Companies, but that arose out of the fact that the British Electric Traction Co. held a larger proportion of ordinary shares than of debentures and preference shares in those companies. The reason he had mentioned those figures was that they might understand the position which the British Electric Traction Co. occupied. The bulk of its profits must continue to be derived from the Associated Companies. It was to the improvement in the profits made by the Associated Companies that they had to look for improved results, and that they were steadily improving these was perfectly evident from the figures. Last year the Associated Companies collectively showed an increase in net profits of close on £100,000. That was no small achievement, and he hoped they would do still better this year. But that was not the only direction in which the position was being improved. The Associated Companies were steadily striving by negotiations with the local authorities and otherwise to improve the undertakings in respect to their capital values, but these improvements were not expressed in the balance-sheets. They did not increase the capital of an Associated Co. whose tenure had been improved, but these aspects must be taken into consideration if any valuation of this company's assets was contemplated, and that was where the real difficulty of making a valuation arose. They could not prognosticate even approximately what would be the result of pending and future negotiations by the Associated Companies. He would very much prefer to avoid entering upon any controversial matters, as he would like to be able to occupy a thoroughly impartial position in presiding over that meeting, but if he did not refer to the circular which had been issued from the offices of the Municipal Trust his silence would be liable to be misconstrued. He, therefore, proposed very briefly to reply to the main points raised in that circular. Referring to the second paragraph of the circular, he wished to point out that an interpretation had been put upon his words which he did not intend to convey. What he said was that the question of what proportion of the annual profits should be set aside for reserves could be better discussed after this scheme had been adopted, not, as suggested in the circular, that the question of depreciation could be better dealt with after the scheme had been carried. His reason for the statement he made was this: He was aware that the holders of the ordinary shares felt that while there was depreciation of assets the present rate of dividends on the preference shares should not be increased, even in the event of an increase in profits, and while they felt this it would be exceedingly difficult to discuss as a general principle the question of what proportion of the annual profits should be put to reserve, but if the interests of the two classes of shareholders in the distributable profits could be brought into unison, the objections of the ordinary shareholders to an increased rate of distribution on the preference shares would disappear, and they would then discuss the question of reserves to be made from year to year, without involving them in the larger discussion of the question of depreciation of capital. In the fourth paragraph complaint was made that they did not give an approximate idea of the depreciation. Well, they had stated repeatedly that to arrive at any truly approximate figure was the real difficulty of the situation as presented by the balance-sheet. He would like to make clear what he meant by the difficulty of making a true valuation of their assets. He did not refer to the small practical difficulties arising out of the work of making a valuation, but the difficulty was that they could not, with any degree of accuracy, forecast the future, and no experts, however able, could help them in this. It was suggested that they had the market values to go upon, but the market value of their shares and debentures had varied a million sterling during the year. It was clear, therefore, that the market values were not sufficient, even approximately, to be accepted as a basis for the future capitalisation of the company. It must be remembered that their assets were of a very special kind, and were subject to statutory and other conditions for which there was no parallel in any other industrial branch. In the fifth and sixth paragraphs of the circular a figure, which he mentioned merely by way of example or illustration, was made to appear as a definite statement of something which was certain to take place. Then the circular went on to point out that the divisible profits would have to be three times the amount distributed last year, in order that the holders of the ordinary shares might receive a dividend of less than 1 per cent. on their present holdings. But what was the position now? The preference shareholders had to receive four times as much in dividend as they received now, and then they were entitled to be paid the arrears to the extent of £266,000 before the ordinary shareholders could receive anything. The concession which the scheme made to the ordinary shareholders meant that when the preference shareholders received only 3¾ per cent. on their £10 shares the ordinary shareholders would receive nearly 1 per cent., and he did not think that that was a concession which could be accurately described as of no practical value. With regard to the question, "What amount of reserve ought, in the opinion of the board, to be set aside each year to meet the ordinary depreciation on the undertakings?" after each company had provided for its maintenance and renewals, the amount it should set aside for extraordinary contingencies, or, in other words, reserve, depended upon a consideration of all the circumstances of each case and largely upon the amount of profits which was available for that purpose. An explanation was required in the circular in regard to the amount of the reserve fund which was applied last year. The figures given in his memorandum were quite correct. Out of the net profits, amounting to over £600,000 for the year, an aggregate sum of £221,000 was placed to reserve by the various companies, and £169,000 was applied during the year, but not, as stated in the circular, for extraordinary expenses of the year out of the reserve of the year. The accumulated reserve funds of the Associated Companies amounted to £1,228,000, while the B.E.T. Co. had other reserves of £730,000, and it was out of the accumulated reserves that the sum of £169,000 was applied last year. These reserves were provided for these very purposes, but it was not correct to say when they applied accumulated reserves to writing down that such writing down was done out of the amounts reserved for that particular year. In reply to the third and last question as to how, in view of the admitted depreciation in the company's assets, dividends had been paid in the past, and how any dividends were to be paid in future until the lost capital had been made good, all he had to say was, that they had been definitely advised by leading counsel, and the law on the subject was clear, that a loss on capital account was not necessarily a loss which had to be made good out of revenue. There was no loss on the revenue account of the company, and there was no legal or practical reason why all division of profits should be stopped because the assets had depreciated in value. With regard to the amendment proposing the appointment of a committee, from a purely personal or selfish point of view the directors would welcome a committee of inquiry (cries of "why not have it"?), but their first consideration must be the interests of the company, and from that point of view they felt bound to advise the shareholders that the appointment of a committee of inquiry would do the company a great deal of harm (cries of "bosh" and "humbug"), because of the time it would take up, because of the dislocation it would cause to the business, and because of the injury it would do to the credit of the company. (Cries of "rubbish.") The proxies which had been lodged indicated that the directors enjoyed the confidence of the shareholders, and he understood that in view of the large support which the directors had received, the amendment for the appointment of a committee would not be moved. That being so, the directors were willing, after the first resolution had been carried, to agree to an adjournment of the proceedings for a fortnight, so as to allow time for discussing the situation with the representatives of the dissentient shareholders. He concluded by proposing the following resolution:—"That the scheme for a sub-division and rearrangement of the capital of the company submitted to this meeting be, and the same is hereby approved, subject to such modification, if any, as may be made and approved at the requisite extraordinary meetings of shareholders, and that the meeting stand adjourned till November 3rd next at 2.30 p.m."

Sir Charles Rivers Wilson formally seconded the resolution.

Mr. Lea Smith said he was a holder of 5 per cent. debentures and also preference and ordinary stock. They had had a good deal of literature on the subject, and had listened attentively to the speech of the chairman, but they had not heard from him what seemed to be the crux of the whole position, and this was the question of fares. The fact was, they were carrying the people at too low a rate. He would like to know what chance there was in the future of the company carrying people at a reasonable rate.

Sir A. Anderson said he approached the matter as the representative of the interests of the Anglo-American Debenture Corporation, which had a substantial holding in the ordinary shares, and also he was a constituent member of the committee which had been in communication with the ordinary shareholders with regard to this proposition. They had issued a statement to the shareholders with regard to the proposition which had been submitted, and on that they had obtained a substantial number of proxies. The directors had invited the members of that committee to meet them and discuss the situation, and as a result of that interview it was arranged that the motion to be submitted that day should be modified in such a way as to give an opportunity for the representatives of both ordinary and preference shareholders to meet the directors and discuss the scheme, with the object that they might ultimately be able to agree upon a scheme which they would recommend to their friends as one which ought to be carried out in the best interests of those concerned. In the ordinary way, he would have explained the views which the committee held, but in view of the suggestion to adjourn the meeting, he would say nothing now.

Mr. Alden said he had given notice of amendments which he had intended to move. He was strongly opposed to the scheme of reorganisation because it was in no way final: it conferred no benefit on either class of shareholders and no benefit on the company itself. He held that the capital should not be reduced, as it was impossible for experts to fix the capital value of the shares when a small increase of 5 or 10 per cent. in the fares would increase the capital value of most of the Associated Companies by 50 per cent. The only way to provide for the depreciation was when it was ascertained, and that would be when the local authorities took over the companies. He had intended to move amendments to the effect (1) that the preference shares remain 5 per cent. cumulative shares, but that all arrears of dividend be wiped out, and (2) that after the debenture interest had been paid a quarter of the profits should be set aside for the purchase of debentures in the open market. If, however, the board would give him the assurance that his views would be considered he would not move these amendents.

The Chairman: I understand that Mr. Alden does not wish to move his amendments if the directors give an undertaking that his views shall be carefully considered, and I will give that undertaking.

Mr. A. H. Cooper remarked that if the meeting was going to be adjourned, it was useless to waste time in discussing the scheme. Their shares had dropped from 13 to three-quarters, and he thought

it was quite time they had a Committee to thoroughly look into the affairs of the company.

Mr. Freeman said he was one of those unfortunate shareholders who, about eight or nine years ago, put a large sum of money into the company. The question for them to consider was, what was the value of their shares now? He would be willing to part with his shares for 25 per cent. of what he gave for them, but he doubted whether anyone present would be willing to buy them at that price even. He hoped the shareholders would not be satisfied with any plausible excuses of the directors, but would insist on knowing where the capital of the company had gone. There was one company—the Brush Electric—into which the B.E.T. had poured money like water, and he found that two or three of the directors of the latter company were also on the board of the Brush, so that they had the same directors selling from one company and buying in another. He did not think that was right. He contended that they wanted a separate directorate for all of the associated companies.

Mr. J. B. Braithwaite said he represented a large holding both in ordinary and preference shares, and he had endeavoured to look at the matter from both sides. The first point he wanted the shareholders to get into their heads, was that they were not there to discuss the affairs of a derelict concern. There had been too much of that sort of talk in certain sections of the Press. He would like to remind them that quite apart from their holdings in electrical undertakings the company possessed liquid assets amounting to a quarter of a million sterling, so that its financial position was a strong one. Their earnings last year were £166,000—not as large as they would like, but still they could not call a concern that was earning £166,000 a year a derelict or bankrupt affair. Then again, the associated companies had reserves of £1,228,000 and the B.E.T. itself had reserves of £641,331, to which they added £25,000 out of last year's profits, so that the concern altogether had reserves of £1,894,000. They were discussing the affairs of one of the largest and most important transport companies in the United Kingdom, and if they only had that coin which represented 1¾d., instead of 1d., the company would be earning 10 per cent. on its ordinary stock. With regard to the scheme, it was a matter which they could discuss without any heat or any question that the brokers would be put in if they did not pass it. Taking, first, the case of the preference shareholders, they were asked, under the scheme, to surrender three-fourths of their cumulative rights from date, that was to say, that in futnre only £2 10s. of their £10 would be a 6 per cent. cumulative stock, but they retained their arrears, amounting to £266,000, although they would not get them until after the full dividend had been paid on the preferred ordinary stock. As a *quid pro quo* they were going to have their capital preferred in the event of liquidation or winding up, to the extent of 50 per cent. Whether or not it would turn out to their advantage he did not know. The Stock Exchange, which was supposed to be a fairly good index of these things, had shown what it thought of the scheme from the preference shareholders' point of view by advancing the price of the shares from £3 8s. 9d. to abont £4. Whichever way they looked at the scheme as preference shareholders, he did not think they could do otherwise than support it heartily. As to the case of the ordinary shareholders, at the present moment the ordinary shares got nothing until the preference shares had received their full 6 per cent., and the whole of the arrears which had accumulated year after year to a very considerable extent. Under the scheme the whole of the existing arrears of £260,000 were proposed to be wiped away, and no future arrears were going to be accumulated. In addition they were to receive a dividend as soon as the full 6 per cent. had been paid on half the present amount of the preference shares. He was really astonished how any ordinary shareholder could say that the scheme was unfavourable to them, seeing that it brought them almost within sight of a small dividend. Therefore, as an ordinary shareholder, he welcomed the scheme, and again applying the market test, since the chairman's explanation of the scheme was published the ordinary shares had advanced from 20s. or 22s. 6d. to 30s. a share. In his opinion, the scheme was fair and equitable as between the two classes of shares. Those who were opposing the scheme, though they had had the details before them for the past two months, had so far failed to produce a better scheme, and that, to his mind, implied that they would do well to accept it as it stood. The opponents of the board said it was absolutely necessary to ascertain the depreciation in the company's assets, but that was absolutely impossible unless they could produce three or four prophets, or sons of prophets, who could ascertain what would be given by an arbitrator, 30 or 40 years hence in some cases, for their different undertakings. Any valuation that might be made would be the merest possible guesswork, and he thought the directors would be acting very unwisely if they yielded to any pressure on that point. He had hoped that after the long time which they had had in which to consider the scheme they would have voted upon it definitely that day. He felt sure it would be greatly to the advantage of the company and to the value of their shares if the scheme went through. The company's earnings were showing satisfactory signs of improvement, and if they could only get the scheme through he believed they would rapidly see the company regaining its prestige and its old position; and if some means could be devised of slightly increasing their fares—if a new coin of the value of 1¾d. could be produced, he believed it would not be long before the company would once again be in a prosperous condition.

Mr. Bond wished to speak on behalf of his wife, but

The Chairman said he must wait until all shareholders had spoken.

Mr. Soames said that Mr. Braithwaite was evidently unaware that a considerable number of men had approached the board. The Committee had spent much time and money in this matter, and had only one object before them, which was the best interests of the company. The Committee proposed to examine into all these things and the result of their investigations would, he hoped, be that a scheme would be propounded. Mr. Braithwaite said that the shares had gone up in the market on account of the general acceptance of the scheme by the shareholders, but he differed from that view. Many purchasers opposed to the scheme bought shares because they felt that some alternative scheme would be put forward and carried by the shareholders. A number of gentlemen had written to the Press and said they were wreckers, but their action was justified by the number of proxies received. If the shareholders allowed the Committee to confer with the board, and produce a scheme suitable to all parties, there was no reason why the company should not have a bright future before it.

Mr. Baldwin said he was a holder of both preference and ordinary shares, and he did not think the preference shareholders ought to be asked to give up so much of their preferential rights. The board ought not to tamper with the essential rights of the preference shareholders.

Mr. Fells said he thought the scheme did but the barest justice to the preference shares. The Committee seemed to be largely composed of ordinary shareholders, and he hoped they would not have such influence with the board that the interests of the preference shareholders would be prejudiced. He agreed that it was impossible to form any idea of what the value of the assets of the undertaking were, as it depended on a variety of causes operating over a long series of years. He hoped there would be no question of the reduction of capital, because if there was the board would naturally wish to make the reduction considerable, so as to pay large dividends on it, and any accretions to the preference capital would benefit the ordinary shareholders.

Mr. Chalmers (Liverpool), as a large preference shareholder and representing others, said he had it on good authority that it was impossible for the board to carry their resolutions that day, and therefore it was only waste of time keeping busy people there. He suggested that the chairman should give them the names of the Committee, and then take a vote as to the meeting being adjourned.

Mr. Cantler said it was all very well for Mr. Braithwaite to tell them the good position the company was in, but what puzzled him was how they were going to get more income. He thought the transport companies would have to combine together to increase the fares, and by that means make a success of a company which had done much excellent work, and which had been so much pushed aside by local boards.

Col. Bates remarked that he was the owner of 200 preference shares. Although many things had been discussed, one matter seemed to have been lost sight of, and this was whether the preference shareholders were going to consent to have their interest "scaled" down. When they talked of interfering with the rights of preference shares, it seemed to him they were approaching very nearly to the border line between honesty and dishonesty.

A Shareholder asked if the preference shareholders would be represented at the conference with the board.

The Chairman said he did not wish to intervene in the discussion, but they had had some references made to the appointment of the Committee, and he wished to make it perfectly clear what the position was. Mr. Chalmers had expressed the opinion, on what he called good authority, that they could not pass the resolution. He had already told them that the proxies the directors had received, not only indicated that the directors enjoyed the full confidence of the shareholders, but, he believed, were more than amply sufficient to carry the resolution they had to deal with in the first instance. But the directors recognised that the dissentient shareholders were pretty numerous; therefore they thought it right that the representatives of the dissentient shareholders, both ordinary and preference, should have the opportunity of meeting the directors and discussing the situation with them, and therefore the directors, instead of forcing the resolution through at that meeting, which they would be perfectly justified in doing, considering the mandate they had received from the shareholders all over the country, suggested that the meeting should be adjourned for 14 days in order that the board might invite representatives of the dissentient shareholders to meet them. It would not be a formal committee, but the board would of their own volition invite these gentlemen. It might help matters if he said who would represent the preference shareholders. They were not very particular, but they thought it better to ask those gentlemen to whom proxies had been given, and so if Mr. Chalmers would accept the invitation they would be glad to see him. They would also be glad to invite Mr. Soames, but it was only right that they should know that Mr. Soames had accepted a position in the company, and was giving them the benefit of his services as a director of some of the associated companies. He did not think he could carry it any further. He did not wish to keep them there, but they were the servants of the shareholders, and they could sit there as long as they wished to discuss the matter.

A Shareholder asked what were the proportions of preference and ordinary proxies which the board held.

The Chairman said he understood the point of the speaker was that the ordinary shareholder would support the scheme, but not the preference shareholders. Let him tell them quite plainly that the proxies which the directors had received from the preference shareholders would enable the resolution to be carried by an overwhelming majority.

Replying to Sir R. Anderson, the Chairman said the ordinary shareholders who would be invited were Mr. Alfred Shepherd, Mr. Duke and Mr. W. Parker.

Mr. Braithwaite again raised the question of the proxies sent to the board being available for a modified scheme, and

IORSE, solicitor, said a proxy could be withdrawn. If the was substantially modified, notice would have to be given hareholders. All the proxies would be valid for this same

CHALMERS pointed out that there were three ordinary ders and only two preference shareholders named.
HAIRMAN said the board would invite three of each.
BOND raised the point of whether he was to be allowed to nd
CHAIRMAN took a show of hands, which resulted in a for allowing him to speak.
BOND said he was the organising secretary of the British Traction Shareholders' Association, and he asked where the 0 reserve was.
HAIRMAN said that the balance-sheet showed where it was.
BOND: They do not understand the balance-sheet.
HAIRMAN explained that the balance-sheet gave all the

HAYES asked for an explanation of the chairman's tion.
HAIRMAN said the reserve was invested in the business of pany. It was in the investments of £5,200,000.
BOND: It is no reserve at all.
CHAIRMAN remarked that at the next meeting he would y have something to say on the subject of fares. With to Mr. Freeman's complaint that he considered it absolutely that the directors of the B.E.T. should be directors of the and other companies, he (the chairman) thought it was an l part of their duty to look after their various investments, e directors of the B.E.T., who were directors in the ed companies, were acting in the interests of this company, deed, he should consider that they were neglectful of their they left those large investments to others.
show of hands, 110 voted for the resolution, which the MAN declared carried by an overwhelming majority.

Grindell-Matthews Wireless Telephone Syndicate, Ltd.

BULL presided at the first ordinary general meeting, he other day at Winchester House, E.C. He said, in moving option of the report, that one of the things that the ir Clifton Robinson especially wanted him to look after his Grindell-Matthews invention, therefore he became an. A large amount of experimental work had been l out at their depôt at Pilning, on the River Severn. were delayed by a flood sweeping away some of their instru- last autumn, so that they had to begin again. In January ey had to obtain further funds to carry on the experiments, n eminent engineer was consulted, who sent Mr. Simkins to prepare a report. The general and original shareholders t seem inclined to put any more money into the concern, so rectors obtained capital from other sources. In regard to the ations for the sale of the syndicate's property, while it was sirable to go too closely into detail, he ought to say that a e company had agreed to provide further capital to complete experiments. They had been given an option to take up the ce of the unissued capital of the syndicate, and the board had ed intimation that the option to purchase at £150,000 would ercised, provided certain tests now in hand were satisfactorily eted, as Mr. Grindell-Matthews said they would be. This l give the shareholders in the syndicate £7 10s. for each of £1 shares. The short-distance experimental work being now ically finished, the Pilning depôt was being removed to on, where the larger instruments were being prepared for distance tests. Options had been granted in respect of various rn patents, in one case the purchase price being £33,000 in or shares, at the option of this syndicate, and £50,000 each ne others. Therefore, although they had not been as rapid as had hoped, on the whole he thought he could present to a fairly satisfactory report. Mr. Grindell-Matthews had ed extremely hard at his invention, and, of course, if it ified in the way they hoped, namely, that they could increase stance from 40 to 50 miles, it would mean that it would utionise the whole of the communication in this country advantage of a system by which they could telephone through ir must be manifest to them all.
SHAREHOLDER asked Mr. Grindell-Matthews to tell them thing which would arouse their enthusiasm.
R. GRINDELL-MATTHEWS, in reply, said that the conditions down by the company which had the option to purchase had dy been complied with, and it only remained for him to carry out before their experts.

Drake & Gorham, Ltd.

B. M. DRAKE presided at the annual meeting, held at 66, oria Street, S.W., on October 11th, and in moving the adoption he report (see ELECTRICAL REVIEW, October 6th), he said that e had been a considerable increase in the turnover of all ons of the business. Severe competition, however, still con- ed, and it was at times difficult to get people to appreciate that hey accepted a lower tender they would not necessarily be ing the same quality of material and workmanship, for, as lts proved, the profit at which they undertook work was very onable, their turnover being in excess of the nominal capital of company. They had been told that their firm had a reputation for doing very good work, but that they were expensive. There was as much scope for variation in prices in electric lighting as in anything he knew, but their policy to maintain, at all costs, their reputation for a high standard of excellence would remain unaltered, for it was constantly brought home to them, after 30 years' experience, that the best work was the cheapest in the end. The item of stock might appear large, but they must be in a position to deliver promptly. They had dealt liberally with the question of depreciation of stock. The chairman proceeded to give a list of those for whom they had carried out orders during the year, and he added that they had still a considerable amount of work in hand for important clients. They started this year with an increase of nearly £5,000 worth of orders on the books. The speaker next referred to the lack of support given by shareholders in the way of influence and orders, and to the increase in the petrol-gas department, gas having proved a useful adjunct to electric lighting installations where coal gas had formerly been used for cooking. The factory showed considerable increase in profits, electrical apparatus having been made for the Government and the trade.

MR. J. C. FORSTER seconded the motion, which included the payment of 4½ per cent. dividend, and it was carried unanimously.

Monte Video Telephone Co., Ltd.—The directors' report for the year ended July 31st last, states that after providing for all charges in Monte Video and London, the net profit for the period is £22,145, as against £20,564 for the previous year. The interim dividends paid on May 1st last absorbed £4,343, leaving a balance of £17,802, to which is added £3,921 brought forward, making an available balance of £21,724. After applying £13,000 to depreciation of the company's property and plant, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares, and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference, and 6 per cent. on the ordinary shares, leaving a balance of £4,381 to be carried forward. The number of new subscribers during the year has shown a substantial increase. During the year the chairman paid a visit to Monte Video and inspected the company's system, both in the city and the country. Acting under powers conferred by the board he appointed a local board, consisting of Dr. A. Rodriguez Larreta, who has been legal adviser and representative of the company for many years, and Mr. Charles W. Bayne, general manager of the Central Uruguay Railway Co., of Monte Video. This arrangement should prove advantageous to the company.

National Telewriter Co., Ltd.—The report for the year to May 23rd, which was submitted at the meeting held on Monday in London, states that the operations of the company have been considerably hampered owing to technical difficulties which have arisen, and the directors decided towards the close of 1910 to suspend further efforts to obtain subscribers until these difficulties have been overcome. With this object arrangements have been entered into with the owners of the American patents, which secure for this company the full benefit of the wide technical experience of the American company, as well as supplies of the latest type of American instruments, of which a limited number has been ordered and are being installed in London and elsewhere. The contract department has been reopened and canvassing resumed under the supervision of an experienced telephone contract officer. The City Telewriter Exchange continues to make progress, and a small West End exchange has been opened, with a view to facilitating intercommunication between West End and City firms.

Our summary of the meeting is unavoidably held over.

STOCKS AND SHARES.

Tuesday Evening.

THE various foreign political complications, excepting Chinese, appear to be gradually straightening themselves out, and the Stock Exchange markets have been making progress towards recovery under the cheering influence of a sharp rise in Consols. Amongst the leading features of the domestic departments, the rise in Home Rails stands out particularly; and, speaking generally, the tone all round shows more confidence, although the Stock Exchange has been so hit during the past nine months by one occurrence after another that it is not surprising to hear members ask "What next?"

In the Home Railway market the feature has been a rise of 1½ in City and South London Ordinary. A demand for a few thousands stock coming upon a market slenderly supplied proved all that was necessary to bring about the advance. Metropolitans put on a point, and Districts rose 1¼, in sympathy with the better tone all round the House. On the other hand, Metropolitan 3½ per cent. Preference declined 1, and District 4 per cent. Debenture lost a similar sum, although Underground Electric Railways 4½ per cent. bonds at par middle are a point to the good.

There was a good deal of dealing and very considerable interest taken in British Electric Traction issues right up to the time of the meeting. In addition to the circulars already sent out, came another last week asking for proxies against the scheme from the British Electric Traction Shareholders' Association, Ltd., saying that proxies must in all cases be accompanied by a subscription to carry on the work of the Association. The circular started with extracts

from five different newspapers, and went on to say that there must be "loyalty to the cause. If one thinks to put his little load on the shoulders of another, defeat is certain, for all may think the same."

The market view of the directors' scheme was none too favourable at the time that the letter was formulated, but, upon consideration, some of the principal dealers arrived at the conclusion that it was the best which could be expected in the circumstances, and they expressed their intention of supporting the board. The more the matter became studied, the more difficult was it to see how all the conflicting interests could be harmonised on a fair basis to all of them. The mere fact that various classes think that they are being unfairly treated, one at the expense of another, is used by some as an argument to demonstrate that the directors' scheme is, at all events, a sincere effort towards drawing up an equitable arrangement. Probably the outcome of to-day's meeting will be a compromise, and it is well that the various dissentient parties are to have the opportunity for quiet discussion, face to face.

The prices of the Ordinary and Preference shares on the week have fallen ⅛, but the Debenture stocks rose 1 each. It has been pointed out in the Press that the company's 4½ per cent. Second Debenture, yielding 5¾ per cent. on the money, is anomalously low as compared with the ordinary stocks of certain foreign railways, but these comparisons are somewhat dangerous; while, as in the case of a good many anomalies, the true inwardness is not difficult to discern when the matter is more closely explored.

The market in English Electricity Supply shares is no better, either as regards the volume of business or the trend of prices. St. James's Ordinary have fallen to 8½, Edmundson's Ordinary to 10s., and South London Ordinary to 2 1/16. The only rises in the list have been secured by Oxford Ordinary, and Bournemouth Second Preference, where the shares gained ⅛ each.

From the merely market point of view, the Exhibition at Olympia cannot be called a success. The shares of the London Companies have not benefited so far in any way. This is hardly as it should be, and looking at the Exhibition simply from a layman's standpoint, it must be confessed that the leading London companies seem to have missed a fine opportunity for further educating the public in the uses to which electricity can be put. We were glad to see that the conference of chief officials of the London companies did at last make, although late in the day, their stand of some practical use, but that it might have been much more valuable as a business proposition, possibly others besides the simple layman may be constrained to agree.

In the Telegraph list, the outstanding features are Anglo-American Telegraph Deferred stock and Marconi shares, both of which show substantial rises on the week. The jump in Anglo "A" is no less than 1⅝, and is due to the change of sentiment in the American market, where the view is now taken that there will be nothing much to fear from Government interference with the alleged trusts. This considerably frightened the many bears of the Anglo-American stock who had sold short and were unprepared for the little rush of buying. They have been badly caught, and it is their purchases that have materially assisted the big rise. The Preferred stock, allowing for deduction of the 30s. dividend last week, is a little better, while the Ordinary at 68½ has recovered the dividend of 15s. and another 10s. in addition. Direct United States shares have been bid up in sympathy, although the nominal quotation shows no change. West India and Panama Ordinary are also better, speculation being revived in them. The rest of the telegraph market is steady, but the changes are mainly due to dividend deductions. Great Northern Telegraphs at 31 are 5s. up, the Chinese disturbances being considered likely to promote traffics. Cuba Submarines are unchanged on the issue of a good report, closely akin to that of last year. The dividend is maintained at 6 per cent.

Marconis rose to 50s., and still the bulk of the buying comes from Ireland. Rumour, however, is very busy with the progress which the company is declared to be making, and the insiders say that the rise is justified—upon which point it is impossible for anyone not having first-hand information to express an opinion. The company proposes to make a fresh issue, to take the shape of 250,000 ordinary shares. American Telegraph and Telephone capital stock has regained most of its dividend, and New York Telephone bonds are a little better. The National Telephone septet is very quiet again, business having rather died down in the Deferred stock and the Third Preference shares. Monte Video Preference rose 1/32, the company's report being regarded with satisfaction.

The Mexican group is decidedly good. Demand has run most strongly upon the bonds, the floating supply of which is again becoming absorbed. The Common stocks, however, are also better—Mexican Light and Power, for instance, showing a rise of 1½. Mexican Tramways Common shares put on 1¾, while both classes of the company's bonds have improved. Rio Trams rose 1, allowing for the dividend, and the First Mortgage Bonds at 102¼ are rather higher. The rise of 4½ in Sao Paulo Trams last week has been followed by a further jump of 3½ this week, so that the price now stands at 182½, while the First Debenture stock at 106 shows a gain of 1½. Montreal Light and Power has held its improvement, but there is no further change in the price. Shawinigan gained a point, and there has been a good demand for the company's 4½ per cent. Debenture stock and for West Kootenay 6 per cent. Gold Bonds. Other changes in this section are mostly to the good. Anglo-Argentine Tramways are a trifle easier, and La Plata Electric Preference are nominally down.

The Manufacturing division is very steady. There has been a little selling of Babcock Ordinary, which reduced the price 1/16. Beyond this there have been no changes worth mentioning, but it may be observed that the Rubber market is very dull, prices having given way upon the continued sagging of the raw material.

ELECTRIC TRAMWAY AND RAILW. TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*
Aberdeen	Oct. 11	2,804	+ 31	19	30,792	+ 1,736
Ayr	,, 14	427	+ 25	24	8,912	+ 89
Bath	,, 14	1,582	— 79	41	35,216	+ 980
Birkenhead	,, 15	2,208	+ 66	28	33,080	+ 1,221
Birmingham Corp.	,, 7	19,163	+4,745	27	223,785	+39,401
Blackburn	,, 11	2,334	+ 92	28⅔	31,348	+ 2,988
Blackpool Corp.	,, 12	2,251	+ 145	.	52,935	+ 7,069
Blackpool-Electw'd	,, 14	1,187	+ 109	15	22,796	+ 2,007
†Bolton	,, 8	2,566	+ 148	28	71,338	+ 4,831
Bournemouth	,, 11	3,398	+ 35	28	54,855	— 1,121
Bradford	,, 7	10,684	— 437	27	153,887	+11,097
Brighton	,, 15	1,918	— 46	28	32,898	+ 2,042
Bristol	,, 13	12,557	+ 544	..	..	..
Brit. Elec. Trac. Co.						
Airdrie	,, 6	471	— 4	40	8,780	+ 50
Barnsley	,, 6	385	+ 21	,,	7,415	+ 517
Barrow	,, 6	662	+ 136	,,	12,477	+ 1,582
Devonport	,, 6	1,027	+ 130	,,	20,076	+ 2,955
Gateshead	,, 6	2,178	+ 57	,,	41,769	+ 2,317
Gravesend	,, 6	440	— 10	,,	8,659	+ 278
Greenock	,, 6	1,498	+ 235	,,	29,315	+ 3,914
Hartlepool	,, 6	572	+ 47	,,	11,132	+ 984
Kidderminster	,, 6	201	— 39	,,	4,869	+ 288
‡Leamington	,, 6	324	— 6	,,	7,324	+ 481
Merthyr	,, 6	414	— 11	,,	8,439	+ 117
Metropolitan	,, 6	17,981	+1,355	,,	355,185	+53,871
Middleton	,, 6	648	— 4	,,	13,951	+ 1,158
Mid. Joint Com'tee	,, 6	8,865	—3,928	,,	217,558	—14,188
Oldham—Ashton	,, 6	1,172	+ 23	,,	23,102	+ 844
Peterborough	,, 6	314	— 20	,,	5,266	+ 515
Potteries	,, 6	4,367	+ 406	,,	77,589	+ 7,377
Rothesay	,, 6	344	— 14	,,	9,683	+ 68
Southport	,, 6	563	— 45	,,	12,604	+ 485
S. Metropolitan	,, 6	1,703	— 149	,,	35,438	+ 1,917
Swansea	,, 6	2,286	+ 63	,,	46,196	+ 2,780
Tynemouth	,, 6	421	— 44	,,	11,238	+ 436
Weston-s-Mare	,, 6	358	+ 1	,,	7,850	+ 1,016
‡Worcester	,, 6	578	— 39	,,	12,128	+ 582
Wrexham	,, 6	212	— 16	,,	4,102	+ 182
Yorks. Wool. Dist.	,, 6	2,100	— 34	,,	42,396	+ 2,899
Miscellaneous	,, 6	411	+ 8	,,	9,266	+ 525
Burnley	,, 14	2,941	+ 264	..	..	..
Burton-on-Trent	,, 15	582	+ 22	28	8,453	+ 550
Bury	,, 15	2,522	+ 88	24	37,620	+ 3,295
Cardiff	Sept. 24	4,861	+ 240	25	64,554	+ 5,643
Chatham and Dist.	Oct. 12	1,666	— 292	41	35,610	+ 26
Cork	,, 12	956	— 45	41	20,802	+ 552
Croydon	,, 6	3,503	— 91	27	31,079	+ 3,946
Darlington	,, 14	433	+ 14	29	6,472	+ 638
Darwen	,, 13	521	+ 8	23	7,716	+ 623
Dover	,, 14	478	+ 43	28	8,036	+ 1,214
Dublin	,, 13	11,230	+ 327	..	100,047	+10,408
Dundee	,, 11	2,339	— 232	21⅔	25,833	— 612
East Ham	,, 14	2,106	— 30	23	31,406	+ 1,609
Exeter	,, 13	655	— 17	28	10,378	+ 798
Glasgow	,, 14	40,445	+2,616	..	373,737	+24,697
Hastings	,, 12	1,920	— 99	..	..	..
Huddersfield	,, 14	3,782	+ 226	28	56,640	+ 6,470
Hull	,, 14	6,947	+ 81	28	81,742	+ 3,792
Ilkeston	,, 12	252	— 22	28	3,796	+ 89
Ipswich	,, 14	805	— 47	28	13,734	+ 811
Kilmarnock	,, 7	316	— 1	21	3,646	+ 327
Lancashire United	,, 11	2,662	— 61	41	55,824	+ 1,771
Leeds	,, 14	15,021	+ 587	28	215,946	+14,501
Leicester	,, 14	5,141	+ 137	..	..	..
Leith	,, 14	1,205	— 64	21⅔	15,194	+ 1,087
Liverpool	,, 7	23,782	+1,093	40	458,562	+13,666
‡L.C.C.	,, 4	86,633	+ 585	..	1,195,724	+67,924
London United	,, 14	11,842	— 970	..	273,686	+ 9,577
Lowestoft	,, 14	398	+ 14	2	398	— 27
Manchester	,, 14	32,713	+1,401	23	462,886	+25,388
Newcastle	,, 14	8,551	+ 650	..	121,497	+ 8,873
Newport	,, 7	1,847	— 46	27	19,853	+ 885
Oldham	,, 15	3,986	+ 249	29	57,007	+ 2,409
Pontypridd	,, 14	838	+ 29	28	11,846	— 42
Portsmouth	,, 7	4,126	+ 197	27	67,457	+ 5,946
Preston	,, 11	1,520	+ 63	28	22,556	+ 1,702
Rotherham	,, 12	1,362	+ 36	28	19,241	+ 1,597
Salford	,, 9	9,624	— 41	27⅔	136,076	+ 6,235
Sheffield	,, 17	12,945	+ 604	..	187,262	+12,143
Southampton	,, 11	2,357	+ 98	28	36,387	+ 4,648
Southend-on-Sea	,, 11	1,188	+ 16	28	22,624	+ 3,407
South Shields	,, 14	1,162	+ 89	28	18,354	+ 2,023
Swindon	,, 11	316	+ 8	..	4,627	+ 624
Tyneside	,, 11	920	+ 111	15	8,136	+ 1,058
Wallasey	,, 14	2,085	+ 183	28½	33,911	+ 4,932
Walthamstow	,, 14	1,351	— 83	28	22,650	+ 1,607
West Ham	,, 5	5,270	+ 97	27	74,817	+ 7,006
Wolverhampton	,, 11	1,964	+ 5	28	28,249	+ 1,725
Cen. London Rly.	,, 14	10,285	— 859	15	67,127	—12,747
City & S. Lon. Rly.	,, 15	6,426	+ 154	15	46,175	— 202
Dublin-Lucan Rly.	,, 15	295	+ 9	15	2,557	— 32
G.N. and City Rly.	,, 14	2,921	+ 89	15	20,584	+ 378
L'pool Overh'd Rly.	,, 15	2,994	+ 251	..	23,127	+ 1,261
Llandudno-Col. Bay	,, 13	462	+ 35	45½	14,398	+ 557
London Elec. Ry. Co.	,, 14	27,490	+1,670	15	180,380	+ 4,090
Mersey Railway	,, 14	4,123	+ 91	15	27,994	— 1,597
Metropolitan Rly.	,, 15	34,238	+ 134	15	248,854	— 5,155
Met. District Rly.	,, 14	22,276	+1,334	15	160,686	+ 7,095
Anglo-Argentine	,, 14	100,827	+6,777	..	2,000,041	+180,705
§Auckland	Sept.	15,905	+1,310	3	48,872	+ 3,617
Bombay (B.E.T.)	Sept. 15	5,837	+ 337	37	105,182	+ 6,203
§Brisbane	August	24,650	+2,700	8	163,520	+18,725
Brit. Columbia Rly.	..	..	..	..	..	..
Calcutta	Oct. 14	7,235	— 801	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	3,891	..	..	31,523	..
§Lisbon	..	..	..	..	..	..
Madras	Oct. 15	1,489	+ 48	..	28,141	+ 2,340
§Montevideo	Sept.	23,246	+1,886	11	273,519	+16,540
Perth (W.A.)	Oct. 13	3,421	+ 848	..	65,873	+14,997

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
urnemouth & Poole, Ord.	* 10	5½	5½	7⅜ — 8⅜	..	6 5 9
Do. 4½ % Pref.	10	4¼	4½	8⅜ — 9⅜	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10¼ — 10⅜	+ ⅛	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
ompton & Kensington, Ord.	5	10	10	7⅞ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 7⅞	..	4 7 6
ntral Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	8 18 5
aring Cross, West End & City	5	5	5	3⅝ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	— 1/16	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4½	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
elsea, Ord.	5	4½	5	8⅞ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
y of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12⅜	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
unty of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
unty of London, Ord.	10	5	5	7⅜ — 7⅞	..	6 7 0
Do. 6 % Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100⅛ —103½	..	4 7 0
mundson's, Ord.	5	Nil	Nil	3/8 — 5/8	— ⅛	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
kesstone	5	5½	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4¼	4½	95 — 98	..	4 11 10
rs	5	8½	9	5¾ — 7¼ xd	+ 1/16	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6¾ — 7½	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	8	2	2	1⅜ — 2	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅛ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	8½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	8⅛ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102 xd	..	4 18 0
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7½	6¼ — 6⅝	+ 1/16	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8¼ — 8⅜	— ⅛	5 14 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	5	2⅜ — 2⅝	— ⅛	6 19 2
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 — 1 1/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	5	⅛ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86¼ — 88⅛	..	5 1 8
Westminster, Ord.	5	10	10	7⅜ — 7⅝	..	6 7 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

elaide, 6 % Pref.	5	6	6	5⅛ — 5⅝	..	5 6 8
cutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 10 11
gary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
adian Gen. El. Com.	$100	7	7	106 —109	..	6 8 5
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
rdoba Lt., Power and T., Ord.	1	2	3	2/32 — 3/32	— 1/32	8 11 1
Do. 5 % Deb.	100	5	5	92 — 95	..	5 5 3
o. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
o. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
o. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	88 — 90	..	5 13 8
goorlis Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	Nil
o. 6 % Pref.	1	6	6	1 1/16 — 1 1/16 xd	..	8 14 6
ministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	..	4 16 7
dras, Ord.	5	Nil	..	2⅜ — 3⅜	+ ¼	..
lbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
xican El. Lt., 5 % 1st M. Bds.	..	5	5	86¼ — 88½	..	5 13 0
xican Lt. & Power, Common	$100	4	4	86¾ — 88½ xd	+1½	4 10 11
o. 7 % Cum. Pref.	$100	7	7	105 —107 xd	+ ½	6 7 3
o. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	+1	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	6	7	170 —175	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	34 — 36	..	13 17 10
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	4	118 —120 xd	+2½	3 6 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ —105½	+ ½	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	15/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	106½ —108½	+ ½	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

azon Telegraph	10	Nil	Nil	7¼ — 7⅜	..	Nil.
o. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
erican Telep. & Teleg., Cap.	$100	8	8	138 —140	+2	5 14 4
o. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
glo-American Telegraph	Stock	3⅝	3¾	67⅛ — 69½ xd	+1¼	5 7 11
o. 6 % Pref.	Do.	6	6	110⅜ —111⅜ xd	+1⅝	5 7 5
o. Dsf.	Do.	25/-	30/-	26⅜ — 26⅝	..	5 12 8
glo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
ll Telephone	5	8	7	6 1/16 — 7 3/16	..	4 18 3
mmercial Cable, Stlg. 4% Deb.	Stock	4	4	86¼ — 88½	..	4 10 5
a Tslegraph	10	6	6	10¾ — 11	..	5 9 1
o. 10 % Pref.	10	10	10	17¾ — 18½	..	5 9 7
ect Spanish Telegraph, Ord.	5	4	4	3¾ — 4	..	5 0 0
o. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 8
o. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
ect United States Cable	10	4½	4½	7⅜ — 8½	..	5 9 1
ect W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	..	4 8 8
tern Telegraph, Ord. Stock	Stock	7	7	136 —139 xd	+ ¼	5 0 9
o. 8½ % Pref. Stock	Do.	8½	8½	83 — 85 xd	..	4 2 4
o. 4 % Mort. Deb.	Do.	4	4	102¼ —104½	..	8 16 7
stern Extension	10	7	7	13¼ — 14 xd	+ ⅛	5 0 0
o. 4 % Deb.	Stock	4	4	100¼ —102½	..	3 18 1
t and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
be Telegraph and Trust	10	5⅞	5⅞	10¼ — 11	..	5 6 10
o. 6 % Pref.	10	6	6	12⅜ — 13⅜	..	4 9 9
at Northern Telegraph	10	18	18	30½ — 31½	+ ¼	5 14 3
o-European Telegraph	25	18	18	56½ — 58½	..	5 11 1
ckay Companies Common	$100	4	5	85 — 88	+ 2½	5 13 8
o. 4 % Cum. Pref.	$100	4	4	74 — 76	..	5 5 3
rconi's Wireless Telegraph	1	Nil	Nil	2 1/16 — 2 3/16	+ 3/16	..
Monte Video Telephone, Ord.	1	6	6	¾ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	13/16 — 15/16	+ 1/32	5 6 8
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	118 —121	..	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	96 —101	..	8 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	8 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	+ ¼	4 6 7
Oriental Telep. and Elec.	1	8	8	1 1/32 — 1 3/32 xd	..	4 16 7
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 1/16 xd	+ 1/32	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5	9 — 9½	..	4 4 3
Submarine Cables Trust	Cert.	6	6	180 —183 xd	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 1/16 — 7 1/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	..	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	¾	2¾ — 3	+ 1/16	2 10 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13¼ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	8 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	105½ —108½ xd	+ ½	8 13 9
Do. 4½ % Fdg. Bonds.	$1000	4½	4½	99 —102 xd	..	4 8 3

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 17th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	77 — 81	..	5 11 1
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 1/4 — 1 5/8	— 1/8	Nil
Do. 6 % Pref.	10	3	1½	3 1/2 — 1 1/2	— 1/4	3 12 9
Do. 5 % Deb.	100	5	5	91 — 94	—1	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	+1	5 13 11
Central London Railway, Ord.	100	3	3	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1¾	1½	30 — 31	+1½	4 16 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	105 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	7/8 — 1 1/8	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1/2 — 3/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancasbire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	2 1/2 — 3 1/2	— 1/8	Nil
Do. 4 % Deb.	100	4	4	71 — 75	.	5 6 8

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 17th.	Rise + or Fall —	Pres Yie p.
	*					£ s
Metropolitan Railway Consol.	100	1	1⅛	42 — 42½	+ 1	3
Do. Surplus Lands	100	2¾	2¾	64 — 66	..	4
Do. 3½ % Deb.	100	3½	3½	88 — 90	..	3 1
Do. 3½ % Pref.	100	3½	3½	85 — 87	—1	4
Do. 3½ % Con. Prcf.	100	3½	3½	84 — 86	..	4
Metropolitan District Ord.	100	Nil	Nil	25½ — 26	+1¼	N
Do. 6 % Deb.	100	6	6	144 —146	..	4
Do. 4 % Deb.	100	4	4	96 — 98	—1	4
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 1
Do. 4½ % First Pref.	100	Nil	3½	85 — 87	..	3 1
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 1
Metropolitan Elec. Trams, Ord.	1	5	5⅛	27/32 — 29/32 xd	..	5 1
Do. Def.	1	Nil	Nil	5/32 — 7/32	—1/16	N
Do. 5 % Pref.	1	5	5	3/4 — 1	..	5
Do. 4½ % Deb.	100	4½	4½	100—102	..	4
Do. 5 % Deb.	100	5	5	100—102	..	4 1
Potteries, Ord.	1	2	2	1/2 — 11/16	..	.
Do. 5 % Pref.	1	5	5	1 1/32 — 1 3/32	..	7 1
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 1
South Metro. Trams, 6 % Pref.	1	3	6	3/8 — 7/8	..	6 1
Do. 4 % Deb.	100	4	4	72 — 77	..	5
Underground Elec. Railways	10	..	..	1 3/8 — 1 5/8	..	.
Do. 4½ % Bonds	100	4½	4½	99 —101	—1	4
Do. 6 % Income	100	Nil	1	57 — 59	..	1 1
Do. Power House Debs.	100	..	4	100 —102 xd	.	3 1
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/16 — 3/16	..	N
Do. 6 % Pref.	5	Nil	Nil	2 3/16 — 2 7/16	..	N
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	4 15/16 — 5 1/16	— 1/16	4 16 5
Do. 2nd Pref.	5	5	5	4 15/16 — 4 3/4	— 1/16	5 2 7
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 8 9
Do. 4½ % Deb.	100	4½	4½	102 —104	+ 1	4 6 7
Do. 5 % Deb.	100	5	5	100 —102	— 1	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11 1/4	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6 5/8 — 7 1/8	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	121 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108½—111½	+ ½	4 9 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101 xd	+ ½	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5 1/4 — 6 1/4 xd	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/8 — 3/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 1/8	..	4 12 6
Do. 4 % Deb.	100	5	5	97 —100	+1	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—104½	+1	4 15 8
Kalgoorlie Elec. Trams	1	Nil	Nil	3/4 — 7/8	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	62 — 66	..	7 11 6

La Plata Elec. Trms, Prf,	1	6	6	23/32 — 1	..	6
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1 1/2	..	4
Do. 6 % Pref.	1	6	6	1 — 1 1/2	..	4
Do. 5 % Deb.	100	5	5	96 —100	..	5
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	..	5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5
Mexico Trams Com.	$100	7	7	117 —119 xd	+1¼	5
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	+ ½	4
Do. 6 % Bonds	100	6	6	99 —101	+1	5
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 1/16 — 7 1/8	+ 1/16	6
Do. 6 % Pref.	5	6	6	5 1/2 — 5 5/8	..	5
Do. 5 % 1st Deb.	100	5	5	99 1/4 — 101 1/2	..	4
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1 3/8 — 1 1/2	..	2
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 3/8 — 5 5/8	..	5
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4
Rio de Janeiro Trams	$100	1	4½	117 —118 xd	+1	3
Do. 1st Mort. 5 % Bonds	..	5	5	101 3/4 — 102 1/2	+ ½	4
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5
Sao Paulo Tram, Lt. and P.	$100	10	10	180 —185	+3½	5
Do. 5 % 1st Deb.	$500	5	5	105 —107	+1½	4
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	..	5
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96½ — 97½	..	5
Un. Elec. Trams Monte Video	5	5	6	5½ — 6	..	5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½—107½	..	4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	9/16 — 11/16	..	Nil
Do. 6 % Pref.	1	12	9	7/8 — 1 1/16	..	7 7 8
Babcock & Wilcox	1	24	26	5 1/16 — 5 1/16	— 1/16	4 11 5
Do. Pref.	1	6	6	1 3/8 — 1 5/8	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 3/4 — 7 1/4	..	6 17 11
Do. Prcf.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	Nil	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	99 —101	..	5 18 10
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/8 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	Nil	3/8 — 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9 1/4	..	7 13 10
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 1/2 — 3 5/8	..	4 16 7
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10

Dick, Kerr	1	6	5	3/4 — 7/8 xd	..	5
Do. Pref.	1	6	6	1 5/16 — 1 7/16 xd	+ 1/32	5
Do. Deb.	100	4½	4½	95 — 98	..	4
Edison & Swan, A, £3 paid	5	Nil	Nil	2/- — 1/4	..	
Do. fully paid	5	Nil	Nil	1 3/8 — 2 1/4	..	
Do. 4 % Deb.	100	4	4	67 — 71	..	5
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6
Electric Construction	2	Nil	Nil	1/8 — 3/8	..	6
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8
Do. Deb.	100	5	5	94 — 96	..	5
General Electric, Pref.	10	5	5	8 3/4 — 9 1/4	..	5
Do. Deb.	100	4	4	86 — 91	..	4
Henley's, Ord.	5	15	15	12 — 12 3/4	..	5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4
Do. Deb.	100	4½	4½	106¼—108¼	..	4
India-Rubber, G. & T.	10	10	10	13 1/2 — 15 1/2	..	6
Do. Pref.	10	5	5	9 1/4 — 10 1/2	..	4
Telegraph Construction	12	17½	20	34½ — 36½	..	6
Do. Deb.	100	4	4	100 —102	..	3
Willans & Robinson	1	Nil	Nil	3/32 — 3/32	..	
Do. Pref.	5	1½	Nil	1/4 — 3/4	..	
Do. Deb.	100	4	4	55 — 65	..	6

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

E ELECTRICAL APPARATUS CO.'S NEW WORKS.

eems but a short time since we visited the works of young but thriving company in Battersea, when it had y established itself in the manufacture of meters, motor-



Starter Assembly Benches.

ters and fuses. So dly, however, has company's business eloped that it has found imperaely necessary to ain increased acmodation in order ope with the orders hand and in pros-. At first this accomplished by king extensions at Milford Works, about a year ago directors realised t the limit had been ched, and that the ks must be removed more suitable site. As a rule, it is found isable, at this stage, remove a business n the area con-



Meter Assembly Benches.

led by the London County Council altogether, order to escape the oppressive conditions imposed on manufacturers within that area, as well as heavy rates and taxes, and to facilitate access the works on the part of the employés, at the ne time reducing the cost of land and labour. e nature and conditions of the company's siness, however, were such as to render this urse undesirable, and the directors decided that would be advantageous to remain in London, spite of the drawbacks above mentioned. ey, therefore, decided to purchase a large freeld site at Vauxhall, on part of which they have cted the "Vauxhall Works," in South Lambeth ad.

The buildings are of modern design, all on one or, well lighted from the roof and adequately ntilated; at present they provide accommodan for 250 men, and the remainder of the site ll afford space for almost as many more when tensions are required.

The company has taken the opportunity to install e best modern machinery for the manufacture its apparatus, and has found it profitable to make for itself even such standard parts as nuts and screws. A gear-cutting machine has also been installed for cutting the teeth of all kinds of small toothed wheels, especially those used in the manufacture of meters.

We give herewith some views of the interior of the works, showing the general construction of the buildings, the excellent system of roof lighting, and some of the equipment. The chief lines of manufacture are the E.A.C. high-torque meter, which is widely known and used both in this country and in the Colonies; the E.A.C. motor control gear; the Koolark patent enclosed fuses; and, of more recent adoption, totally enclosed switches and switch fuses; A.C. motor control gear of various types, and drum controllers.

A well-equipped testing department and laboratory is provided, where finished parts are inspected and tested before they are issued for assembly. Meter gears are run through their whole range by a gentle breeze from electric fans, so that no faulty gear can escape detection, and magnets, armatures, &c., are required to pass a number of tests to ensure their freedom from any defect. Completed meters are tested and calibrated, and must be accurate within the limits allowed by the Board of Trade; no meter which fails to run well on its starting current during a whole night is passed for dispatch.

Switchgear, fuses and starters similarly undergo tests under working conditions, and it is almost impossible for faulty apparatus to escape detection.

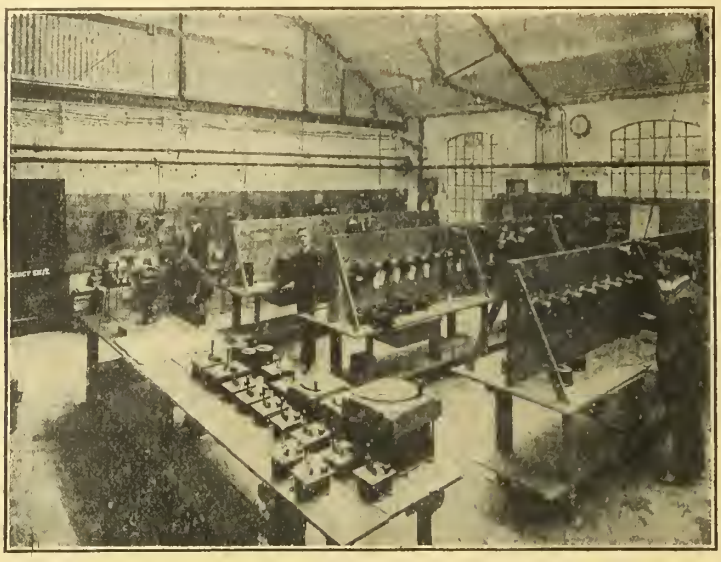
The E.A.C. meter, which is of the motor type, with the three-coil armature winding enclosed between the aluminium braking disks, is insulated throughout with mica, with the sole exception of the commutator segments, which are mounted on an ebonite sleeve. It is guaranteed accurate for three years. A prepayment meter, consisting of the standard meter, combined with a patent penny-in-the-slot attachment, has recently been introduced.

The company's standard starters and regulators have been



Machine Shop.

described in our "New Electrical Devices," and are constantly increasing in number and variety. We illustrate one of these as an example of the work turned out—the E.A.C. patent D.C. automatic starter, which is actuated by means of a solenoid main switch: larger starters of this kind, with separate solenoid switches mounted on panels, are also made. Cinematograph resistances, A.C. starters, induction regulators,



Test Room.

&c., come within the scope of the company's operations, and it is satisfactory to note that in a business which is already subject to such severe competition, an enterprising young firm like this can not only make a reasonable profit, but has also been able to place a considerable sum to reserve each year.

ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 631.)

In No. 4 (Yorkshire) District there were five cases of death from electric shock, one being on the surface. Of these Mr. Pickering says:—

"Two of the cases may be described in detail, as they are typical of accidents from electric shock, and emphasise the importance of *skilled supervision of electrical work and of effective earthing*. (The italics are ours.)

"At 10 p.m. on April 20th, at South Wingfield Colliery, a miner and his brother took charge of a Diamond coal-cutting machine which had been at work during the previous shift, and started the machine without making an inspection of cables or connections, as required by Special Rule No. 30. At 5.30 a.m. a distance of 70 yd. had been cut, and deceased was in front of the machine and in contact with the haulage rope by which the machine is pulled along. He received a shock and was killed. His brother went along the face a distance of 70 yd. to the gate-end box, switched off the current, and then went 400 yd. to the shaft for assistance. Thus, much time was lost before artificial respiration could be tried.

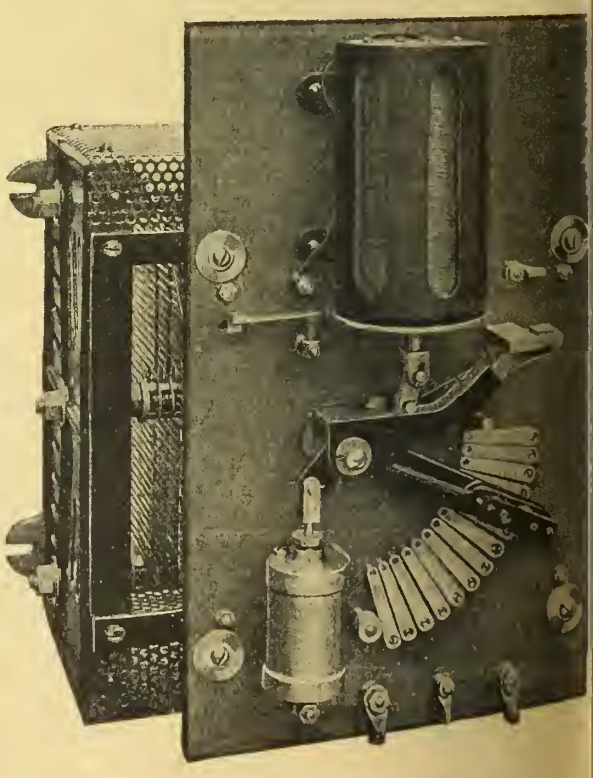
"The circumstances of the accident suggested electric shock from the haulage rope, and a defect was ultimately found to account for the 'live' haulage rope, as the earthed negative cable was fractured.

"The system of distribution was direct current 500 volts by means of concentric cables, the outer conductor being connected to earth at the surface and at the shaft bottom. The trailing cable was a two-core leather and rope-protected cable. One of the cores was connected to the 'live' inner wire and to the positive terminal of the coal-cutter, the other to the earthed outer wire and to the negative terminal of the coal-cutter. This negative terminal of the coal-cutter was again connected to the machine frame, so that the only way the frame of the machine could become alive was by fracture of the earthed negative cable. That is what took place, and the whole machine and haulage rope became charged the full voltage of the positive line through the armature windings and the cable connecting the negative terminal with the machine frame. The cause of the fracture was frequent movement of the cable at the place where the cores of the trailing cable are brought together. As break was gradually being made under insulation remained intact, it is difficult to award a blame, *but a careful examination* by passing hand along the insulation might have revealed some broken wires.

"As the safety of the workmen at this coal-cu depended entirely on the continuity of the nection to the outer conductor, the safest for connection would be a "plug" connection similar to that at the machine end. This accident cl emphasises the importance of maintaining outer conductor in a concentric system of d bution absolutely continuous. So long as th done the concentric system may be regarde perhaps the safest system from a shock point view."

Not only should there have been a "plug" nection, but there should have been a pl junction box, provided with a switch for disc necting the machine at the end of the trailing c

"A fatal accident occurred at No. 5 pump h at the Sutton No. 1 Colliery, Nottinghamshir connection with the removal of a pump driven 20-H.P. motor taking 500 volts, direct cur At 110 yards from the pump was a switch and the main cable was laid from it to the m pump switch which was carried on an angle-iron switchb on which were also carried the starter frame, shunt regul and the ammeter. In addition to these cables to the p room switchboard there was an auxiliary lighting circuit two 250-volt lamps in series on it taken from the side of the switch on the switchboard, and on this ci there was a subsidiary switch by the side of the switch at the top right-hand corner.



E.A.C. Patent D.C. Automatic Starter.

"The pump was not much above its work, and therefo was necessary to pump the water down as low as poss and then remove the pump, motor, switchboard, gear, rapidly to prevent their being drowned. The water been pumped down and the connection from the switch the motor and starter disconnected, but the lighting ci was left on and the lamps were burning.

The electrician gave instructions to two men to remove ump and motor, and "to make everything safe," but es not appear to have given any specific orders as to s. The two men were working with the auxiliary ng circuit on, and when detaching the frame of the r from the switchboard they both received a shock. man was unconscious, but soon recovered, and walked ards to the shaft. The other man died instantly.

The accident appears to have been due to a fault on the ng circuit which caused the frame of the starter to be and as soon as the contact between the switchboard he frame of the starter was slightly broken, the two received a shock. The floor of the house was wet and irders on which it was formed were in water. The hboard frame was earthed by means of a single gal- ed wire to the girders on which the pump and motor placed, and through them to the suction and rising pipes.

t was highly dangerous to have a lighting circuit con- d to a board from which the apparatus was being red. The whole of the current should have been hed off at the box 110 yards away, so that everything e pump house would be dead. If this had been done ccident could not possibly have occurred. *After the ty the whole of the plant was overhauled and put into order.*" (Again the italics are ours.)

may be remembered that in his last report Mr. ring condemned electricity in mines wholesale, and one ot wonder at his attitude if this sort of thing is ical" of the way in which electricity is installed and ed in the mines in his district.

ere was only one fatal accident underground in No. 5 chester) District and one on the surface. In the first f-acting incline attendant termed a "jigger" was l. "The self-acting incline is 200 yd. long, rising 3, and electric cables conduct continuous current at volts up this incline to work coal-cutting machines in eam at the top. Galvanised wire signal cord, which ls by pulling, passes along the left-hand side of the ie; for 70 yd. from the bottom an electric cable passes the same side, then crosses the brow, and is from that carried to the top on the side opposite to the signal to the gate-end switchbox. The electric cable had nd the copper conductor india-rubber insulation; this was cted by jute braiding, and around this was steel wire uring, and outside all, simple braiding. About 9.30 a.m. tub ran amain from the top, and two or three men down to put this right; the tub was an iron one. ased went about 40 yd. down the brow, leaving a man e brake of the jig wheel: while deceased was in the , communications passed from the men putting the run- on the rails with a view to the rope being moved, and sed signalled by pulling the signal cord. Shortly after, epairing men passed up the brow and found Merrick on his back dead. These men testified to receiving s when dealing with the tub, from the tub, the haulage and from the signal cord. When the electrician tested able, he found at the gate-end switchbox a leakage, the ation of the conductor had been broken from chafing on dge of the box, there being no bush; this caused the e of the armouring of the cable to be alive. Mr. Nelson, Inspector of Electricity in Mines, found on examina- that the earthing of the armouring of the cables was effective. Instead of proper clamps, thin wire loosely ped around the cable was depended upon. The final ing was underground in a water lodge, and was not factory. The coal-cutter only worked in the night time; 50 a.m. the coal-cutter men said they switched off the ric current in the level, on the out-bye side of the jig , which, had it been done or had it continued so, would made the cable in the brow dead.

Either the coal-cutter men did not switch off the current itness said he saw it done), or some meddling person ched on the current. All the boys in the vicinity denied ng touched the switch."

his accident again raises the question of wire armouring the difficulty of getting and maintaining an efficient th." Had the cables been unarmoured and laid in ng wood boxes the accident would have been absolutely ssible.

Two non-fatal accidents on the surface are reported, in one of which an electrical apprentice, whilst assisting to renew the wiring for an electric lamp, came into contact with a live wire, with the result that the palm of the left hand was burned and he received a slight shock. A misunderstanding caused the current to be taken off the wrong wire; the person in charge, instead of doing this himself, sent a message. The pressure, 500 volts, is now being reduced by the installation of transformers.

In the other case a surface labourer received a severe electric shock, and was rendered unconscious for several minutes. He was restored by Sylvester's method, his right hand being burned. Machinery from an old engine house was being removed, and to get the fly-wheel out a derrick pole was put up. In the absence of the foreman a labourer threw a 5/16-in. galvanised wire rope over five overhead electric cables, bare wires; the wire rope caught on one, and probably on other electric cables, causing a short to earth by the wire rope. Morton took hold of the wire rope, receiving the shock. Two of the cables carried current at 120 volts, three at 400 volts.

Such an accident as the former may never be completely eradicated until colliery electricians are properly trained and made responsible for carrying out their duties. It is interesting to note that the pressure is being reduced from 500 volts for lighting purposes, a very sensible and proper thing to do. As regards the second, this may be put down as a pure accident, as, no doubt, the labourer, in throwing the rope, would think he could clear the cables, assuming that he was aware of what would happen if he did not, which is doubtful.

There were no fatal accidents in No. 6 (Manchester) District, and only four non-fatal accidents are reported, two on the surface and two underground. Of the surface accidents, one was due to a fitter touching a live part in a power station; of the other case, particulars are given below. In the two underground accidents, slight injury in both cases was due to a glove not being put on whilst a fuse was being inserted. There ought, however, to be no necessity for gloves to be worn during the insertion of a new fuse, as fuse boxes should be so made that they cannot be opened unless the current is first cut off. The second surface accident was caused through a contravention of No. 10 of the rules governing the use of electricity. The injured man was the attendant, and had been so employed six months in charge of the power station where the current, three-phase, at 2,200 volts, is generated for use underground, being there transformed to 450.

"The parts at the back of the switchboard in the power station were enclosed by a locked cage 7 ft. 8 in. high × 2 ft. 10 in. × 2 ft. 7 in. The attendant had unlocked and opened the door, and through touching a live part, got seriously injured. He said he did not remember what happened, but as a piece of waste was found on the floor, it was concluded that he was dusting the apparatus without first switching off the current. Since this accident, the cage has been fitted with a device which ensures that the door cannot be opened before the current has been switched off."

Under the head of "dangerous occurrences," an underground fire caused by electricity is reported. This was investigated by Mr. Nelson, H.M. Electrical Inspector, who reported as follows:—

"Current is generated as three-phase current at 500 volts, 40 cycles. The shaft cables are protected from mechanical damage by steel-wire armour, but the in-bye cables are unarmoured and of various kinds; the older cables being insulated with rubber and the newer with vulcanised bitumen.

"The fire occurred at the junction of two roads running at right angles in the Orrell seam; one a main haulage road in which the electric cables were suspended, the other a branch road rising from the main road, and along which there is an auxiliary haulage. A runaway set of tubs coming down the auxiliary road carried away the cables at the junction, and in so doing drew out three ends of cables from a joint box supported on a wooden frame in the main road, and fixed just at the junction of the two roads. The resultant arcing fired the cable insulation, but the fire was soon extinguished. Such an accident can clearly only be avoided if it is forbidden to carry unprotected cables in haulage ways. Even if the circuit-opening device is efficient and acts promptly (as it appears to have done in this case) with similar cables to those in use, similarly supported, there is evidently still

the possibility of fire. The place could not, I think, be described as 'dusty'—in a dry and dusty pit a similar occurrence might clearly have provided a very serious accident.

"It can only be said that efficient mechanical protection for underground cables in haulage ways is really very important. I understand that steps will be taken to so place the cable that a similar occurrence at that spot will hardly be possible in the future; but the only way in which to avoid accidents of this kind would be to provide strong armouring for underground cables in haulage ways. It may be pointed out that in this case the fault occurred at a junction box; and in this connection, whether the cable system be armoured or unarmoured, junction boxes form the weakest link in the chain. But if the cables be armoured the armouring can be strongly secured to the box, and in this way an armoured system can be made much stronger than an unarmoured system at junction boxes elsewhere."

Mr. Nelson has great faith in wire armouring, but in such an accident as this it cannot be said that it is absolutely safe, and cables laid in strong wood boxes would undoubtedly be safer against falls of roof and sides, or iron girders or runaway tubs.

In No. 7 District (South Wales) the Inspector says (the italics are ours, and need no further comment), "that there were three fatal and four non-fatal accidents by electricity underground. Two of the fatal accidents were by electric cables, and one by a switch. Three of the non-fatal accidents were by cables, and one by changing a fuse with the current on. There is room for *great improvement in many of the smaller mines in the supervision and maintenance of the electric plants.*"

On the surface there were one fatal and four non-fatal accidents. The fatal one was caused by an overhead cable. One of the non-fatal accidents was caused by the brush of a motor, one by a transformer, one through the bursting of an incandescent lamp used for testing phases, by which two persons were injured, and one by contact with live metal at the back of a switchboard.

In No. 8 (Midland and Southern) District, one fatal and four non-fatal accidents were reported to the Inspector. The accident occurred to a mechanic's assistant who received an electric shock which resulted in his death. Three cables, conveying three-phase current to an 80-H.P. motor situated near the shaft bottom, had been fixed temporarily in the shaft near the end of one of the cage spaces, and were being removed to their permanent position by the side of the same cage space. The pressure was 550 volts, and each cable carried 74 amperes. They were insulated with rubber and jute, sunk in grooves in a $7\frac{1}{4} \times 1\frac{1}{2}$ in. deal, and covered with a $\frac{3}{4}$-in. deal nailed on at the edges. Deceased and two other men were engaged in stripping off the covering deal, preparatory to shifting the cables, the deceased being in charge of the shift. He had been instructed to have the current switched off while they were at work in the shaft, but to utilise every opportunity while they were up for snap or for other purpose to let the pump men get the water out. In addition to this a notice was posted at the pit bank, which stated: "When men are working in the shaft the electric motor must be switched off." When the men came up for snapping at 11 p.m. the current was switched on, but on descending the shaft again some 20 minutes later they, unfortunately, neglected to have it switched off. Deceased was driving a steel chisel into the joint of the covering board close to a nail, to make an opening for the insertion of a wooden wedge which was to be driven in to spring off the covering board. He held the chisel in one hand while driving it. It pierced the insulation, and he received a shock which caused him to fall from the cage to shaft bottom, a distance of about 253 yards. The men on the cage should have known that the cable was alive, as from the point where they were at work the noise caused by the pump could be very distinctly heard. The accident emphasises the danger of permitting such operations to be carried on without skilled supervision.

Particulars are not given of the other accidents, but enough has been gathered from a review of those reported to show that it is not electricity that is at fault; every accident is due either to want of skilled supervision or to the disgraceful way in which the plant is installed and worked. In view of all that has been said against the use of electricity in mines principally by persons who know nothing whatever ab the matter, such methods cannot be too strongly condem and it would certainly be to the benefit of workmen, ow and managers of mines if more electrical inspectors coul appointed to see that the electricity rules are strictly car ont.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear the following week. Correspondents should forward their comm cations at the earliest possible moment. No letter can be publ unless we have the writer's name and address in our possession.

Trade Discounts to Private Consumers.

With reference to Mr. A. F. Lord's letter on the a subject in your last issue, it does not appear to me th contractor, who cuts the price of his jobs so fine that he to rely on the discount he may obtain from the m facturers of the fittings to make his profit, is any authorit the subject. And then he says he sometimes has to di this discount or profit with ironmongers and builders! is not my idea of a good "business man."

I quite agree with the last paragraph of "Anc Manufacturer's" letter, that X. & Co. acted very gener in offering Messrs. Coates & Co. 10 per cent., and Messrs. Coates & Co. thoroughly deserved the snub received.

C. G. F

London, N., *October 17th*, 1911.

I have read with interest the two letters which a in your issue dated October 13th, also the letter from M Coates & Co. in your previous issue which caused the to be written.

I quite agree with the remarks of "Another Manufactu but with regard to Mr. A. F. Lord's letter, it appears t that he has only got himself to blame if he quotes for at under cost price, in the hope of making a profit out discount which may or may not be allowed to him manufacturer of fittings.

So far as a fittings manufactuer is concerned, I t he ought to adopt one of two courses. One is to refu supply the private customer direct and to insist upo order coming through a contractor. The other is to ci the full list price to the private customer and pocke extra profit himself, only giving a discount to trade custo To my mind the matter is quite simple; it is pur matter for the manufacturer to decide as to which he prefers to do business—that is, which way suits his p best. After all, we all look after our own interests, no m what the line of business is.

I can quite understand that Mr. A. F. Lord would con himself lucky if he made 10 per cent. profit on his turnc he is hardly likely to do this if he carries out wiring jobs loss, depending upon fittings manufacturers for a profit. a total abstainer of 40 years' standing, I am glad tha whisky merchant did not offer him a discount on the modity he deals in.

P. A. Re

London, N.W., *October 17th*, 1911.

The Evolution of Wiring Systems.

The communication made by your correspondent, Electrician," will undoubtedly prove very encouragin many central station engineers, although I consider tha wisdom of publishing "rock bottom" prices, even in a t journal, is somewhat doubtful.

My estimates of the prices of different kinds of w were based upon experience of the working of moderate- contracting businesses, and the lamp was taken as co 2s. 9d.

Your correspondent may rest assured that an enor amount of work is being done in moderate-sized pr houses at the prices mentioned, and that those who carr

is work do not appear to be getting rich very rapidly ; lis, of course, may be their own fault, but it does not alter ie fact that the central station engineer in many places has compete with gas through the medium of these contractors id prices of this order.

The chief object of the list of prices given was to draw tention to the relative costs of the different systems; where ip-conduit work can be properly carried out for 20 per cent. ss than the figure shown, presumably the other systems will op in almost the same proportion.

In spite of the fact that enamelled wire has been otainable for years and that surface wiring has been carried it in many places, even in this country, these systems are ill rarely met with and cannot hope to become general until ie smaller contractor, who most needs cheap methods, can e induced to actually put them up and enable his men to ecome acquainted with them. Nearly all these systems rove at first to be as expensive as simple conduit work, and, enerally speaking, they are abandoned as not being worth hile, whereas with a little pains the men would become ccustomed to them, and their full economy would stand evealed.

The cases mentioned where lights were installed very neaply in factories bear little or no relation to ordinary ouse work with one or two lights and one switch to each oom, and where all the plaster work has been completed nd floors are laid, this being the condition under which a reat amount of wiring has now to be carried out.

The cab tire and heavily covered flexibles have not so far een used extensively for ordinary house work, and the riter's object in mentioning them was merely to state a ase for their employment, more particularly for heating ircuits, where it is found so frequently that the cost of xtra wiring is the greatest deterrent to the introduction of adiators in houses.

Possibly the most promising of all cheap systems of wiring s that in which enamelled or other lightly insulated wire is un on porcelain cleats, and your correspondent is undoubtdly right in saying that objections on the score of ppearance may be easily overcome ; unfortunately, the pecial fittings required to carry out this work satisfactorily ave not up to the present been well advertised or brought o the notice of the average wiring contractor. It would be dvantageous if some firm interested in the sale of these ittings could make a display of wiring carried out by means f them.

J. W. B.

With reference to the letter in your October 13th issue, n pages 597 and 598, dealing with the above, we should ust like to point out that the style of the firm mentioned is ncorrect. This should be D. H. Bonnella & Son, Ltd.

This is rather awkward, as we have no connection with he firm mentioned. We trust, therefore, you will be good enough to correct the error in your next issue.

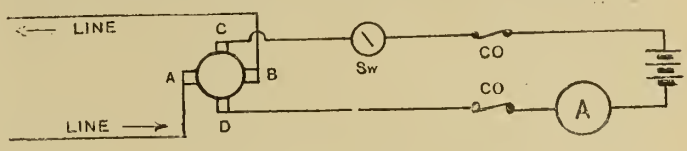
D. H. Bonnella & Son, Ltd.

London, W., *October 16th*, 1911.

Charging Ignition Cells.

I have noticed lately a discussion in your paper *re* the charging of small accumulators, and think, perhaps, you would like to have just another way of carrying out the above without serious losses. The method I am about to describe is one that occurred to me some time ago ; it can be applied to any D.C. generator or motor provided the load is fairly constant. Take a simple illustration, a two-pole machine with brushes A and B in the usual position, and take a second pair of brushes on a separate rocker, their position being at right angles to the brushes (but not connected to them); on running the machine no current will pass C and D if circuit is closed.

Now, if E and D are rocked forward from the neutral position, the voltage will be proportional to the number of commutator bars cut into cell circuit; by this means any number of cells, say, within 20 per cent. of line voltage, may be charged, but of course this depends upon the type of armature used. The result to a motor is to slightly increase the speed and, of course, if the brushes are rocked too far, serious sparking will result ; but for, say, 8 or 10 volts on a 220-volt circuit with an amperage of 1 to 5, any well-designed dynamo or motor should not give trouble from bad commutation. I have carried out tests under these conditions. The machine voltage was 230, the C and D circuit being 45 to 60 volts, and supplying X-ray coils giving 12-in. sparks : the machine used was an old 8-H.P. Crompton two-pole motor. The



Sw., Switch; CO, Cut-out.

amperes taken from the machine varied between 3 and 15. You will thus see that the action is practically that of an ordinary armature, used as a direct-current balanced auto-transformer.

Another method that works well with large generators, and can be used on almost any machine, is a brush placed in a separate holder in advance of the negative line brushes, the number of sections being determined by experiment ; this owing to the small current taken does not interfere with the machine commutation.

I found by experiment that the C and D brushes should not cover more than two sections, and if the sections are wide, one section's width is still better.

J. R. Smith.

Dartford, *October 14th*, 1911.

Corrosion of Bell-pushes.

I should be glad if any contractor or electrochemist could give me a satisfactory explanation of the following :—

In a house which has been built about 15 months, I have found that in every bell-push on the upper floors, one of the terminals is corroded to a black colour, a slight crystalline deposit of a white colour appearing on the edges. The corrosion is sufficient to prevent current passing, but the second terminal in each case is still perfectly bright and clean. It would interest me to know whether this is due to electrolytic action, such as causes dust to accumulate on the positive side of switchboards, &c., or whether it is caused by damp (there is no external evidence of this in the house). The wires are laid in the usual way in zinc tubes buried under the plaster on the walls. The bells have not been used very much.

E. A. P.

October 11th, 1911.

Olympia Electrical Exhibition.

Our attention has been called to a letter in your issue of the 13th inst., from Mr. Justus Eck.

As there will not be a meeting of the Committee in time for the Committee to reply to this letter, we take the responsibility of answering it, as the letter in question is written by Mr. Eck under an entire misapprehension.

There has been no change whatever from the policy adopted at the Manchester Exhibition. At Manchester the supply authorities (municipal and otherwise) purchased right out 100,000 tickets, without any consideration as to whether these tickets were made use of or not.

Tickets were supplied to exhibitors on exactly similar terms, so that the procedure on the present occasion is identically the same as that adopted in Manchester, both as regards the supply authorities and the exhibitors. Moreover, no complaints were ever received by the Committee or management in respect of these conditions during or subsequent to the Manchester Exhibition.

We may add that at the Olympia Exhibition, 1905, donations were made for the purchase of tickets by the supply authorities (municipal and otherwise) to the number of over 120,000. On that occasion also no return was made in respect of unused tickets.

In point of fact, the Committee have been more liberal on the present occasion than in either of the preceding Exhibitions, inasmuch as where numbers of 1,000 tickets

have been ordered 1,300 have been sent, and charged for as 1,000; thus the 1s. tickets of admission cost the supply authorities only 2¾d., which we hope allows very fully for wastage in distribution.

In regard to Mr. Justus Eck's reference to what he considers is the high price for space rental, it may also be mentioned that the charge for space in this Exhibition is rather less than the charge for space in Manchester.

The space rentals do not exceed those made for similar exhibitions promoted by private enterprise, whereas on this occasion there will probably be a substantial rebate made to all the firms showing.

It need hardly be pointed out that this rebate would not have been possible had some of the suggestions as to the granting of free tickets and expenditure on increased advertising been adopted by the Committee.

The Electrical Exhibition.

H. L. Benjamin, *Organising Manager.*

London, E.C., *October 16th*, 1911.

The Demand for Technical Men.

The article which you publish in your last issue upon this subject is of great interest, and is quite in accordance with our experience. So far as this College is concerned, we have, for some time past, found considerable difficulty in supplying the demand made upon us for trained men, and have been able to place all our students easily, many of them before their time had actually expired, and, what is of greater general interest, at salaries considerably higher than those offered a few years ago.

On the other hand, whilst there has been for some years a steady falling-off in the number of new students, the tide turned last April, and this term we have had the largest entry in the 22 years of our existence.

Ernest A. Nash,

Secretary and Business Manager.

Faraday House, London, W.C.
October 16th, 1911.

I am rather surprised at a paper like the Electrical Review upholding such misleading advertisements as the letter in the *Daily Mail* of September 26th. Anyone who is thoroughly acquainted with the conditions of electrical engineering will see at once why this letter was written. The firm it came from have made quite a business of the premium pupil system, and I daresay have arranged their system of education so as to give their pupils a very good training; at the same time, they only do it because it pays, and if they could not make it pay they would give it up. At present they have evidently got room for more pupils than they can get, hence the letter, or rather advertisement in the *Daily Mail*, and a very good method of advertising it will prove, because it will be read by the people for whom it is intended.

As to the shortage of trained men, I think the majority of your readers will agree with me when I say that the great difficulty of managers when they want a man is not to find *one* suitable one, but to choose one from the many suitable ones. If they are short of highly trained men at the Falcon Works, Loughborough, why don't they advertise and offer a reasonable salary?

If you will refer to your advertisement columns you will find very few positions vacant at £150 per annum or over, and if ever these do appear it is only necessary to insert them once, and the advertisers will have at least a dozen men to choose from, each capable of filling a much better position if he could only get it.

As to technical training, managers appear to attach very little importance to this. I hold a City and Guilds Honours certificate myself, besides many for mechanical engineering, and I have had a good practical training, but I have competed many times for positions with men having the same practical experience, but almost no technical training, and time after time these men have been left on the short list, and got the position, and I cannot even get on the short list for a position worth £150 per annum. I have known as many as five B.Sc.'s apply for a position at 30s. per wee and yet a man with no high technical training got it. this case the manager said they did not want B.Sc.'s, as th had tried them.

There are too many good men, and too few well-pa positions in electrical engineering, and anyone paying premium to enter the profession will waste many valua years as well as his money.

Aving Sum.

[If our correspondent will read the article to which refers, he will see that we fully discounted the letter in t *Daily Mail*, on the grounds that he bases his own remar upon. He appears to voice the central station view in pa ticular, and it cannot be denied that this commands o sympathy; but this is only one department of the electric industry.—Eds. E.R.]

Quartz in Electrical Heaters.

I have read the long letter from Messrs. Paterson & C which you print in your issue of October 6th, and it appea to me that they do not appreciate the difference betwe mere laboratory experiments and practical commerci achievements, such as are borne witness to at the Basti Electric Heating Syndicate's stalls at Olympia.

Bastian has used Nichrome in his heaters for nearly tv years, and I doubt if any single man has done more than has to turn fused silica to practical account, for he h applied it in the manufacture of mercury lamps and sparki plugs, as well as electric heaters.

It is absurd to suppose that Bastian does not know that is worth knowing about quartz, as he was expe menting with it and referred to it in his patents as far ba as 1903.

Who first produced manufactured articles from fus quartz has nothing to do with the original inquiry, whi raised the question as to who first used it in electric heati apparatus. I replied, and I repeat, that Bastian was t first to use it successfully. Messrs. Paterson & Co. ha kindly supplied a list of unsuccessful experimenters users of quartz for purposes entirely different from that und discussion.

But may I ask, in all innocence, who are Mess Paterson & Co., and why do they appear to be so angry?

Alfred A. Newman.

London, S.E., *October 10th*, 1911.

I have just seen your issue of September 22nd, and not on page 450, Mr. Alfred A. Newman's letter, in the co cluding paragraph of which he mildly criticises my applic tion of quartz tubing to electric heating devices. I may sa in response, that in certain cases it is found desirable t close one end of the quartz tube and bring both ends the resistance wires out at the open end. Hence the use the small inner tube to insulate the return wire. When th quartz tube is left open at both ends, the inner tube obviously unnecessary. My U.S. patents show bot methods.

W. S. Andrews.

London, *October 16th*, 1911.

Lux Electric Candles.—The Lux Candle Co., Ltd. of London, have lately shipped 4,000 of their Lux candles for us in the Coronation festivities in India. These candles are greatly appreciated for large buildings, as they can be cleaned by anyon without removing the lamp. The firm are now making them with metal filaments up to 125 volts without bulging tops, giving a artistic effect.

Hope's "Bimetal" Fuse Wire.—We are informed that this new fuse wire, invented by Mr. Vernon Hope (the patent for which is owned by Messrs. Parmiter, Hope & Sugden), is manufactured by Simplex Conduits, Ltd., and sold by them, under licence, at the same price as by the patentees.

Belgium.—La Société des Ateliers Electrotechniques is the title of a new company which has just been formed at Mons with a capital of £4,000.

PROCEEDINGS OF INSTITUTIONS.

A New Miner's Electric Lamp with Gas-testing Device.

ome time ago we referred to the likelihood of a miner's electric mp being produced which would have attached to it a device apable of giving an indication in some way or other of the esence of fire-damp, and this prophecy seems to have been lfilled in the Holmes-Ralph gas-detecting portable electric lamp, lustrated below, which was exhibited before the members the North of England Institute of Mining and Mechanical ngineers on Saturday last.

The device is really the outcome of a suggestion made by Mr. J. B. tkinson, H.M. Inspector of Mines for the Newcastle District, to dapt the Holmes-Alderson automatic fire-damp cut-out to a port-ble form. As may be remembered, this apparatus—which depends r its operation upon the catalytic action of gas upon platinum, using a rise in temperature—was intended to be used in mines ear the coal face for the purpose of automatically operating a t-off switch some distance away, thus stopping all electrical achinery in a danger zone created by a sudden outburst of gas, in case gas was given off more quickly than it could be carried way by the ventilating current; so that credit is due to Mr. lderson for originating an idea which may prove to be of in-timable service to the miner, and the inventors are to be con-atulated upon their skill in perfecting the present arrangement.

Fig. 1 shows a portable lamp which may be used in ships' nkers, shaft tunnels or petroleum tanks, as well as in mines, and is ted with a small bell or buzzer, which when used in a mixture of s and air of from 2½ per cent. upwards, commences to sound and ntinues to do so until the lamp is removed from the mixture.



Fig. 1.—Fitted with Audible Signal.



Fig. 2.—Fitted with Cut-Out.

Holmes-Ralph Gas-Detecting Portable Electric Lamp.

In the construction of this device two compound metal strips e fixed near one another in such a manner that, under ordinary nditions, their free ends do not make contact. Underneath one these strips is fixed in clips a short length of platinum wire, adily removable, similar to an ordinary clip-fuse, connected in ries with the lamp. When additional heat is generated in the latinum by catalytic action, the compound strips touch, and ereby complete the circuit through a bell or buzzer. The use of second compound strip, instead of a fixed contact, compensates for ariations of atmospheric temperature.

To switch the light off and on, a screw in the cover is used, and y minute spark which may be generated is confined within a auze-protected case.

Means are also provided for testing the working of the apparatus artificially heating the platinum wire to a bright red heat. This done by slightly unscrewing the cover, thus connecting a resis-ance in parallel with the lamp and increasing the current through e platinum wire. Occasional testing ensures a clean and active rface on the platinum wire.

Another form of lamp is somewhat smaller, and is shown in g. 2. It can be readily set for various gas percentages, from 2½ per nt. upwards, and is so constructed that, when brought into tion by the presence of gas, the light is either extinguished together or merely dimmed. The dimming of the light seems to e preferable to complete extinction, for the reason that it will ford a glimmer to enable the user to find his way about, but will, the same time, render it impracticable for him to continue his ork effectively. In order to restore the normal light, the lamp ust be unlocked and a new fuse inserted, which, of course, can ly be done at a relighting station.

The construction of this form of the apparatus is very similar that already described; the bell or buzzer is absent and an rdinary tin or lead-wire fuse employed, which, upon the com-ound strips making contact, is connected direct across the battery, nd at once melts. In the ordinary way this melting of the fuse ould extinguish the light; but, by connecting a wire of high esistance across the fuse terminals, a current still passes, although uch reduced in strength. By the insertion of a new fuse the normal ght is restored, and the burnt-out fuse-holders are so adapted as be easily re-wired.

As in the buzzer type a clean and active surface on the platinum wire can be maintained, and the proper working of all parts tested, by occasionally connecting a resistance in parallel with the lamp. This is very simply and conveniently done by means of a holder provided with two contact-studs, which are connected together in the handle by a suitable resistance wire. By applying these contact-studs to two points of the detector, the platinum wire is raised to a bright red heat, and the apparatus so caused to operate.

A somewhat more elaborate form of apparatus, capable not merely of detecting gas, but of showing the actual percentage present, for the use of officials in mines, is shown in figs. 3 and 4.

The principle is that the lamp, or a non-catalytic wire, is connected in series with a length of platinum wire, and a small differential galvanometer or voltmeter is connected up to three points of the circuit, namely, to the two battery ends and to the

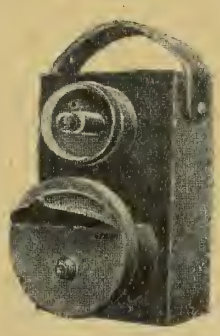


Fig. 3.—Front View.

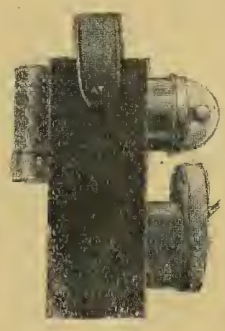


Fig. 4.—Side View.

Holmes-Ralph Gas-Detecting Portable Electric Lamp, Fitted with Indicator.

junction between the lamp and the platinum wire, as shown in the diagram fig. 5. The voltmeter has two coils, so connected that when the currents in each are equal, no movement is produced on the pointer and moving portion of the instrument. The length and resistance of the platinum wire are so proportioned to the resistance of the lamp or the other wire that, under normal conditions, the fall of potential is equal in both, and therefore the currents in the two coils of the instrument are equal.

When, however, the resistance of the platinum wire increases, as it will when the temperature increases, owing to catalytic action, the current passing is slightly reduced, the voltage across the lamp or wire becomes less, and the voltage across the platinum wire increases. Currents of different strengths will then pass through the two coils of the instrument, the moving system of which will be deflected, such deflection being shown by the pointer. The scale across which the pointer moves can be graduated to read directly the percentage of gas present. As arranged at present, this instrument will read up to about 4 per cent., the scale being

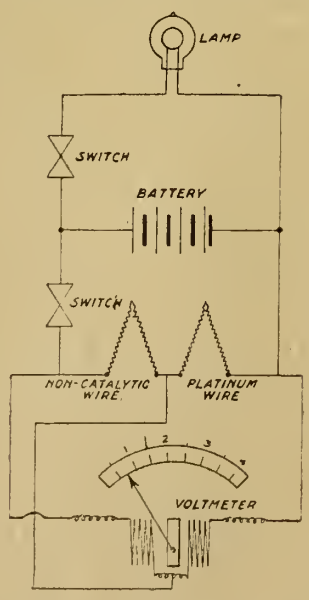


Fig. 5.—Diagram of Connections of the Holmes-Ralph Fire-Damp Indicator.

marked for each ½ per cent. Quite a readable deflection is produced by so small an amount of gas as ¼ per cent. The instrument can, however, be readily arranged to read, say, from 1½ to 6 per cent., if the recording of such small percentages as a quarter and a half is not required.

It has, for two reasons, been thought advisable to mount the platinum wire in a separate gauze-protected cylinder (fig. 4), instead of putting it in the instrument case. One is, that the platinum is more accessible for renewal, should this become necessary, and the other, that the instrument case can then be sealed up to prevent moisture from getting in, and to prevent it from being tampered with.

A hinged cover (fig. 3) is provided for the protection of the glass dial, the cover also acting as a reflector to throw the light on the dial, and as a mirror in which the movement of the pointer may be seen if the lamp is held below the line of vision.

The platinum is mounted on a holder, which slips into spring-clip contacts, and is readily removable. To screen it from draught, it is protected by a thin asbestos tube, placed within the gauze-lined tube.

The effect of petrol vapour, instead of coal gas, is of interest, the presence of the vapour being clearly indicated, as are also other gases or vapours, such as ether, turpentine, benzene, &c.

In conclusion, it has been stated that the absence of means for detecting inflammable gas has been one of the chief factors in retarding the adoption of electric lamps for mining work ; and it is hoped that the apparatus described may prove a step towards the ultimate replacement of the so-called "safety" oil lamp by one lighted by electricity.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,639. "Telephone apparatus." F. L. Muirhead. October 2nd.

21,647. "Electrodes for arc lamps." W. R. Ridings. October 2nd.

21,649. "Automatic electric switching apparatus." A. J. Howard and A. C. Allen. October 2nd.

21,662. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd., and J. Witcher. (Divided Application on 17,177, July 19th 1910). October 2nd.

21,678. "Plug and socket connections used on electric lighting or pow circuits." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. Octob 2nd. (Completa.)

21,687. "Systems of electrical distribution." Siemens Bros. Dynamo Works, Ltd., and H. D. Cook. October 2nd.

21,692. "Storage battery electrodes." H. C. Hubbell. October 2nd. (Complete.)

21,720. "Apparatus for electrically bonding rails or the like." E. Vedovelli. Ootober 2nd. (Complete.)

21,735. "Arc lamps." W. R. Ridings. October 3rd.

21,755. "Magneto machines." W. H. Moore. October 3rd.

21,765. "Driving gear for the cam shafts or for the magneto-electric ignition devices of internal-combustion engines and the like." A. H. Burnand. October 3rd. (Complete.)

21,783. "Storage-battery electrodes." H. C. Hubbell. October 3rd. (Complete.)

21,784. "Storage-battery electrodes." H. C. Hubbell. October 3rd. (Complete.)

21,785. "Electric sparking apparatus for internal-combustion engines." Unterburg & Helme (Firm of). (Convention date, October 11th, 1910, Germany.) October 3rd. (Complete.)

21,796. "Self-regulating dynamo-electric generators with variable speed." T. G. S. Rogers. October 3rd.

21,800. "Controllers for electric motors." W. B. Bennett. Ootober 3rd.

21,806. "Electromagnetic reciprocating motors." W. E. Lake. (Dulles-Baldwin Electric Drill Co., United States.) October 3rd. (Complete.)

21,812. "Telephone or like instruments." W. H. Derriman. (Automatic Enunciator Co., United States.) October 3rd. (Complete.)

21,814. "Telephone or like instruments." W. H. Derriman. (Automatic Enunciator Co., United States.) October 3rd. (Complete.)

21,815. "Telephone systems." W. H. Derriman. (Automatic Enunciator Co., United States.) October 3rd. (Complete.)

21,827. "Vapour electric apparatus." P. C. Hewitt. October 3rd.

21,828. "Vapour electric apparatus." P. C. Hewitt. October 3rd.

21,829. "Apparatus for sterilising liquids by ultra-violet rays." A. Helbronner and M. von Recklinghausen. (Divided application on 23,078, May 1st, 1910.) October 3rd. (Complete.)

21,844. "Device for the ordering (by electrical and mechanical means) of refreshments and the like." F. Croft and H. Swaby. October 4th.

21,863. "Railway block telegraph indicator." A. T. Blackall and C. Jacob. October 4th.

21,869. "Vacuum electric retort." A. T. Smith. October 4th.

21,873. "Electrically controlled railway signals and the like." Siemens and Halske Akt-Ges. (Convention date, November 4th, 1910, Germany.) October 4th. (Complete.)

21,881. "Luminous electric devices." L. H. Walter. October 4th.

21,883. "Electrical conductors placed in air tubes." T. Petersen and Anchor Cable Co., Ltd. October 4th.

21,903. "Circuit interruptors." F. W. Harris. (Convention date, October 8th, 1910, United States.) October 4th. (Complete.)

21,904. "Vapour electric apparatus." P. C. Hewitt. October 4th.

21,911. "System of electric advertising." L. S. Thorp. October 4th.

21,913. "Dynamo-electric machines for mine exploding." Sterling Telephone and Electric Co., Ltd. (Schaffler & Co., Austria.) (Addition to 22,648/1907. October 4th. (Complete.)

21,924. "Common battery telephone systems." Aktiebolaget L. M. Ericsson & Co. (Convention date, October 7th, 1910, Sweden.) October 4th. (Complete.)

21,942. "Electric welding machines." British Insulated and Helsby Cables, Ltd., and P. Bucher. (Divided application on 26,478/1910. November 15th.) October 5th.

21,954. "Release attachment for electromagnetic separators." H. G. Richardson. October 5th.

21,967. "Apparatus for recording leakage to earth from electrical conductors." Anderson, Boyes & Co., Ltd., and A. Anderson. October 5th.

21,987. "Insulating compositions." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 5th.

22,001. "Electric cookers." R. Haddan. (Copeman Electric Stove Co., United States.) October 5th. (Complete.)

22,011. "Primary batteries." H. Reynolds. October 6th.

22,021. "Construction of electrically-heated oven." Veritys, Ltd., and A. Fletcher. October 6th. (Complete.)

22,046. "Telephone switchboards." E. S. McLarn. (Convention date, October 7th, 1910, United States.) October 6th. (Complete.)

22,049. "Telephone transmitters." C. E. Egner and J. G. Holmstrom. October 6th. (Complete.)

22,053. "System of alternating magnetic flux applicable to magneto-electr machines and to alternate-current machines." Societe n'Electricit "Nilmelior." (Convention date, October 8th, 1910, France.) October 6t Complete.)

22,068. "Process and machine for making perforated strips with check ir pressions in type, or for electrically translating perforated strips into typ writing." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany October 6th. (Complete.)

22,079. "Means or apparatus for electrically transmitting and receivir messages." A. T. M. Johnson, F. H. Vabley and Johnson Secret Wirele Telegraph and Telephone Testing Syndicate, Ltd. October 6th.

22,094. "Means for adapting electrically or otherwise propelled ro vehicles to run on tramway or like rails." E. Cross. October 7th.

22,098. "Electrical safety railway appliance." G. W. Bowett. Octob 7th.

22,111. "Electrically-heated sad irons." H. J. C. Forrester. (Diamo Electric Co., U.S.) October 7th. (Complete.)

22,123. "Electric signalling apparatus." E. Hermsnorf. (Conventon dat Ootober 19th, 1910, Germany.) October 7th. (Complete.)

22,127. "Systems of electric distribution." British Thomson-Houston C Ltd. (General Electric Co., United States.) October 7th,

22,138. "Couplings for electric conductors." A. J. Buckland. October 7t

22,141. "Electrolytic deposition of metals, particularly upon iron and ste surfaces." P. Marino and Q. Marino. October 7th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtain of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and Liverpool and Bradford ; price, post free, 9d. (in stamps).

1910.

Electric Selective Systems for Operating Printing Telegraphs, Typ Setting Machines, and Similar Devices. C. R. Jones. 14,484. June 15t (Cognate application, No. 21,503 of 1910.)

Process of Producing Metals and Alloys by Smelting in Electr Furnaces. Ampere Ges. and Prof. Dr. E. Müller. 21,603. September 16t

Switches for use with Electrical Heating and other Apparatus. A. Berry. 21,943. September 21st.

Railways or Tramways using a Slot Conduit. A. K. Jack. 22,120. Septemt 23rd.

Coin-Controlled Mechanism for Governing the Supply of Gas Electricity. A. W. Glover and George Glover & Co. 25,172. October 29

Electric Motors and their Application to the Rectification of Alte nating Electric Currents. J. S. Montgomery. 25,385. November 1st

Arrangement for Varying the Tuning of the Receivers of Electric Apparatus for Operating or Stopping a Number of Machines a other Devices from a Distance. C. Wirth and C. Beck. 28,973. Decemt 13th. (Addition to No. 5,811 of 1909.)

Automatic Feed Regulators for Regulating the Voltage of Alternati Currents, Single or Polyphase Circuits. B. P. R. Rucker. 30,0 December 28th.

Apparatus for the Electrical Purification of Gases. J. Y. Johns (Badische Anilin & Soda Fabrik.) 30,194. December 29th.

1911.

Electric Supervision of Railway Points. Siemens Bros. & Co. (Siem and Halske Akt.-Ges.) 774. January 11th.

Method of Hermetically Sealing Electrical Conductors through or in Hard Vitreous Substances. C. B. Burnside. 1,880. January 25th.

Automatic Commutator for Radio-Telegraphic Plants with Indire Excitation. E. Girardeau. 3,946. February 16th. (July 30th, 1910.)

Electric Illuminating Bonies. G. Weissmann. 3,950. February 16 (February 17th, 1910.)

Electric Switches. G. S. Weymouth. 4,922. February 27th.

Reversing Switch for Electric Hub-Motors for Automobile Vehicl V. Harborn. 5,871. March 8th. (March 12th, 1910.)

Apparatus for Transforming Continuous Currents into Alternati Currents. Ozonair, Ltd., and E. L. Joseph. 7,295. March 23rd.

Arrangement for Producing Slightly Damped Electric Oscillatio B. Macku. 8,524. April 5th. (May 2nd, 1910.)

Arrangement for Producing Slightly Damped Electric Oscillatio Ges. für Drahtlose Telegraphie. 8,712. April 7th. (November 2nd, 1910

Hot-Wire Electric Measuring Instruments. Hartmann & Braun Akt.-G 10,056. April 25th. (June 3rd, 1910.)

Method of Mounting, Receiving and Transmitting Apparatus in Rad Telegraphic Stations. E. Girardeau. 11,999. May 18th. (May 28th, 191

Automatic Electric Switches. R. F. Venner and R. C. Griesbach. 13,1 May 31st.

Method of Using Electric Batteries for Supplying Lamps. Chemisc Fabrik Griesheim-Elektron. 15,447. July 3rd. (August 2nd, 1910.)

Exhibition at Rugby.—Messrs. Linnell & Son, Lt electrical engineers, Rugby, are arranging an electrical exhibiti at the Municipal Buildings under the direct patronage of the U.D. Electricity Supply Committee. It is to be held on November 9t 10th, 11th ; the buildings have been taken for a week, a special terms regarding free space, &c., are being made with firn who desire to exhibit and to keep their manufactures distinct.

Case of Fraud.—Archibald Bryce was, at Paisl Sheriff Court, on Friday last, charged with having furnish the Clyde Valley Electrical Power Co. with fraudulent tin sheets while acting as the company's district engineer Barrhead, and appropriating to his own use seven weel payments amounting to £8 2s. 2d. Sheriff Lyall pass sentence of two months' imprisonment.

THE
ELECTRICAL REVIEW.

VOL. LXIX. OCTOBER 27, 1911. No. 1,770.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

PUBLICITY.

THE activity of the gas interests in devising methods for business getting should stimulate the commercial management of electricity supply companies, which is far from perfect. They leave no stone unturned to effect their object, and their latest move was to hold a meeting on Thursday, 12th inst., to inaugurate the "British Commercial Gas Association."

The gas interests desire not only to extend their business, but to preserve that which they have—both very difficult to achieve in the face of the formidable competition of electricity. The contest between the two systems is so nnequal, owing to the great superiority of the electric current for lighting and power, that it is purely a question of good commercial management as to the rapidity with which the change over will be accomplished.

There will always be a certain percentage of the residents and manufacturers who will lag behind the rest in making changes: this is due to special circumstances. Occupants of houses under short terms of tenancy decline to go to the expense of wiring and fitting their premises; the innate conservatism of others, who lose all the benefits of improved conditions, and the cost in factories of scrapping the obsolete machinery—these are the conditions favouring the systems in possession. But the ultimate result is a foregone conclusion; in fact, as one of our contemporaries has put it, the weapons in competition are like a magazine rifle against a muzzle loader.

Meanwhile, it is essentially important that the commercial management of electricity supply companies should be thoroughly efficient and under the control of business, as distinguished from technical, men, whose attention must be concentrated upon the important work of securing new and profitable consumers of energy.

The programme of the British Commercial Gas Association covers most of the ordinary methods of pushing business known by the generic term "Publicity"—such as the use of the newspaper press for direct and indirect advertising—the education of the public by exhibitions, lectures, publications, and canvassing.

The organisation is based upon a comprehensive publicity and propagandist system, supported by the gas interests throughout the country, with ample capital provided by the companies. A map published in the *Journal of Gas Lighting* shows the amounts already subscribed, the United Kingdom being divided into areas, and the present contributors in each division shown by dots. The amount subscribed up to October 17th was £10,635, a sum far below the estimated requirements of the new Association, which

Mr. H. J. Yates, chairman of the Society of British Gas Industries, considers ought to be £25,000 to start with.

Is it not time that the electricity supply industry took a leaf out of their competitors' book, and by a vigorous effort dealt with the "Publicity" or "Business-getting" organisations in a much more satisfactory manner than at present?

The suggestion of the promoters of the new Gas Association is the formation of a Committee consisting of district representatives, in order, by interchange of information, to pool the local experience for the benefit of all the members of the Association.

The electrical industry, like that of the gas suppliers, is divided between private companies and the municipal authorities, with the complication of several Town Councils undertaking both the gas and electricity supply in competition with each other.

For the whole electrical industry to be combined in one great organisation such as the gas people propose would be unnecessary and impracticable, but there is no reason why companies and Corporations should not form these business-getting associations in districts, or by the combination of suppliers dealing with similar classes of consumers.

The leading spirit in organising and managing the commercial business should be selected from those who have had the longest and widest experience in connection with the development of the industry.

Hitherto too much has been imposed upon the local managing engineer in leaving to him business-getting details in addition to the efficient and economical working of the plant for the generation and distribution of the current, as well as the thousand and one technical details connected with the supply and attending to the individual wants of the consumers.

In dealing with this important matter it is not a mere question of appointing canvassers to knock at people's doors and ask if they will change their old lamps for new, or to imitate Sam Slick's system of selling his clocks, nor will the business be procured by the issue of trade circulars, numerous leaflets and *ex parte* statements alone, though these methods are all good in their way.

It has been well said that *a satisfied consumer is the best canvasser*, and where the publications issued to residents on the line of mains contain testimonials from their neighbours, giving their experience of the new system of light, heat and power, more satisfactory results are produced than by any other mode of persuasion.

One reason put forward for establishing the British Commercial Gas Association is "to meet the current of vituperative misrepresentation which the industry was called upon to meet." This is a roundabout way of alluding to the unpalatable facts with which they have to deal in the comparison between electricity and gas as to their relative merits. "Vituperative misrepresentation" indeed! —Surely a strange charge to come from such a quarter!

The many advantages of electricity have to be impressed upon those who have never experienced them, and there is no more efficient way of accomplishing this result than by publishing locally the experience of the users.

The British Commercial Gas Association appears to contemplate an extensive system of advertising in the local Press, and the chairman pointed out that "he knew what £10,000 meant in advertising—it would not go very far."

Now, what is of still greater importance is to secure the interest of the Press in every locality, by giving it t opportunity of testing the merits of the claims made by t competing systems, especially in relation to the pub lighting of the towns, which concerns every resident. T Press is always ready to publish such facts as can verify for the general information of its readers. is of great importance that in all publicity arrangements t fullest use of the channels of information offered by t local newspaper should be made.

Imperial Cables.

The Imperial Cable position was d cussed at some length by a correspond in the *Morning Post* of October 12 We learn from him that the object of the Imperial Pr Conference of 1909 was to bring about a reduction of ra across the Atlantic, but after the lapse of almost three ye its attainment appears as remote as ever, and Canada the interim has seceded from the agitation for an Atla cable, and is still awaiting the results of efforts made the British Government.

The small reduction of the Press rate made by the Pac Cable Board has been of no use to Canada and South Afr but has resulted in inducing Press cables, described as of grotesquely parodying British and European news, from Pacific Coast of America at 3d. per word, as against 9d. word from London. Setting aside the injury to Impe solidarity, speedy business and social intercommunication, effect of dear Press cables is to enforce a starved Impe service to and from the overseas Dominions, prevent passage of great speeches and comment on Imperial affa and substitute a record of sport and catastrophe upon wh the Press depends; and, finally, Canada and Australia rely largely on the United States Press agencies. We gather f the rest of the article that reforms are required as follows (1) a guarantee against injurious monopolies obtaining con of cable companies and preventing free competition; (2) a P rate for ordinary news as cheap as traffic warrants; (3 special rate for Imperial news—*i.e.*, reports of Parliame of political speeches and statements, of political Press c ments—the rate for these to fall below the remunera level to encourage their transmission. An effective rem for the evils, the correspondent further states, is a syste either State-owned or State-controlled cables, the arteric Imperial life to be under Government guardianship; then he discusses questions as to absolute or company ow ship under control, and the subsidising of overseas newspa to print more cables, concluding with the statement it would be a startlingly unexpected development i public department were found fit for doing journalistic w requiring the highest skill.

Dealing with these points in order: (1) A guara against monopolies, in view of the process of handing ove foreign management all the British cables now being car out, cannot be made, competition is materially lessened, inadequate measures for control have been taken. (2) control of rates is now practically in the United States, it will naturally be used by and for themselves. (3) T will be no need for the foreign managers to pose as Bri Imperialists, as they have command of all the traffic, will not fill the cables unless they choose. Finally, think it is quite time that the Empire Press Union sh fully recognise that the only way to secure contro anything is by complete ownership, and that this ob must be continuously worked for.

The *Colonial Office Journal* of October also contains article dealing with this subject. It states that there is a of logic in the idea that the Government service shoul carried out from end to end, especially if the Atla cables come under American control. At a sec general meeting of the Anglo Co. on October 16th the l was ratified, and this settles this question.

The journal, however, rather weakens its position by sta that as all the foreign companies are interested in the co tion of traffic for the Pacific line, this would be adve affected if the Governments invaded the Atlantic fiel

itting down a line of their own, and the amount of business e Pacific cable would secure would be small, unremunera-ve and difficult to collect in Canada and the United States, the face of the strong combination between the cable and ndline organisations. We join issue with these conclusions. ne foreign companies would remain allies for the simple ason that if they did not collect for the Pacific cable in rope they would lose Australasian traffic entirely, and if they t Canadian and American traffic *via* Europe, it would be rcharged 1s. per word more. With regard to the amount support which could be obtained for an Atlantic cable—all e present ones being pretty well employed—and the absence collecting offices and other facilities, these questions would st be left to a business man, who would be as likely to ake the undertaking remunerative as a private company.

The West India Committee's circular of October 10th ates that their secretary has been assured by Mr. Borden at the Dominion Government appreciates the importance adequate telegraphic facilities between Canada and the est Indies. Perhaps some day the improvement agitated so long may come about.

Co-Partnership and Labour Unrest.

We have been favoured with an advance copy of a "pronouncement" signed by some of the leading employers of labour and others who are authorities on indus-al economics. The pronouncement is by way of an appeal all who are connected with the nation's industry, either as rkers or employers, for the recognition of the principle of -partnership. The signatories point out that a system ich divides those who are engaged in the necessary work producing wealth into two armies, usually in a state armed neutrality towards one another, can never be tisfactory.

In its simplest form, co-partnership of labour and capital volves (quoting from the circular) :—

"1. That the worker should receive, in addition to the ndard wages of the trade, some share in the final profit of e business or the economy of production.

"2. That the worker should accumulate his share of ofit, or part thereof, in the capital of the business em-oying him, thus gaining the ordinary rights and responsi-ities of a shareholder.

"Co-partnership assumes a standard wage before there n be any talk of profit to divide.

"A standard wage assumes organisation to maintain it and raise it. It assumes reasonable forms of trade unionism, llective bargaining, and the meeting of capital and labour on equal terms. Organisation of both employers and ployed, with conciliation machinery to fall back upon ien outstanding differences remain, we regard as necessary the interests alike of labour, capital and the community a whole."

It is not, however, considered that such organisation is fficient in itself, as the conflict of interest still remains o acute. A narrow-minded employer might still believe at every gain to labour is filched from his profits, and the rkman on his part might be equally imbued with the idea at every improvement in profit is filched from his wages. is essential to introduce some measure of unmistakeable mmon interest, and this is to some extent met by the pro-sion of benefits for old age, which may either take the rm of a lump sum payment or the payment of a weekly m.

There are already in existence a large number of works rried out on co-partnership principles, the most successful ing those connected with the gas industry. It is some years since the system was first adopted by the South etropolitan Gas Co., and the success of the system induced her companies to follow their example, with the result that the present time the workers in the three London gas mpanies have accumulated nearly £600,000 capital in the rks in which they are employed. Furthermore, the co-rtnership undertakings now control more than half the pital which is invested in the gas companies in England. is worth while to consider whether or not the successful sults which have followed the adoption of the co-partner-ship principle in the production and distribution of gas could not be equally secured in the production and distribution of electricity. There is no obvious reason why they should not.

Whilst agreeing generally with the views set out in the memorandum, we consider that the greatest hindrance at present to the development of the co-partnership principle in manufacturing industries is the antagonistic attitude maintained by the officials of the large Trade Unions towards it. Many of them have bitterly opposed every attempt to introduce co-partnership methods into existing works, and the hostile criticism of the Furness scheme, which was given a trial by the men against the wishes of their leaders, is still fresh in the minds of our readers and of the public.

The Johannesburg Failure.

Elsewhere in this issue we give a full account, derived from an authoritative source, of the circumstances which led up to the erection of a gas-driven power station at Johannesburg, and the disastrous fate of that unfortunate installation. As our readers will remember, the contractors, after a period of strenuous efforts to complete the plant and to fulfil their obligations, finally abandoned the attempt in 1906; the usual litigation followed, and has dragged its weary length through the past five years, ending a few weeks ago in a judgment entirely favourable to the Corporation of Johannesburg.

We cannot recall a parallel to this remarkable episode in the whole history of power station engineering. The financial interests at stake were of the first magnitude; the scheme was conceived in a spirit of bold but confident enterprise, and failed only in respect of the power station; and there can be little doubt that had it proved successful, the employment of the large gas engine fed with producer gas for the generation of electrical energy would have received an immense impetus—whereas in fact it undoubtedly sustained a crushing blow.

It is difficult in so involved a problem to single out any one feature to which can be attributed the failure of the scheme. It must be granted that accident played a large part in the succession of reverses met with by the contractors, such as the death of their expert, the loss of part of the plant by shipwreck, the explosion in one of the blowers, and so on. Mature consideration of the circumstances, however, has led us to the conclusion that the fundamental and all-pervading factor to which was due the inevitable result was simply lack of experience.

It is a fact well known to those who have "gone through the mill" that the purchase of a licence, together with drawings and specifications, by no means conveys to the licensees the accumulated knowledge and experience of the original inventors. Of this fact we have seen not a few notorious examples of late years, in connection with the manufacture of steam turbines, and of large gas engines to Continental designs, and several engineering firms have burnt their fingers more or less severely. In the present instance the use of producer gas on an enormous scale was a practically untried feature; at the time of the execution of the contract, we believe there was not a single installation in Europe of large gas engines fed solely by producer gas. Hence, just as the earlier blast-furnace gas plants suffered from troubles due to the lack of any cleaning plant at all, so the Johannesburg gas engines suffered from the inadequate provision of cleaning plant to deal with the exceptionally tarry gas supplied by the producers; and when the cleaning plant was provided, it suffered from defects which were never rectified sufficiently to enable the plant to run with satisfaction.

The root of the trouble, both in the administration of this large contract under unique conditions as regards the remote situation and inaccessibility of the installation, and in its execution under equally unique conditions connected with its technical features, was lack of experience. It was too big a departure from the known and beaten track. We have no doubt whatever that, given sufficient time and money, the undertaking could have been brought to a successful issue, and it was most unfortunate that circumstances prevented the attainment of that result.

THE ELECTRICAL AND GENERAL ENGINEERING EXHIBITS AT THE TURIN EXHIBITION.

[BY OUR SPECIAL COMMISSIONER.]

In view of the importance of bringing it about that British engineering exhibits should on future occasions be better than was the case at Turin, a brief recital of the facilities offered by the Board of Trade to exhibitors at this Exhibition will indicate how valuable they are, and how little real trouble is occasioned to exhibitors. These facilities were widely recognised by other than the engineering industries, whose displays evoked universal praise and admiration. The activities of the Board of Trade in organising the Exhibition commenced with a circular about the Exhibition in general and the commanding site secured for the British Section. The Board then proceeded to set out arrangements as to—

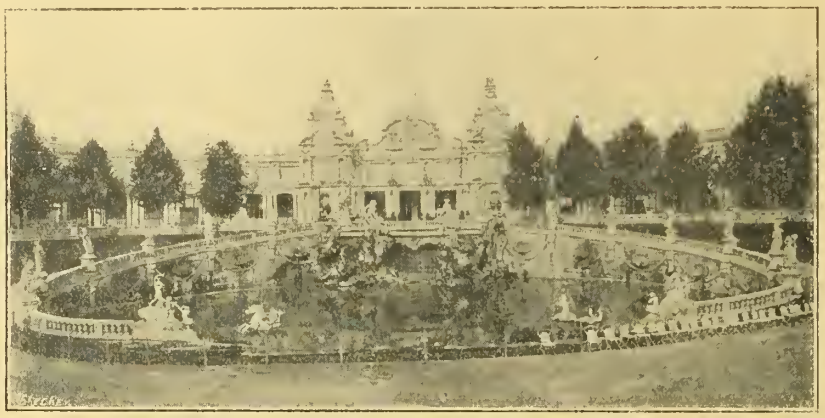


Photo. by] [Argent Archer.

Turin Exhibition: Exterior of British Section.

1. *Transport Facilities.*—While full rates were charged on the outward journey, the return journey is free of charge. Special lines were laid down connecting the railway stations with the Exhibition. Substantial rebates were secured from the steamship companies.

2. *Customs Formalities.*—Exhibitors' goods were transmitted in bond to the Exhibition. No duties are levied on goods re-exported at the close of the Exhibition.

3. *Installation of Exhibits.*— The handling of exhibitors' goods within the Exhibition was undertaken without further charge beyond that made for space occupied, such services including taking delivery of packages at the Exhibition, unloading and placing on the space or stand allotted, removal, storage and return of empty packing case, and reloading at the close of the exhibition.

4. *Show Cases and Stands.*—The charge made for space allotted covered show cases, platforms and railings, and the fixing, free of charge, of exhibitors' names on the upper panels of showcases. Internal fittings were supplied by the exhibitors themselves. As uniformity in this respect was desirable, approval of these was insisted on, but exhibitors were able to purchase materials to certain standard patterns at cost price.

5. *Motive Power, Lighting and Water Supply.*—In order to make the display as effective as possible, the Royal Commission made arrangements for the supply of gas, steam and electricity when used for showing machinery producing finished articles or illustrating manufacturing processes, at the special reduced prices of gas at 2s. 6d. per 1,000 cb. ft., electricity at 2d. per unit, and steam at 176 lb. pressure superheated to 280° C. at the boilers at 3½d. per 100 lb. For lighting purposes gas was charged at 3s. 6d. per 1,000 cb. ft., and electricity at 4d. per unit.

So much for the special facilities, which so many British engineering firms disregarded. The British Section had the great merit of having practically its entire exhibit concentrated at one place. The situation was fairly central, and the position a commanding one. A quadrant frontage, some 500 ft. in length, surmounted by a large central dome and flanked at each end by smaller domes, gave access to the 220,000 sq. ft. given to the British Section. This, and the interior of the British Pavilion, are illustrated herewith.

The supply of light and power to the British Section was effected by D.C. generators belt driven from internal combustion engines. The gas producers were placed outside the Machinery Hall of the British Section.

Power Plant.—The duties of supplying power to the British Section were divided between Messrs. Richard Hornsby & Sons, Ltd., of Grantham, and Messrs. The Campbell Gas Engine Co., Ltd., of Halifax. Each firm had its own installation of suction gas producers situated on some vacant ground immediately at the back of the section. The Campbell Gas Engine Co.'s equipment included one horizontal suction gas engine rated at 120 B.H.P. (maximum) running at 160 R.P.M., driving an 80-KW. Phœnix dynamo through a laminated leather belt. The engine is throttle-governed. The other set supplying light and power to the section consisted of a four-cylinder vertical engine rated at 150 B.H.P. (maximum) running at 300 R.P.M., direct-coupled to a 100-KW. Phœnix dynamo. This type of engine has been specially designed for small station work. Forced lubrication is employed for the main bearings.

A small but useful starting set is shown, comprising a Campbell 4½-B.H.P. lampless oil engine direct coupled to an air compressor which delivers air at 200 lb. per sq. in. into a steel receiver. Each engine, of course, has its air starting valve.



Photo, by] [Argent Archer.

Interior of Machinery Hall, in the British Section.

There was also exhibited a larger four-cylinder (290 B.H.P.) vertical engine similar to the 150-B.H.P. engine.

The suction gas producers for these engines are of the Campbell Gas Engine Co.'s latest type, and are specially designed for working with inferior fuel such as anthracite peas or coke breeze. The producer is arranged so that the ashes and clinker can be removed at any time during the production of gas without stopping the engine. The hearth is entirely open, so that the condition of the fire can be inspected without any trouble.

Messrs. Hornsby & Sons' installation comprised two horizontal 100-H.P. suction gas engines running

30 R.P.M., and driving Lancashire Dynamo and Motor Co.'s enerators. These engines govern partly by variation of the uantity of the charge and partly by variation of the quality. 'he makers claim for this a high efficiency at light loads. ompressed-air for starting from a receiver is installed, the air ompressor which charges the receiver being driven by a small etrol engine. Messrs. Hornsby's producers are designed for orking on anthracite, coke or charcoal. The fire-grate has s bars so arranged that they can be rocked to and fro to ee the fire from clinker.

The control of the generators and distribution to the arious circuits is effected by Messrs. Reyrolle & Co.'s main witchboard, illustrated in our issue of October 6th.

The board consists of 10 panels in all, comprising five enerator panels, two power distribution panels, and three ghting distribution panels.

Panels Nos. 1 to 5 control 150-KW., 75-KW., 75-KW., 0-KW., and 60-KW. generators respectively, No. 1 panel eing fitted with 800-ampere circuit-breakers and fuses, and ie remaining four with 400-ampere circuit-breakers and ises. The equalising switch is of the same capacity, and oltmeter, ammeter, shunt breaking switch, and shunt heostat handwheel are also fitted.

One of the power panels is fitted with two 500-ampere rcuit-breakers, one double-pole 500-ampere fuse, and an mmeter reading to 600 amperes, and the lower half of this panel devoted to a recording voltmeter and recording ammeter. he other power panel is similarly equipped except that the

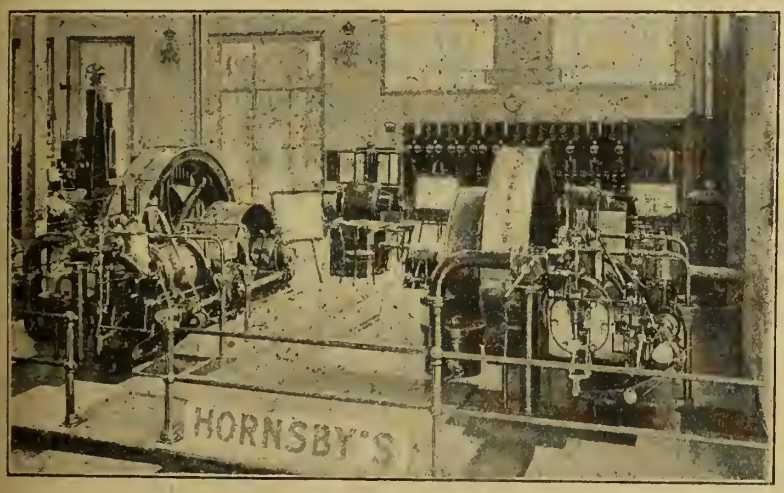


Photo. by] [ARGENT ARCHER.

ELECTRIC GENERATING PLANT IN THE BRITISH SECTION.

wer half is devoted to four 50-ampere lighting circuits, uble-pole switches and fuses being provided.

One of the lighting panels is fitted with an overload 800-mpere D.P. circuit-breaker, with ammeter and D.P. switch similar capacity. Another of the lighting panels is milarly equipped, and the third has fuses in place of rcuit-breakers and a ground detector in place of the mmeters. The lower portion of each of the lighting panels equipped with switches and fuses for four D.P. circuits.

An illuminated voltmeter on a swing frame is fixed at one id of the board for paralleling, and illuminating lamps are aced along the top at regular intervals. The connections the back are made by means of copper strips of very mple section, and on every part of the board all joints which rry current are carefully scraped to fit.

The board is surmounted by a handsome wrought-iron roll carrying a large eight-day clock and name-plate.

Beside the switchboard platform, Messrs. A. Reyrolle and o. are also exhibiting a handsome swing frame containing 4 large photographs of their works and their leading manu-ctures.

From the point of view of the visitor to the Exhibition, it as, perhaps, regrettable that the switchboard was placed gainst an end wall of the building at right-angles to the ath followed by visitors. It would have been more striking space considerations had permitted its directly facing the ectator.

On the general engineering side, mention must be made internal combustion engines of various sizes and types. Messrs. Blackstone & Co., Ltd., showed a 25-H.P. stationary engine for working on crude oil, and smaller engines requiring refined petroleum. The National Gas Engine Co., of Ashton-under-Lyne, exhibited a 36-H.P. suction gas engine with its producer, and four oil engines ranging in horse-power from 3 to 22.

Agricultural engines were in strong evidence with handsome exhibition finish. The leading makers, such as Messrs. Clayton & Shuttleworth, Messrs. Marshall, Sons & Co., Messrs. J. & H. McLaren, and Messrs. Ruston, Proctor and Co., Ltd., sent characteristic types.

In regard to the auxiliary features of power station supply, many familiar items were in evidence—such as Messrs. E. Green & Son's economiser, and Holden & Brooke's injectors, steam traps, feed water-heaters, centrifugal pumps and liquid meters for various fluids. Boiler and steam pipe coverings were shown by Messrs. Wm. Kenyon & Sons, Ltd. Messrs. Reavell & Co. showed several of their patent air compressors, one in operation, pneumatic hoists, and high-speed steam and oil engines, the steam engine being in operation. The Underfeed Stoker Co., Ltd., displayed a duplicate of the mechanical stoker which was in operation under the Tosi boilers in the Exhibition main generating station.

In regard to machine tools, special mention must be made of the excellent displays by Messrs. Alfred Herbert, Ltd., and by Messrs. Hulse & Co. The former showed in operation a complete equipment of automatic and semi-automatic labour-saving machine tools, including screw-cutting machines and turret lathes. Drilling and milling machines were displayed as well as tool and cutter grinding machines, and also an automatic bevel-gear cutting machine. The latter exhibited a three-spindle motor-driven universal horizontal drilling, boring, tapping, studding, and milling machine, also a horizontal straight milling machine of the planer type, together with various other milling and shaping machines. These two stands were in every way creditable to British manufactures. Tools, tool steels and wood-working machines were also shown.

Returning to matters of a more immediately electrical nature, reference must be made to what can only be regarded as akin to a species of overflow from Olympia. Small in extent, and inferior to the home exhibition which has made large demands on our manufacturers, we can only regard the collection in Classes 28, 29 and 30 (respectively the generation and distribution of electricity, the mechanical application of electricity, and electric lighting), considered as a national example, as a pettifogging display. In saying this, one obviously excepts the round dozen of individual British firms exhibiting under these sections, to whom all credit is due for their courage. Naturally, there was nothing startling; small Crypto motors, Morganite and kindred brushes, Muirhead rectifiers and automatic transformer switches, Venner time switches, Westinghouse-Cooper Hewitt mercury rectifiers for D.C. flame arc lamp circuits, Nalder instruments, and Reason meters and demand indicators with measuring instruments and fuse boxes are familiar enough to us, and are likely to appeal to a small class of Exhibition patrons.

At every turn one felt disappointed and discouraged by the fewness of the electrical firms exhibiting. Individually, the small collection of British exhibits is of apparatus intrinsically good, and often very good. If British electrical firms, as a whole, are to secure a better footing on the Continent, it can only be by a concerted display organised by some central body and supported by the industry as a whole.

What can be done in scientific matters alone is well exemplified by two of the organised exhibits of the British Section, namely, the Chemical Laboratory and the Physical Laboratory. In the former is found all the equipment of a complete chemical laboratory fitted alike for the routine of works industrial practice, or for specialised research. It

was a splendid assertion of national capability and resource, and a justified declaration that Great Britain was able to challenge the supremacy of Teutonic manufacturers in this field. Compared with this, the scattered examples of chemical laboratory apparatus and reagents displayed by all other countries in the Turin Exhibition suggested rather the contrast between the universal provider selling miscellaneous commodities in a country village and his rival in a large city.

Yet of greater interest to our readers, and indicating the value of an organised exhibit, was the physical laboratory. Perhaps electro-physical would have been a better title, for most of the apparatus was of an electrical nature, and many instruments of a purely physical character were to be found in adjoining show cases. The special "Catalogue des Instrnments Mathématiques et Scientifiques" issued by the Exhibitions Branch of the Board of Trade is well worth its small cost, and a permanent position on an engineer's book shelf. For the organisation of the laboratory itself we are indebted to Dr. Glazebrook and the National Physical Laboratory, and to two very strong committees for the organisation of the displays respectively of scientific and chemical instruments. Within the physical laboratory were to be found an Ayrton-Mather galvanometer by Baird & Tatlock; a Duddell oscillograph (with all accessories for use on a 50,000-volt circuit), a Callender pyrometer, and an Einthoven galvanometer by the Cambridge Scientific Instrument Co.; and an Irwin Oscillograph, by Robert W. Paul. Outside in show cases there was much deserving of mention, in the way of microscopes, spectroscopes, Weston cells, theodolites and pyrometers. Space alone prevents our dealing in detail with these.

Organised exhibits of industrial sections can be the only effective manner of doing justice to British potentialities. This was done in the case of the Bradford woollen industry, and in that of automobiles; surely it should not be beyond the range of British efforts to do the same for our electrical manufacturers when the next International Exhibition comes along.

JOHANNESBURG GAS PLANT.

In our issue of the 13th inst. we reported the judgment by Lord Ormidale in the action brought by the Johannesburg Council against Messrs. D. Stewart & Co. and Mr. William Beardmore. A considerable time has elapsed between the events leading up to this action and the judgment just announced, due in large measure to the intricacy of the case. It may be of interest to our readers to recall briefly the history of this matter.

About the middle of 1902, on the conclusion of the South African war, the Municipal Council of Johannesburg instructed a London firm of consulting engineers to report to them on the reorganisation of the electric lighting and power supply, and the electrification and extension of the tramways. The electric supply station then in existence had grown up gradually during a number of years and had become quite inadequate to the demands of the town, and still more so to the greatly increased demands which were anticipated due to the development which was expected to follow the conclusion of the war.

The consulting engineers visited Johannesburg at the end of 1902 and beginning of 1903, and presented a detailed report, recommending the establishment of a new generating station, supplying both lighting and tramways, with a distributing network in the town and suburbs for light and power, and a completely new tramway system, amounting to about 15 miles of track, and the removal of the old narrow-gauge horse tramway.

The choice of motive power for the generating station was discussed in the report, the comparative advantages of gas and steam plants being considered at some length. An important consideration in the comparison was the high cost of water in Johannesburg, amounting to 3s. 6d. per 1,000 gallons.

The coal available was all of a bituminous character. Those samples which were sent home and subjected to preliminary tests with a view to ascertaining its suitability for producer work, showed satisfactory results. The report showed that while the capital cost of a gas plant would be somewhat larger than that of a steam-driven plant, the total cost of energy, including capital charges, would be lower with the gas-driven plant, the adoption of which was recommended, subject to satisfactory bulk tests of the coal for gas-producer work, and subject also to unusually stringent guarantees.

It was afterwards found in actual practice that the cost of the coal was more than covered by the value of the tar recovered. This was used in large quantities by the municipality itself for spraying roads, and, when not produced by the power plant, had to be imported at a very high cost.

The report came in for a good deal of criticism. The energy required was said to be greatly over-estimated, and the estimated cost was declared to be too low. Similar criticisms were made on the tramway proposals. Subsequent experience, however, justified the estimated figures.

Early in 1903 the Council instructed the consulting engineers to proceed to carry out the recommendations contained in their report, and specifications were issued for various parts of the plant.

The specification for generating plant issued in September 1903, invited alternative tenders for gas and for steam plant and for both classes of plant it aimed at obtaining definite results rather than defining details of design. Thus in the case of the gas-producer plant, it defined the quantity of coal to be gasified and required that the cleaning plant should be such that the resulting gas should contain no more than one ounce of dust in 20,000 cb. ft., while the tenderers were asked to state and guarantee the analysis of gas produced and the calorific value per cubic foot and per pound of coal gasified.

With regard to the producers and cleaning plant, the specification contained as a suggestion, a fully worked out general arrangement, particulars of the units required, also a good deal of detail regarding coal handling and other auxiliary plant. Similarly, with regard to the gas engine detail of construction was left open, so as to make it possible for the various standard designs to be included in tenders by the respective makers, tenderers being required to state and guarantee the efficiencies obtainable under various conditions of load.

To meet the possibility of separate contractors being employed for the producer plant and the engine plant, the cleanness of gas required in the producer specification was defined as one of the conditions available in the engine specification. The electrical sections of the specifications were on similar lines. In the case of all guaranteed data a scale was defined imposing a deduction on the one hand for failure to fulfil the guarantees, and on the other hand giving a bonus for the attainment of results better than the guarantee. Corresponding conditions as to consumption were defined for the alternative tenders for steam plant.

For gas-producer plant, five different makers submitted tenders, and 12 different manufacturers tendered for gas engine plant with electrical machinery. Tenders for steam plant were received from 16 different firms. With regard to the latter, it is noteworthy that the tenderers for steam turbine plant contemplated driving only the alternators by turbines, the development of the direct-current generator for the speed required in turbine work not being at that date sufficiently advanced.

In the report on the tenders submitted by the consulting engineers and considered by the Municipal Council in March 1904, the most advantageous tender for steam plant was shown to involve a capital expenditure of about £28,000 less than the most advantageous tender for gas plant, but the comparison of working expenses based on the tenderers' guaranteed consumption, with the liberal margin of 50 per cent. for actual working conditions, showed a difference in favour of the gas scheme of over £15,000 per annum.

During the period allowed for the preparation of tenders Transvaal coal in considerable quantity had been placed at the disposal of tenderers and approved—a leading maker of gas producers described it as an ideal coal for gas production. The Council decided to accept the lowest tender, that of Messrs. Poetter & Co., of Dortmund, for gas-producer plant, to be manufactured in Great Britain to their design, and of Messrs. Siemens Bros. & Co., Ltd., for electric generating plant, with Oechelhauser gas engines manufactured by Messrs. D. Stewart & Co., Ltd., of Glasgow. Fr

nwin, to whom the matter had been referred for an dependent opinion, concurred in the recommendation of e consulting engineers.

In the course of subsequent negotiations, it was arranged at Messrs. D. Stewart & Co. should themselves be main ntractors for the whole plant, including producers, gas gines and electrical machinery, while Mr. William and . Joseph Beardmore undertook to act as sureties for half value of the contract, as required by the general nditions. Messrs. D. Stewart & Co., before agreeing to take r Messrs. Poetter & Co.'s tender, made close investigations to the suitability of the plant included therein, availing mselves of the experience in gas plant of the firm Messrs. William Beardmore & Co., with whom they re closely allied. The producer work was subsequently ried out by Messrs. Beardmore and Co. in their ious works, in which they had numerous large pro-ers in use making gas from bituminous coal not very ike the Transvaal coal, this gas being used partly steel making and partly for driving large gas engines of ilar type to those included in the tender.

It was arranged that one producer, with cleaning plant, uld be erected and tested in those works with Transvaal l, of which a considerable quantity was brought over for t purpose.

In April, 1905, the first producer was erected at Messrs. rdmore's works at Dalmuir, and tested both with Scotch l Transvaal coal. It was then found that the anticipa-ns of the consulting engineers regarding the inadequacy he cleaning plant was justified, and that further cleaning aratus would be necessary. The consulting engineers l already insisted that provision should be made in the -out of the piping for the addition of cleaning fans, if essary.

n the discussion of the type of fan to be adopted, it was rted by the contractors that the fans manufactured by ssrs. Crossley Bros. could not be bought independently of ir complete gas plant, but this statement was not borne by the evidence. Finally, fans of the design of Mr. ersedge with vertical shaft were adopted, but it was found test that the contractors had greatly under-estimated the er required to drive them and there was great delay in ing new motors.

Meanwhile, during the latter half of 1905, shipment of erial to Johannesburg had been proceeding and the tion had been taken in hand. At the very outset of the k at Johannesburg, the contractors suffered the serious loss heir erecting engineer, Mr. Sinclair, who, after having had rge of the designing in the Glasgow works, had gone out represent them in Johannesburg. He died, after only a days' illness, and there is little doubt that his loss con-uted in no small degree to the unsatisfactory result of contract. He was never adequately replaced. A minor hap was the loss of a steamer carrying parts of several of engines and producers, which, though of course replaced, olved vexatious delays and confusion.

In April, 1906, the first producers were fired, and in May first of the gas engines was ready to run. The con-tors' representative was now faced with a dilemma. contract time for setting to work—October, 1905 ad been long exceeded, the public were becoming atient at the delay in working the electric tram-s and the new light and power services, which had n completed. On the other hand, the delays in provision of cleaning fans, which have been ribed above, involved the risk that, in starting up plant, dirty gas would be supplied to the engines most injurious results. After consideration of matter, it was believed by the contractors that for the paratively small amount of gas required at first, the bbers which were already in place would clean the gas iciently, and in May, 1906, the contractors elected to t the first engine, which was run for public service on 22nd of that month. The arrangement was that the tractors were to get the engines into running order, and n to submit them to test by the consulting engineers.

Unfortunately, it was found that the cleaning of the gas by the scrubbers was insufficient, and as further engines were started and put into service, the inadequacy of the cleaning of the gas became more and more marked. The cleaning fans, even when erected with their larger motors, were found to be mechanically unsatisfactory, owing to vibration, leading to frequent breakdowns and a return to the dirty gas conditions. While the minor troubles which might be expected in the starting up of a plant of such magnitude—such as lubrication and ignition troubles—were being gradually eliminated during June and July, fresh troubles, due to the dirtiness of the gas, were gradually accumulating. The erecting staff of the contractors was largely occupied in "nursing" the engines taken into service, thus delaying the completion of the rest of the plant, while some difficulty arose through the division of responsibility between the contractors and the municipality's staff who were running the engines for the public service.

In September, 1906, Mr. W. D. Bell, the contractors' managing director, visited Johannesburg, and entered into negotiations, as a result of which, in November, 1906, a new contract was entered into. The contractors undertook to run the plant on behalf of the municipality for 12 months, taking entire charge of the station, and supplying energy at a certain rate per unit. New times of completion were defined within which the contractors were to get the plant into fit condition for the tests defined in the original contract.

It was hoped on all sides that, with the signing of this running contract, the end of the troubles was in sight. The cleaning plant, however, was still unsatisfactory, and as a result the condition of the engines went from bad to worse. It is probably not too much to say that, with the exception of minor troubles at starting up, all the troubles experienced with the engines were due to the presence of tar in the gas.

At the end of March, 1906, an explosion occurred in one of the blowers supplying air to the producers. Four blowers had been specified—all driven electrically—and their switching arrangements allowed them to be driven, either from the traction or lighting bus-bars of the main switchboard, from an independent steam plant in the old town lighting station, or from a small steam plant at the refuse destructor works a short distance away. It would be thought that with four different sources of energy for the blowers, it would have been possible for the contractors to keep them going continuously, but on the evening of March 28th the blowers were accidentally stopped, owing to the mistake of a switchboard attendant, the gas diffused from the producers to the air pipes, producing an explosive mixture, which was fired, either by a spark in the blower house or by the producer fires, wrecking one blower, damaging the producer house and injuring one of the attendants.

The contractors have attributed a large part of their troubles to the fact that the blowers were electrically-driven, but readers of the Electrical Review do not need to be convinced that an electrical drive in itself is quite as trustworthy as a steam drive, and the number of different sources of energy mentioned above show that it should have been possible to keep pressure constantly on the air pipes. The contractors had, from the first, had the opportunity to propose other arrangements if they wished to do so.

During the months of March and April, 1906, the contractors were in a serious financial position. The payments for energy supplied under the running contract were largely counterbalanced by the penalties incurred for interruptions to supply and the contractors' representative in Johannesburg was left almost without resources; indeed, in April, 1906, he wrote to his principals that the municipality was keeping them going. Finally, on May 15th, the contractors threw up the contract on the ground that they were at the end of their resources.

The subsequent history of the contract is a legal, rather than an engineering matter. There is no doubt that the failure of this contract has had a most prejudicial effect on the development of large gas engine and producer plants. Yet we think we have said enough to show that, properly regarded, it is in no sense a proof of the unsuitability of large gas engines using producer gas for the public supply of electrical energy. The proper cleaning of the gas required by the specification, as originally issued, and on the provision of which the consulting engineers, Messrs. Mordey and Dawbarn, had insisted at a very early stage, would have reduced the difficulties experienced in the setting to work of

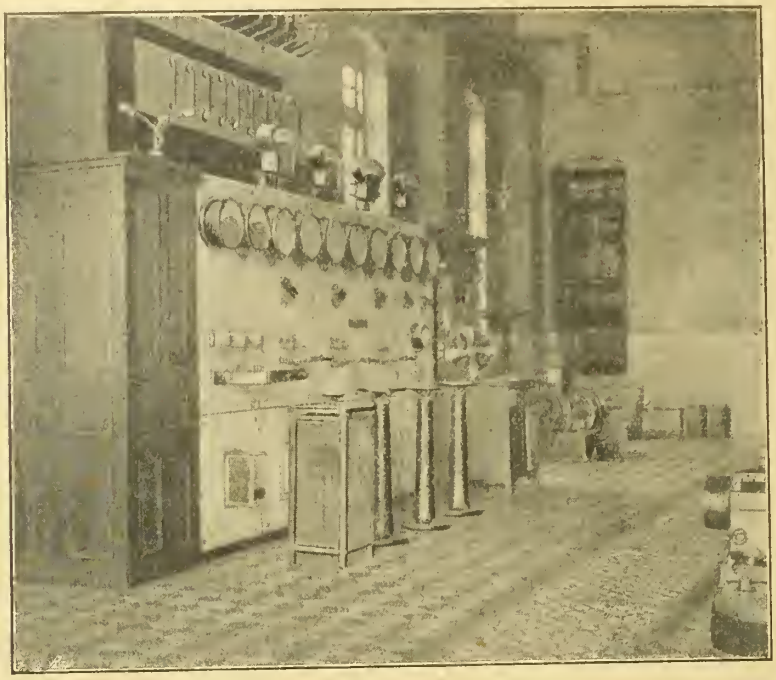
this plant to such minor troubles as are familiar to every erecting engineer, however little they may be remembered after a plant has been set to work.

The Johannesburg matter has been so long *sub judice*, that the actual facts regarding it have not transpired till now. The result of the trial is that the Johannesburg Corporation has been awarded substantially everything for which it sued, and the evidence has shown that the failure was due rather to defective business management on the part of the contractors than to anything inherently defective in the generating plant itself. The contractors had every assistance given them, and on this point Lord Ormidale, in his judgment, makes the following observation :—

"There appears to have been a good deal of give and take on the part of the consulting engineers in order to further the work of the contractors. I think the suggestion that they were obstructive or hostile is totally unfounded. I am also satisfied that at no time did the pursuers deal otherwise than helpfully and considerately with the contractors. They were obviously anxious that this very costly undertaking, which they hoped was to prove of immense advantage to the community, and the demand for the completion of which was becoming more clamant every day, should not be hampered by captious complaints on their part."

The attention given to the generating plant has caused the fact to be overlooked that all the rest of the very extensive power and tramway systems were entirely satisfactory, the original estimates which were so severely criticised locally having been fully confirmed.

We think all parties to this affair deserve commiseration, the Corporation for the loss and inconvenience to which they were put, the contractors for the very serious losses they have incurred due to their failure to realise the conditions necessary to success, particularly in the direction of administration, and the consulting engineers perhaps most of all, for the failure of the power part of the scheme for reasons which had nothing to do with the engineering merits of their recommendation.



The Main Switchboard : Tientsin Electric Supply.

THE ELECTRIC SUPPLY OF TIENTSIN.

Although the Tientsin Gas and Electric Light Co., Lt —a British company registered in Hong Kong, bears t combined title of gas and electricity, the supply of t former has been entirely superseded the latter since 1905, the chief rea being that the production of oil was both costly and unsatisfactory.

The attention, therefore, of the dir tors of the company was called to t production of electricity as the bet illuminant, and at a general meeting the shareholders the old gas compa was granted a 15 years' franchise the British Municipal Council to ins an entirely new electrical plant.

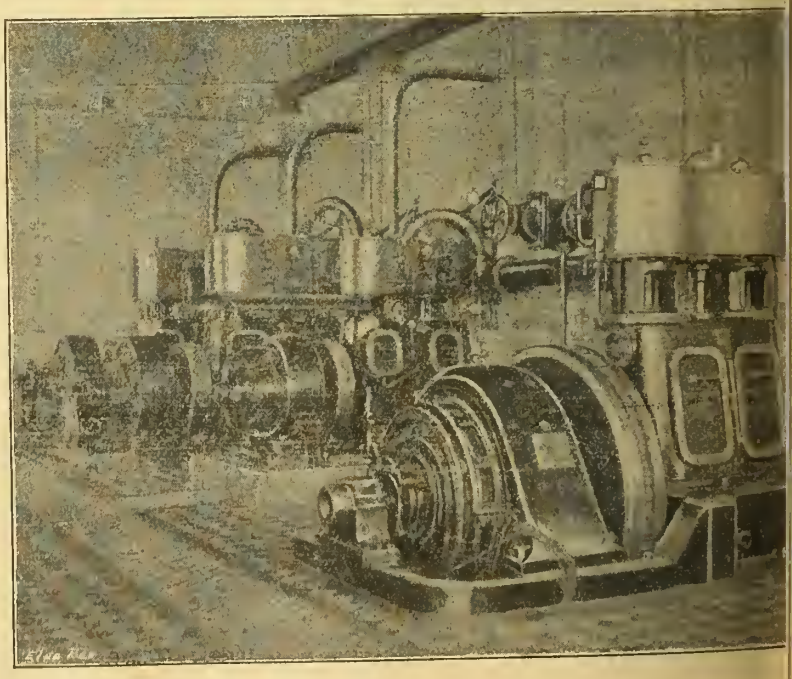
Tenders were invited for the insta tion of suitable machinery, and work was given to Messrs. Arnh Karberg & Co., representing A.E.G., who installed two 80-kw. one 40-kw. generators, with necessary boilers and auxiliaries, cluding an 85 ft. × 4 ft. 6 wrought-iron shaft, this portion of plant being described in the Electri Review of February 23rd, 1906.

In the early part of 1908 to n the increasing demand for current extension of the plant was made in shape of a new B. & W. boiler and 175-kw. Belliss-E.C.C. set.

The present plant consists of following :—

Three B. & W. boilers, two having 1,426 sq. ft. heating surface, and the third, 2, sq. ft. heating surface, all being hand-fired, with a wor pressure of 120 lb. per sq. in. without superheat.

The water supply is obtained from the town mains, is fed to the boilers by four feed pumps (two Worthin duplex, one Mumford compound vertical and one vertical) after passing through a Green's economiser filter at a temperature of about 200° F.



Generating Plant : Tientsin Electric Supply.

The generating plant consists of four sets, one 40 Robey-A.E.G., two 80-kw. Robey-A.E.G. and one 17 Belliss-E.C.C., each set being capable of dealing wit overload of 20 per cent. for two hours. The mac generate direct current at a pressure of 440-500

:ross the outers of a three-wire system having five eding points.

The balancing of the network is performed by four static alancers on the Dobrowolski system, each connected to its vn generator by slip-rings.

The switchboard for the first three generators was made by e A.E.G., and for the fourth by the B.T.-H. Co. All four achines have B.T.-H. meters to record their outputs.



Tientsin Electric Supply: The Engineer's House.

The exhaust steam of the four sets passes through an separator into a Worthington condenser having 700 ft. cooling surface, the circulating water for this being tained from a creek which passes close to the works and always capable of an ample supply.

The mains are all carried overhead on lattice or C.I. ular poles in the chief thoroughfares of the settlement, d on Oregon pine poles in the outlying districts.



The Generating Station, Tientsin G. and E.L. Co.

The five feeders, each averaging ¾-mile in length, have a tional area of ·12, ·06, ·12 sq. in., and about 25 miles of tributors have been erected.

The European staff consists of Mr. G. Paton, A.M.I.E.E., M.I.M.E., chief engineer, and one foreign assistant, the retarial work being carried out by Messrs. William Forbes l Co.

The rest of the staff are all Chinese, some of whom have en with the company since its formation.

Exhibition Competition: Result.—The first competition arranged by the Electric Supply Companies at Olympia was one that was open from Wednesday, October 4th to 11th, in which competitors had to submit schemes for the selection and placing of everything electrical required in a modern five-roomed villa. A large number of prizes were offered, and we learn that the winner of the first prize (electrical goods to the value of £30) was Mr. S. Loughton (St. Mark's Electrical Co., 181, Victoria Park Road, N.E.). The competitors were very numerous, and the prize winner is to be congratulated upon his success in submitting the best scheme. We understand that he went about his selection, cost investigation, and testing of the variety of articles required for the villa on the different stands at the Exhibition in a very systematic manner, the economic current-consuming qualities being taken into account in submitting his proposal.

THE ELECTRICAL EXHIBITION.

By "MIDLAND."

"Olympia, 1911," has come—and gone. How much we had expected! But how much have we realised? The Exhibition had many good features, but none of salient merit. Its virtues were ordinary, but its defects were many and of considerable importance. The writer had exceptional opportunities of obtaining the views of stall holders and visitors, technical and non-technical, and he trusts that the following notes may be accepted as a frank, unprejudiced and tolerably representative criticism.

The main object of the Exhibition was to bring prominently before the public new applications of electricity. Technical men, who are actually or prospectively in the market for electrical equipment of any nature, can be secured as customers without the aid of exhibitions, but the latter are, if properly managed, of the greatest value where the general public is concerned. In order, however, that the public may be influenced by the Exhibition, the public must be persuaded to attend the show, and in this direction enterprise has been flagrantly wanting. Before the opening of the Exhibition, none but the most inconspicuous posters, and few enough of these, were shown in railway stations and on hoardings, &c.; the earlier advertisements in the daily Press were insignificant. After the show had been open a week or 10 days, greater newspaper publicity was secured, but well-founded rumours were current that a number of the larger exhibitors contributed a large part, or even the whole, of the cost of these notices (the advertisements of individual firms were, of course, entirely at the expense of the latter).

As usual, stall holders were provided with adhesive stamps (announcing their intention to exhibit at Olympia), some months before the opening date. These stamps were generally used indiscriminately on every letter dispatched by the exhibitors, but their value may be doubted. They never reached the general public, and, to business firms, they developed into a nuisance. The main result of this persistent announcement, so far as the regular customers of exhibitors were concerned, was to create a wide demand for complimentary tickets. Regular clients could reasonably expect these from their business friends exhibiting, but in few cases would the requests have been made had the customers known that each "complimentary" ticket cost the donor 4d.

Next to the wretched publicity arrangements, the extraordinary dearth of free or really cheap tickets for use at the discretion of stallholders formed the basis of most general indignation. Several influential exhibitors expressed the view that central stations, which, after all, reap the most lasting benefit from the Exhibition, might have contributed to its success by distributing complimentary tickets (even if the latter had to be bought) among their consumers.

Apart from the ineffectual measures taken to secure a large public attendance—and one looked in vain for the crowds and general briskness and enthusiasm of the 1905 Exhibition—the Exhibition was not representative of the industry. Even a casual glance down the official catalogue of exhibitors reveals the absence of a number of very important firms. Many are the excuses made—publicly and in private—for this absence; some firms are "too busy in their shops," others aver that what business they cannot get without Exhibitions they are not likely to secure by their aid; others, again, remark tersely that "it does not pay."

The provincial sales manager of an important electrical firm assured the writer that the Exhibition at Olympia was little heard of in the provinces before its opening. Having travelled from the Midlands to take charge of the Exhibition business for his firm, he was leaving town after only two days. He placed the Exhibition work in the hands of a junior, regarded his Midlands work as far more important, and considered the Olympia Exhibition "an insult to the trade." This was the deliberate opinion of one whose views were worth noting.

Let us now consider a few of those details of arrangement on which the success of any Exhibition so largely depends. The management offices were in a dark and inaccessible corridor, and the names of the temporary occupants of the

various rooms were inscribed in ordinary typewritten characters on tiny sheets of paper stuck on the doors. Fully a dozen people, in two days alone, asked the writer for the management offices or Mr. So-and-So's room, after actually passing along the corridor flanking these rooms.

Visitors desiring a rest after the weary work of pacing the main hall had admirably comfortable seating accommodation in the gallery—the said accommodation being provided gratis by an outside firm merely to advertise its seductive products. Of writing accommodation, such as one might legitimately expect in an Exhibition of this nature, there was none, and did one trespass into the deserted Press room (the lighting switches for which could be found outside after ten minutes' patient search had exhausted every possible hiding place within the room), one speedily realised the reason for its desertion and left the spot with alacrity. A more cheerless room could hardly have been chosen for such unfortunates as were compelled to record their impressions upon the premises; a considerable unfavourable bias must have been automatically imposed on their writings! (N.B.—The present notes are *not* written in the Press room: the memory alone of the latter suffices!)

When the average man attends an Exhibition he expects to be provided with a little music by way of diversion, and in view of the importance of ladies' decisions in influencing the adoption of much of the apparatus shown, one would have expected the engagement of a good brass band as a matter of course. Actually, the stall-holders had to agitate vigorously before any band at all was provided, and even then the mistake was made of engaging a string band, the strains of which could be faintly heard at some parts of the Main Hall during a temporary lull in the clatter of running machinery.

Recent notes on the external illuminations of Olympia have had one fault; they have not been sufficiently caustic. The effect of the illuminations was ludicrous; for a considerable part of the Exhibition the right-hand searchlight (facing the entrance) gave a very poor beam, and the left-hand lamp giving an exceptionally good light, the inferiority of its fellow was the more noticeable. The "lightning" flashes might have been a little brisker; the "fountains" gave one a weird impression of black bands running up the centre (though the down-falling streams were much more natural). Apparently the waving flag was too ambitious—the writer never saw it lighted, much less in "motion." The poor show made by arc lamps, and the general gloominess of the Exhibition building from without, have already been criticised by the Union Electric Co.

As regards the arrangement of the stalls themselves, the appearance of the buildings was, on the whole, less artistic than in 1905. Many most interesting and valuable Gallery exhibits were very poorly displayed. This (the fault of the exhibitors), together with the ragged appearance of the roofs of the Main Hall stands, gave the Gallery a sort of third-rate, back-of-beyond appearance, which was certainly unfair to exhibitors. There should be no difficulty in arranging to finish off the Main Hall stands so as to present a neat, if not an artistic, appearance from the Gallery. By finishing off the tops of their stands and displaying suitable wording and flash signs, most of the exhibitors could have materially increased the attractiveness and advertising value of their stalls.

There was the old difficulty in finding the makers of a speciality known by some trade name, when one could remember the latter, but not the name of its producers. The addition of an alphabetical "Speciality Index" to the official catalogue would remove this trouble, and the moderate cost of its preparation would, doubtless, be borne *pro rata* by the firms benefited.

Very bitter protests were raised by a number of stall-holders against the admission of a certain few, entirely non-electrical, exhibitors: the latter gentlemen, by their characteristic methods of soliciting attention, did no small injury to their neighbours, who had not even the consolation of knowing that it was their own industry which was benefiting. Visitors and electrical exhibitors will, doubtless, appreciate the allusion and its importance.

Many more plaints might be urged, but the above covers the more noticeable and serious shortcomings. So far as the writer's own feelings, and those of practically every authoritative person with whom he has discussed the matter are concerned, "Olympia, 1911," has been a woeful disappointment—far below the 1905 Exhibition, and in appearance, interest and success, inferior to many non-electrical exhibitions occupying the same site since that date.

Let us apply the lesson of our present disappointment to the future; 1917 is still far off, but, as it approaches, let us remember 1911, and to good effect.

NOTES FROM CANADA.

[FROM A SPECIAL CORRESPONDENT.]

Lethbridge, a rapidly growing town in Alberta, has recently decided to have an electric tramway. The power plant, which is steam driven, is to be enlarged to the extent of some 1,500 kw., and about 10 miles of track will be laid down as a beginning with 10 or 12 cars.

Hydro-electric plants being liable to give trouble in the winter owing to ice, and in the summer to shortage of water, the Winnipeg Electric Railway Co. are adding to their steam plant so as to bring its total capacity up to about 20,000 h.p. this will be kept ready to operate, at short notice, at any period of the year.

A Government report recently published on the water powers of Canada contains the following figures and estimates:—

	Possible h.p.	h.p. developed or being developed
Yukon	470,000	55,000
British Columbia	2,065,500	150,100
Alberta	1,144,000	12,000
Saskatchewan	500,000	—
Manitoba	504,000	160,000 abo
North-West Territories	600,000	—
Ontario	4,308,475	350,000 abo
Quebec, exclusive of Ungava ...	6,900,000	125,000
New Brunswick	150,000	9,080
Nova Scotia	54,000	13,300

The Commission of Conservation is obtaining very complete information respecting all the water powers of Canada and it is expected that a report on this important subject will be forthcoming before very long.

New rules for electric wiring are to come into force in 1912. It is understood that these will call for wire similar to that used in England; several of the cheaper grades at present in vogue in Canada will not be allowed in future.

The telephone companies here have a very convenient system for long-distance calls which might very well, one would think, be adopted at home.

If Mr. A. in Montreal wishes to call Mr. B. in Oshawa he merely asks "Central" to get him Mr. B. at Oshawa. As this is a small place it is not even necessary for Mr. A. to inform "Central" where Mr. B. is likely to be found. They will get him some time during the day at his hotel, his office or elsewhere. In the event of Mr. B. having left Oshawa for the day, "Central" is almost certain to ascertain this fact, and will inform Mr. A. not only that he has gone away, but to what other place, and will be quite willing to get him from there if it be possible.

Take now the reverse case, Mr. B. in Oshawa calling Mr. A. in Montreal. The latter city being a large place, it will be necessary for Mr. B. to inform "Central" that Mr. A. is staying at such an hotel or that he is expected to be at So-and-So's office at a given time. If at all possible "Central" will get Mr. A. and ring up Mr. B. some time during the day.

The great point about this system is that no charge is made unless and until the man with whom one wishes to speak is actually brought to the telephone, even though a dozen attempts have to be made to get him.

Another good arrangement is the system of charging only half the day rates for night calls. This applies also to telegraph rates, 25 words costing 25 cents in the daytime, while 50 are allowed at night for the same sum.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Demand for Technical Men.

As an engineer engaged on the manufacturing side of lectrical engineering, I should like to endorse the views of Aving Sum," as expressed in the last issue of the LECTRICAL REVIEW.

To begin with, low salaries are just as much in evidence n works as they are in central stations.

I have had experience in two of the largest firms in this ountry, and I may say that the average wage of a college an is 30s. to 35s. per week. He is usually employed on he test bed or the calculating branch of the design depart- ent.

I know a man who has been to college for two years, and fterwards served two years in works, who is getting £1 per eek at testing. For further examples, see the advertisement olumns of the ELECTRICAL REVIEW.

Incidentally, by way of comparison, I may add that the tandard wage for fitters is about 38s. week. This gives ne a fair idea of the pecuniary value of a college training. o all appearances, it has a negative effect. No wonder the umbers are dropping off at our various technical schools.

It will be found that, in general, the technical engineer eceives a lower salary than his *confrère* in other depart- ents. And the irony of it all is, he has perhaps spent undreds of pounds on his education. He may also, like yself, have served a recognised apprenticeship to mechanical r electrical engineering—or both.

In many cases there is a prejudice against college men, and heard of one assistant manager of works who said he would ot have one in the place if he could help it.

Technical training will never count for much, so long as very Tom, Dick and Harry can call himself an electrical ngineer without such qualifications. To remedy some of ne aforementioned evils, I would suggest that the pro- ssors of our various engineering colleges should draw up scheme for a professional union of qualified engineers.

This has been done in the medical, the legal and other rofessions. Why not in engineering ?

By means of advertisements, it would be very easy for ch professor to get into touch with his old students, and am certain the majority would welcome such an arrange- ent.

Such an innovation would also give some stimulus to r technical colleges. Parents don't like the idea of ending £500 or £600 on a college education for one of eir sons, and then find that he earns 30s. to 35s. per ek for the best years of his life.

Wilkins Micawber.

As an old student of your paper, I should very much like, ithout unduly prolonging a discussion, to pass a few com- ents upon your correspondent's letter bearing the title Demand for Technical Men." With reference to your rrespondent, "Aving Sum," and all due courtesies to his ews of the case, I beg to state that the term "technical en" is vastly misrepresented. For instance, in quoting e instance of as many as five B.Sc.'s applying for a position 30s. per week, I should like to say that, from an employer's int of view, this would about represent their worth. I ve met many highly theoretically-trained men, who have t been worth their presence as ornaments, simply because ey have the knowledge, and are afraid to use it for the ar of soiling their hands. On the other hand, the elec- cal trade is simply glutted with mere labourers, men who n do a thing if they are shown what to do, but the men at understand how the thing is done, why it is done, and n instruct others to do the certain thing, are not to be und. The cry of all large electrical firms is the same ; e men they want they cannot get. The college-trained an is practically useless at the outset of his career, from a siness point of view, and it is eminently the business point firm has to look at. But in all branches of engineering, t exclusively electrical, what is wanted is the practical theoretical man, and not a trained ornament bearing degrees and not daring to demonstrate his knowledge. Mention is also made of managers not attaching any great importance to technical training. If he did but know that the largest firms in electrical work cannot get their men to train technically, let alone not wanting them ! But, as before stated, the whole crux of the matter is, "there is the greatest scope possible in the electrical field, but we must have co-operation of theoretical and practical work."

Walter Beckwith.

October 21st, 1911.

I notice, in the issue of October 13th, that you advise parents to place their sons in electrical engineering. I also notice, that in a footnote to "Aving Sum's" letter, you profess sympathy with the generating branch of the profession. You qualify this latter remark by a statement that it is only one branch of the profession.

That is so, but I venture to say that to about 75 per cent. of technical students and premiumed apprentices, electrical engineering means a shift job with poor salary. It is all very well for technical colleges, training schools and manufacturers, to enlarge on the hypothetical possibilities of their particular courses of study and pupilage, but are these glowing statements supported by facts ? "Aving Sum's" letter was an under-statement of the case.

I should like to see a list of names of their students compiled by the Central Technical College and Faraday House, with the dates of each pupil's course, and his present appointment and salary, and also a similar list of the Brush Co.'s pupils.

I am a product of the premiumed pupil and technical college process, and up to the present I have only secured shift jobs, and poorly paid posts they have been when the outlay on my education is considered. It is certainly an unpalatable state of affairs, when manufacturing firms demand an excessive premium, sometimes as much as £300, and turn out their pupils, after three years, with only the qualifications of a second-rate fitter—and a testimonial ; or (as happened to a friend of mine) secure the unfortunate pupil a post as switchboard attendant at a salary of 16s. per week.

The conditions of labour and salaries of central station engineers are a scandal to all concerned. It is full time that an attempt was made to find a remedy. The law of "supply and demand" is not alone responsible for this uneconomic condition. Might I suggest, Sir, that your sympathy should take a practical form—a campaign among chief engineers and managers, with a view towards inculcating a little professional pride, and acquainting them with the fact that the 56-hour week 40s. shift man is a brother engineer.

This could be accomplished through the medium of the REVIEW, which is undoubtedly the organ of the classes and masses of the electrical industry.

A. B. Fastman.

Greenwich, *October 24th*, 1911.

Quartz in Electrical Heaters.

In reference to our communication of October 6th, we note a reply from Mr. Alfred A. Newman in your current issue. We are sorry to find, however, that this displays such a crass ignorance of the subject under discussion as to be almost unworthy of serious attention on our part. However, in order to avoid any misapprehension, we may point out that we are dealing strictly with facts, which are incontrovertible, and open to proof by any of your readers so inclined. Does Mr. Newman desire to insinuate that the firms we have mentioned, viz., Messrs. Hoskin's Manufacturing Co., Detroit ; Bristol Co., New York ; Heraeus Hanau, &c., are "unsuccessful experimenters" in the use of quartz for electrical heating apparatus ? The above-mentioned firms have a world-wide reputation, and have sold some thousands of electrically-heated quartz appliances, and probably use more quartz in a day than his friends the Bastian Electric Heating Syndicate use in a month. The first-named firm are also the owners of, and control the patents and manufacture of, "Nichrome" resistance wires in the United

States, which Mr. Newman admits the Bastian Electric Heating Syndicate have only been using for the past two years, from which time dates the success of their quartz appliances, but which, as a matter of fact, has been used by the Hoskins Manufacturing Co. and other firms, including ourselves, for the past six years in connection with the manufacture of electrically-heated quartz appliances. We must decline to admit that mere presence at Olympia constitutes a criterion, or is even representative of what has been done in this direction up to the present time. Our only object in entering into this correspondence is to see that credit is given where credit is due, and certainly no credit is due to Mr. Bastian as the originator of quartz for electrical heating purposes, whatever may be due to his particular arrangement of details and to his efforts to advertise his wares. Your correspondent's query as to "who we are," does not affect the question to any extent, and may be dismissed with slight attention: we may, however, inform him that we are manufacturers of electrical heating and cooking apparatus of 10 years' standing, and we can assure him that we possess a thorough knowledge of this subject and business, and our appliances are certainly not "laboratory experiments," as he suggests. If so inclined, we might with equal pertinence inquire who Mr. Newman is?

In conclusion, we would suggest that he makes a study of this interesting subject and obtains some knowledge of what has been done in this direction, when we shall be pleased to discuss the matter further with him.

Paterson & Co.

Newcastle-on-Tyne, *October 23rd*, 1911.

[We have ventured to abbreviate Messrs. Paterson's letter somewhat.—Eds. E.R.]

Olympia Electrical Exhibition.

I am glad Mr. Benjamin has corrected my misapprehension as to the issue of free tickets at Manchester. My memory had taken me back to Olympia Exhibition in 1905, where exhibitors received a quantum of free tickets, and the interest of the supply authorities was so stimulated that they subscribed for 120,000.

It is useless to thrash a dead horse, but in view of future exhibitions it is not useless to seek reasons for the poor attendance, especially during the first two weeks.

With regard to the price of space, "The Electrical Exhibition" draws a wrong conclusion. The return of space money to space hirers can only be from a percentage of the realised surplus, and cannot materially affect the exhibitors' expenses. What is wanted in an exhibition promoted by the N.E.M.A. is not a money surplus, but increased trade, and this, I contend, should have been secured by more liberal advertising, better illumination, the securing of effective support from the supply authorities, a flat-rate of admission, and greater encouragement for ticket issue.

Justus Eck.

Chiswick, W., *October 23rd*, 1911.

Electricity and the Lay Press.

From his article, "Electricity and the Lay Press," Mr. Goody seems to think that electricity is especially singled out for vituperation by journalists. I perfectly agree that the ignorance betrayed is phenomenal, and that gas receives more favourable treatment, but this arises probably from the fact that gas is more easily understood. It generally happens, however, that those whose work is beyond the comprehension of the common mind suffer at the hands of the newspaper critic. To mention only one example, W. P. Frith, R.A., in his "Autobiography" and "Further Reminiscences," inveighs freely against the incompetence of art critics. He is certainly justified by one example given: "'To Arms, ye Brave.' A parcel of people exposing themselves in a manner that calls for the interference of the police." I think that one observation of his is as completely applicable to modern criticism of electrical matters as to the art criticism to which he refers:—"If the public could only be persuaded that painted opinion is but that of a gentleman or lady who can have no technical knowledge, and which, if expressed *viva voce* in general society, would have little or no effect, it would appreciate public art criticism at its true value."

With regard to the invariable statement that any fire was caused by a fusing electrical wire there is an additional cause. The critic above-mentioned sets out to criticise an the reporter of fires has many other things, from police cou cases to religious meetings, to which to attend, and he has t dismiss each in as little time and with as little thought possible. The penny-a-liner in search of copy doubtless find a phrase so universally accepted invaluable to earn a penn To his remarkably catholic collection of achievements he ca not add meticulous accuracy. It hardly seems feasible th this class is subsidised directly by the gas interest, it seem more probable that the newspaper proprietor controls th interest.

R. S. T. V.

Rugby, *October 17th*, 1911.

Trade Discounts to Private Consumers.

With reference to the letters in your last issue fro Messrs. C. G. Fox and P. A. Reed, although I said in n letter that the wiring prices are cut, I did not say I d wiring at cost price. My argument was that we very oft have to pay the carriage on and wiring of fittings out of t amount allowed as trade discount. I quite agree with M P. A. Reed that manufacturers should not supply priva people below list price, and if it pays them to keep the wh trade discount for themselves, that is their look out. B from a contractor's point of view, the contractor will natura influence his clients to deal with those manufacturers w look after his interests. I don't suppose any manufactu wants to give anything for nothing, but there are many w find it pays to treat their contracting friends well.

A. F. Lord

Plymouth.

H. B., Hampstead.—Address not enclosed.

A VARIABLE LOW RESISTANCE.

In *The Physical Review* of September, 1911, Mr. J. H. Dellinger g an account of a convenient low resistance, of small total resista capable of definite variation in steps as small as one-mill onth an ohm, which introduces no irregular variable resistance. consists of an amalgamated copper wire plunging in a tube mercury. The idea has been used in various forms by m experimenters. In the device here described, the copper wir used to short-circuit the mercury, the operation depending on fact that mercury has approximately 60 times the resistivity copper. This principle has a notable advantage in alternati current work, as explained below. The apparatus consists sim of a tube of thin glass, or of porcelain or hard rubber, wit slight enlargement at the upper end to receive the mercury w displaced by the descending copper wire. An amalgamated cop wire, of slightly smaller diameter than the internal diameter the tube, is lightly gripped, either by a cork placed in the to the tube or by a pair of springs faced with insulating material. length of 15 cm. is convenient. A 1-ohm range is obtained using a tube of about 0·4 mm. diameter, and any other range d to 0·01 ohm is obtained by tubes up to 4 mm. diameter. The l are connected to the top and bottom of the mercury column, the plunging copper wire functions simply by short-circui the mercury. A simple and valuable modification is the us two of these resistances in series by the employment of a g U-tube, of which the diameter of one leg is $\sqrt{10}$ times the ot Thus a pair of variables of the ranges 0·1 ohm and 0·01 ohm conveniently obtained. The use of the U-tube eliminates difficulty of sealing the lower end. A scale may readily be attac and when the instrument has been calibrated the resistances of settings are known. The instrument should not usually be for exact quantitative work, however, as it has a large tempera coefficient. The mercury variable resistance has been applie facilitate adjusting to a balance the auxiliary ratio arms of Thomson bridge, in the comparison of low-resistance stands and its use materially increases the speed of working. I especially valuable in the measurement of the resistance of samples for determination of the conductivity, since the magni of the ratio arms may be very different for every sample meas It has also been found to be a convenience in the comparison mercury ohms with wire standard ohms, since the potential of the mercury standards are of relatively high resistance respect to the ratio arms. This apparatus has also been usef applied to the regulation of potentiometer currents. The applica

this device to alternating-current bridge work has been productive of good results. The precision of determination of low inductances may be increased by the use of ratio arms of lower resistance. This has been made convenient by the use of the mercury variable resistance. It has been found that, fortunately for alternating-current work, this variable resistance has practically non-variable inductance (at any rate for moderate frequencies). This is evident, if the copper wire is of practically the same diameter as the mercury column, as the geometry of the circuit is not changed by varying the resistance. Thus this instrument is a complementary apparatus to the usual variable inductance. The total change of inductance of one of these "mercury variables," 15 cm. long, about 5 mm. internal diameter of tube, 1 mm. diameter of copper wire, and a range of 05 ohm, was 6×10^{-9} henry, or 6 centimetres.

WILLANS-DIESEL OIL ENGINES.

On Monday last we paid a visit to Messrs. Willans & Robinson's Victoria Works, Rugby, to inspect a pair of the company's standard 4-cycle 4-crank engines on the Diesel principle, which have been built to the order of the Alianza Co., Ltd., of London, for the lighting and driving of their nitrate works at Bellavista, in the Argentine Republic, to the specifications of Messrs. Strain & Robertson, of Glasgow. Each engine is coupled direct to a three-phase generator built by Messrs. Siemens Brothers Dynamo Works, Ltd., under a separate contract. We give an illustration of the combined set herewith.

The normal output of each engine is 185 B.H.P. at 220 R.P.M., with an overload capacity of 10 per cent. for two hours; in the present instance, however, it was necessary to run the engines at a lower speed (187 R.P.M.), developing 280 B.H.P. at full load, and 325 B.H P. for two hours, at sea level. The site on which they will be installed is about 3,200 ft. above sea level, and at this altitude they will be called upon to give 200 B.H P. and 230 B.H.P. as normal full load and overload respectively.

The alternators, with exciters direct-coupled, work at 220 volts; each is rated at 175 K.V.A. with a power factor of 0·8 at full load, and has an overload capacity of 25 per cent. The sets are intended to run in parallel, and were tested on two days last week, under the supervision and to the satisfaction of the consulting engineers. The specified tests included 24 hours' run at full load (280 B.H.P.), followed by a two-hour run at 15 per cent. overload, and one hour each at ¾, ½ and ¼ load, fuel consumption tests being made at each load, in addition to stringent tests as to the ability of the sets to run well in parallel and governor tests. The guaranteed fuel consumption figures were as follows:—

15 per cent. overload ...	0·44 lb. per	B.H.P.-hour.
Full load	0·44 „	„
¾ load	0·46 „	„
½ load	0·52 „	„
¼ load	0·72 „	„

with a margin of 5 per cent. to allow for the newness of the engines.

The total overall length of the set is 28 ft. 9 in.; width, 7 ft. 6 in.; and height, 11 ft.; and the total weight is about 7 tons. These two sets are identical with two sets recently supplied to the works of the Rosario Nitrate Co., of London, in Peru, which also passed the tests of Messrs. Strain & Robertson satisfactorily. At the time of our visit one of the sets was running on full load without noise or vibration.

A Johannesburg Fatality.—A Cape correspondent states that a terrible fatality occurred at the Robinson central branch of the Victoria Falls power station recently. A young German, named Heintz, was engaged in tapping the wires, when, through some misunderstanding, apparently, the current was switched on, and the man received a shock which burnt every stitch of clothing from his body in an instant. The naked body was also burned from head to foot, the arms and legs being practically frizzled and skinned. He was taken to hospital, where he died in a few minutes in frightful agony.

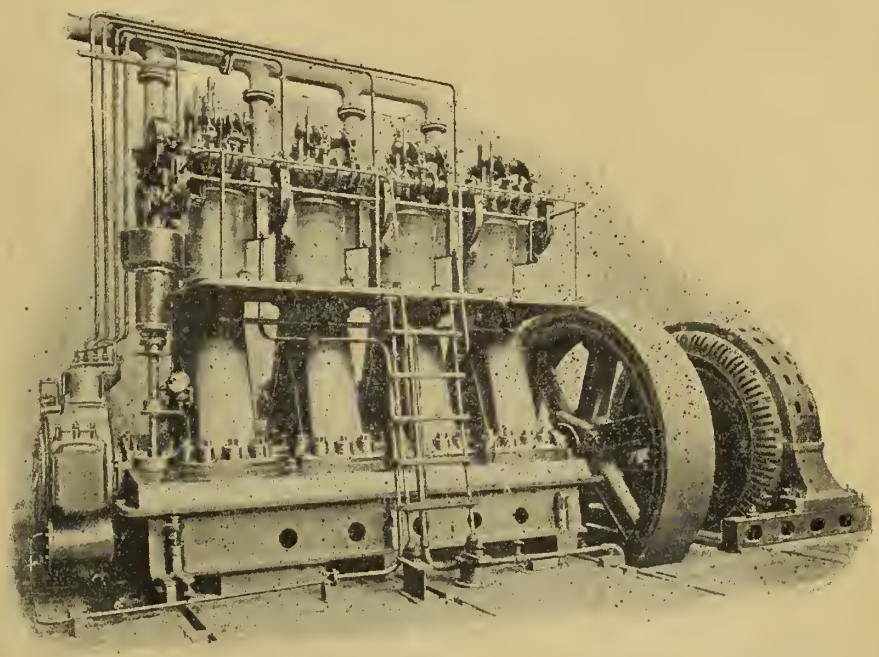
Exhibitions.—The *Times* reports that the New South Wales Chamber of Manufacturers supports the idea of an Empire Exhibition in London in 1914.

According to the *Standard*, an International Exhibition is to be held at Dunkirk from May to September, 1912. It will be under the official patronage of the municipalities of Dunkirk and Malo-les-Bains. Among the sections will be those relating to industry and science respectively.

LEGAL.

A Greenock Tramway Case.

Proof is being heard this week and next, by Sheriff Welsh in the Sheriff Court in an action raised by the Greenock and Port Glasgow Tramways Co., Ltd., against a Glasgow foundry company and a local company of contractors. The pursuers claim compensation for damage alleged to have been caused to their tramway track in Main Street, Greenock, by the haulage of heavy machinery and boilers over the roadway there, and they seek to have the conveyance of such loads over the tramway track prohibited. The contention of the pursuer is that through the conveyance of the heavy haulage over their lines, their track has been broken and destroyed and the service interrupted. They argue that the traffic is not of the ordinary kind that it should continue without compensation, and they ask interdict prohibiting defenders from so using the track. They estimate the damage at £350 but sue for what they characterise as a moderate sum, £67 17s. The case for the defenders is that the present method of traffic has been followed since 1901. This traffic they affirm is merely the ordinary kind in connection with the shipbuilding industries of the town. Had pursuers, they say, laid down granite setts of good quality on substantial foundations, as they ought to have done, no damage would have been caused, or, at any rate, it would have been greatly lessened. They repudiate liability, and oppose the claim for interdict.



Willans-Diesel 175-K.V.A. Generating Set.

Attorney-General *v.* The Mayor and Corporation of Sheffield.

This case was mentioned on Monday, October 23rd, to Mr. Justice Eve in the Chancery Division.

Mr. Sargent, for the defendant Corporation, asked that the case might be postponed. It was stated that it related to the carrying on of an electrical business. The case was then postponed, to be heard not before November 7th.

British Westinghouse Electric and Manufacturing Co., Ltd., *v.* The Electrical Co., Ltd.

Counsel on Tuesday applied to the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Moulton and Farwell, to allow the defendant company's appeal, which had been entered from the judgment of Mr. Justice Swinfen Eady, to stand over till November 20th, as he said there was a prospect of the parties arriving at a settlement.

The application was acceded to.

The T.F. Syndicate, Ltd.

In the Chancery Division on Friday, October 20th, Mr. Justice Joyce heard a motion in the debenture-holder's action of Churchman *v.* The T.F. Syndicate, Ltd., which carries on the business of manufacturing filaments for electric lamps.

Mr. Galbraith stated that the plaintiff was the holder of £950 worth of debentures, and asked for the appointment of a receiver

and manager. There was a considerable quantity of these filaments in stock.

The company appeared and consented to the appointment and submitted to the usual judgment in a debenture-holder's action.

His Lordship made the orders asked for.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Winton" writes:—"Referring to the case of a company or corporation letting out wiring installations, on the free wiring system, at a rental of so much per quarter, the Electric Lighting Act of 1909, Sec. 16, states, among other things, that 'All electric lines, fittings, apparatus and appliances, let by any undertakers on hire, or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession, shall . . . . at all times continue to be the property of, and be removable by, the undertakers . . . . Provided that such electric lines, fittings, apparatus or appliances have upon them respectively a distinguishing metal plate, affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon sufficiently indicating the undertakers as the actual owners thereof.'

"So far as I am aware, it is the general custom to label these installations by a single metal plate, fixed on or near the undertaker's meter board, stating that

"'This installation is the property of the
..... Company or Corporation.'

"The query now arises, however, as to the word 'respectively' in the above quoted section. Does this mean that every switch, lampholder, ceiling rose, and different wires must all be labelled, or is the above single plate deemed sufficient in law to proclaim the ownership?"

*** It could hardly be the intention of the legislature that every piece of apparatus which goes together to make up an installation should be marked with a plate. The section must be interpreted by the aid of the words "sufficiently indicating the undertakers as the actual owners thereof." If the inscription on the plate were so framed as to indicate (to the uninitiated) what was included in the word "installation," it is conceived that such an inscription would suffice to comply with the requirements of the Act.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Witton" Fool-Proof H.T. Control Panel.

We illustrate herewith a compact arrangement of control panel for a three-phase high-tension motor or feeder—the design of the General Electric Co., of Witton, Birmingham. This consists of a boiler-plate cubicle suitable for fixing to the wall.

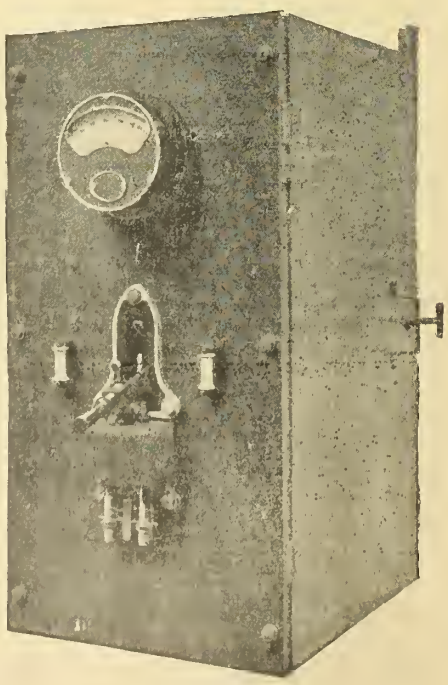


Fig. 1.—Witton H.T. Control Panel

The cubicle contains three single-pole isolating links; a three-pole automatic switch; also the necessary current and potential transformers for operating the trip coils or oil switch, &c., and an ammeter or wattmeter, the latter fitted on the front of the cubicle above the oil-switch operating handle.

The special feature about this cubicle is that the arrangement of interlocking the various pieces of apparatus with the door renders it absolutely fool-proof. The isolating links are interlocked with the doors of the cubicle in such a way that the action of opening the door also opens the links. The door is further interlocked with the oil switch, so that it cannot be opened until the switch is in the

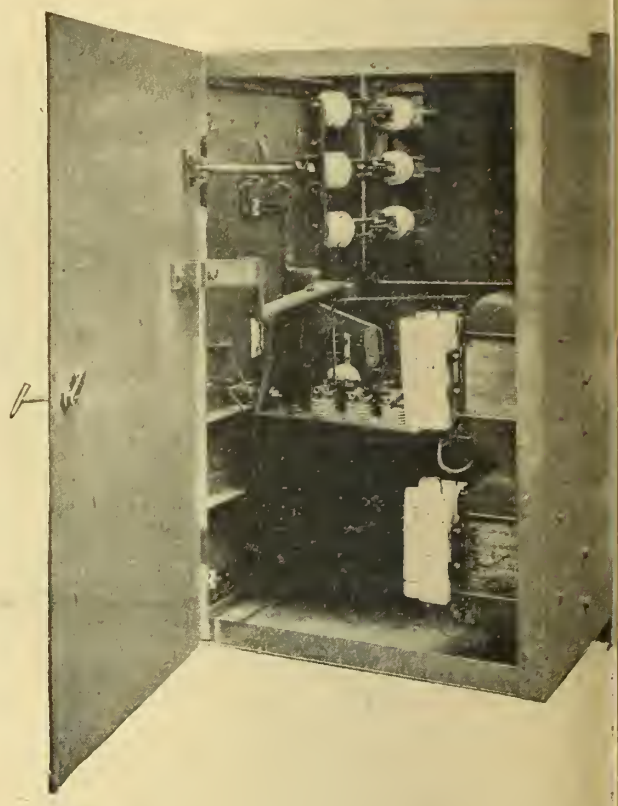


Fig. 2.—Showing Interior of Witton H.T. Panel.

"off" position; also, the oil switch cannot be closed until the door of the cubicle is closed. It will thus be seen that it is impossible to either make or break the circuit by means of the isolating links.

Careful attention has also been paid to efficiently isolating the "line" sides of the isolating links by means of insulating barriers, so that it is impossible to touch any live parts when the door of the cubicle is open, and consequently adjusting and cleaning of the various apparatus can be done in absolute safety.

The "Powerful" Tool Holder.

Amongst the novelties shown at Olympia by Messrs. Geo. W. Goodchild & Partner, of 30 and 32, Farringdon Road, E.C., was an improved lathe tool holder. The special feature of the

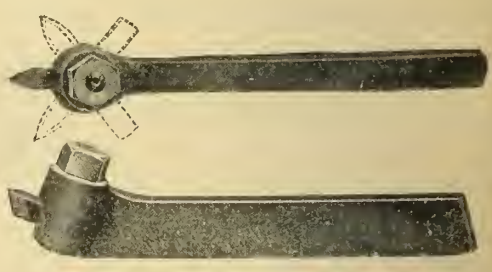


Fig. 3.—"Powerful" Tool Holder.

device is the provision of grooves in the end of the holder which permit the tool to be rigidly held in any of the three positions shown in fig. 3, thus making the holder of practically universal application, whilst retaining extreme simplicity.

New Projector Lamp.

The Regina Electric Co., Ltd., of Cologne-Sulz, Germany, have recently brought out a new projector lamp intended especially for use in bioscopes where the supply pressure is 100 or 110 volts. In the ordinary way, unless a motor-generator is used, the lamp takes, say, 40 amperes at 45 volts, and the excess voltage is wasted in resistance, the power lost being much greater than that usefully employed. The new lamp, we are informed, works with 70 or 80 volts across the arc, and takes a current of only 20 amperes, while yielding the same light as a 40-ampere 45-volt arc. Thus the loss is greatly reduced, being, in the case mentioned at 110 volts, only

500 watts instead of 2,600 ; and the total power consumed is halved. The carbons used cost no more than those used in the ordinary lamp, and are automatically fed ; adjustments for the length of the arc and for focussing are provided.

Electric Fittings.

In their recently issued catalogue of electric light fittings the the Metallic Seamless Tube Co., Ltd., of Wiggin Street, Birmingham, show a variety of choice designs of art metal work. A line of black iron and copper wall lanterns particularly catches



Fig. 4.—Metallic Seamless Tube Co.'s Pendant Fitting.

the fancy, and there are hall lanterns in polished brass or oxidised copper and silver, table standards and wall brackets, ceiling fittings and electroliers. A typical rise and fall pendant fitting for three lights with 18-in. band is illustrated herewith. It is supplied in polished brass, or oxidised copper or silver finish.

BUSINESS NOTES.

Dissolutions and Liquidations.—Beck Flame Lamp, Ltd.—This company is winding up voluntarily for the purpose of reconstruction Mr. H. J. Page, 21, Ironmonger Lane, E.C., liquidator. A meeting of creditors is called for November 6th, at Winchester House, E.C.

Winchester Electric Light and Power Co., Ltd.—A meeting of creditors is to be held at Broad Sanctuary Chambers, Tothill Street, S.W., on November 1st.

Electric Fog Signal Co., Ltd.—A meeting is to be held at Vine Street, Uxbridge, on November 27th, to hear an account of the winding up from the liquidator, Mr. A. T. Spear.

Aluminium Corporation (1907), Ltd.—A meeting is to be held at 60, London Wall, E.C., on December 6th, to hear an account of the winding up from the liquidators. This is not the 1909 company.

F. Woodfin & Co., electrical engineers, 138, Northgate Street, Chester.—Messrs. A. J. Williamson & F. Woodfin have dissolved partnership. Mr. Williamson will continue the business as Williamson & Co., at the same address.

Metallic-filament Lamps.—Price Reduction.—In addition to the firms mentioned in our last issue, we are informed that Messrs. Falk, Stadelmann & Co., Ltd., the "Z" Electric Lamp Manufacturing Co., Ltd., and Pope's Electric Lamp Co., Ltd., have made similar reductions in the prices of their metallic-filament lamps.

Electric Lighting at the Canadian Exhibition.—At the Canadian National Exhibition held at Toronto, a new installation was recently put in, and for the purposes of lighting its buildings 1,795 20-in. Benjamin reflector fittings were used, such as is illustrated below. These units, according to the *Canadian Electrical News*, have been run in series of six, so that low-voltage tungsten lamps may be used. The fittings consist of a deeply-hooded one-piece enamelled steel reflector and a specially designed lampholder. These reflectors are made in both distributing and concentrating types, and are for lamps from 25 to 500-watt sizes. The fittings were constructed with a separate fitting above the



Canadian Exhibition Fitting.

reflector, so that they could be taken down after the exhibition and stored away until next year. Each reflector is designed for use with a definite range of lamps, and with particular regard for the correct relation of lamp filament and reflecting surface. The stage setting in front of the grand stand for the spectacle of the Coronation was illuminated by the means of these reflectors hung at a slight angle with the horizontal, so as to throw the light directly on the performers, and the illumination results are described as being most satisfactory. The Benjamin Electric, Ltd., of 117, Victoria Street, S.W., have issued a handy little booklet of 48 pages giving illustrations and prices of the complete range of their wireless clusters and cluster fittings.

Arc Lamp Patents.—In a circular letter issued by the Electrical Co., Ltd., it is stated that a rumour has got abroad that D.C. "Sunshine" flame arc lamps have infringed patents, and cannot be sold. This they state is not the case. An arrangement has been entered into with the owners of the master patent, and the Sunshine lamps are now sold under royalty, and do not infringe any patents. Forms of indemnity will be given whenever required.

Street Lighting Fittings.—In the accompanying figure we show a fitting (No. 58) designed and supplied by the Wardle Engineering Co., Ltd., of 196, Deansgate, Manchester, to meet the demand for a water-tight fitting for one high candle-power lamp. The top is of cast-iron ; an internal convex zinc reflector is fitted, and is adjustable in height to suit various lamps. It is 24 in. diameter, and is finished in green and gold. Another new



Wardle Water-tight Fitting.

feature being placed on the market by this company is No. 53 "Beatark" type fitting, in which the globe is provided with a patent telescopic lowering device, by which it can be lowered to clean the lamps without detaching it from the fitting. It is a four-light (100 c.p. each) fitting 24 in. diameter, and is intended for street, yard and railway station lighting, and other such service. It is standardised to take four lamps around the centre, but No. 52 type is made to accommodate a centre 100-c.p. lamp as well.

The "Cole" Code.—The price of this code has been raised to 15s. net.

Electrical Trade in China.—A correspondent at Tientsin, in a recent letter to us, says:—"With regard to general electrical trade, I am afraid there is not a great deal doing in this part of the country, but we are all hoping for better times some day. Suction gas plants seem to have caught on very well in connection with press packing concerns, and about four sets have been, or are being, installed at the present time."

Book Notices.—*The Motor-Cycling Manual.* By the Staff of *Motor-Cycling*. London: Temple Press, Ltd. 1911. Price 1s. 6d. net.—The growing popularity of the motor-cycle has led to the issue of this work, a companion to the well-known manuals, and we have no doubt that very many of our readers will welcome it. Apart from the electrical ignition and the use of electric lamps, there is, of course, nothing electrical in the book, and what there is does not impress us with its accuracy. The explanation of the fundamental principles of the magneto, which is written in a "popular" style, is not free from errors—in particular, the illustration on page 29 shows the poles of the magneto short-circuited by a block of what appears to be cast-iron, for it is in one piece with the pole-pieces; and it is not true (page 33) that the primary current *increases* at the moment when the circuit is broken. On page 127 the reader is advised to use an amber-coloured lamp bulb in foggy weather, because it "has a much greater penetrative effect"—but the penetrative power resides in the rays of light, and can only be diminished, not increased, by the use of any tinted glass whatever. In discussing an epicyclic change-speed gear, the author says that the *number of the planet pinions* must be divisible exactly into the *numbers of teeth* of both the sun pinion and the drum—an absurd statement which shakes one's faith in the reliability of the work. However, in spite of such blemishes, the book undoubtedly contains a vast amount of useful information in a small space, including numerous practical hints obviously derived from experience on the road.

Boilers and Boiler Control. By J. B. C. Kershaw. London: Davis Bros. 1911. Price 1s. net.—This little book is an attempt to summarise the art of boiler control so far as regards the combustion of coal in an economical and smokeless manner, apart from any question of other matters of attendance. It is difficult to criticise such a book from the standpoint of its intended users, because the subjects of chemistry and physics are not yet as a rule familiar to the men on whom boiler attendance devolves. One recognises, of course, the value of high furnace temperature as a means of transmitting heat through plates, but here we run at once against one of the troubles of a boiler, for high furnace temperature cannot be employed when the plates are scaled or the water thick or muddy or colloidal. Boilers, of course, ought not to contain dirty or scale-forming water, but this brings up the whole question of water treatment and plate thicknesses and types of boiler, and would demand a much bigger volume than the one before us to treat it adequately. As regards grease in water, it is not generally known that if condensed engine discharge water is made to trickle through a filter of coke breeze a very large proportion of the grease will stick to the coke. Such a filter is easily replenished, and the greasy coke can be burned in the boiler furnace.

"Fortschritte der Elektrotechnik." By Dr. Karl Strecker. 1911. Berlin: Julius Springer. Price M15.

Catalogues and Lists.—Messrs. W. Mickelwright and Co., Sicilian House, Southampton Row, London, W.C.—Set of lists, in binding cover, describing, illustrating and giving prices of the following manufactures for cinematograph theatres and similar purposes:—Sliding contact type regulating resistances for small currents, small power motors, regulating resistances, plain resistances without regulation, knife switches, auto-converters and motor-generators.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—New trade catalogue consisting of several hundred pages. It is conveniently divided up into a number of sections which are indicated by a thumb index. The first contains full illustrations and tabulated prices of various makes of incandescent lamps, metal and carbon filaments, battery lamps and heating lamps. The next deals similarly with arc lamps (flame, enclosed and photographic). The rest of the sections are these: cables and flexibles, switchboards and general accessories, heating and cooking apparatus, bells and telephones, auto-transformers, two-part insulators, fans, vacuum cleaners, and fittings. The last-named section is the largest of all, and it contains a great variety of fittings of all styles for inside and outside lighting, picture reflectors, advertising signs, Holophane glassware, ships' fittings, hand lamps, &c. The catalogue should be of considerable service to contractors and the trade.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, London, E.C.—New list No. H81, containing a full description of their Globe electromagnetic hammer made on the Basic Rowe patents which they control in the principal European countries and the British Colonies. The tool is equally suitable for drilling, clipping and caulking purposes. The list gives prices.

Messrs. Perry & Grinsell, Ltd., 1 & 2, Leopold Street, Birmingham.—Leaflet giving illustrations and prices of their "P. and G." copper and tin electric kettles, also a couple of small and neat electric ovens, electric cooking plates and frying pans.

Mr. F. Patrick, 15, Oxford Street, Leeds.—Price list of small lathes and other tools, &c.

The Wright Electrical Sales Co., Ltd., Upper Mill Hill, Leeds.—Catalogue entitled "Something Electrical for Everybody," giving particulars and prices of a variety of electric bells and bell fittings, wires, motor-car accessories, pocket flash lamps, electric torches, dry batteries, portable battery lamps, battery electric fans, electro-medical coils, &c.

Allgemeine Elektricitats Gesellschaft, Berlin.—Pamphlets describing their arc-welding system and showing its application to large repair jobs; their compound controller for dock cranes; and tower signals for goods yards.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster London, S.W.—Very finely produced and well bound catalogue of over 100 pages (art paper). It is No. 527, Section I, and contains a fully illustrated and comprehensive account of the Morse telegraph apparatus manufactured by the firm. Accompanying it is a useful 24-page pamphlet containing instructions, with numerous diagrams, for using Morse station sets, single current, simplex and duplex, double current ditto and ditto, and quadruplex system. The contents of the catalogue include between 40 and 50 pages of illustrated descriptions of various Morse apparatus, about 30 pages dealing similarly with Morse station sets. The scheme on which the catalogue has been arranged is that the component parts of which telegraph station sets are made up are listed at the commencement, beginning with inkers and continuing with keys, sounders, galvanoscopes, relays, &c., to switches. After that are the station sets, the first section dealing with single current, which, in turn, is divided into simplex and duplex; the next with double current, which is also divided into simplex and duplex; and then follows the quadruplex system. The catalogue concludes with a few pages of accessories, diagrams of connections of station sets, and a comprehensive code and index. All the illustrations have been made from photographs of actual apparatus made at the firm's Woolwich Works, and, in many cases, there are offered not only Messrs. Siemens's own patterns, but those to the specification of the British Post Office. Every class of article is illustrated, and each item is provided with a clear specification, catalogue number and price, a point which will be appreciated by foreign buyers when ordering.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Booklet giving illustrations and particulars of their electric turret clocks (the patent "waiting train" system), including the very large clock at the Royal Liver Friendly Society's office at Liverpool.

The International Time Recording Co., 151-155, City Road, London, E.C.—Booklet of 80 pages giving a large number of half-tone views of their system of time recording in operation in a large number of works and offices in this and other countries.

The British Electric Calibrated Fuse Co., Luton, Beds.—New catalogue of the Weekes "Safetee" enclosed indicating fuse, standard terminals and clips, Pyrotin fuse wire and strip, &c. The company lay themselves out as "fuse specialists," and welcome inquiries for the solution of difficult fuse problems, such as are mentioned on the last page of the catalogue, in the course of a couple of letters reporting excellent results with "Safetee" fuses on public supplying circuits.

Magic Enterprise.—Not content with the display referred to in our last issue, Messrs. Magic Appliances organised a further attractive advertisement on Saturday last, the closing day of the Exhibition at Olympia. On this occasion there were three trim housemaids, each armed with a Magic suction cleaner, while two others, with dirty aprons, wielded the old-fashioned dust-pan and broom, thus bringing into sharp contrast the ancient and modern systems of cleaning. These clever and effective demonstrations deserve the reward which their originators will doubtless reap in the near future.

Trade Announcement.—The Electrical Co., Ltd., announce that Mr. W. G. Mayer is now with them, and has taken over the management of their "Plania" carbon business, for whose carbons and by-products they have been appointed sole agent for United Kingdom since September 30th, in place of Messrs. H. G. Mayer & Co.

Awards at Turin.—Messrs. Hans Renold, Ltd., have been awarded two Grand Prix for their display in the Engineering Section at the International Exhibition at Turin. In addition, they have been awarded two Grand Prix for their display in the Cycle and Motor Sections at the same Exhibition.

Messrs. Nalder Bros. & Thompson have been awarded the Grand Prix at the Turin Exhibition, where they are showing a very wide range of their well-known specialities.

LIGHTING and POWER NOTES.

Baildon.—The U.D.C. has appointed a Special Committee to investigate the unsatisfactory gas supply, and if failing to get satisfaction, to consider ways and means of providing facilities for electric supply.

Belfast.—The electrical engineer has presented a further report on the question of reduced charges for electricity, and has been instructed to have copies of same sent to each member of the Committee, the matter to be specially considered at the next meeting. Mr. Bloxam has also reported on tenders for switchboard extensions, and Mr. Bertram Thomas's, of Manchester, quoting £154, was accepted. Questions relating to the making of provision for increased facilities for storage of coals for use in cases of emergency at the electric station were discussed, and the engineer was instructed to submit a report thereon.

Biddulph.—The U.D.C. has engaged Messrs. Crewes and Handforth, of Manchester, to advise it respecting the E.L. scheme submitted by Mr. R. Heath, and to act as engineers if the scheme is adopted, at an inclusive fee of £5 per cent. The Council will apply for a prov. order if the scheme is to be carried out.

Blackpool.—The Tramways and Electricity Committee has had under consideration a report by Mr. C. Furness, the electrical engineer, in which it was pointed out that there was only a very small margin of reserve power in connection with the lighting and traction plants. Considering the loss in revenue and inconvenience which would follow a breakdown of any part of the present plant, the engineer suggested the desirability of having a complete steam turbo-alternator installed, at an estimated cost of £6,650. This, with £4,200 for additional traction plant, £350 for a cooling tower extension and £560 for contingencies, brought the suggested total expenditure under this head to £11,760. The Committee resolved that application be made to the L.G.B. for sanction to borrow £12,000 to enable the extensions to be carried out, and agreed that specifications be drafted and advertisements issued inviting tenders for the new plant.

Bradford.—The Electricity Committee of the T.C. has decided to extend the mains from Huddersfield Road along Cleckheaton Road and Park House Road, and to construct a transformer station, at an estimated cost of £1,935.

Brentford.—The Brentford Electric Supply Co. has recently entered into an agreement with the Metropolitan Electric Supply Co., Ltd., for a bulk supply and is now in a position to deal with all applications for a supply of electricity in the district. A large number of important contracts have already been secured. The registered offices of the company are now at 16, Stratford Place, Oxford Street, W., the secretary being Mr. E. Cunliffe Owen. The local office and showroom are at 3, The Broadway, Hanwell, and all communications respecting supply should be made to that address.

Brighton.—The T.C. has been recommended to rescind the resolution of August 28th, abolishing the existing charges for meter rents except in the case of consumers upon the maximum demand system, which would entail a loss of £1,200 a year. The Council is also recommended to fix a charge of 1d. per unit for current for power, heating and cooking at premises fitted with a lighting installation of not less than six 16-c.p. lamps.

A further recommendation favours the insertion, in any Bill promoted by the T.C., of powers to supply current in the Urban Districts of Portslade-by-Sea, Southwick and Shoreham-by-Sea, subject to the consent of the local authorities being obtained.

Burnham (Somerset).—The U.D.C. has decided not to relegate the powers for electric supply to a company, but to apply for its own prov. order.

Burton-on-Trent.—In order to encourage the use of electricity for heating purposes, the T.C. has instituted a rate of 1d. per unit for this purpose.

Chelmsford.—The electric light has been installed at St. Mary's Church, together with an electrical organ-blowing apparatus, at a cost of £370. The installation has been carried out by Messrs. Christy Bros., of Chelmsford.

China.—The extensive harbour works under way in South Manchuria, at Dalny, Port Arthur, Antung, Niuchwang and Hnlutau will, according to the German Consul at Mukden, afford opportunity for the placing of considerable quantities of electric machinery and accessories.

Coatbridge.—Messrs. Wm. Bain & Co. have completed important modifications at their Lochrin Steel Works, including the substitution of an electric drive for a steam engine on the main rolling mill. Power for operating the mill is taken from the local supply company's mains, and is three-phase alternating current at 25 periods per second.

Continental Notes.—Turkey.—The production of electricity for distribution in Constantinople is effected by means of water-power. Surveys are now being made for utilising waterfalls situated near Sakana, in Asia Minor, where two stations will be established. The one above the falls will be served by the water impounded in a dam, giving a head of 53 m.; the second will make use of a head of 35 m. The power of the upper works will be 14,400 h.p.; that of the lower 7,650 h.p.—*La Revue Electrique.*

France.—A new company has recently been formed in Paris with a capital of £24,000 and the title La Société Electriques des Ilots de la Seine, Quartier Wagram.

The rural electrical installation at Valcanville-Barfleur shows, says the *Revue Electrique*, what can be obtained from between 15 and 20 h.p., and how much the metal-filament lamp facilitates the extension of the use of the electric light. The two-phase current generated is distributed at a pressure of 110 to 120 volts, the farmers in the rural districts being supplied at this pressure, or at 210 volts, and Valcanville, Montfarville and Barfleur at a higher pressure. The power at the falls is 13·5 kw.; that available at the terminals of the 210-volt alternators is 7·5 kw. An 8-h.p. petrol motor is used as an auxiliary. The transmission lines are of aluminium. To avoid limitation of the number of lamps used, current is sold at 105 francs per ampere-year, with a minimum of 75 francs for three lamps lit at the same time, the number being automatically controlled.

Spain.—An electric furnace on the Louviere-Louis system has been set up at the ironworks at Ayaya, in the province of Alava, where ferro-silicon has been produced from the slag of the puddle furnaces. It appears that two classes of ferro-silicon are produced—one of from 25 to 30 per cent., and the other of from 50 to 60 per cent., the consumption of energy for the former being 3,790 kw.-hours per ton with the use of coke, and 3,445 kw.-hours with the use of vegetable charcoal. To obtain ferro-silicon of from 50 to 60 per cent., the consumption of energy is 8,020 kw.-hours per ton with coke, and 7,105 kw.-hours with the use of vegetable carbon.

Russia.—Contracts have been sealed with the St. Petersburg electric lighting company to light certain streets and squares with 133 arc lamps for a period of five years, and several boulevards for a period of six years.

According to the *St. Petersburg Zeitung*, an electric railway, 140 km. long, is to be built by a company to Antrea, in the Viborg district, the current being generated at a station to be built on the River Imatra.

Doncaster.—The Corporation is contemplating applying for a provisional order enabling it to supply electricity to Wheatley, the fashionable quarter of the town.

Dublin.—The Electricity Supply Committee of the Corporation announces that it has organised an Electrical Exhibition of all classes of apparatus and fittings relating to the use of electricity for lighting, heating, cooking and power purposes, which will be held in the Mansion House from October 30th to November 4th. The Exhibition will be confined exclusively to manufacturers, and the exhibitors have agreed that no goods shall be sold in any section. Several gentlemen have accepted the invitation of the Committee to deliver short addresses in the evenings. On Monday, October 30th, Mr. Richard Cronin, chief locomotive engineer of the Dublin and South-Eastern Railway, will lecture on "Electricity in Home Decoration"; on Wednesday, Dr. Maurice Hayes, on "Electricity in Medicine and Surgery"; on Thursday, Mr. Ramsay MacNab, on "Electricity and Insurance"; on Friday, Mr. R. Borlase Matthews, M.I.E.E., on "Electric Cooking and Power in the Home," and again on Saturday on "The Comforts of Electric Lighting and Heating."

Eccles.—The electrical engineer has submitted a report with regard to the supply of electricity for lighting purposes to the houses of the Corporation in Corporation Road, for the year ended September 30th last. In his report he points out that 1,150 units were consumed which, charged at standard rates, realised an income of £14 17s. 11d. This amount had been paid over by the Health Committee to the electricity department, while the former had received from their tenants (at 6d. per week each) an income of £15 0s. 6d., therefore making a slight profit on the transaction. This result, the engineer states, which is a repetition of the satisfactory result obtained during the previous 12 months' supply, strongly demonstrated that the cost of electric light need be no obstacle to its general adoption in small houses. The cost of lamp renewals which were paid by the tenants worked out at 1s. 8¾d. each.

Erith.—The U.D.C. has applied to the L.G.B. for a loan of £7,671 for electricity purposes.

Exeter.—The E.L. Committee of the T.C. has decided to apply for a loan of £1,500 for new services.

Fareham.—The B. of G. has appointed a committee to consider the question of lighting the Workhouse by electricity.

Haslingden.—The electric light has been installed throughout the Haslingden Union Workhouse and offices, as the result of an agreement with the Rawtenstall Corporation, which is supplying the current. In switching on the light, Mrs. Mountain, the chairman of the board, expressed the hope that they would derive great benefit from the new means of illumination. She thought they would not be roasted or broiled or melted, as they had been sometimes by the heat from the gas-lights, in dark weather.

Heckmondwike.—The U.D.C. has decided to arrange with the Yorkshire Electric Power Co. for a supply of electricity in bulk.

Holmfirth.—A member of the U.D.C. has given notice to move, at the November meeting of the Council, that a prov. order for electric light be applied for, and a loan of £8,000 sought for carrying it out.

Houghton-le-Spring (Co. Durham).—The Education Sub-Committee has decided to obtain estimates for lighting Penshaw School with electricity.

Itchen.—The U.D.C. evidently seriously contemplates adopting electricity for lighting in the near future, as, notwithstanding the fact that the authority has ahead the prospect of having to proceed at once with a scheme in the event of a provisional order being issued, the Council has decided to take steps to ascertain the terms on which an engineering firm would advise on a scheme.

London.—Marylebone.—At the ordinary meeting of the B.C., on Thursday night, the adjourned report of the Electric Supply Committee was debated, the recommendation before the Council being that the statement of accounts for the year ending March 31st, 1911, be adopted. The first criticism levelled at the accounts was by Mr. Helsdon, who having objected to the way in which the two sets of accounts (one audited, and the other presented to the Joint Committee) differed in the apportionment of expenses, urged that the revenue accounts be referred back. Mr. A. J. Hopkins (Chairman of the Electric Supply Committee), in his answer, also dealt with some of the other charges which had been

made against the Committee. Having explained the reason of the difference in the two sets of accounts, and the necessity for certain adjustments when separating the Publicity and Sales Department accounts from the others, he said the explanation of the free use of current was this: that the Committee had felt it necessary some time back to get an independent opinion on the electrical cooking apparatus it was supplying, and on the uses and advantages of the method of cooking. Dr. Bokenham had consented to use one for the purposes of the test. The apparatus was lent to him, and that was the extent of the free use to "any privileged person." He was not aware of sundry consumers having a supply for nothing. But, in order to compete, with success, with the gas company, who were prepared to fix a consumer's house up for nothing, they (the Electricity Department) pushed the sale of current by loaning apparatus and doing wiring free. The result had been satisfactory. Another charge was that their man had gone into a house where a contractor's man was doing wiring, and tried to get an order for fittings. In that instance the wiring was being done by the contractor to the builders, who were working for the landlord, while their customer was only a tenant in the house. After giving figures to show that, compared with other London municipal and private undertakings, their electricity undertaking placed aside a proper and reasonable amount for the sinking fund, Mr. Hopkins urged that exceedingly good results were placed before them, and he was surprised that no note of appreciation had been sounded. The position of the undertaking, as compared with others in London and the provinces with outputs of over 10 million units a year, was good. Marylebone had the largest consumption of electricity per head of population of all but one place. The percentage of Marylebone was 87 units; the nearest below that was something like 60 units. Also their expenditure on working in comparison to their revenue had a much better showing than that of any of the other undertakings referred to, being about half of that of the highest. The recommendation was adopted.

The general manager of the electricity undertaking, and the station superintendent, reported that as a result of their recent visit to Germany, they were of opinion that there was a possibility of re-arranging the plates in the present battery cells, which would increase the capacity considerably. Thus, there was a good prospect of the Council's £27,000 battery scheme being deferred for some years. The manager is experimenting on the above lines, and is to report at a later date.

Hampstead.—The sanction of the L.C.C. has been asked by the B.C. to the borrowing of £15,000 for the conversion, throughout the area, of the present street gas lamps to electric lighting.

West Ham.—The Highways and Parks Committee has accepted an offer of the electricity department to install a 100-c.p. lamp on each traction standard on both sides of Prince Regent's Lane, at £2 11s. per lamp per annum.

The Legal and General Committee have had under consideration a list of matters for inclusion in the Bill which they proposed to promote in the next session of Parliament, which include the following:—(1) A recommendation from the Electric Lighting and Tramways Committee to the effect that a fixed-price-light scheme should be considered by the officers with a view to including a clause in the next Bill to obtain the power suggested by the electrical engineer; (2) To enable the Corporation to form a working balance for the undertaking, which subject was the cause of recent correspondence with the L.G.B. who would have granted a provisional order dealing with the matter on the condition that the Corporation should accept audits by the district auditor which were refused by the Council. If a clause for this purpose were to be inserted, the electrical engineer suggested that it should be wide enough to cover the undertaking generally, including the sales department, also to allow for the fixed-price-light scheme if adopted; (3) The question was raised by the engineer as to whether it would not be desirable in connection with the limited consent given by Wanstead as to the supply of electricity in their area to deal with the following matters:—(*a*) To ensure that the sales department powers are operative in the Wanstead area to be supplied; (*b*) to obtain powers to give supply in bulk to the Wanstead Council; (*c*) to supply public lighting in Wanstead; and (*d*) to erect any transformer chambers, sub-stations or any other buildings required in connection with the supply in Wanstead.

Stoke Newington.—In regard to the new agreement between the Council and the North Metropolitan Electric Power Supply Co., Ltd., for a bulk supply to the Council, Councillor Savery, chairman of the Electric Lighting Committee, explained that the new agreement would come into operation in March. There was a considerable profit on the electricity undertaking last year, and under the new agreement he believed that this would be considerably increased. Much difficulty had been experienced in making out the agreement, because the company stated that the Council were only using them as a stand-by, and there was a good deal of truth in this. The company finally came to an arrangement with the Council on the terms that it undertook to put a limitation on the plant, and the agreement would be for so long as the Council did not extend its generating plant. The company had required something in exchange for its reduction, and accordingly the contract period had been lengthened from 12 to 18 years.

Woolwich.—The Electricity Committee reports that under Sec. 29 (2) of the Council's Electric Lighting Order, the Council is required, on the expiration of the fifth complete financial year after the commencement of the supply under the Order, to reconsider and, if necessary, revise and thereafter maintain, the scale of prices charged for electrical energy under the Order, so that, so far as it is reasonably practicable, no rate will be required for the purpose of defraying the future expense of the undertaking during the next three years. The fifth complete financial year after the commencement of the supply expired in April last, and the Committee had had under consideration since that date the necessity of revising the scale of prices for the purposes set out in the clause referred to. It had considered from time to time for some years past the price charged to consumers as necessity arose, and had found it necessary to reduce same for the purposes of obtaining and retaining consumers. The result of the policy of the Council in thus reducing the charges had been to considerably increase the number of consumers, and to also increase the working profit on the undertaking from £1,108 in 1908 to £3,942 for the year ended March 31st last, the increase in this profit for the past year being nearly £1,050. This increase had taken place, in the Committee's opinion, in consequence of the reduction in the price of current. The Committee was satisfied that the only effect of an increase in the prices of energy supplied would be the loss of many consumers, with a consequent reduction in the revenue of the undertaking and the working profit therefrom, and a consequent substantially increased charge upon the rates, a result which would entirely frustrate the intention of the clause. It was, therefore, of opinion that for the purpose of the clause referred to, it was unnecessary at present to revise the scale of prices charged for energy and recommended accordingly. This was agreed to.

Newport (Mon.).—The B. of G. has decided to install an electric lift at the workhouse at a cost of £700.

Newton-le-Willows.—Messrs. Lacey & Sillar have been called in as consulting engineers to the U.D.C.

Penzance.—The T.C. has passed the plan of the electric supply scheme which is to be carried out under the 1904 Order by the Penzance and District Electric Supply Co., Ltd.

Salford.—The Electricity Committee has considered a report of Mr. C. D. Taite with reference to the generating plant at the Frederick Road electricity works, and has decided to adopt scheme "A" contained therein, which provides for the alteration of the existing engines and the provision of two turbo-generator sets, with necessary cables, switchgear, &c, at a total estimated cost of £35,000; further, to make application to the L.G.B. for the borrowing of £15,500 to cover the cost of two turbo-generator sets &c. The work of altering the engines is to be carried out by Messrs Browett, Lindley & Co. The Committee has also decided to enter into a three years' agreement with Mr. C. D. Taite for advising it in a consulting capacity, at a fee of £250 per annum, plus travelling expenses when absent on the Committee's business.

Sheffield.—The electric supply department is to be instructed to replace the present arc lamps in two of the bays of the Corn Exchange Hall with metal-filament lamps of 400 c.p., fitted with Holophane reflectors, and if these prove to be satisfactory, to extend same throughout the building, at an estimated cost of £29 otherwise to install 600-c.p. lamps instead of 400-c.p., at an estimated cost of £32.

Southend-on-Sea.—The T.C. has decided to engage a canvasser for the E.L. department for a term of six months, and to extend mains, when desirable, to the Thorpe Hall Estate, at a cost of £956.

Sowerby Bridge.—According to the *Halifax Weekly Courier*, Sowerby Bridge was in a state of gloom for part of last week, the local incandescent gas lamps in the streets and houses having practically given up business.

It is recorded that at a presentation ceremony at the Council offices the clerk found it necessary to strike a match in order to read the inscription on the gift, and almost a famine occurred in candles. Whatever may be the excuse for the gas shortage, and we feel sure our gas friends will find one, the Council has only itself to blame for not providing reliable street lighting, with an electric supply at hand.

Stockton Heath.—The P.C. has decided to ascertain what demand there is in the parish for electricity. The Salt Union offer to supply current.

Swanage.—The B. of T. has granted the Electric Supply Co. a final extension of time until June, 1912, for carrying out the electric light order granted in 1906.

Swansea.—The Markets Committee has decided to make the following charges to stall-holders for the supply of electricity: 25-c.p., 3½d. per week (single lamp, 4d.); 32-c.p., 4d.; 50-c.p., 5d. 70-h.p., 7d.; 100-c.p., 9d.—Hefner c.p. in each case.

Ventnor.—The U.D.C. has accepted the tender of the Isle of Wight E.L. Co. for lighting the pier during the winter.

Winchester.—Owing to the electric supply undertaking having been acquired by the T.C., the electricity company is to be voluntarily wound up, the directors being paid £1,290, the amount of remuneration from 1897 to 1905, which was not paid, and the secretary and manager, Mr. Warburton, receiving £450 in lieu of notice.

Wolverhampton.—A L.G.B. inquiry will be held on October 31st into the application of the T.C. for a loan of £11,000 for the extension of the electricity buildings and plant.

Wombwell.—The U.D.C. has had the question of electric lighting under consideration, and decided to refuse the application of the Electrical Distribution of Yorkshire, Ltd., for consent to a proposed provisional order for a supply of electricity in the district

TRAMWAY and RAILWAY NOTES.

Aberdare.—The U.D.C. has decided to proceed forthwith with the construction of the electric tramways.

Blackpool.—The tramways manager has obtained the sanction of his Committee to a revision of the scale of pay and hours of a number of tramwaymen, by which the wages of some will be increased, though none will be reduced.

Six new cars of the "toast-rack" type, so popular this season at Blackpool, are to be ordered in time for next Easter. Mr. Furness told his Committee on October 19th that he would like even more of these cars, but there was not sufficient housing accommodation for them.

This has been a record season in the history of the tramways. From April 1st to October 12th, the total receipts were £52,985, or £7,068 more than last year; 7¾ millions of passengers were carried, or 1,089,000 more than in 1910.

Continental Notes.—GERMANY.—It is stated that the Prussian Railway estimates for 1912 will include the first instalment for the conversion of the Berlin City and Circle Railways to electric traction. The preliminary works, which have now been finished, have convinced the Ministry of Finance that the transformation would have a beneficial effect upon the receipts of the railway. Trials with electric locomotives which are intended for the Berlin City Railway are at present being made at Bitterfeld.

The preliminary works of the 129 km.-long electric railway to Konigszelt, in Silesia, having been completed, the electric portion of the installation will now be taken in hand. The line is expected to cost 10 million marks. Three schemes having been sent in for the projected electric railway through the picturesque Taunus district of Hesse-Darmstadt, the authorities of the Homburg circuit have chosen that submitted by Herr August Scherl, of Berlin, being the gyro-mono-rail system, subject to the satisfactory results of the experimental working of a stretch of 5 km. which the tenderer will install. If the system answers expectations, a company will be floated for the construction of the line, which is to extend from Homburg to Kronberg.

SWEDEN.—The preliminary works are being actively pushed forward for the power station at Elfkarleby, 145 km. from Stockholm. The power, to the extent of 40,000 H.P., produced is to be used for the working of a railway near the capital and for the States Railways generally. Tenders for the equipment are being invited in our "Contracts Open" column.

AUSTRIA.—The dry summer and autumn have had, says *Der Elektrotechniker*, the effect of extraordinarily forwarding the construction of the great electric railway which is to run from Innsbruck in the Tyrol, through the Mittenwald to Karwendel, in Bavaria. Instead of being completed in 1913, as previously timed, the railway is expected to be out of the contractors' hands by October, 1912, Over 6,000 men are employed in the construction of the permanent way. Work at the numerous tunnels, viaducts and bridges has also made unusual progress. All the tunnels in the first section are completed, save the last begun—the Kerschbuch tunnel near Kranebitten—which will be finished in three months' time. In the longest tunnel of the whole line, the Martinswand tunnel (1,787 m. long) the metals are being laid, the tunnel the while being mechanically supplied with fresh air. The Isar viaduct near Scharnitz and the other viaducts in the stretch between Innsbruck and Scharnitz are finished all but one; the permanent way and overhead work of the bridges will be finished during the winter. Seven stations and watch-houses of the first section are roofed in. The completion of the first section will liberate the workmen for the second or Leermoos line, work on which will be actively prosecuted. The big Loisach viaduct, between Leermoos and Ehrwald, is almost finished, and the Klausen tunnel near Seutte is in hand, and other above-ground works are nearing completion. The generating station, which will supply current to the new line. the Ruetz station, will be erected to the south of Innsbruck near the Stephens bridge. It will supply current to both the Scharnitz and Leermoos lines until the Bavarian station on Lake Walchen is completed.

A preliminary concession has been granted to the municipal authorities of Brixen in respect of a projected electric tramway from that town to the summit of the Ploseberg.

SPAIN.—The Compañia de Ferrocarriles electricos en España is the style of a company formed in Almeria for the construction of an electric railway between that city and Granada. The preparation of the plans have been entrusted to Señor Cervantes, engineer-in-chief of the works of the Port of Almeria. The line will traverse a most picturesque country, including the celebrated Sierra Nevada, and serve some 32 towns and villages.

BELGIUM.—La Société des Tramways Vervietois has just secured a concession for the extension of the Verviers-Ensival electric tramway as far as Pepinster.

FRANCE.—The Board of Bridges and Roads of the department of the Muerthe et Moselle has applied to the Government for sanction to the installation of electric haulage in the Tunnel de Fourg and for 5 km. along its course. The feasibility of its employment has already been demonstrated by experiments carried out at the Ecluse de Jarville by the Compagnie Générale Electrique. The current will be supplied by the Compagnie Lorraine d'Electricité.—*Revue Electrique.*

Dewsbury.—Considerable extensions of the electric tramway system are being made by the Corporation. A prov. order has been confirmed by Parliament for the construction of a line from Dewsbury Market Place to the suburb of Shaw Cross, and negotiations are to be entered into with the National Electric Construction Co., Ltd., for the construction, working, &c., of the tramways. The Dewsbury to Ossett cars are already being run by that company. The Corporation has also decided to apply for a prov. order for the construction of tramways from the junction of Halifax Road and Willans Road to the boundary of the borough at Dewsbury Moor, and it is sought to make an arrangement with the Borough of Batley for running powers in a portion of that town, so that the proposed tramways can be connected up to those to Heckmondwike. On account of the heavy gradients in the Dewsbury Moor district, which it is expected will be rapidly developed when an efficient service of cars is established, proposals for the adoption of the railless trolley system has been rejected as impracticable. The British Electric Traction Co. allowed its powers with respect to Dewsbury Moor to lapse, as it did not think the amount of traffic would, for a considerable period, give an adequate return for the necessary heavy capital outlay.

Edinburgh.—The proposal to adopt railless traction and the suggested routes have been discussed at a conference between a Sub-Committee of the Corporation Tramway Committee and the directors of the tramway company. It is stated that the meeting revealed a satisfactory attitude on the part of the company towards the new system. A deputation from Leith T.C. had an interview with the Edinburgh Sub-Committee regarding the proposals in Leith for tramway extension. Although no definite decision was arrived at, it is expected that the railless trolley system will be so arranged, so far as routes are concerned, as to meet the case of Leith.

Glasgow.—The members and officials of the Tramways Committee who went over English and Continental works to select additional turbine plant for the Pinkston power station, have issued a report, in which they state that they had had considerable difficulty in deciding from among the many excellent makers which firm they should recommend, there being very little in the question of price; indeed, this was a contract in which the question of cost did not enter very largely. In making a selection they had been largely influenced by the three features previously referred to in this report:—(1) The Curtis wheel at the high-pressure end; (2) the governor gear; (3) the blading. With these three points before them they had come to the conclusion that the turbines which correspond to their standard were the impulse turbine, which was offered by the British Thomson-Houston Co., of Rugby, and the impulse-reaction type, which was offered by Messrs. Richardsons, Westgarth & Co., of West Hartlepool. Another very important element in regard to the whole question of the installation of turbines which was brought very forcibly under their notice was the almost entire disuse of reciprocating plant. In many stations comparatively new engines were standing idle, the whole load being taken by the turbine sets. Municipal authorities and private companies were, apparently, finding it advantageous to install turbines and simply keep their reciprocating sets for use in emergencies. This was exactly their position at Pinkston. They, therefore, strongly recommended the purchase of two turbine sets at this time instead of one, so that the whole load might be taken up by the turbines. They were convinced that such a course would prove very advantageous to the department. The Committee thought it advisable to take this course, they recommended that one turbine of the pure impulse type, with the alternator, be purchased from the British Thomson-Houston Co., and another turbine of the impulse-reaction type, with a Brown-Boveri alternator, be purchased from Messrs. Richardsons, Westgarth & Co. They would then have at Pinkston a pure reaction turbine, a pure impulse turbine, and an impulse-reaction turbine, and their experience with these various types would prove of great service to the Corporation in the event of any extensive scheme being proposed for the installation of more power plant. The parent Committee has approved this. A special Committee is to report on the advisability of making an experiment over the tramway system of the proposed granting of two of the present ½d. stages for one ½d.

Hove.—The Brighton Corporation has written the Council to the effect that it has under consideration the question of providing a system of railless electric traction in the borough, and asking the Hove Corporation to co-operate with it in an application to Parliament for powers to construct and work a joint system which would meet the traffic requirements of the two towns. The General Purposes Committee, after receiving a deputation from the Brighton Council, decided to promote its own Bill for a trolley vehicle system within the boundaries of the borough of Hove.

Leeds.—The Tramways Committee on Monday decided to double the tramway lines on several routes where there is at present only a single track. The work is expected to cost about £10,000.

Mossley.—Early on the day of our last issue another unfortunate tramway accident occurred to a workmen's car on the Stalybridge Joint Board's system. The car—a single-decker—apparently got out of hand on a steep hill near Mossley station, left the track at a curve, and after running through a walled garden, fell into a railway cutting, four persons being killed outright, while two others have since died. A Board of Trade inquiry was opened on Tuesday, when Col. Von Donop inquired into the circumstances of the accident. The evidence of passengers and eye-witnesses was taken, but no material facts as to the cause of the disaster were elicited, and the inquiry was finally adjourned until the driver of the ill-fated car is able to give evidence.

Newcastle-on-Tyne.—At a meeting of the City Council, on the 20th inst., the Tramways Committee submitted a report on the proposed works, powers for which had been obtained in the

Corporation's recent Bill. The Committee recommended that the works be carried out by labour employed directly by the Corporation, with, perhaps, the exception of some of the street works at Newburn, which it might be desirable for the local Urban Council to execute. With regard to the extension of the system to Newburn, negotiations were proceeding in regard to acquisition of land, alteration of waggon-ways, &c., and the Committee recommended that that portion of the work be not commenced until next spring. As to tramway No. 2 (between New Bridge Street and Jesmond Road), the Committee recommended that this be started as soon as the preparation of materials permitted; the rails were in stock. Benton Bank was to be raised, but, except this portion, the whole of the work in connection with this section would be proceeded with. In connection with this work a portion, where the gradient was steep, would require heavier rails than those in stock. The Chillingham Road section was to be proceeded with as soon as material was prepared; for this rails in stock would be used. The report was adopted practically without discussion.

Oxford.—The T.C. on Monday decided not to adopt an overhead system for the proposed tramways.

Railway Electrical Developments.—The *Daily Express* understands that the L. & N.W. and G.C. Railways are experimenting with self-contained electric locomotives, and adds that these will be of the petrol-electric type: the *Standard*, dealing with same subject, says a leading British railway has given instructions for the preparation of designs for a Diesel electric locomotive of 500 H.P., and mentions that the results obtained with the Scottish turbo-electric locomotive have not come up to expectations. These developments are interesting, but contrary to the views expressed by the above papers, any form of self-contained locomotive is at best a makeshift on routes which, on account of heavy traffic conditions, are suited to ordinary electric traction.

Salford.—The town clerk reports with regard to the appeals to Quarter Sessions of the Corporation against the assessment of the Corporation by the Barton-upon-Irwell Union Assessment Committee, in respect of the use by the Corporation of the Eccles tramways and the Swinton township tramways, that these have been satisfactorily settled by him with the solicitors of the Union, as follows:—The assessment in Eccles reduced from £2,434 to £262; and the assessment in Swinton reduced from £1,002 to £75, thus making a net saving of rates levied in the past three years of £3,252.

Sheffield.—The Corporation has decided to double the tramway track at the city end of Ecclesall Road.

West Ham.—The Electric Lighting and Tramways Committee has had under consideration the provisions to be made in the proposed Bill in Parliament for the construction of a tramway across Wanstead Flats, and its continuation to "The Green Man." A report from the borough engineer states that the estimated cost of constructing a double line of tramway from the Council's tramway terminus along Woodford Road, Blake Hall Road and Bush Road to "The Green Man" terminus of the Leyton Council's tramways would be approximately £19,000. The estimated cost of the overhead equipment would be about £1,500, the cost of widening Woodford Road from the Forest Gate terminus to Aldersbrook Road to 50 ft. would be approximately £8,000, and the cost of maintenance of the widened roadway, exclusive of the tramway, but including lighting the road with arc lamps, would be about £600 per annum. The Committee recommended that provision be made in the Bill for the construction of a double line of tramway from Forest Gate to "Green Man," expressing the opinion that as no widenings were necessary for tramway purposes, the Bill should not include a provision therefor. Should, however, the Council determine to carry out the widenings apart from tramways, it considered that the £8,000 estimated outlay and £600 estimated cost of maintenance should not form a charge against the tramway undertaking.

TELEGRAPH and TELEPHONE NOTES.

A Trieste - Alexandria Cable.—It is reported from Vienna that a company is to be formed under the lead of the Austrian Felten & Guilleaume Co. for the establishment and working of a cable between Trieste and Alexandria. The capital is to be £416,000.

Anglo-Continental Telephone Service.—As the result of the test calls mentioned in our last issue, a telephonic service between subscribers in Inner London and in Geneva and Basle will be inaugurated when the necessary arrangements between the two Administrations are completed.

Automatic Register.—It is reported that a Mr. E. G. Godfree, of the Victorian Railway Department, has devised an automatic registering device for telephone calls, which is operated by the removal of the receivers from the hooks of two subscribers when put into communication. The device is intended for use with the C.B. system.

Falmouth.—A situation has arisen at Falmouth similar to that at Hythe; the owner of a garden across which 50 overhead wires are carried has objected to their presence, and as the National Telephone Co., in view of the coming expiry of the licence, will not undertake the expense of substituting a cable was last week announced that unless the objection were withdra the wires would be removed, isolating the town.

Hythe.—While the Corporation arrived at an agreem with the Post Office regarding the substitution of underground overhead wires in the Mayor's Avenue, the National Telephone appears to have been no party to this settlement, and Wednesday this week, if terms were not previously arranged, company was to have removed the wires, leaving the town isola from telephonic communication with other centres. A subscri however, applied for an injunction to prevent the company fr cutting off the service, and no action will be taken until this been disposed of.

Melbourne. — The new central-battery exchange brought into use at the end of August, 3,000 subscribers be transferred from the old "City" exchange. The Wills St exchange subscribers were afterwards changed over to the n exchange, to the number of 4,000. The undergrounding of lines, however, will not be completed for another year, and u this is accomplished the full benefit of the new equipment can be obtained.

Russia.—According to Russian newspapers, the quest of a telephone connection between St. Petersburg and Berli under the consideration of the Russian Post and Telegr Administration, as a consequence of the offer of a large Rus electrotechnical firm to build the line. The estimated cost is at 10,000,000 roubles.

The Russian Administration of Posts and Telegraphs has appl for powers to lay an additional telephone line between Mos and St. Petersburg. The cost of the work is estimated at £21,1 —*Board of Trade Journal.*

Spitzbergen.—The trials made at the wireless stat recently established at Spitzbergen have yielded favourable resu and actual working is to begin in the near future. It is stated t the station is able to receive radiograms from Norddeich Poldhu, and that this guarantees the certainty of the connect with Ingoe, in Norway. The latter station is to take up the m service with Spitzbergen, and is to be completed in the middl November.

Sydney.—As the result of his investigations, the Spe Commissioner, Mr. H. W. Ramsay-Sharp, appointed to test Sydney and suburban telephone system, has submitted a leng report to the Chamber of Commerce. He makes a number recommendations for the improvement of the service, and comme on the "stupendous task that confronts the telephone offic before the present system can be brought up-to-date and the re of past neglect wiped out."

Wireless Telegraph Patents.—An agreement has b arrived at between Marconi's Wireless Telegraph Co., Ltd., and Lodge-Muirhead Wireless and General Telegraphy Syndic whereby all disputes regarding their respective patent rights ended; the former company takes over all the Lodge-Muirh patents, and Sir Oliver Lodge will in future act as a scien adviser to the Marconi Co. On the other hand, the Marconi has taken steps against Messrs. Siemens Bros. & Co., Ltd., on score of an alleged infringement of its patents.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—October 28th. Gas-raising and by-prod recovery plant, one 1000-H.P. gas engine, and one 750-KW. E. generator, for the Corporation. See "Official Notices" October 13

Australia. — WESTERN AUSTRALIA. — November 21 One automatic or semi-automatic switchboard and equipment, the P.M.G.'s Department. See "Official Notices" September 15t

November 29th.—One portable hand-driven desiccating plant, binders, sleeves, tapes and copper wire, for the P.M.G.'s Depa ment. See "Official Notices" October 13th.

NEW SOUTH WALES.—December 20th. One branching multi magneto switchboard at Broken Hill, for the P.M.G.'s Departme See "Official Notices" September 22nd.

November 15th.—Telephone cords and ear-pieces, for the P.M.G Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M See "Official Notices" October 6th.

November 22nd.—Cable for the P.M.G.'s Department. "Official Notices" September 29th.

VICTORIA.—November 28th. Ebonite earpieces, calculagrap and insulators for the P.M.G. See "Official Notices" October 6t

December 12th.—Ebonite earpieces, telephone cords, bronze a copper wire, Bleeck-Love cells and charges, and telephone mater for the P.M.G.'s Department. See "Official Notices" October 20

TASMANIA.—December 11th. Four nauts of india-rubb insulated submarine telegraph cable (Schedule No. 33), for t Deputy Postmaster-General Hobart. Specifications and forms tender from the High Commissioner in London for the Commo wealth of Australia, 72, Victoria Street, S.W. Copies of the spe fications may be seen by British makers at the Commercial Inte gence Branch of the Board of Trade.—*Board of Trade Journal.*

Belgium.—November 15th. La Société Nationale des hemins de Fer Vicinaux, of 14, Rue de la Science, Brussels, is viting tenders for the supply and erection of the overhead electrical uipment of the light electric railways in the Malines district.

Canada.—Lethbridge.—November 24th. Municipality. ower station equipment, comprising boilers, economiser, steam rbo-generator, condenser and sub-station equipment ; 10 per cent. posit with tender. Plans, &c., from A. Reid, superintendent gineer, Lethbridge.

Dublin.—November 9th. The Corporation is inviting nders for electrically-driven centrifugal pumps for the Ringsend mping station.

November 6th.—General stores for a year, for the Dublin United ramways Co., Ltd. See "Official Notices" October 13th.

Edinburgh.—The Corporation invites tenders for the ectrical installation for lighting, heating and power at the College Art. F. A. Newington, Corporation electrical engineer.

France.—November 4th. The Under-Secretary of State Posts and Telegraphs in Paris (103, Rue de Grenelle) is inviting nders for the supply of five lots of gutta-percha and cotton-covered pper wire.

Great Western Railway.—November 7th. Stores for year. See "Official Notices" October 6th.

London.—L.C.C.—November 6th. Stores for a year. e "Official Notices" October 20th.

Radcliffe.—November 7th. Two 300-kw. rotary con-rters and transformers, and E.H.T. switchgear for the U.D.C. e "Official Notices" October 20th.

Sheffield.—November 13th. One 5,500-kw. steam rbine, condensing plant, pumps, pipework, &c., and alternator d exciter, for the Corporation. See "Official Notices" October 13th.

Siam.—December 30th. Tenders are invited for five ctrically-driven centrifugal pumps for the waterworks at ngkok. Particulars, Local Sanitary Department, Bangkok.

South Africa.—Cape Town.—The Municipal Councils Claremont, Rondebosch and Mowbray are inviting tenders for ctric lighting of roads and thoroughfares, and for a public pply to private consumers. Particulars from the Town Clerks of aremont and Rondebosch.

Spain.—The municipal authorities of Torquemradi rovince of Palencia) have just invited tenders for the concession r the electric lighting of the town during a period of eight years. Tenders have lately been invited by the municipal authorities of nta Perpetua de Moguda (province of Barcelona) for the concession r the electric lighting of the town during a period of 10 years.

Uruguay.—February 6th, 1912. Tenders are invited the Port Authorities at Monte Video for the supply of 13 electric anes, together with 600 metres of steel rails. Tenders, accom-nied with a deposit of 1,000 pesos (about £212), to the "Secretaria l Consejo de Administración del Puerto de Monte Video," Monte deo. Proofs of technical ability are required from tenderers. A py of the specification (in Spanish) may be seen by British anufacturers at the Commercial Intelligence Branch of the Board Trade, 73, Basinghall Street, London, E.C. Local representation advisable. A list of agents established at Monte Video may be tained by British firms at the Commercial Intelligence Branch.—*ard of Trade Journal.*

CLOSED.

Accrington.—The Electricity Committee has considered nders for switchgear required for the sub-station in connection th the high-tension supply to Globe Works. That submitted Messrs. Ferranti, Ltd., at a cost of £143, was accepted, on tober 19th. Tenders were submitted for the supply of one 300-v.a. three-phase transformer in connection with the same supply, d the one submitted by the British Westinghouse Co., Ltd., at 80, was accepted.

Australia.—The following contracts have been placed by e Commonwealth, according to the *Australian Mining Standard* :—

New South Wales.—Department of Home Affairs.—Electric lifts and cranes at Darling Island naval stores, Sydney, £6,000.—Standard Waygood Co.

Victoria.—Postmaster-General's Department.—150 miles of copper wire, £473.—Siemens Bros. Dynamo Works (Sydney), Ltd.

150 miles of tinned-copper wire, £1,226 5s.—Callender's Cable and Construction Co., Ltd.

1,400 protectors, £198.—British Insulated and Helsby Cables, Ltd.

Stay rods, £827.—Victoria Rolling Mills Co. Pty., Ltd.

Switchboard for Bendigo P.O., £3,877.—Western Elec. Co. (Australia), Ltd.

Supply of sulphate of copper to all States, £5,185 15s.—Wallaroo and Moonta Mining and Smelting Co., Ltd.

The *Australian Mining Standard* also states that the order of the ortlake Butter and Cheese Factory (Victoria) for the supply of ires, dynamos and plant, in connection with the electric supply heme, has been placed with the Silvertown Rubber Co., at £1,119.

Bradford.—The Works Sub-Committee of the Tramways mmittee has accepted a tender of Messrs. Cammell, Laird and ., Ltd., for 200 steel tires for tramcar wheels, at £312 10s.

Bristol.—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. Johnson & Phillips, Ltd., for cables for the new cold stores.

Faversham.—The T.C. has accepted the tender of Messrs. S. Davis for 250 tons of anthracite coal for the electricity works, at £1 13s. 9d. per ton.

Government.—The following tenders have been accepted during the past month by the Government departments named :—

Admiralty, Contract Department.

Dry cells.—J. C. Fuller & Son.

India Office, Store Department.

Cables.—Siemens Bros. & Co.
Cells.—Tudor Accumulator Co.
Insulator cups.—Bullers, Ltd.; Taylor, Tunnicliff & Co.
Switchboards.—Johnson & Phillips, Ltd.
Telephone apparatus.—Western Electric Co.
Terminal sets.—British L. M. Ericsson Manufacturing Co.

General Post Office.

Automatic telephone exchange equipment (Epsom Post Office).—British Insulated and Helsby Cables, Ltd.
Ditto for Caterham Valley Post Office.—The American Machine Telephone Co., Ltd., per J. H. Tennant.
Electric lifts (Belfast P.O.).—John McLean & Sons.
Ditto (S.E. District P.O., London).—Medway's Safety Lift Co.
Electric lighting (Newcastle-on-Tyne P.O.).—Falconar Cross & Co.
Telegraphic apparatus, perforators, keyboards.—Gell Teleg. Appliances Syndicate, Ltd.
Telephonic apparatus, bell sets and retardation coils.—Western Electric Co., Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd., and London Electric Wire Co., and Smiths, Ltd.
Jacks.—British L. M. Ericsson Manufacturing Co., Ltd.
Bell receivers.—Siemens Bros. & Co., Ltd.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Conner Telegraph Works, Ltd.; Sterling Telegraph and Electric Works, Ltd.; Walter's Electrical Manufacturing Co., Ltd.
I.R. and C.C. cable.—Henley's Telegraph Works Co., Ltd.
Paper core cable.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Switchboard cable.—London Electric Wire Co. and Smiths, Ltd.; Western Electric Co., Ltd.

Hastings.—At the last meeting of the Board of Guardians tenders were received for wiring the workhouse premises, the Corporation having agreed to extend their mains to that institution. The Board, acting on the advice of Mr. R. Ferguson, the borough electrical engineer, invited tenders on two separate schedules—one for the capping-and-casing system, and the other for Stannos wire or O.S. system. Tenders were opened as follows :—

	Capping and casing.	Stannos wire.
Edmundson Co., London	£1,025	£986
Harland, Bowden & Co., London	755	—
Bance & Co., Hastings	775	—
Taylor & Co., London	870	—
Sherland Bros., Birmingham	535	500
Tredegar & Co., Westminster	412	348
Galliers, Brighton	610	705
A. H. Wood, Hastings	797	—
Small & Walton, London	929	985
Newbald, Sutton	758	775
Banbury Electrical Co.	600	—
F. G. Petitt, Hastings	672	785
Fryer & Co., London	1,255	—
Price & Co., Cardiff	401	380
Tilley Bros., London	570	596
Besant, Eastbourne	760	765
Hancock & Rickson, London	568	490
Weston, London	608	690
Reed & Sons, Brighton	695	687

In reply to a question, it was stated that the engineer's estimate was £468. Debate ensued as to the two systems, and it appeared that it was Mr. Ferguson's opinion that for a workhouse the Stannos system was quite as good as the other, and that it would be cheaper and more easily fixed. The Chairman moved that the tender of Messrs. Tredegar & Co. for the Stannos system be accepted. Councillor Hill seconded. Mr. Kelly thought the matter should be referred to the Committee for inquiry as to Tredegar & Co. and the next lowest tenderer. The Clerk explained that Tredegar & Co. had carried out big jobs in various parts, including Waterloo Station. The tender of Messrs. Tredegar & Co. was thereupon accepted.

London.—Southwark.—The B.C. has accepted the tender of Messrs. Alfred Blackmore & Co., Ltd., for the supply of 7,000 tons of various kinds of coal ; half the quantity at 11s. 8d. per ton and the remaining half at 11s. 3d. per ton.

L.C.C.—The Education Committee received the following tenders for the electric lighting of the Great College Street School, St. Pancras, E. :—

Saville & Walton	£340
G. Weston & Sons, Ltd.	(accepted) 395
T. H. Smerdon	412
Johnson & Phillips	455
Tredegar & Co.	465
Williams & Bach	484
Waring & Withers	497
E. Lawrence & Sons, Ltd.	525
Fleet Electrical Co.	567

In pursuance of the authority delegated to the vice-chairman of the Buildings Sub-Committee, the lowest tender for the electric lighting work—viz., that of Saville & Walton, amounting to £340, was accepted, and the work was ordered without waiting for the formal completion of the contract. "After a short time, however, the men and the material delivered were withdrawn from the school, the contractors stating that they did not intend to proceed with the contract. Having regard to the neccssity for the work being put in hand without delay, our chairman accepted the next tender, that of G. Weston & Sons, Ltd., amounting to £395, and authorised the commencement of the work without waiting for the formal completion of the contract. . . . We are of opinion that the name of Messrs. Saville & Walton should be entered on the list

of persons and firms from whom the Council will not accept tenders."

The Highways Committee has accepted the tender of Hadfield's Steel Foundry Co., Ltd., for single and double junction lines for tramways in South London, at £2,815.

Five tenders were received for sand drying and crushing plant for the permanent-way depôts, but as none was regarded as satisfactory, none is to be accepted.

The Highways Committee accepted the following tenders for rails for new car-sheds and the central car-repair depôt :—

Bolckow, Vaughan & Co., Ltd.—300 tons of No. 60 rails ..	..	£6	7 0
" " 13 tons of fishplates ..	..	8	7 0
P. & W. Maclellan, Ltd.—15 tons of No. 25 rails	..	7	10 6
" " ½ ton of fishplates	..	8	13 0
Cammell, Laird & Co., Ltd. 2½ tons bolts and nuts (No. 60)	..	14	10 0
P. & W. Maclellan, Ltd.—¼ ton bolts and nuts (No. 25) ..	..	19	0 0
Bolckow, Vaughan & Co., Ltd.—500 fishplates (to sketches)	..	9	12 0

None of the tenders for punching and shearing and other machines at the Stockwell depôt was satisfactory, and fresh ones will be invited later.

HACKNEY. The B.C. Electricity Committee received the following tenders for the supply of white open type arc lamp carbons, the prices being per 1,000 pairs :—

	"A.B." quality.	"C.D." quality.
Siemens Bros. Dynamo Works, Ltd.	£5 8 0	£4 10 5
W. Geipel & Co.—H. 201	3 4 3	2 13 9
H. 202	3 18 7	3 2 5
Sloan Electrical Co., Ltd.	3 1 3	2 11 3
Brush Electrical Co., Ltd.	3 13 8	3 1 4
Ship Carbons, Ltd.	3 6 11	2 15 10
Crompton & Co., Ltd.	3 16 0	3 3 6

The tender of the Sloan Electrical Co. is the lowest and is for "C" quality Conradty carbons which have been used by the department before and found satisfactory, therefore their tender for the supply of 100,000 pairs of white open type arc lamp carbons at £2 11s. 3d. per 1,000 pairs is recommended for acceptance, subject to the Borough Electrical Engineer's tests upon the samples submitted proving satisfactory.

Salisbury.—The following is a list of tenders received by the Salisbury and District Joint Isolation Hospital for the electric light and power installation (architect, Mr. J. H. Goodman, Reading) :—

Cozens, S. G., London	£1,267
Edmundson's Electricity Corporation, Ltd., London ..	1,394
Edwards & Armstrong, Bristol	1,020
Electrical & Motor Co., Banbury	1,266
Ellis & Ward, Ltd., Birmingham	1,188
Felgate Installation Co., Ltd., Reading	1,176
Giffen Bros., St. Albans	1,160
Graham Bros., Middlesbrough	1,091
Grossmith & Co., Southsea .. .. .. (accepted)	998
Hancock & Rixon, London	1,093
Innes, Albert, Leeds	1,221
Johnson & Phillips, Ltd., Charlton	1,169
Lea, Son & Co., Shrewsbury	1,220
Malcolm & Allan, Ltd., London	1,406
Mann, Egerton & Co., Ltd., London	1,374
Mansfield Engineering Co., Mansfield	1,114
Price, Fred., & Co., Ltd., Cardiff	1,025
Saville & Walton, London	1,309
Vaughan, T. W., & Co., Ltd., London	1,380
Wallsall Electrical Co., Ltd., Walsall	1,390
Wilkins, Fred., & Brother, Ltd., Liverpool	1,098

Weston-super-Mare.—The U.D.C. has accepted the tender of Weston and District Electric Supply Co., Ltd., for a motor and starter for the depôt, at £52 10s.

Worthing.—The T.C., on the recommendation of the resident engineer, has accepted the following additional tenders in connection with the installation of the new Diesel engine plant at the Corporation generating station :—

Fuel oil tank.—Messrs. J. J. Whittaker & Co., £39.
Fuel oil measuring tank and meter, £13, and ammeters and automatic circuit-breakers, £24.—Messrs. F. A. Greene & Co.
Combination generator switches and bus-bars.—Messrs. J. Fowler & Co., Ltd., £27.

FORTHCOMING EVENTS.

Physical Society.—Friday, October 27th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "Further Observations on the Afterglow of Electric Discharge and Kindred Phenomena," by the Hon. R. J. Strutt; and "Homogeneous Fluorescent X-Radiation of a Second Series," by Prof. C. G. Barkla and Mr. J. Nicol.

Institution of Electrical Engineers (Manchester Local Section).—Friday, October 27th. At 7.30 p.m. At the University, Manchester. Address by Mr. W. Cramp.

Association of Engineers-in-Charge.—Saturday, October 28th. At 6.30 p.m. At Liverpool Street Hotel. Social. Ladies' night.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, October 31st. At 7.30 p.m. At the Manchester School of Technology. Opening meeting. Address by Mr. J. F. C. Snell.

Electrical Treatment of Milk.—A report has appeared in the *Daily Express* regarding a system of electrical treatment of milk and other liquids, whereby they are successfully sterilised and purified. The process is the invention of Mr. Douglas L. V. Browne, of 38, Rue des Perchamps, Auteuil, Paris, but no information is given as regards his *modus operandi*.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

The following orders are issued :—

Wednesday, November 1st.—N.C.O.'s mess meeting at 8 p.m.
Thursday, November 2nd.—"C" Company. 7 p.m., lecture. 8 to 10 p. technical work and infantry drill.
Friday, November 3rd.—"D" Company.—7 p.m., lecture. 8 to 10 p. technical work and infantry drill.
Saturday, November 4th.—Headquarters will be opened for Regimen business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant fo O.C. London Electrical Engineers.

NOTES.

Sweating Skilled Labour.—A correspondent, who quired after an appointment in the Midlands as "meter tester a testing assistant," has sent us the following schedule of qualifi tions required of candidates for the post :—The candidate must not less than 19 years old, and must have successfully pas through a complete course of theoretical and practical training a recognised technical school or college, gained a certificate diploma, and have had some experience in a works of good sta ing. He must be thoroughly experienced in testing and adjusti meters, indicators, and apparatus of all types and makes ; capa of using potentiometers and standard instruments, and of calibr ing, checking and maintaining accurate all the electrical appara in the works ; and able to localise faults on mains and to test in lation during working, besides investigating complaints. He m be ready to assist the mains superintendent in technical matt and act for him in his absence, and must be a fair draughtsm quick at figures, and able to use logs and the slide rule. Moreov besides taking charge of the test-room and maintaining its conte accurate and in good order, he will be required to show a thoro knowledge of all branches of D.C. and A.C. testing, and m possess sufficient mechanical knowledge and skill to repair inst ments and meters.

To comply with all the requirements demanded, the candid would have to be more like 29 than 19 years old. Yet the "salar offered for this compendium of mechanical, electrical, mat matical, experimental, technical and scientific excellences, is more than 26s. a week—about 4s. 6d. a day—less than the pay o day-labourer or a charwoman !

If this is not sweating, what is ?

Electrical Openings in Servia.—As a market electrical machinery and apparatus Servia affords, according to German Consul at Belgrade, a noteworthy opening. In 1900 imports of dynamos, motors and other electrical goods tota 214,000 dinar, showing, however, a fall of 15,000 dinar on those the previous year. Germany's share of the trade in both ye amounted to 77,000 dinar. The honours of the chief supplier to France. Of other electrical goods the imports were 643,(dinar, almost 50 per cent. below the figures of the foregoing ye Germany was the leading contributor with goods to the value 335,000 dinar ; France supplied 168,000 dinar, and Austria 126,0 No doubt can be entertained, says the Consul, that the call for th articles will increase, as all the concomitants therefor are pres such as water power for the establishment of generating static demand for industrial undertakings, high price of petroleum, the defects of local gas works.—*Elektr. Nachrichten.*

Electric Lighting in a Hindu Temple.—Accordi to a correspondent of the *Statesman* (India), the famous temple Kali, at Kalighat, has, after all, been provided with an elect installation. "When a proposal was first made, some of orthodox Hindus asked each other 'are electric lights permissi in a Hindu temple ?' The learned body of Sebait Samiti at Kalig held several sittings, and after fully discussing the matter w pundits and scientists, they came to the conclusion that there nothing objectionable in electric wires and accessories to for their introduction into a Hindu temple. The cost of installat and consumption is borne by two Hindu gentlemen who do not w their names to be disclosed. The installation is received by Hindu community with immense delight, as the pilgrims visiti the temple used to be very much inconvenienced owing to defect lights in the temple. In view of the large influx of pilgrims duri the Durga Pujah, the Calcutta Electric Supply Corporation gave connection at very short notice, and the Hindu community app ciate their promptitude in the matter." An ELECTRICAL REVI correspondent who sends us the above cutting, says :—"This pl is noted for the great Juggernaut Temple which is visited daily about 10,000 pilgrims, and at the Great Festival in May by o 100,000. Up to now I understand no European has ever b inside. It will be interesting to see if the Hindoo, who is gett more emancipated every day, will install electric light in this fam building, which is 900 years old, the same as has been done Calcutta."

A Portable Motor for General Agricultural Work.

he extreme convenience of the use of electricity as the driving er for the many small machines used in agricultural work has dly been recognised yet. The cost of installing and maintaining nerous small motors, each of which is in use only very occasion-, is one of the chief hindrances, but one which would soon ppear if the custom of employing a single portable motor for whole miscellaneous work of the farm became more general. notor suitable for such work has been recently brought out by a ss firm, and is described in *L'Electricien*.

general view of this combination is given in fig. 1. It will be that it consists of a small semi-enclosed motor (of from 2 to P., according to the work to be dealt with), mounted on a light le iron trolley on two wheels. The breadth between wheel res is only 16½ in., so that it can be drawn along the narrowest

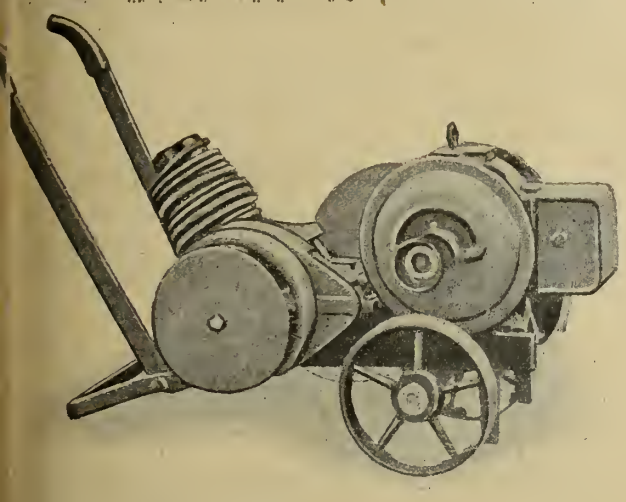


Fig. 1.

s or passages. The weight is carefully distributed, so that some 49 lb. falls on the handles. One end of the motor dle carries a pinion which drives a countershaft, carrying at end a double pulley, and at the other the pinion of a second uction gear also driving a double pulley. Finally, the free end he motor spindle carries a small pulley. In this way five dis- t belt speeds are made available of the values of 102, 155, 530, and 1,950 ft. per minute respectively. Further, the addition of nd disk to the lower speed pulley transforms it into a simple t drum suitable for winding up loads, such as sacks, &c.

s an alternative, the disk can be replaced by a simple adjustable k and connecting rod for the purpose of providing reciprocating ion when necessary for pump driving or similar work. At the of the trolley a small cable drum is fixed carrying 20 yards able attached to the motor terminal board at one end, and

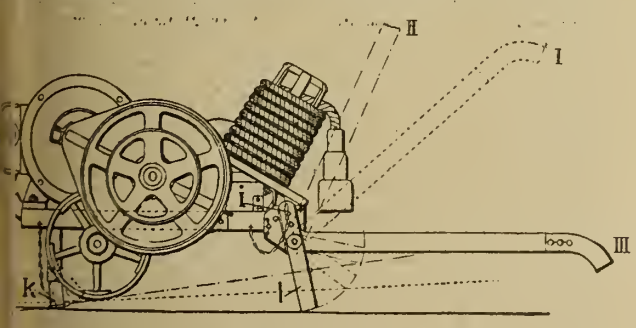


Fig. 2.

l (for three-phase supply) with a four-way plug connector he other end. The fourth plug is for the purpose of earthing motor frame. The socket for the plug has five ways arranged at the motor will rotate one way or the other, according to the in which the plug is inserted. The enclosed terminal board ounted direct on the motor and carries a suitable triple-pole tch.

will be seen from fig. 2 that the trolley when at work does not e on its wheels at all, but stands firmly on four legs, the change g readily effected by a single person by suitably manipulating handles, first into position I, to enable the front legs to be set, then into position III, which raises the wheels off the ground.

portable machine of this type is obviously readily applicable ork of the most varied kinds, including the driving of thrashing hines, sifters, chaff-cutters, winnowing machines, crushers, ge pumps, wine presses, mills, hoists, band saws, circular saws, in fact, practically any of the machines met with on a farm.

nstitution and Lecture Notes. — Institution of ectrical Engineers (Glasgow Section).—The tenth annual er of this Section will be held at the Grosvenor, Gordon Street, December 12th. The inaugural address by the chairman of the ion will be delivered on November 14th. Other arrangements he programme for the session are :—December 15th, Prof. F. G. Baily on "The Heriot-Watt College Laboratories" January 9th, 1912, Mr. J. B. (?) Mackenzie on "Illumination." The Students' Section opens on October 20th, with an address by Mr. W. W. Lackie, the chairman.

Rugby Engineering Society.—The syllabus for the session 1911-12 contains the following arrangements :—

Meetings.

October 12th, paper on "Multiple-effect Evaporation," by E. R. Briggs.
November 16th, lecture on "Gyrostats," by R. C. Clinker.
December 14th, paper on "Machine Shop Practice," by P. V. Vernon.
January 11th, 1912, paper on "Air-Compressor Efficiency," by B. M. Woodhouse.
February 15th, paper on "Workshop Economics," by J. Picken.
March 21st, paper on "High-Speed Electrical Machinery," by F. H. Clough.

Visits.

October 14th, National Physical Laboratory, Teddington.
October 28th, Portland Cement Works, Rugby.
Other visits are being arranged.

Two premiums of £2 2s. each are offered to writers of papers.

Association of Mining Electrical Engineers (East of Scotland Branch).—The following dates for meetings and special district lectures—the latter with a view to popularising the work of the Branch and the Association generally—have been provisionally fixed : Friday, November 10th, special lecture at Alloa. Friday, December 8th, general meeting at Dunfermline. Friday, December 22nd, special lecture at Wemyss. Saturday, January 6th, 1912, general meeting at Edinburgh ; Friday, January 19th, special lecture at Cowdenbeath. Friday, February 16th, general meeting at Dunfermline. Saturday, March 9th, general meeting at Edinburgh. Friday, March 29th, general meeting at Dunfermline. Saturday, April 20th, general meeting at Edinburgh : and Friday, May 24th, annual business meeting at Dunfermline.

The opening meeting for the session of the West of Scotland Branch of the Association was held on October 20th in the Technical College, Glasgow. It was reported that the total membership of the branch stood at 134. Mr. Alexander Anderson, Motherwell, in the course of his presidential address, said the demand for earthing all apparatus had added to the duties of the colliery electrical engineer, and in this connection he urged the necessity for a little theoretical knowledge. Earthing systems could not be relied upon unless they were carried out in strict obedience to Ohm's law. He announced that during the present session prizes would be presented for the best papers contributed by Scottish members of the Association who were acting colliery electrical engineers.

Reunion of Old Cromptonians.—One hundred Cromptonians, past and present, dined together at the Trocadero Restaurant on Saturday, October 14th, under the chairmanship of their old chief, Col. R. E. B. Crompton, C.B., R.E. As it was some 20 to 30 years since many of those present had left the Crompton Works, the meeting was of particular interest, and gave an opportunity to many to renew friendships which dated back to the earliest days of electric lighting in this country.

Mr. W. A. Chamen acted as vice-chairman, and Col. Crompton was supported at the chairman's table by, among others, Mr. James Swinburne, a former works manager at the Arc Works, and Mr. A. P. Lundberg, Col. Crompton's first assistant at the works.

Mr. Chamen, in proposing the toast of "Cromptonians, Past and Present," recalled some of the experiences met with in their earlier contracts, and enumerated the many responsible positions occupied at the present time by those who had at one time been associated with the company. He added that there were no fewer than 25 Old Crompton men occupying at the present time the position of chief engineer to electric lighting and power undertakings, and further, that the names of men such as James Swinburne, Gisbert Kapp, A. P. Lundberg, Sam Mavor, J. F. C. Snell, J. W. Kempster, A. Bergtheil, &c., bore witness to the important part which the old firm had played in the building up of the electrical industry.

Col. Crompton, in a happy speech, declared how pleased and proud he was to see around him so many of those who were associated with him in his earlier days, and how gratifying it was to him to realise that many of those who had started their engineering life with him had, after going out into the world, made names and positions for themselves. He felt convinced that whatever branch of engineering or business might lie before a man in after life, the precision gained during training at electrical work formed a more sound ground work than did many other branches of engineering.

The dinner was organised by a Committee consisting of Messrs. W. A. Chamen, S. Dobson, E. J. Fox, H. Leaf, C. Peel, A. H. Pott and W. L. Pakenham. Many still associated with the company were present ; among others, Lieut.-Col. Clibborn and Mr. B. Gibson, directors, and Messrs. E. Reeves and A. H. Hodson, joint managers.

Educational Notes.—Northampton Polytechnic Institute.—At the invitation of the Governors, under the new scheme of management recently sealed by the Charity Commission, the Duke of Connaught has accepted the office of President of the Polytechnic.

Faraday House.—Mr. R. J. Wallis-Jones will begin a series of demonstrations of electric welding and allied processes to the senior students on November 8th.

Appointments Vacant.—Improver, for the Perth Corporation electricity works (15s.). ; commercial assistant (£2 and commission) and draughtsman (35s.), for the Battersea B.C. See our advertisement pages to-day.

Steam Turbine Tests.—Referring to the abstract which we recently published of a paper on the subject of "Steam Turbines," read by Mr. H. Zoelly before the Zurich meeting of the Institution of Mechanical Engineers, the British Thomson-Houston Co., Ltd., write pointing out that this paper contains disparaging references to the compound velocity impulse turbine, and, as the principal makers in this country of the "Curtis" turbine—the only turbine in which this system is employed in its entirety—they ask us to publish the following :—

"Mr. Zoelly states that governing by means of successive groups of nozzles is unsatisfactory, and unsuitable for parallel running. So far as our machines are concerned, that statement is not in accordance with the facts, as we have over 50 machines in this country running in parallel with engines or turbines, and in every case this form of governing is operating successfully.

"Mr. Zoelly also specially remarks that he has proved, after many years of experimenting and testing, that it is not possible, under most favourable conditions, to obtain with the compound velocity turbine a higher thermal efficiency than 58 per cent. We can only say that his researches could not have been complete, as the thermal efficiencies of "Curtis" turbines given below are considerably higher than 58 per cent., and compare well with those given by Mr. Zoelly as having been obtained with his turbines.

"In order that the results may be readily compared, we have reproduced Mr. Zoelly's table, and in doing so we have given the superheat of the steam instead of the total temperature, as this

Some Test Results obtained with Zoelly Steam Turbines.

Installation.	kw. load.	Pressure. Lb. per sq. in. gauge.	Superheat. Deg. F.	Vacuum. Per cent.	Steam consumption. Lb. per kw.-hr.	Steam consumption. Lb. per h.p.-hr.	Thermal efficiency per cent.
4,000-kw. turbine,	4,189	164·7	184	95·8	13·25	9·36	68·7
Charlottenburg.	3,092	168·3	184	96·2	13·77	9·58	66·2
1,000 r.p.m.	2,199	161·9	147	97·4	14·40	9·84	63·2
Tested Dec., 1910	1,138	166·9	147	97·8	16·00	10·12	59·9
2,000-kw. turbine,	2,052	179·0	205	94·9	13·04	9·18	70·5
Helsingfors.	1,514	181·7	183	95·5	13·67	9·52	67·2
3,000 r.p.m.	1,026	177·5	187	95·8	14·53	9·76	65·2
Tested Nov., 1910	510	171·8	167	96·6	17·33	10·68	58·8
1,700-kw. turbine,	1,691	206·0	280	93·3	13·04	8·91	69·7
Hagendingen.	1,366	202·3	284	94·2	13·77	9·18	66·5
3,000 r.p.m.	851	205·2	272	95·2	15·52	9·81	61·0
Tested Dec., 1910	457·5	208·0	256	94·9	18·91	10·68	57·1
1,200-kw. turbine,	1,235	162·3	79	94·0	15·34	10·77	67·0
Aurich.	949	164·0	70	95·5	15·99	11·08	62·8
3,000 r.p.m.	606	166·7	53	96·5	17·1	11·48	59·9

Some Test Results obtained with Curtis Steam Turbines.
The British Thomson-Houston Co., Ltd., Rugby.

Installation.	kw. load.	Pressure. Lb. per sq. in. gauge.	Superheat. Deg. F.	Vacuum. Per cent.	Steam consumption. Lb. per kw.-hr.	Steam consumption. Lb. per h.p.-hr.	Thermal efficiency per cent.
							,,
3,000-kw. 1,500-r.p.m. turbine, Olympia Oil and Cake Co., Selby. Tested April, 1911.	2,987	140	144	89·4	15·96	11·2	70·2
	2,280	145	137	91·3	15·90	10·9	68·9
	1,584	150	151	91·7	17·10	11·43	64·8
1,500-kw. 1,500-r.p.m. turbine, The Fife Power Co., Dunfermline. Tested September, 1911.	1,541	135	8	93·4	17·46	12·12	65·7
	1,185	129	15	94·7	18·05	12·3	63·1
	739	129	7	95·3	19·3	12·52	60·9
1,250-kw. 3,000-r.p.m. mixed-pressure turbine, The Bedwas Navigation Colliery Co., Ltd. Tested December, 1910.	1,566	140	106	92·1	16·95	12·04	63·7
	1,185	140	102	91·7	17·2	12·05	64·4
	893	141	98	91·7	18·55	12·78	60·7
	626	140	100	91·7	20·35	13·6	56·9
	1,268	1·5	23	91·6	29·8	20·95	73·4
	916	1·4	23	91·7	31·5	21·65	70·9
	548	1·6	24	91·5	37·5	24·72	62·0
1,000-kw. 3,000-r.p.m. turbine, Messrs. W. N. Brunton & Sons, Ltd., Musselburgh. Tested May, 1911	1,221	120	98	90·8	17·75	12·5	65·1
	995	120	99	92·7	17·3	12·07	65·0
	500	120	89	91·8	19·9	13·1	61·1

gives at a glance a better idea of the conditions. Below his schedule we have tabulated test results on "Curtis" turbines built by this company at Rugby. It should be noted that we have omitted the column of efficiencies based on conditions behind the stop valve, as these are of no interest to the user, who is only concerned with the efficiency of the machine based on the steam conditions in front of the stop valve.

"In accordance with the more conservative practice in this country, the superheat in our tests is generally lower than in the tests published by Mr. Zoelly, with the result that our efficiencies are somewhat lower than would have been the case had our been carried out with a higher degree of superheat, it being known that the thermal efficiency of a turbine increases wi increase of superheat.

"We should add that all the test results of "Curtis" tur given in the above tables were obtained on official tests."

Turbine Accident.—According to the *Daily Telegr* an explosion which occurred on Tuesday afternoon at the A Engineering Works of Greenwood & Batley, in Armley Leeds, caused serious injury to a fireman, Arthur William I of Horsforth, who, with a second sufferer, was removed t infirmary. The latter was not detained. The explosion occ in the power station, shattering all the windows and conside damaging the building. The machinery is worked by tu power, and it was discovered that one end of the turbine had blown out. All the machinery was stopped. Nearly 1,000 me to cease work temporarily.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected wit technical or the commercial side of the profession and ind also electric tramway and railway officials, to keep readers Electrical Review *posted as to their movements.*

Central Station Officials. — Mr. R. H. Cam borough electrical engineer of Dewsbury, is now well o way towards recovery from a severe illness which has pre him from performing his duties for nearly four months. Campion had an attack of double pneumonia, and for some his condition caused grave anxiety.

Mr. Cecil C. Fowler, deputy manager at the Brighton e city works, has resigned, he having obtained an appointm India. Mr. Fowler has been with the Brighton Corporati 19 years.

Tramway Officials.—Mr. W. T. Dawson, Buckh Fife, has been appointed manager of the Wemyss Tramway place of Major Marshall, V.C., resigned.

General.—Messrs. Ernest Long and Robert C ford, who have been for many years with Messrs. W. T. and Co., Ltd., Manchester, in charge of power, tramwa general electrification contracts, have now started busin Long & Crawford, Ltd., at 28, Deansgate, Manchester. Th specialising in collieries and textile works equipment and g power work, and want trade catalogues and lists.

The *Australian Mining Standard* states that Mr. H. G. general manager of the Union Electric Co. of Australia, Lt just returned to Sydney from a tour through South Australi West Australia. "Mr. Henry F. Nichols has been appointed company's agent for the sale of motors, switchgear, &c., in Australia, whilst the firm of Ritchie & Jackman, 197, Street, Perth, have been appointed as the sole agents fo Australia. In both places heavy stocks of the 'Excello' motors, instruments, &c., are carried. Mr. Such states th electrical market in Perth shows distinct signs of incr activity, and that before long electrical business in that Sta prove of considerable interest to the trade. At the present t is stated that there are over £250,000 worth of buildings in of erection in Perth alone."

An Australian exchange states that Mr. G. G. Balsill expert recently appointed to take control of wireless tel operations within the Commonwealth, arrived in Melbour month. The same journal also records that Mr. R. P. Wil member of the firm of Merz & McLellan, electrical eng London, who was recently in Melbourne in connection wi proposal to electrify the suburban railways, is about t Australia again. Mr. P. Norwood, formerly assistant ele engineer for the Newcastle (N.S.W.) Council, has been app electrical engineer to the Inverell Council, where a syst electric lighting is being installed.

It is announced that Captain Harry Mance, R.E., eldest Sir Henry C. Mance, is to marry Miss Stenhouse, younger da of Major-General W. Stenhouse, Indian Army, at St. Peter's C St. Albans, on November 2nd.

Obituary.—Mr. John Conacher.—Many of our r interested in electricity supply within the Metropolitan ar have heard with deep regret of the death of Mr. John Co who, some years ago, rendered splendid service as general m of the Metropolitan Electric Supply Co., Ltd. Prior to h nection with that company, he had shown valuable quali railway management, and it was to return to work in this that he retired from his responsible position with the Metro Electric Co. a few years ago. Mr. Conacher passed away o nesday last week at the age of 66 years.

Mr. W. G. Hull.—The death occurred on October 16th injuries received in a cycle accident, of Mr. Wm. Geo. who was in business as an electrical engineer at Thames A Pangbourne (Berks.). Deceased, whilst proceeding to execut at Goring, was thrown from his cycle and picked up dead. a member of the Parish Council and a prominent Churchma

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Grimshaw, Baxter & J. J. Elliott, Ltd.—A memorandum satisfaction to the extent of £500 on September 29th, 1911, of debentures ted April 6th, 1909, securing £19,850, has been filed.

Lamplough & Son, Ltd. (99,688).—Particulars of £6,000 bentures, created September 25th, 1911, filed pursuant to Sec. 93 (3) of the mpanies (Consolidation) Act, 1908, the whole amount being now issued. operty charged: The company's undertaking and property, including uncalled pital. No trustees.

Barbados Electric Supply Corporation, Ltd. (104,367).—arge dated September 23rd, 1911, to secure £3,000, charged on the company's dertaking and property, present and future, including uncalled capital. lders: Anglo-American Debenture Corporation, Ltd., 20, Birchin Lane, E.C

South Metropolitan Electric Light and Power Co., Ltd. ,875).—Issue on September 27th, 1911, of £10,000 debentures, part of a series which particulars have already been filed.

English Electrical Co., Ltd. (112,639).—Particulars of 000 debentures, created September 7th, 1911, filed pursuant to Sec. 93 (3) the Companies (Consolidation) Act, 1908, the amount of the present issue ng £1,000. Property charged: The company's undertaking and property, sent and future, including uncalled capital. No trustees.

Llangollen and District Electric Light and Power Co., Ltd. 384).—Debenture dated October 4th, 1911, charged on the undertaking and neral assets, to secure £500. Holder: P. H. Mitchell.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—he on October 1st, 1911, of £13,000 debentures, part of a series of which ticulars have already been filed.

CITY NOTES.

National Telewriter Co., Ltd.

. E. W. Edwards, who presided at the meeting held last k in London, said that in March last, when it was considered irable, in view of the position and volume of the company's iness to reduce the number of directors, Sir W. Treloar, Sir K. Rollit, Mr. Liddell and Mr. A. R. Prideaux withdrew. Turn- to the accounts, the income from rentals showed a considerable rease, but, owing to several causes, their progress had been iously retarded. The chairman went on to refer to the difficulties h which they had been confronted, and the steps taken to overcome m. At the date of the last meeting measures had been framed the active development of the business, and new subscribers re obtained, but unfortunately it became increasingly evident t in many cases they were unable to cope successfully with the ely varying conditions in connection with private line work hout incurring expenses for maintenance which were com- cially prohibitive. At the time the company was formed the rd, acting on the experience obtained with some 100 machines, ich had already been in constant use for several years through- the London district, placed an order for 700 instruments for ior and private line work, with an electrical firm of the highest ding. These machines were constructed on the basis of the st technical information then obtainable, but in the light of tical experience, the user of the instrument had disclosed ects which made it difficult, even with the most care- supervision, to obtain that general expression of satisfaction ich was necessary for the proper development of the business. of the main difficulties lay, not so much with the instrument lf as with the devices which were necessary to transform and l with the line currents and voltages of the various electrical ems. This was the position with which they were confronted November last, and in view of the circumstances it was deemed dent, for the time being, to close down the contract department, to deal only with such inquiries as arose in the ordinary course rade. Prompt measures were immediately taken to deal with technical position, and in November last one of the directors for America, where several thousand instruments of American nufactnre were already in public use, in order to negotiate with American company with a view to obtaining the benefit of ir wider technical knowledge and practical experience. haustive tests made with the instruments of the American com- y had satisfied the board that they were superior in design and struction to the English instruments for interior and private work, and that they fulfilled the requirements and conditions elewriting in commercial practice. They were endeavouring to minate from their installations all unstable units, such as teries, electric valves and similar devices, for which small tor-generators would be substituted, which would have the ect of reducing the cost of maintenance to a minimum, while iency would be proportionately increased. Arrangements with American company were in course of completion for supply of instruments on terms which compared ourably with prices paid to British manufacturers, a full exchange of all technical information, and the formation of a British company to deal with the European Colonial rights of the American companies in which the ional Telewriter Co. is substantially interested. The general eement embodying these arrangements would, it was expected, ery shortly signed. In view of the serious issues involved, the ctors conferred with a number of the principal shareholders in rch, and they expressed the unanimous opinion that the only icy to be pursued under the existing circumstances was to con- ue to push forward the company's business and to purchase erican instruments. A limited number of instruments, involv- ing an outlay of about £2,000, was accordingly ordered, and these were now being installed with some of the principal users, but if these gave the results they anticipated, the greater part of the private line instruments at present in use would have to be replaced, a step which would involve further substantial expenditure. In regard to the Telewriter Exchange, from which they hoped to obtain a large proportion of their revenue, the number of their subscribers had steadily increased, and the volume of calls, chiefly dealing with the transmission of telegrams between the subscribers and the General Post Office, had now reached substantial proportions. The Telewriter Exchange was gaining in public favour, and were it not for the technical difficulties, the number of subscribers would have been trebled, or possibly quadrupled. The rapid growth of the exchange system would depend upon the extent to which written communication for the transmission of orders, &c., was appreciated by business houses, and the more this practice was recognised the easier it would become to control fresh subscribers from sources such as the railway companies, carriers, theatres, box offices, co-operative stores, clubs, &c. They had reopened their contract department, and canvassing had been resumed under the supervision of an experienced telephone contract officer, and they might reasonably look to a very considerable extension of business in the future. A great deal of spade work had been done in the provinces, and installations have been obtained with a number of important firms in Manchester, Liverpool and other industrial centres. The telewriter has been exhibited both at the Glasgow Exhibition and at Olympia, where it has aroused great interest, and led to inquiries from important corporations, which, it was hoped, would result in business. After referring to the inquiries received from and business done abroad, the Chairman moved the adoption of the report (see Electrical Review, page 673).

Mr. Ellice-Clark seconded, and after a number of questions had been asked and answered, the motion was carried.

Edison & Swan United Electric Light Co., Ltd.

The directors' report for the year ending June 30th, 1911, states that the net revenue account shows that the sum of £49,154 has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £15,702 ; £5,500 has been set aside as depreciation on freehold and leasehold property, plant and tools ; £7,500 has been applied in writing down values of stocks, and the sum of £1,439 has been reserved on account of bad and doubtful debts. The result, as shown in the net revenue account, is a credit balance of £19,013, to which must be added the sum of £6,843, brought forward from the previous year, thus making a total of £25,856. Of this amount the directors propose to place £17,500 to reserve fund, carrying forward £8,356. Cost of establishing the business, goodwill, &c., £390,432, has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1911, less depreciation charged in net revenue account. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to progress, and has paid the usual dividend on its shares of 7 per cent. for the year ended December 31st, 1910. Its indebtedness to this company has been reduced during the year by £328. There has been expended on capital during the year ending June 30th, 1911, £5,361, mainly on account of plant in connection with the manufacture of metal-filament lamps. The trading since the close of the financial year on June 30th last shows satisfactory progress.

Auckland Electric Tramways Co., Ltd. — The directors report that the total revenue for the year to June 30th was £216,624. The traffic receipts, which amounted to £210,167, show an increase of £22,838 over the previous year. After deducting all expenses chargeable to revenue, including £16,878 for debenture and other interest, the rental and percentage of profits payable to the Auckland City Council, amounting to £4,718, and setting aside £20,000 to the depreciation account, there is a surplus of £43,575, making, with the balance brought forward, £49,648. The directors recommend (says the *Financier*) that £15,000 should be placed to reserve account, and a dividend on the ordinary shares at the rate of 7 per cent. per annum, in respect of which an interim dividend for the half-year to December 31st, at the rate of 6 per cent. per annum, was paid in May, leaving £7,148 to be carried forward. During the year £3,600 5 per cent. first mortgage debenture stock was redeemed and cancelled under the operation of the sinking fund, reducing the amount outstanding at June 30th to £321,932. The stock was redeemed at a premium, which has been charged direct to the profit and loss account. Subsequent to June 30th an issue of £50,000 in 6 per cent. preference shares had been made. These shares were offered to the existing shareholders at par, and the whole of them have been taken up.

Sunderland District Electric Tramways, Ltd.—The report states (says the *Financier*) that the accounts for the year to October 31st show, after providing for interest on the prior lien bonds and first and second mortgage debentures and loans, and the Receiver's remuneration and expenses, a loss of £1,599, making a total loss of £16,202. A scheme for the reorganisation of the company is in course of preparation.

Callender's Cable and Construction Co., Ltd.—The directors have declared the usual interim dividend on the ordinary shares at the rate of 10 per cent. per annum.

British Thomson-Houston Co., Ltd.

The sixteenth ordinary general meeting of this company was held at the offices, 83, Cannon Street, on Wednesday last week, under the chairmanship of Mr. J. F. Nauheim.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 624), said that they had given the shareholders a very full account of last year's business, and if the profits of the period ending March 31st, 1911, this year were not so large as those of the preceding 12 months, it was owing, first, to the fact that, as they stated in the report, the improvement in business came too late to affect the present balance-sheet, while, on the other hand, their expenses in connection with advertising and the charges for interest on loans during the year had largely increased. They had been continuing, in fact, their pioneer work, which they fully expected would yield good results in the near future. The works continued to be fully occupied, and only the previous day when he was in Rugby he had the satisfaction of seeing that business was very active at present, and he was told by the chiefs of the various departments that they were as full of work as they could be. The value of their orders from March 31st last, when they closed their books, up to last Saturday, was very largely in excess of the corresponding period last year. While this in itself was very satisfactory, he was sorry to say that the percentage of profit still remained low, competition being almost as keen as ever, and it must be remembered that they were continuing to spend large sums in advertising and other progressive work, in the effort to thoroughly establish their drawn-wire lamp in the position to which its merits entitled it. In looking over the balance-sheet, on the debit side they found that their indebtedness to the General Electric Co., of New York, had largely increased, and they had taken a loan of about £50,000 from the bankers. On the other hand, they would see that the expenditure at Rugby for the factory had been £52,000 during the year ; the item of apparatus, &c., at Rugby showed an increase of £50,000 ; and the money outstanding due to them also showed an increase of £50,000. Their holding of shares and debentures had gone up by about £75,000. They had an opportunity of acquiring a block of shares in a very well organised concern in this country, paying a good dividend. As mentioned in the report, they would in future close their books on December 31st, which would be a great convenience to all the staff, and enable them to present the report before the summer holidays. It would interest them to hear that they had that day authorised a further extension to the iron foundry, and the erection of a large four-storey building for general manufacturing purposes. He also invited their attention to "Mazda House," the extensive premises which they had taken in Upper Thames Street for the lamp and wiring supplies business, and which was one of the finest and most up-to-date buildings in London used for a similar purpose. This would be opened in a few days. These extensions emphasised the confidence which they and their friends had in the future of the business. He hoped when they next met the report would show further signs of improvement, and that their progress from now on would fulfil their expectations.

Mr. G. Franklin seconded the motion, which was adopted without discussion.

Ferranti, Ltd.

The sixth annual general meeting of Ferranti, Ltd., was held at Basildon House, E.C., on Friday, under the chairmanship of Mr. A. W. Tait.

The Chairman, in moving the adoption of the report (see Electrical Review, page 653), said he was sure that the shareholders would feel that the accounts were satisfactory, as showing a considerable extension of the business. The trading profits for the year amounted to £49,074, against £41,236 last year, being an increase of almost £8,000. The net profits, after providing for general establishment charges, repairs, renewals, &c., amounted to £22,045, against £17,392, being an increase of £4,652. It would be observed that the general charges were larger, owing to increased development work, whilst repairs and renewals amounted to £4,877, as compared with £3,159, showing that the machinery and plant were being efficiently maintained. The net profits for the year had been dealt with as follows : Interest on prior lien debentures, £806 ; interest on first mortgage debentures, £5,000 ; interest on bank loan, £1,073 ; depreciation, £10,000 ; and prior lien debenture redemption account, £1,000. This amounted to £17,879, and left a balance of £4,166, which, added to the £1,162 brought forward from the previous year, gave a balance to the credit of profit and loss account of £5,327. He would just mention the fluctuations in the main assets and liabilities of the balance-sheet, as at June 30th last. Leasehold land and buildings were £48,543, compared with £46,891 ; plant, machinery, tools, &c., £105,840, against £100,202 ; expenditure on work in hand £51,347, against £39,251 ; stock and stores in hand £11,772, against £10,231 ; sundry debtors, &c., less reserve, £49,428, against £42,122 ; cash in bank and in hand, £3,931, against £6,238 ; and goodwill and patent rights stood at £69,546, as before. On the other side the prior lien debentures were £16,100, against £17,100 ; the first mortgage debenture stock and interest accrued was £101,250, as before ; temporary loan and interest was £3,162 ; loan from bankers £19,632, against £20,148 ; sundry creditors £34,214, against £24,379 ; depreciation reserve account £36,350, against £26,350 ; and prior lien debenture redemption account £1,000. The principal item was, of course, the increase in the amount for depreciation. Two years ago they placed £5,000 to that account, and last year £7,500, and now they had put £10,000. The directors felt that with a growing business they could not be too careful in dealing with the subject of depreciation, and he was sure the shareholders would agree that t reserve so put aside was a proper one. The business during the ye had undoubtedly been progressive, and it looked as if t results would certainly be as good in the present ye One did not like to be a prophet so early in the year, but if the i dications which were at present showing were kept up during t whole period they would be able to submit as satisfactory account next year. He was pleased to say the development of t business was not confined to any one department, but that t meter, switch and transformer departments had all contributed the improvement. He thought that the customers now felt th the manufactures of the company were of standard first-ra quality, and they were now only in the beginning of reaping t benefit of years of hard work in putting the manufactures of t company on a sound and proper and efficient basis. They were al bringing out certain new lines which had been developed, and which the company had spent a fair amount of money, which h been charged against the ordinary working expenses of the ye They were bringing out a cooking and heating apparatus, which thought was meeting with a fair amount of support. If any the shareholders had been to the Exhibition at Olympia they wou have seen the company's stand, which was undoubtedly a certific to the manufactures of the company. The articles shown were n those which had been made for the purpose of the Exhibition, b were simply the standard articles sold by the company. There w one other matter in regard to the development of the business, a this was the question of capital resources, and later on he wou move a resolution to enable them to increase the borrowing pow of the company. He would say they were only taking that step a matter of prudence without at the moment having any p gramme to submit. They would be aware that under the memo dum and Articles of Association at the time of the reconstructi their borrowing powers were restricted to the sum of £150,0 These borrowing powers were all the company had, and the boa felt that it was only a necessary measure of prudence that th should get authority to increase the borrowing powers from £150,(to £200,000.

Mr. A. B. Anderson (managing director) seconded the moti and the report was adopted.

The retiring directors and auditors were re-elected, and

The Chairman then moved :—"That the directors' power to ra or borrow or secure the payment of any sum or sums of money the purposes of the company, conferred by Article 57 of the Artic of Association, be and is hereby extended, so that the amount any one time owing in respect of moneys so borrowed, raised, secured shall not, without the sanction of a general meeti exceed £200,000."

Mr. A. Whittaker seconded the resolution.

Mr. Nalder said the increased borrowing powers appeared to justified by the increase of the business, but he understood at pres that no dividend could be paid to the ordinary shareholders un the prior lien charge was extinguished. He would like to kn if such a condition would attach to the new loan, because if so, hardly thought it would be fair to the shareholders.

The Chairman said he had a good deal of sympathy with w Mr. Nalder had stated. As he had said, they had no definite p gramme with regard to this borrowing, but he thought they mi take it to be the desire of the board that if this £50,000 i founded as permanent capital of the company, they would t steps that in connection with the provision of such additio capital they would get rid of the prior lien debentures, which wo consequently remove the restriction on the company at present apply all their surplus profits to the redemption of the prior l debentures. They knew how difficult it was in a growing busi to do this when capital was wanted for the development of business. They would also have to consider a scheme for deal with the arrears of dividend on the preference shares, which had on for the last six years. He had been giving the matter a cert amount of thought, but at the moment he could give no indicatio how it would be dealt with. Undoubtedly it was in the minds of board, and at the proper time some scheme would be brou forward dealing with it, so that when the company was in position of having sufficient capital to carry on its business, profits which the board considered it advisable to divide should co to the shareholders in the proper manner.

Mr. Nalder said he meant to have prefaced his previous rema by congratulating the board on the improved results. Two ye ago they had a debit balance, and this had now been turned i a credit balance. It looked as if they were progressing, and t they might begin to look forward to the happy time when t would get a dividend.

The resolution was carried.

On the motion of the Chairman, seconded by Mr. Anderso hearty vote of thanks was accorded the staff for their loyal operation.

Stock Exchange Notices.—Applications have been ma to the Committee to appoint a special settling day in and to gr a quotation to—

British Columbia Electric Railway Co., Ltd.—Further issue of £60 4½ per cent. perpetual consolidated debenture stock.

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordi shares of £5 each fully and partly (£3) paid.

City of Birmingham Tramways Co., Ltd.—18th inst., at Electrical Federation Offices, Kingsway, Mr. E. Gar presided at a meeting of debenture-holders of the company which a scheme of arrangement between the debenture-holders the company was approved. The meeting was held by order of Justice Warrington, dated July 28th, 1911.

Swiss Electrical Companies.

HE Continentale Gesellschaft für Angewandte Elektrizitat (Con-ental Co. for Applied Electricity), of Glarus, proposes to pay a ividend of 5 per cent. for 1910-11, being the same rate as in the revious year.

The dividend of the Usines Electrochimiques de Hafsluna, of eneva, is to be 10 per cent. for 1910-11, as compared with 5 per nt. in 1909-10. A year ago the crisis in the electrochemical ıdustry exercised an unfavourable influence on the market, the ices of carbide and ferro-silicon in particular having been very w.

The directors of Escher, Wyss & Co., of Zurich and Ravensburg, ate that the turnover in the 12 months ended last March consider-ly declined as compared with the preceding year. The unfavour-le situation of business continued, and hampered the receipt of ıe requisite orders, whilst prices further receded in consequence of en competition. The reduction of orders was particularly felt in ie first half of the year, but an improvement took place in the cond half, and has been maintained in the new financial year. fter appropriating £34,000 for depreciation, as contrasted with 28,000 in 1909-10, the accounts show a loss of £5,200, as against t profits of £17,000 and a dividend of 6 per cent. in 1909-10.

The report of the Maschinenfabrik Oerlikon, of Zurich, states at the unsatisfactory prospects mentioned a year ago were fully alised in 1910-11. Orders were only obtained with difficulty and ices were at the lowest level throughout the year. The scarcely vourable results were attributed to the circumstance that business other countries was rendered difficult by the exclusion of the mpany's manufactures from contracts for Governments and local thorities, by the efforts to promote native industries, by the pulation in many concessions that directly excluded products not ıde in the country and by protective duties, whilst at the same ne inconsiderate cutting of prices prevailed in connection with ntracts thrown open to competition. In addition there was a k of adequate protection in Switzerland. The report states that ing to the unfavourable situation of trade, and as abun-ıt provision for depreciation was made in preceding years, e amount allocated to this purpose in 1910-11 has been luced, namely, to £23,000, as compared with £31,000 1909-10. The net profits are, therefore, returned at £15,700, as ainst £15,000, and it is proposed to pay a dividend of 4 per cent., ng the same rate as in 1909-10. The department for electrical chinery had fewer new installations to carry out than formerly, it was in part well employed on contracts for existing works l installations. The degree of activity in turbines was good, but ces were unfavourable. Among other work, the branch for ctrochemical apparatus completed a large order for the English nistry of War for the production of hydrogen. The company s successful with the 2,000 H.P. experimental locomotive in the petition for the Lötschberg railway. In addition to the orders eived from the latter since the end of the financial year and for motives for the Rhatian railways, a number of contracts had n booked for tramways and mountain railways and also for new s. It is added that the agreement concluded a few years ago h the Siemens-Schuckert works, whereby business in respect of conversion of Swiss Railways was to be jointly undertaken, had n dissolved by friendly arrangement.

Monte Video Telephone Co., Ltd.

. C. Isock (chairman) presided at Winchester House, E.C., on sday, over the twenty-third annual meeting of this company.

moving the adoption of the report (see Electrical Review, e 673), the Chairman said he was once again in the position of ig able to report moderate progress in the affairs of the com-y. The amount received by them during the year in the way ubscriptions, rentals, &c., was £52,253, which compared with ,389 in the preceding year and £43,000 in the year before that, would be seen there had been a very substantial increase each . Of course, this involved a corresponding rise in the working enses, and this year they had been somewhat unfortunate in matter of storms, which had caused more damage than usual. wever, after deducting the working expenses, administrative rges in London, and providing for the exceptional repairs he alluded to, they had the very respectable net balance to the it of profit and loss account of £22,144, which was an improve-t of about £1,600 over the net balance of the previous year. y proposed that £13,000 should be placed to depreciation, which rather more than they had set aside in previous years. This de-iation fund would enable them the better to meet the situation ch might arise when they came to install the underground plant uld they be so fortunate as to make an arrangement with the ernment for that purpose. This was an urgent need for the of Monte Video in the interests of the public, and they were ays looking forward to the necessity of doing it. When it did ur there would, of course, be a good deal of scrapping of the present nt, and the depreciation fund was set aside to meet this scrapping ess when the necessity arose. They had already paid interim idends of 2½ per cent. on the preference and 3 per cent. on the nary shares, which absorbed £4,342. They proposed to pay in dividends of the same amount, which would absorb another 42, and carry forward £4,381, which would be more than cient to meet the next half-year's interim dividends. The cipal item in the balance sheet was the purchase price of the erty, which stood at £200,790, and which was a sum materially than that at which it stood two years ago, before they started depreciation fund, although during the interval they had made considerable capital expenditure. The figure of £200,000 would be still further reduced by the application of the £13,000 for depreciation, and this would bring the capital value of the system down to what they might call bedrock value as a going concern. The stock of materials was, of course, a fluctuating quantity. Sundry debtors was £2,300 less, due to a closer collection of the accounts. Real estate in Monte Video remained the same, although there was no doubt that the property had appreciated in value, and would probably realise more than the sum named. Investments which cost £23,000 showed an increase of about £9,000, and that was a very substantial addition to their financial resources in one year. There also there was a moderate appreciation in value. They were not all trustee securities, but they were good and sound and of a very liquid and realisable character. He thought the financial strength revealed by the balance-sheet, combined with the satisfactory increase in their subscriptions, offered a satisfactory record and one with which they hoped the shareholders would be satisfied. The Chairman proceeded to refer to his recent visit to Monte Video, during which, he said, he was able to make a very considerable acquaintance with the position of affairs there and with their system. He considered that their system, for an overhead one subjected to all the influences of weather, was very well maintained and in good order, and this was due to the constant vigilance exercised by the manager and his energetic staff, who were continually about the city and the camp looking after the property. He also went into the camp, or country, and there he found the branches and exchanges left a good deal to be desired. At the present time the camp system, which they bought some years ago, was leased at an annual rental, and that lease expired last June and was now taken over. The expense of maintaining the property would now devolve on the company, and the work of improving it would be taken in hand systematically. After debiting the amount so far received as rent to the company, he thought the cost of repairs, &c., could be met out of the surplus revenue. They had appointed Dr. A. Rodriguez Larratta, and Mr. C. W. Bayne, general manager of the Central Uruguay Railway Co., as a local board, and expected to derive considerable advantage from the association of these two gentlemen with the company. He interviewed the President of the Republic and several Ministers in regard to the question of the installation of an underground system, and he found that they had studied the telephonic system, and was told that the Government would probably desire to nationalise the telephone service and establish a service of their own. He naturally discussed the matter from the point of view of the company, and after several interviews, he received from one Minister certain suggestions. He could not say they were more than suggestions, but they were quite capable of being worked up into an arrangement, which, if the Government would abandon their idea of nationalisation, would be satisfactory alike to the Government and the company. At the present time he could not say the matter was in a very advanced stage, but it had been left in the hands of the local board, with whom it was discussed in all its bearings, and when the Government were disposed to renew the discussion the local board would be thoroughly equipped to deal with the matter, subject, of course, to reference to the London board. Personally, he was not sanguine of an early settlement, for the Government had in hand large schemes to take over various industries, and in the meantime they must wait patiently.

Mr. J. C. Le Marchant seconded the motion.

Mr. Herzheim having congratulated the board on the progress made, said it was rather surprising that the Uruguay Government should dream dreams of nationalising everything when one read the history of telephony, and became acquainted with the fact that this great public service had reached its highest stage of efficiency in the United States where it was unhampered by official interference.

The motion was carried.

Mr. J. E. Kingsbury, in proposing a vote of thanks to the board, also expressed his regret that the utility of such a service should be hampered by the Government delaying coming to a decision. It would be an advantage if the Government made up its mind one way or the other, and if they wanted a national service, why did they not purchase the company's system as a nucleus.

A Shareholder asked whether there was any understanding between the board and the Government that in case of nationalisation the Government would buy the company out, or would they start an entirely new service and leave the company to do the best they could?

The Chairman said that the views of Mr. Kingsbury had, of course, been impressed on the Government, and, he had no doubt, had had some effect. They had not, of course, raised the question of compensation. They wished to go on, and until the Government moved in the direction of a national service, it would be premature for the company to raise the point.

Prospectuses.—*Anglo-Argentine Tramways Co., Ltd.*—An issue of £1,500,000 of 5 per cent. debenture stock at 97½ per cent. has been offered this week, and the list of applications is to close to-day. The purpose of the issue is to provide capital towards the construction of the subways, and for the general capital purposes of the company.

Fife Tramway, Light and Power Co., Ltd.—Subscriptions were invited last Saturday for 51,195 ordinary shares of £1 each at par.

Metallic Seamless Tube Co., Ltd.—According to the *Financier* the net profits for the year to June 30th were £2,010, and £4,573 was brought forward. A dividend of 7½ per cent. on the ordinary shares is proposed, carrying forward £5,034.

MARKET QUOTATIONS.

Wednesday, October 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3¾d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	9¼d.	¼d. inc.
c „ „ (solid drawn)	„	7¾d.	¼d. inc.
c „ Wire, basis	„	6⅝d.	..
c Copper Tubes (brazed)	„	9⅝d.	..
c „ „ (solid drawn)	„	8⅝d.	..
g „ Bars (best selected)	per ton	£72	£1 inc.
g „ Sheet	„	£72	£1 inc.
g „ Rod	„	£72	£1 inc.
e „ (Electrolytic) Bars	„	£58 10	£1 inc.
e „ „ Sheets	„	£74 10	£1 inc.
e „ „ Rods	„	£62	£1 10 inc.
e „ „ H.C. Wire	per lb.	7⅝d.	⅛d. inc.
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	5/- to 7/-	..
h India-rubber, Para fine	„	4/3½	2d. dec.
i Iron Pig (Cleveland warrants)	per ton	46/3	1½d inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£16	10s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£196	£4 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/1½	¼d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£31 12 6	27/6 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
j Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange are still in a somewhat unsettled condition. The continued strength of Consols affords a buttress against selling in the investment markets; and as it is supposed that the Morocco difficulty is practically settled, there is more disposition to buy good securities. The revolution in China and the war in Tripoli are not having much effect upon prices, speaking generally; but business, as a whole, comes very patchily, and the autumn revival upon which the Stock Exchange can, as a rule, depend, still delays its advent.

The Railway Commission report had the effect, in the first place, of putting Home Rails better, though subsequently prices fell away, with a few exceptions, the latter being confined principally to the Kentish stocks, whose buyers pin their faith to a successful issue of the Kent coal business. It is feared, however, that the absence of recommendation as to how strikes are in the future to be averted will tend to vitiate the usefulness of the report, with which some of the representatives of the men have not been slow to express vigorous dissatisfaction. So far as the Electric prices are concerned, City and South London continued its rise, and gained another ½, but Metropolitans and District 4 per cent Debenture are both a point lower. Underground Electric Railways shares have risen ⅛, and the Income bonds 2, the remainder of the stocks being unchanged.

British Electric Traction Ordinary are being bought and recovered their ⅛ of last week. Pending the result of the conference between the company and what may be called the dissentients the market is a little fearful of making prices. The opinion of the majority in the Stock Exchange seems to favour the hope that the directors' scheme will go through, in spite of the opposition raised against it. No doubt, as we suggested last week, something in the nature of a compromise will be arrived at. Amongst the other English Traction descriptions, Bath 4½ per cent. Debenture rose 3 points, while smaller improvements have been gained by Potteries Debenture and Metropolitan Electric Tramways Debenture stocks.

The Mexican group is steady, with rises in Mexico Tramways Common stock and the 6 per cent. bonds, the latter hardening to 100½. The feature, however, in this department is a rise of in Montreal Light, Heat and Power, where the recent highly satisfactory report has brought in buyers, in addition to which there are still rumours of amalgamation. Electrical Development of Ontario Bonds rose 1 to 90. Amongst the Traction issues Anglo-Argentine Trams 5 per cent. Debenture stock eased off 100 on the new issue of similar stock at 97½. The first payment of interest on the new stock is due on June 1st, 1912, and will be calculated upon the amounts paid up at that time. Allowing for this, there is not much difference between the two issues, although the new is, as a matter of fact, a little cheaper. Rio Trams were back ½, and the First Mortgage Bonds ¼ upon the revived suggestion of competition in the City. This, however, need not be taken too seriously. Sao Paulo 5 per cent. Debentures are ½ lower. Auckland Tramways Debenture rose 1, and Bombay Secured Debenture gained an equal amount, while Winnipeg 4½ per cent Debenture at 107 is ½ higher. Amongst the shares, Para Electric Railways are a trifle easier, but City of Buenos Ayres Trams at show a small rise.

The Electricity Supply market is very quiet, but the tendency shows up rather better. County of London Ordinary at 8¼ middle are 10s. to the good, the company's energetic management being recognised in the market. South London Ordinary put on ⅛, and so did County Preference, the latter regaining most of the fall last week. On the other hand, St. James's are ¼ off again, the price going back to 8¼ middle. A little inquiry for the Debenture stock is reflected in two or three small rises. Foreign shares are equally quiet, and there is no special change to record.

The Telegraph list is noticeable principally for declines in the Anglo-American trio, all three stocks giving way. The market moved a good deal in sympathy with that for American rails, with the approach of the settlement this week led to profit-taking in the Deferred by those who had bought more cheaply early in the account. Direct United States shares responded to the buying, which mention was made here last week, and show a 5s. rise. Western Telegraphs are ½ higher, while Eastern Extensions were back ¼ on realisations, it is said, for account of a deceased holder. The gamble in Marconis received something of a check in consequence of the proposed new issue of shares, and the price at 4 shows a slight loss. But the highly important announcement that Sir Oliver Lodge has joined the company as scientific adviser, and that the Marconi undertaking will absorb the Lodge-Muirhead patents, has afforded the market the utmost satisfaction.

Direct Spanish Telegraph have been flat, losing 10s. Mackay Companies' Common further improved, although the Preferred was back a point.

National Telephone Preferred eased off ½, while the Third Preference slightly hardened, and the Deferred kept steady at 1. Monte Video Telephones rose to 1 middle, the recent report being the cause for the demand. Chili Telephones, however, are ⅛ easier. The revolution in China has made Great Northerns 10s. better. It is thought that whatever damage may be inflicted upon the various companies' property, even if it cannot be reclaimed, will be met by the extra business that the unrest is certain to cause for a long time to come.

Callender's Cable rose ¼, and Telegraph Constructions ½, while Henleys eased off ⅛. The demand for General Electric Preferred, to which reference has been made here once or twice, is still a feature in this market, and the price of the Preference shares has been raised ¼ to 9¼ middle. British Thomson-Houston Debenture is unchanged at 95½, although it must be admitted that the company's report shows anything but a pleasant result. The Edison and Swan report, with a fine record of recovery, disappointed some people, who had rather expected a dividend of 2½ to 5 per cent. However, to fortify the reserve and carry forward a substantial sum is manifestly sound policy. We may call attention to the fact that, instead of giving the dividends for 1909, we have this year provided those for 1911, as declared up to the present. It must be pointed out, for the avoidance of misunderstanding, that a good many of the 1911 dividends already declared are interim distributions, and it will not be until the end of the financial year that the full amount can be inserted. Occasion was taken two or three months ago to show the principle on which our dividend tables are arranged, but the difficulties which arise by reason of companies closing their books at all kinds of dates are prolific in raising questions on that point. It is no idle boast to claim that keen vigilance is exercised in the dividend columns set out overleaf, but we are at all times glad to hear of any slip that may creep in, and we take this opportunity of acknowledging the few kind hints which have been offered us in this connection. The yields are calculated in every case upon the results for the complete year 1910.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Oct. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Barnemouth & Poole, Ord.	*					
Do. 4½ % Pref.	10	5½	5†	7⅜ — 8⅜	..	6 5 9
Do. Second 6 % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. 4½ % Deb. Stock	10	6	6	10¼ — 10¾	..	5 11 7
Brompton & Kensington, Ord.	Stock	4½	4½	101 —103	..	4 7 5
Do. 7 % Cum. Pref.	5	10	9†	7⅞ — 8⅛	..	6 3 1
Central Electric Supply, 4 % Guar. Deb.	5	7	7	7⅞ — 7⅝	..	4 7 6
Charing Cross, West End & City	100	4	4	99 —102	..	3 18 5
Do. 4½ % Cum. Pref.	5	5	5†	3⅝ — 4½	..	6 1 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	+ ⅛	4 12 4
Do. Do. 4 % Deb.	5	4½	4½	3¾ — 4¼	..	5 5 11
Chelsea, Ord.	100	4	4	94 — 98	..	4 1 8
Do. 4½ % Deb.	5	5	4†	3⅝ — 4⅜	..	5 14 3
City of London, Ord.	Stock	4½	4½	98 —100	..	4 10 0
Do. 6 % Cum. Pref.	10	7	6†	12 — 12½	..	5 12 0
Do. 5 % Deh.	10	6	6	11⅜ — 12¾	..	4 14 1
Do. 4½ % Second Deh.	Stock	5	5	119 —123	..	4 1 4
County of Durham, 5 % First Mort. Deb.	100	4½	4½	100 —103	..	4 7 5
County of London, Ord.	Stock	5	5	89½ — 91½	..	5 9 3
Do. 6 % Pref.	10	5	4†	7⅞ — 8⅝	+ ½	5 19 5
Do. 4½ % Deb.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Second Deb.	Stock	4½	4½	108 —110	..	4 1 10
Edmundson's, Ord.	Stock	4½	4½	101 —104	+ ½	4 6 7
Do. 6 % Cum. Pref.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 4½ % First Mort. Deb.	5	Nil	Nil	2 — 2½	..	Nil
Ekestone	100	4½	4½	83 — 86	..	5 4 8
Do. 5 % Cum. Pref.	5	6	6†	4½ — 5	..	6 0 0
Do. 4½ % First Deb.	5	5	5	4⅝ — 5⅛	..	4 17 7
Clive	100	4½	4½	95 — 98	..	4 11 10
	5	9	8†	6¾ — 7¼ xd	..	6 4 2

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Oct. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	*					
Do. 4 % Deb.	5	9	8†	6¾ — 7½	..	6 0 0
Kent Elec. Power, 4½ % Deh.	Stock	4	4	91 — 93	..	4 6 0
London Electric, Ord.	Stock	4½	4½	80 — 84	..	5 7 2
Do. 6 % Pref.	3	2	.	1⅝ — 2	..	3 0 0
Do. 4 % First Mort. Deb.	5	6	6	4½ — 4⅝	..	6 3 1
Metropolitan	Stock	4	4	89 — 92	..	4 7 0
Do. 4½ % Cum. Pref.	5	5	4†	3½ — 4	..	6 5 0
Do. 4½ % First Mort. Deb.	5	4½	4½	4¼ — 4⅜	..	4 14 9
Do. 3½ % Mort. Deb.	Stock	4½	4½	100½—105½	+ ½	4 5 4
Midland Electric Corporation 4½ % First Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Newcastle-on-Tyne	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Pref., Non. Cum.	5	4	4†	3½ — 4	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	5	5	5	4 — 4½	..	5 11 1
Notting Hill	100	5	5	99 —102 xd	..	4 18 0
Oxford	10	8	6†	..	..	..
St. James' and Pall Mall, Ord.	5	7½	6†	6⅛ — 6⅝	..	5 9 5
Do. 7 % Pref.	5	10	10†	8 — 8½	— ½	5 17 8
Do. 3½ % Deb.	5	7	7	6¾ — 7¼	..	4 16 7
Smithfield Markets, Ord.	100	3½	3½	85 — 87	..	4 0 6
South London, Ord.	5	Nil	.	1⅜ — 1⅝	..	Nil
Do. 5 % First Mort. Deb.	4	5	..	2⅜ — 3	+ ⅛	6 13 4
South Metropolitan, 7 % Pref.	100	5	5	99 —102	+ ½	4 18 0
Do. 4½ % First Deh. Stock	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Urban, Ord.	100	4½	4½	95 — 98	..	4 11 10
Do. 5 % Cum. Pref.	5	5	..	½ — 1	..	..
Do. 4½ % First Mort. Deb.	5	5	..	2 — 2½	..	..
Westminster, Ord.	100	4½	4½	86½ — 88½	..	5 1 8
Do. 4½ % Cum. Pref.	5	10	10†	7⅞ — 7⅝	..	6 7 0
	5	4½	4½	4⅜ — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	..	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7†	106 —109	..	6 8 5
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	23/32 — 27/32	..	3 11 1
Do. 5 % Deh.	100	5	..	92 — 95	..	5 5 3
Do. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Do. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	89 — 91	+1	5 9 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 1 1/16 xd	..	8 14 6
Seministiquia Power, 5 % G. Bs.	$500	5	5	101⅛—103½	..	4 16 7
Madras, Ord.	5	..	..	2⅜ — 2⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4†	86 — 88 xd	— ½	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	104½—106½ xd	— ½	6 11 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 4 2

Monterey Rly. Light & Power, 5 % 1st Mort. Deh.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8†	178 —183	+8	3 15 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	34 — 36	..	13 17 10
River Plate, Ord.	Stock	10	..	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	—1½	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Eleo. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	119 —121 xd	+1	3 6 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103½—105½	..	4 5 4
Toronto Power, 4½ % Deh.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11¾d.	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½—108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	..	7¼ — 7¾	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	138 —140	..	5 14 4
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3¾	3†	67 — 69 xd	— ½	5 8 8
Do. 6 % Pref.	Do.	6	6	110½—111½	— ¼	5 7 7
Do. Def.	Do.	30/-	..	26 — 26½	— ⅛	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Bili Telephone	5	7	..	6⅞ — 7⅛	— 1/16	4 18 3
Commercial Cable, Stlg. 4 % Deh.	Stock	4	4	86½ — 88½	..	4 10 5
Cuba Telegraph	10	6	..	10¼ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅞	— ¼	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅝	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	8 — 8½	+ ¼	5 5 11
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½—101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139 xd	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	83 — 85 xd	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	102½—104½	..	3 16 7
Eastern Extension	10	7	5†	15⅛ — 15¾ xd	— ¼	5 1 10
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5¼	6	10¼ — 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12⅞ — 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	31 — 32	+ ½	5 12 6
Indo-European Telegraph	25	13	..	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5†	87 — 90	- 2	5 11 1
Do. 4 % Cnm. Pref.	$100	4	4	73 — 76	— ½	5 5 3
Marconi's Wireless Telegraph	1	5	..	2⅜ — 2½	— 1/16	..

Monte Video Telephone, Ord.	1	6	6†	1/16 — 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½—105½	— ½	5 13 9
Do. Def.	Do.	6	6†	118 —121	..	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 7/16	— 1/16	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	95 —101	..	3 9 4
Do. 4 % Deh.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	..	4 6 7
Oriental Telep. and Elec.	1	8	..	1 1/16 — 1 3/16 xd	..	4 16 7
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16 xd	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5†	9 — 9½	..	4 4 3
Submarine Cables Trust	Cert.	6	6	130 —133 xd	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16 — 7 7/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅞ — 1⅞	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	1¼	..	2⅜ — 2⅝	..	2 10 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	6†	12⅜ — 13⅞	+ ⅛	5 0 11
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	105½—108½ xd	..	3 13 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99 —102 xd	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	+3½	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1⅜	+ ⅛	Nil
Do. 6 % Pref.	10	1½	1½	3⅜ — 4½	..	3 12 9
Do. 5 % Deb.	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	3	3†	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1¾†	30⅞ — 31⅛	+ ⅛	4 15 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	⅞ — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅝ — ⅞	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅜ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Prof.	10	Nil	..	2⅞ — 3⅛	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Metropolitan Railway Consol.	100	1⅜	2†	41 — 41½	— 1	3 6
Do. Surplus Lands	100	2¾	3†	64 — 66	..	4 8
Do. 3½ % Deb.	100	3½	3½	88 — 90	..	3 17
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Prof.	100	3½	3½	84 — 86	..	4 1
Metropolitan District Ord.	100	Nil	..	25½ — 26	..	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2
Do. 4 % Deb.	100	4	4	95 — 97	— 1	4 2
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18
Do. 4½ % First Pref.	100	3½	4½†	85 — 87	..	3 14
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13
Metropolitan Elec. Trams, Ord.	1	5½	5†	27/32 — 31/32 xd	..	5 12
Do. Def.	1	Nil	..	3/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	5	⅛ — 1	..	5 0
Do. 4½ % Deb.	100	4½	4½	100—102	..	4 8
Do. 5 % Deb.	100	5	5	100—102	..	4 18
Potteries, Ord.	1	2	..	7/32 — 1/2	..	..
Do. 5 % Prof.	1	5	5	7/8 — 15/16	..	7 12
Do. 4½ % Deb.	100	4½	4½	89 — 92	+1	4 17
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 7/16	..	6 17
Do. 4 % Deb.	100	4	4	72 — 77	..	5 8 1
Underground Elec. Railways	10	..	..	1⅛ — 1⅜	+ ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9
Do. 6 % Income	100	1	1½†	59 — 61	+2	1 12
Do. Power House Debs.	100	4	4	100 —102	..	3 18
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅜ — 2¾	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 1

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 1/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4⅜ — 4½	..	5 2 7
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	99 —101	— 1	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	+ 1	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	+ 1	5 0 0
Brisbane Trams Invt., Ord.	5	8	..	6⅝ — 7⅛	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	121 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108½ —111½	..	4 9 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101 xd	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 5 4
Calcutta Trams, Ord.	5	6	..	5¾ — 6⅛ xd	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	..	7/16 — 9/16	..	Nil
City Buenos Aires Trams (1904)	5	5	2½†	5⅜ — 5⅝	+ 1/16	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½ —104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Elec. Trms, Prf,	1	6	6	25/32 — 1	..	6 0
Lisbon Elec. Trams, Ord.	1	5½	5†	1 — 1¼	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16
Do. 5 % Deb.	100	5	5	96 —100	..	5 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 92	..	5 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0
Mexico Trams Com.	$100	7	7†	117½ —119½ xd	+ ½	5 17
Do. Gen. Con. 5 % Bonds	..	5	5	98½ —100½	..	4 19
Do. 6 % Bonds	100	6	6	99½ —101½	+ ½	5 18
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 — 7⅛	— 1/16	6 15
Do. 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½ —101½	..	4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅜ — 1 7/16	..	2 7
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝ — 5⅞	..	5 6
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9
Rio de Janeiro Trams	$100	4½	5†	116½ —117½ xd	— ½	3 16
Do. 1st Mort. 5 % Bonds	..	5	5	101¼ —102½	— ¼	4 17
Do. 5 % Mort. Bonds	100	5	5	95¾ — 96½	..	5 3
Sao Paulo Tram, Lt. and P.	$100	10	10†	180 —185	..	5 8
Do. 5 % 1st Deb.	$500	5	5	101½ —106½	— ½	4 13
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	..	5 17
Southern El. Tr. B.A., 5 % Deb.	100	5	5	9⅝ — 97⅛	..	5 2
Un. Elec. Trams Monte Video	5	6	7	5⅝ — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	+ ½	4 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/16 — 1/4	..	Nil
Do. 6 % Pref.	1	9	6	11/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	26	24†	5 7/16 — 5 1/2	..	4 11 5
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6⅜ — 7¼	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westingbouse, Pref.	3	Nil	..	¼ — ½	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	99 —101	..	5 18 10
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	..	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	..	1/8 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	..	9½ — 10	+ ⅛	7 10 0
Do. Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3½ — 3⅝	..	4 16 7
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10
Dick, Kerr	1	5	..	¾ — 7/8 xd	..	5 14
Do. Pref.	1	6	6	1 1/16 — 1 1/8 xd	..	5 12 1
Do. Deb.	100	4½	4½	95 — 98	..	4 11 1
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¾ — 2¼	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5
Electric Construction	2	Nil	2¼†	⅛ — ¼	..	6 13
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8¼	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	9 — 9½	+ ⅛	5 5
Do. Deb.	100	4	4	86 — 91	..	4 7 1
Henley's, Ord.	5	15	10†	11⅞ — 12⅝	— ⅛	5 18 1
Do. Pref.	5	4½	4½	4 1/32 — 5 3/32	..	4 5 1
Do. Deb.	100	4½	4½	106⅜ —108½	..	4 2 1
India-Rubber, G. & T.	10	10	..	13⅜ — 15⅜	..	6 9
Do. Pref.	10	5	5	9⅝ — 10⅜	..	4 16
Telegraph Construction	12	20	10†	35 — 37	+ ½	6 7
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	..	3/32 — 5/32	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1911.

HE September returns of electrical export business compare badly ith those of the preceding month, and, indeed, with the last 18 onths' figures.

The total of £298,876 is over £100,000 lower than the August otal, and one has to go back to February, 1910, to find a month ith less export business. The falling off appears to be mainly due decreased machinery exports, the decrease that month, as com- ared with the previous one, being approximately £60,000, but a con- derable decline is noticeable in the telegraph and telephone sections.

As an exception to the rule may be mentioned cable exports, which ere somewhat better than in August.

Somewhat improved values obtained in the case of the imports, which reached a total of £213,316, as compared with £179,375 in the preceding month, an improvement traceable to increased telegraphic, telephonic and lamp imports.

The re-exports for September amounted to £19,028, a considerable improvement on the previous month's return, when the total only reached £9,795.

On the month, India was by far our best customer, with Victoria, N.S. Wales, Argentina, &c., following. Canada remains a steady purchaser, while Japanese and Brazilian business proved disappointing.

As regards the imports, Germany contributed over 66 per cent. of the goods entering this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
ussia, Sweden, Norway and Denmark ...	589	153	30	201	245	4,416	135	...	...	62	11,458	17,289
ermany	1,404	1,416	176	453	125	2,846	5	...	...	...	190	6,615
etherlands, Java and Dutch Indies	434	1,460	42	...	105	677	...	16	...	23	11,307	14,064
elgium	813	554	12	76	200	836	18	...	...	3,491	187	6,187
rance	1,487	...	760	178	147	3,527	167	...	...	360	1,703	8,329
ortugal	57	11	24	71	...	151	...	14	...	...	...	328
pain and Canary Isles	236	...	162	...	90	635	126	...	...	...	53	1,302
witzerland, Italy and Austria-Hungary ...	593	2,003	514	58	429	930	204	63	...	17	21	4,832
reece, Bulgaria, Roumania and Turkey ...	251	54	14	16	28	340	15	6	...	27	296	1,047
hannel Isles, Gibraltar, Malta and Cyprus ...	107	406	17	38	15	106	...	18	...	41	572	1,320
U.S.A. and Cuba	...	...	44	350	75	509	...	94	...	...	656	1,728
anada and Newfoundland	678	3,639	581	2,400	2,200	6,542	...	41	...	431	290	16,802
ritish West Indies and British Guiana ...	31	42	55	77	...	73	...	...	...	56	34	368
lexico and Central America	615	30	...	...	...	89	1,660	43	...	237	180	2,854
eru, Uruguay and Paraguay	49	50	279	...	...	418	...	...	...	374	...	1,170
hile	296	455	153	337	108	1,764	43	359	...	192	220	3,927
razil	253	637	217	456	206	3,723	602	280	17	1,031	5,296	12,718
rgentina	1,380	5,323	1,177	1,527	1,148	3,455	40	1,736	435	3,746	1,399	21,366
olombia, Venezuela and Bolivia	...	...	10	...	16	75	...	...	...	...	...	101
gypt, Tunis and Morocco	108	752	62	37	83	1,100	12	...	1	95	129	2,379
ritish West Africa and Ascension	4	248	5	100	11	320	...	15	...	284	798	1,785
hodesia, O.R.C. and Transvaal	3,729	1,321	280	1,547	73	2,456	20	25	44	86	110	9,691
ape of Good Hope	1,084	1,805	180	419	102	2,436	11	198	...	46	953	7,234
atal	1,253	6,206	354	175	52	3,335	198	31	55	84	274	12,017
anzibar, Brit. East Africa, Mauritius & Aden	148	81	79	...	19	163	...	122	...	66	330	1,008
zores, Madeira and Portuguese Africa ...	206	514	254	179	99	500	...	52	...	148	57	2,009
rench African Colonies, Madagascar, &c. ...	...	...	...	45	...	60	76	36	...	12	31	260
hina and Siam	707	5,563	570	886	...	2,780	83	38	244	42	417	11,330
apan and Korea	692	2,406	72	284	232	3,735	2,312	1,471	...	2,198	321	13,723
ndia	2,438	9,288	2,054	3,935	632	10,710	1,605	2,434	224	5,557	1,175	40,052
eylon	29	343	49	32	6	100	745	52	...	159	237	1,752
traits Settlements and Fed. Malay States ...	235	549	59	16	178	476	...	107	14	786	1,260	3,680
ong Kong	117	1,733	12	...	...	74	110	151	21	32	...	2,250
est Australia	269	476	264	20	45	373	...	7	...	23	49	1,526
outh Australia	1,934	1,569	33	186	563	3,516	18	230	...	390	20	8,459
ictoria	1,589	4,850	322	1,463	554	5,094	23	98	53	11,618	194	25,858
ew South Wales	1,779	5,288	489	1,458	53	10,630	514	309	...	1,426	782	22,728
ueensland	249	524	...	207	...	1,097	169	...	...	254	50	2,550
asmania	14	...	3	13	...	75	...	...	...	161	...	266
ew Zealand and Fiji Islands	862	812	158	362	7	2,527	208	713	19	294	10	5,972
Total, £	26,719	60,561	9,566	17,602	7,846	82,669	9,119	8,759	1,127	33,849	41,059	298,876

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	165	...	...	130	...	4,511	363	739	...	7,055	12,963
Germany	2,952	6,801	2,477	31,977	2,584	59,584	154	1,266	6,561	27,419	141,775
Holland	...	99	...	1,794	...	150	24	...	68	46	2,181
Belgium	353	855	205	78	20	1,768	...	276	629	15,812	19,996
France	362	28	736	1,366	981	471	36	1,450	2,492	828	8,750
Switzerland	119	359	...	112	120	1,444	...	...	...	135	2,289
Italy	15	891	...	9	...	...	...	...	...	1,388	2,303
Austria-Hungary	...	992	33	635	...	130	...	...	520	182	2,492
United States	2,071	601	221	501	43	10,677	1,919	88	1,081	131	20,333
Canada	9	...	...	...	...	...	...	...	15	120	111
Total, £	6,046	10,626	3,672	36,602	3,748	78,735	5,496	3,819	11,366	53,116	213,226

Additional imports: Spain, carbons, £90.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	10,511	664	...	1,811	...	5,442	...	190	337	73	

TOTAL EXPORTS: £298,876. TOTAL RE-EXPORTS: £19,028. TOTAL IMPORTS: £213,316.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns Imports are credited to the country whence consigned, which is not necessarily the country of origin.

COAL COSTS.

By "INTERESTED."

Coal is an important factor in the working of an electricity supply station; it is at once the best friend and biggest enemy. Cost of fuel alone represents about one-third the total works costs, therefore too much care cannot be exercised in handling fuel. None will gainsay that an efficient means of keeping proper track of all coal delivered and consumed is essential. Such a system, whether comprised of books or cards, in order to be of any practical use, must give in a clear, concise form full details of quantities and qualities received and consumed, and, on the other hand, must be simple enough to enable one to obtain the desired information therefrom without unnecessary trouble and waste of time.

Coal Ordered (No. 1, left page).

Name of contractor.	Date of order and order No.	Name and class of fuel.	Total quantity.	Dates due for delivery and quantities.	Price per ton.

Coal Received (No. 1, right page).

Date.	Rail or seaborne. Truck Nos. or name of barges.	Names of coal.				Total weight of each order.	Average price per ton delivered.	Calorimeter tests. B.T.U.
		t c q	t c q	t c q	t c q			

When making arrangements for booking fuel, the points which should be borne in mind are as follows:—(*a*) The correct weight of coal actually delivered into the bunkers should be obtained, irrespective of whether payment is made on the railway companies' weights, the agents' certified meter, the works weighbridge, or by any other means, because it will be obvious to anyone that a true record of quantities consumed will very soon throw out the amount supposed to be in stock, if less coal is actually received than is booked inwards. The merits of various methods of purchasing coal need not enter into discussion here, as the value of any discrepancy between the quantity received and that actually paid for must be added in the cost by booking out at the average price per ton. This can easily be obtained by dividing the weight of each delivery into the figure actually paid for same. (*b*) A record should be made of the amount each stoker burns, and also the total used on each shift. This is necessary for the purpose of checking any waste in the way of bad stoking, and likewise an inferior delivery. A calorimeter test cannot always be relied upon to show a true value of the whole contents of a barge load, or even a train load, unless many samples are taken and tested. (*c*) Costs should be prepared at least once a week. I use the words "at least" here advisedly, because, in order to secure a strict hold on coal consumption and obtain the best results, weights should be compared with each other day by day. In actual practice a return showing costs, prepared once a week, is found to be sufficient information for the purpose of comparison, but with quantities used, a day by day return is required. By comparison of figures each day it is possible to make inquires into any apparent wastage at the time it occurs, and this enables such steps to be taken as may be deemed necessary for preventing a continuance of waste.

In the method of booking described and illustrated below, arrangement is made whereby quantities used are shown at the end of each shift, and the cost shown only once a week. Such a system as described, with but little alteration to suit particular requirements, is in use at present in a certain London works, and is reported to work exceedingly well. Four books are used as follows:—Coal Order Book, Job Order Book, Coal Book, and Record of Coal Tests.

The patterns shown almost explain themselves, but for the sake of a little more lucid explanation here and there I will briefly run through them.

Coal Book (No. 3, left page).

Date.	Shift No.	Boilers on load.	Steaming coal.			Banking coal.			Totals. Cwt.	Remarks.
			Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.		
Sunday ...	1									
	2									
	3									
Monday ...	1									
	2									
	3									
Tuesday ...	1									
	2									
	3									
Wednesday	1									
	2									
	3									
Thursday ...	1									
	2									
	3									
Friday ...	1									
	2									
	3									
Saturday ...	1									
	2									
	3									
Totals ...										

No. 1, *Coal Order Book.*—Directly an order is placed for fuel, an entry is made in this book in the columns set apart for the desired information, and the deliveries are set out in a similar manner from time to time, in the respective columns for same. The last column it will be noticed is for the results of calorimeter tests. A glance at this book at any time will show just how much of each class of coal is on order, when due for delivery, and the price, &c.

No. 2, *Job Order Book.*—In some works it is not found advisable to ask shift men to make up time sheets, the hours worked being obtained from some form of time recorder. However, in this case, use is made of these books in which the men enter their time on one page and material on the other. Of course each stoker enters the quantity and quality of coal he uses day by day, making a note of that used for banking, if any. From these books the engineer-in-charge abstracts figures for making up the No. 3 Coal Book.

Job Order Book (No. 2, left page).

Dr.			Cr.		
Date.	Description of goods.	Quantity.	Date.	Description of goods.	Quantity.

Job Order Book (No. 2, right page).

W. O. No.		J. O. No.					Totals.
Date.	Description of work.	On.	Off.	On.	Off.	On.	Off.

Engineer-in-charge .....

No. 3, *Coal Book.*—This is *the* book of the set, and, I think, shows all the desired information at one opening. It gives much useful and important information. The engineer on each shift enters up the fuel used on his particular shift, and by doing so is continually brought into touch with the coal consumption.

Coal Book (No. 3, right page).

	Tons.	Cwt.	Qrs.
tal delivered :—			
Total			
al used from beginning of year to date ...			
al in stock at midnight.....day.....191...			

Coal Analysis.

Quality.	Brought forward. t. c. q.	Delivered. t. c. q.	Total. t. c. q.	Issued. t. c. q.	Carried forward. t. c. q.	Total. t. c. q.
Totals ...						

	Corresponding week last year.
mount of coal used ... t. c. q.	Amount of coal used ... t. c. q.
st ... ... £ s. d.	Cost ... ... £ s. d.
nits generated at lb. per unit	Units generated at lb. per unit
nits metered at lb. per unit	Units metered at lb. per unit

No. 4, *Coal Test Book.*—Here we have a permanent cord of calorimeter tests, which forms a useful reference hen considering quotations for coal.

Coal Test Book (No. 4).

Date .....
Name of coal .....
Delivered by .....
Name of barge .....
Price at wharf ..... Class of coal .....

Details of Test.

Weight of coal .....
Temperature of water :
Time ..... Temperature .....
,, ... ,, ...
,, ... ,, ...
,, ... ,, ...
,, ... ,, ...
,, ... ,, ...
,, ... ,, ...
Total rise in temperature of water .....
Residue weight .....
Calorific value .....

THE HOMOPOLAR DYNAMO.

By E. KILBURN SCOTT, M.I.E.E., A.M.I.C.E.

Considering that Faraday exhibited the first homopolar dynamo at the Royal Society in 1831, and that many inventors since then, including the versatile Prof. G. Forbes, have studied the problem, it is a little strange that the homopolar machine has not been more successful.

Its simplicity as compared with the commutator machine constantly forces itself on the attention of all who study dynamo-electric machinery. Yet for years we have been content to make very bad alternators of many phases, and by means of complicated commutators and brush gear converted the alternations into direct current. As a matter of fact, the homopolar is the only true direct current machine, for it is the only one that gives a current without pulsations such as one obtains from a storage battery.

Until the advent of the steam turbine only comparatively low speed prime movers were available, and at low speeds the voltage of a homopolar is low. For a given power the current is also relatively high, and as the construction is such that the current has to be collected many times, this means special brushes. Many designs have failed because of this brush problem.

Some designs were also mechanically faulty, because of being made with disks like the original Faraday machine. This means *radial air gaps*, and they have always been a source of trouble in all dynamo machines.

A cylindrical core having an air gap parallel to the shaft was made by Rankin Kennedy to get over the end thrust difficulty, but even so the homopolar made little progress. The fact is, it was invented before its time, and only now, when large units of power running at high speeds are required, is the type really having what one might call "a square deal." It is essentially a machine for coupling to steam or gas turbines.

Many cases could be instanced where plant made and experimented with on a small scale has not shown to advantage, but in large sizes it has been all right. This is most distinctly the case with homopolar machines, for they have little scope in small sizes and at low speeds.

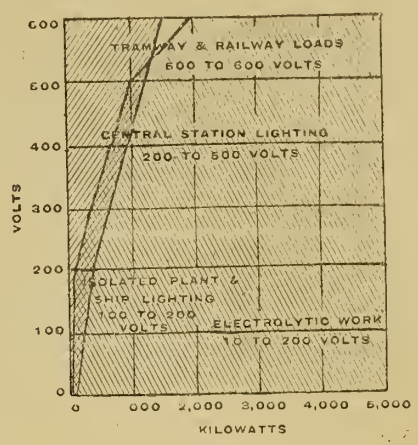


Fig. 1.

In the case of commutator machines, it is a widely known fact that for every voltage there is a limit of size, above which practicable machines cannot be built. On the other hand, it is also beginning to be recognised that for larger outputs the homopolar type has an almost unlimited field. This is well shown in fig. 1, where the left-hand section shows roughly the field for which commutator turbo-dynamos are suitable, and the right-hand section the field for which homopolar machines are best. Between the two there is a narrow debateable area, for which each may be used.

Unlike commutator machines, which are limited by permissible commutator speeds, homopolars are in every way suited for high speeds. Commutators not only give trouble by getting out of shape at high peripheral speeds, but above a certain output it is necessary to connect two dynamos in tandem to one steam turbine. This lowers the efficiency of the power unit, increases cost, and leads to vibration troubles by reason of the long thin shaft.

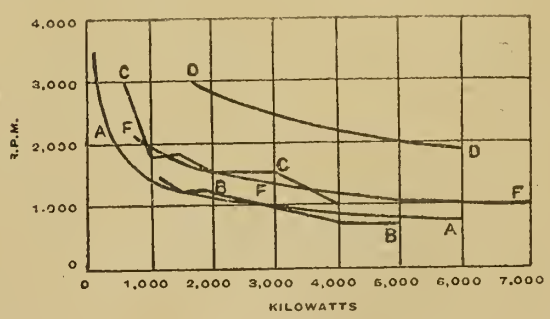


Fig. 2.

Homopolars, on the other hand, can be made of any size, and within the limits of tensile stress of steel, can run at practically any speed. The parts with least strength are the collector rings, and thanks to high grade steels now in use, they can be run at as high as 24,000 ft. per minute. As compared with commutator machines, the rotating part can be short and stiff; it is easily balanced, and what is more to the point, it stays in balance.

From every point of view, the faster a homopolar runs, and the larger its output, the better it works. The higher the speed the greater the efficiency, and the smaller the weight and cost per kilowatt. The most suitable speeds are the same as for steam turbines, so that the two are exactly suited to each other.

This is well shown by the curves in fig. 2. Curve A shows the speeds of a line of homopolars that have been designed by Mr. R. H. Barbour, a sample machine of which was exhibited at the Electrical Exhibition at Olympia. Curve B gives the lowest speeds of standard turbines by a well-known maker. Curve C shows the speed given by turbine builders, as those at which they prefer the machines to run. Curve D represents the absolute limit of speed beyond which it would be mechanically impossible to run homopolars. Curve F shows speeds of homopolars having a peripheral velocity of about 16,000 ft. per minute, that is to say, about 25 per cent. higher than Mr. Barbour's homopolar machine.

As curves C and F almost coincide, they prove that so far as speeds are concerned the steam turbine and homopolar machines are exactly suited to each other.

Fig. 3 is a view of the Barbour homopolar machine previously mentioned, and as it presents many novel features, a description will be of interest. The machine gives 50 KW., 100 volts, 500

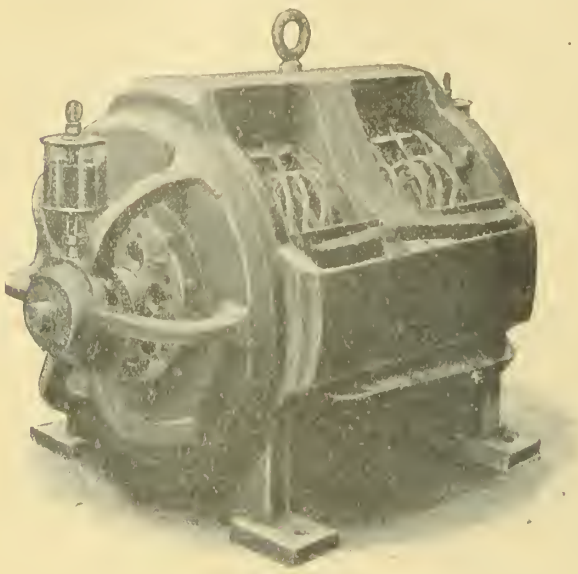


Fig. 3.—The Barbour Homopolar Dynamo.

amperes, when running at 3,500 revolutions per minute, and has the following dimensions :—

Total length between bearings	...	29½ in.
Height of frame	...	28¼ ,,
Width of frame	...	28 ,,
Diameter of rotor	...	14¼ ,,
Length axially of centre pole	...	6 ,,
Length of each end pole ...	...	3½ ,,
Width of each slip ring ...	...	½ ,,
Number of conductors ...	...	12
Field current	...	5 amperes
Peripheral velocity of rotor...	...	12,800 ft. per minute

Fig. 4 is a longitudinal section showing the poles, slip-rings and field coils, and fig. 5 is a cross-section showing the four yokes in section and two brushes pressing against a slip-ring.

The frame consists of three poles, A B and C, each extending without interruption or change of sign completely round the rotor. These are connected together by the four yokes D, E, F, G. The three castings are bolted together after the field coils, H, J (and two similar coils not seen), have been placed in position. It will be noticed that these field coils are placed olose to the air-gaps, so that there is very little opportunity for magnetic leakage.

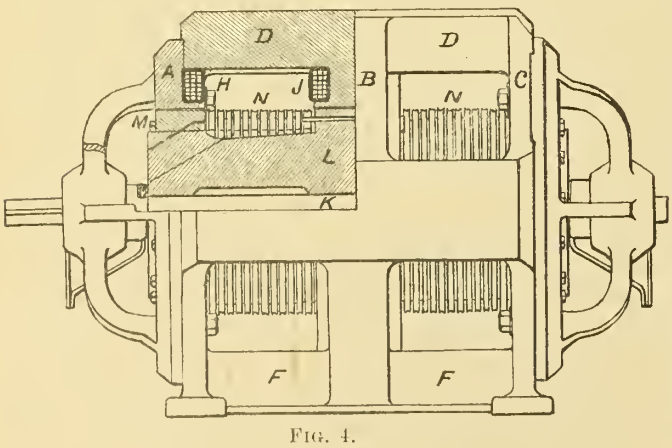


Fig. 4.

The rotor consists of a shaft K carried in bearings, which may be part of the end frames, as illustrated, or separate. A core L midway between the bearings is of the full rotor diameter, where it forms the centre pole under B, and has end rings which form the end poles. Only one of these end rings M is shown.

Between the centre and end poles are the slip-rings N N, 12 on each side. The slip-rings and end poles are firmly connected together by 12 through bolts P, which are insulated from the slip-rings by mica washers. In addition to the bolts there are 12 conductors Q which connect each pair of slip-rings together. When these conductors pass through slip-rings to which they have not to be connected, they are, of course, insulated therefrom by mica washers. There are also mica washers between adjacent rings to insulate the rings from each other. Between the washers, air can circulate freely.

The method of fastening the slip-rings to the rotor core is seen in fig. 6. This shows the through bolts in position and the holes in the slip-rings for 12 conductors. The six ventilating holes at the end of the core by which air is led underneath the slip-rings are clearly seen. As the voltage between adjacent rings is only about the same as between adjacent bars on a commutator, there is very little risk of flashing across. But even if an incipient arc did form, it would be immediately blown out by the draught of air.

The slip-rings are endless and of special steel, which can be safely worked up to 12 tons per sq. in. tensile stress. The rings have semicircular grooves, and these take the brushes R, R as shown in fig. 5. The brushes are held in position by the springs S, S, which can be adjusted.

The brush consists of a flexible stranded copper core wound with an armouring of German-silver wire. This armouring has been found by experience to make better contact and give more consistent results as to friction, &c., than any other metal. Under actual test, one of these brushes will collect 500 amperes without any undue heating from a ring 14 in. in diameter and only ½ in. wide.

Independently of mechanical reasons for German silver working well on steel rings, it has been thought that the remarkably good and consistent results obtained with this type of brush may be due to the current being evenly collected over the whole surface, each coil of wire armouring picking up its proportion of current and passing it into the central copper core. It is conceivable that a brush made of copper only would not only give trouble for mechanical reasons, but that on account of the low resistance of the copper the current would tend to bunch at that end of the brush to which the terminal leads are connected. Whatever the reasons the fact remains that the armouring of resistance wire on a flexible copper core does collect very large currents from a slip-ring running at 12,000 ft. per minute without any trouble.

This particular construction of brush is an essential feature of the Barbour homopolar machine, and one of the difficulties overcome. Experimenters in the past have tried to get a large

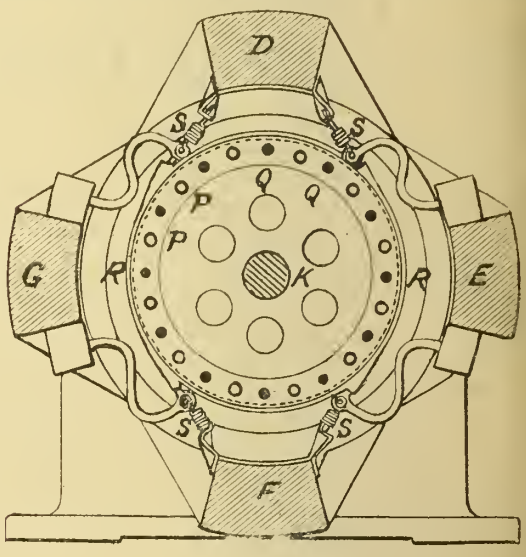


Fig. 5.

amperage per sq. in. of contact surface, the idea being that if only the brush was pressed down firmly enough large currents could be collected. What actually results, however, is an intense concentration of both frictional and electrical heating over a small surface, and naturally this brings about rapid disintegration. Of course, the point was that it would otherwise require an extremely large number of ordinary brushes to collect the requisite amperes.

In this connection it will be of interest to refer to the figures obtained by Messrs. Cottle and Rutherford in Vol. XLV of "The *Journal* of the Institution of Electrical Engineers." They tried four types of brushes :—(*a*) Hard carbon ; (*b*) hard metallic brush with some admixture of graphite ; (*c*) soft graphite brush with trace of copper ; (*d*) pure carbon, moderately soft : of these (*c*) alone gave results which are described as at all workable at high speeds.

In Table I the results obtained with this type at peripheral speeds of 1,850 ft. and 12,000 ft. per minute are tabulated ; also corresponding values for Mr. Barbour's special armoured brushes at the higher speeds are given. The first four columns contain figures taken from the paper, and the remaining four have been calculated from them. The term "frictional volts" is used because it is a convenient synonym for "watts lost in friction per ampere collected."

In this table the lowest value of "total loss—volts," *i.e.*, the sum of the "contact volts" and the "frictional volts" represents the most efficient value of brush pressure and current density. It will be noticed that the best figure obtained by Messrs. Cottle and Rutherford at 12.000 ft. per min. is 6·3 volts. Now, consider the "watts per square inch" ; under these most "efficient," conditions 1,260 watts are being turned into heat for each square inch of contact surface ! It is this rather than the low efficiency which puts such brushes out of court. An excessive temperature must necessarily exist at the surface, with consequent softening of the material of the brush and rapid wear.

With the brushes used by Mr. Barbour, the frictional loss is practically independent of brush pressure and of speed, but varies directly with the contact surface. Beyond a certain very moderate figure, extra brush pressure has no effect on the contact volts

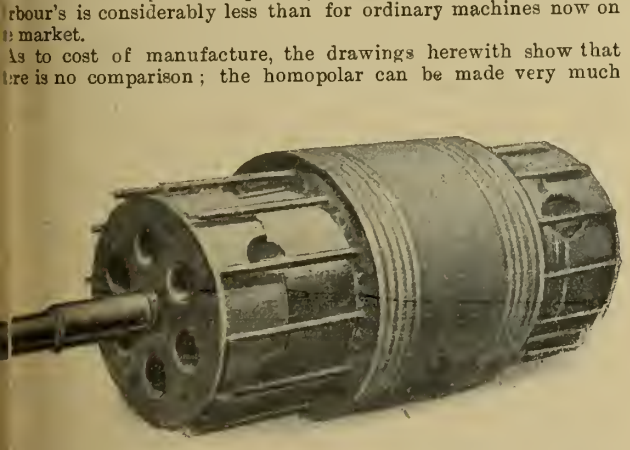
e current density found by experience to be suitable is about amperes per square inch, and a reference to the table below ws that the watts turned into heat per square inch of contact face are 110 under these conditions (see last line of table). Also t the watts per square inch in the case of ordinary slow-speed bon brushes at the usual density of 40 amperes per square inch 116 (see 10th line of table).

t would almost appear that there is a general law that the watts square inch of contact surface ought not to exceed 100 to 120. attempt values of 1,000 watts inevitably leads to trouble.

meter.	Peripheral speed.	Pounds pressure per sq. in.	Amps. per sq. in.	Voltage drop at contact.	Coefficient of friction.	Frictional. Watts.	Frictional. Volts.	Total loss, volts.	Watts per sq. in.
Coode and Anderson.	12,000 ft. per min.	8	40	3·5	0·5	1,090	27·2	31·7	1,230
			120	4·8	0·5	1,090	9·0	13·8	1,656
			200	5·1	0·5	1,090	5·2	10·3	2,060
		12	40	3·8	0·08	261	6·5	10·3	412
			120	5·0	0·08	261	2·2	7·2	864
			200	5·0	0·08	261	1·3	6·3	1,260
		16	40	1·5	0·2	875	21·9	23·4	936
			120	1·6	0·2	875	7·3	8·9	1,068
			200	2·3	0·2	875	4·37	6·7	1,340
	1,850 ft. per min.	4	40	0·8	0·5	84	2·1	2·9	116
			120	1·0	0·5	84	0·7	1·7	204
			200	1·1	0·5	84	0·42	1·52	304
		8	40	0·65	0·3	100	2·5	3·15	126
			120	0·90	0·3	100	0·83	1·73	207
			200	1·10	0·3	100	0·50	1·6	320
		16	40	0·4	0·28	189	4·7	5·1	204
			120	0·6	0·28	189	1·55	2·15	258
			200	0·7	0·28	189	0·94	1·64	328
Barbour.	12,000 ft. per min.	—	40	0·46	—	40	1·0	1·46	58·4
			60	0·54	—	40	0·67	1·21	72·6
			80	0·62	—	40	0·5	1·12	89·6
			100	0·7	—	40	0·4	1·1	110

t is sometimes stated that the homopolar is very heavy for its put, but, if properly designed, such is not the case. At any rate, coupling up to large steam turbines, it can be shown that homo- ars are no heavier than alternators or dynamos. Also it can be own that the space occupied by a design on the lines of Mr. rbour's is considerably less than for ordinary machines now on e market.

As to cost of manufacture, the drawings herewith show that re is no comparison; the homopolar can be made very much



G. 6.—Rotor of Barbour Homopolar, showing slip-rings partly assembled, and all the through bolts in position.

eaper. There is nothing in it except steel and a little copper and ca. Also all the parts are turned to gauge, so there is practically fitting or hand work except on the brushes.

The laminated structure which is so essential in all other dynamo- ectric machines is absent in the homopolar.

So far as the flux paths, &c., are concerned, the ordinary commu- tor and homopolar machines differ as follows: The flux in the r-gap of the former machine is bunched under the several poles, d it flows through the armature in a circumferential direction, so the air-gap has to be long for electrical reasons. With the mopolar, on the other hand, the flux under the poles does not ry, and when it reaches the rotor, it travels through it in an axial rection, also the air-gap can be short, being governed solely by echanical considerations.

Armature reaction can be reduced in the same way as in ordinary namos by throttling the section of the cross magnetic path, and is is done for the centre pole of the Barbour machine.

For a given number of conductors and slip-rings, a number of rying voltages can be readily obtained; thus the Barbour machine ill give 6,000 amperes at 8 volts just as easily as it gives 500 mperes at 100 volts; it simply means that for 8 volts all the lip-rings are connected in parallel, whereas for 100 volts they are n series and there is no difference whatever in the length or con- ruction of the machine.

Now, compare this with an ordinary commutator dynamo; for 8 volts, 6,000 amperes, the commutator would be about five times as long as for 100 volts, 500 amperes, and to collect 6,000 amperes there would be an immense number of brushes. There is no comparison between the two types of machine from this point of view; the homopolar has the advantage in all ways.

One very interesting feature of the homopolar is the exceedingly easy way in which it can be compounded. All that is required is that the flexible connections from the brushes to the terminals shall be a little longer, and be carried round in the same direction as the current that is flowing in the field coils. Then the current in the brush leads adds on ampere-turns, and by merely turning the brush leads the other way the compounding can be made differential.

THE MUNICIPAL TRAMWAYS CONFERENCE.

Tramway Track: Methods of Construction and Maintenance.

Three reports by Messrs. James Grierson, Henry Mattinson and Robt. Holt, heads respectively of the permanent way departments of the Glasgow, Manchester and Leeds tramways, were submitted on the above subject, summarising information which had been obtained from a number of representative tramway systems. To those who are associated with permanent way construction, both the abstract of replies and the reports will be extremely valuable for references. On the subject of rails, Mr. Holt points out that the popularity of B.E. Standard rail sections is not due to any particular merit which they possess; they are purchased because they are stock standards, while Mr. Mattinson adds that their composition is by no means of a grade suitable for electric traction. As regards the use of lighter rails, Mr. Holt considers that these would be a mistake on suburban routes, as rail wear is more a question of speed than traffic density and speeds are highest on outlying routes.

Each report specially refers to the Sandberg silicon steel rail; the systems giving comparative records show a reduction in wear of between 33 per cent. and 40 per cent.

Some 30,000 tons of these rails have been supplied to English tramways, Leeds using upwards of 6,000 tons, on which, Mr. Holt mentions, corrugation markings do not develop as in the case of the ordinary steel, and up to the present, after four years of service, no corrugations have had to be ground from the Sandberg rails in Leeds.

The continued investigation of steel alloys with a view to obtaining a suitable composition for electric traction purposes is advocated.

On the question of joints, Mr. Grierson says the replies indicate that while a large majority use some form of fish-plate, or fishplate and sole plate combined, only four systems claim to have a joint suitable for their traffic, and therefore some good form of plated joint is yet to be found. His experience is that all joints, depending on traffic, sooner or later develop dishing, and in the centre of Glasgow numerous Thermit-welded joints have broken; with plated joint remedial measures can be tried, the welded joints, however, require cutting out and a short piece of rail inserting and jointing up. It is only fair to state that the other reporters have had a wholly satisfactory experience with the Thermit-welded joint, Mr. Mattinson basing his opinion on 7,000 such joints at Manchester, which during five years have developed less than 3 per cent. of breakages, while Mr. Holt mentions that in Leeds 11,000 similar joints (60 miles of track) have been made during the past eight years, and a similar percentage of breakages is recorded for the whole trackage, though only ·7 per cent. on later works.

The cause of the ill success of this joint under heavy traffic at Glasgow is evidently worth careful investigation, in view of its success elsewhere under similar conditions; Mr. Holt points out the close relation between the rail steel and the welded joint, and Mr. Mattinson emphasises the skilful handling required to attain success.

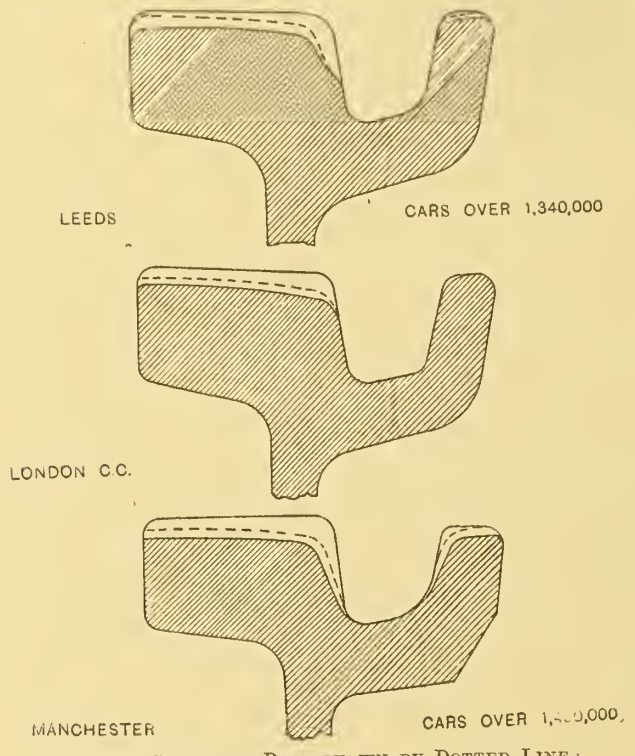
While all agree that the bonding of welded joints is not absolutely necessary, tests in Leeds show that the average conductivity of the Thermit-welded joint is 8·75 per cent. lower than the rail itself, and the addition of one bond greatly increases the conductivity.

There appears to be no general agreement as to anchoring; anchors are, of course, very often inserted, but in Manchester the standard construction has no anchors, and a trial length of two miles of anchored double track has necessitated more maintenance than the adjoining unanchored track under identical usage.

The majority of tramways use solid manganese steel points and crossings: in Glasgow the experience is in favour of cast-steel in conjunction with iron-bound crossings; in Manchester, Mr. Mattinson prefers the iron-bound crossing with manganese renewable plates, while in Leeds, renewable centre plates have been most unsatisfactory. It appears to be admitted that manganese steel castings are very liable to honey-combing.

All the reporters draw attention to the advantage of spiral curves, both in regard to easy riding of the cars and lessened wear and tear; it is noted, however, that 20 systems are laying plain, instead of spiral, curves.

Turning to the question of track laying, 42 systems lay the steel first and afterwards fill in the concrete; both Mr. Grierson and Mr. Mattinson lean towards a reversal of



Wear on Sandberg Rail shown by Dotted Line; Wear on Bessemer Rail, by Hatched Section.
Scale, half-size.

these operations, the latter instancing the difficulty of setting and packing the rails above ground and of handling the concrete round the rails and avoiding any disturbance of them. Mr. Holt, however, considers the favoured method to be by far the most satisfactory, adding that the rails are more readily levelled than the concrete, and the latter is not liable to disturbance by the handling of the rails. Tramway engineers must choose for themselves.

There appears to be a divergence of opinion as to rail packing, but none in regard to the necessity for efficiently draining the concrete bed, the neglect of which generally leads to the well-known "pumping" action of the rail and disturbance of the setts. Sleeper construction is referred to by Messrs. Grierson and Holt; the former has found pitch pine sleepers very satisfactory, while the latter is evidently not smitten with the transverse sleepers used in Leeds, partly on account of the extra initial cost.

In Glasgow, reconstruction work is carried out at night, as, owing to traffic density, single line working on a temporary track is considered impracticable; the cheapest method is by means of a temporary by-pass track with portable turnouts. The corrugation trouble is referred to; grinding out by means of abrasive blocks fitted into the slipper brakes, or by grinding machines, seems to be the only remedy, and must be taken in hand immediately the corrugations are noticed. Mr. Grierson refers to the greatly increased maintenance cost of track along which heavy commercial motor vehicles, traction engines, &c., pass, and notes that this seems to affec very few systems. Discussing the dishing of rails on th trailing side of the joints, Mr. Mattinson mentions, as remedy which is coming to the front, welding into th dished rail a piece of hard steel, by means of the oxy-acetylen blow-pipe; the added steel is hammered during the proces a slight excess being fused in, the surface is then groun and filed even; the 100 joints done in Manchester give ever promise of success.

Manchester also has in use a compact three-spindle dri operated by a flexible shaft for drilling three fish-bolt hol simultaneously; the machine slides along the rail and automatically set.

For expeditious work the oxy-acetylene cutter may b used, but it results in a somewhat ragged hole; either it the oxy-hydrogen cutter may replace the saw, but will n compare with the saw for quality of cut. Mr. Mattinson la stress on the value of this class of apparatus for permane way work where time is an object, and we can only conclu that in view of the proximity of an electric supply, t specialisation of motor-driven tools and electrical apparat for similar purposes must have been sadly neglected.

While in all tramway construction work, local conditio play an important part, the divergences of practice disclos by the reports and abstract of replies, are more than one wou expect under the circumstances, or than can be accounted fo by differences in local traffic conditions.

It appears to be not so much a question of what is use as of how it is used.

Tramcar Meters.

Discussion on the paper by Messrs. R. G. Cunliffe and J. Cunliffe, *printed in abstract in our issue of Oct. 13th, 1911*

The discussion on this paper was opened by Mr. T. B. Goody general manager, Croydon Corporation Tramways, who said that cost of electrical energy was a serious item to a tramways und taking, more especially where the energy was bought from outside body, and tramway managers ought to be thankful for co-operation of meter manufacturers in enabling reliable measu ments of the energy to be obtained. Since the introduction meters in Croydon, the saving had been about £5,000 per annu and returns were showing a still further tendency to decrea consumption per car-mile. He favoured the use of meters beca they tended to make the motorman operate the cars prope They were the means of detecting faulty cars. By enabling fa adjustment of the various parts of motor equipment to be reac discovered, the wear of armature bearings, brake shoes, &c., reduced by percentages varying from 15 to 40. He considered should be possible to obtain similar results on all systems.

The President remarked that if expenses were at bedrock present you could not expect to obtain these large savings.

Mr. W. Clough, Bury Tramways, spoke of the change of sen ment during the last few years. To-day, instead of question the use of meters, we were out only to find the best meter. thought that the type of meter used was a subject which matter. There came a time in the continued use of equipme when they should be scrapped, and the information could only obtained by a meter of absolute, as distinct from relative, accura He entered into a detailed discussion of the relative advanta and disadvantages of the various forms of meters employed. time meter extensively used on the Continent, with a possi accuracy of 10 per cent., was intended only to check "rushin current, and allow coasting, and also to show any undue use of power brakes. The time meter did not differentiate between se and parallel running, and although a new meter with two d had been introduced, it was dearer and less simple in construct To ensure absolute accuracy one could not use ampere-hour meters it was impracticable to assume a constant voltage; hence, he c sidered that the only accurate type was the watt-hour meter. W should anyone be asked to accept anything else? They w formerly somewhat fragile, but certainly not now. He had 50 in use for the last 18 months, with entire satisfaction, and experience was in no way exceptional. Regarding the volt-h meter developed by the authors, to obtain the average value of voltage fluctuation, he thought that this would increase the en which already existed in the ampere-hour meter. He thought t the correct average voltage for each route would have to obtained and corrections made to the ampere-hour readi accordingly; this the men would very likely object to. "moral" effect of meters was in showing the man that he spending money when using current; the "immoral" effect, if might so call it, was the danger of motormen not stopping passengers, in rushing down grades and running through lo The watt-hour meter had traced wasteful cars as well as waste motormen, and the result was a great reduction in repairs. W regard to large systems, he thought they might be divided up districts, and so be worked with as much saving as smaller syste

[R. Pilcher, Aberdeen, stated that he had got good results in district, but he thought too much elaboration was a great ger. He did not take intermediate readings of the meters, but ple readings which applied to groups of drivers. During the last e years he had saved about 13 per cent. in running expenses.

[R. Baker, Birmingham, said there was no scepticism now rding the use of meters; they were considered a necessary part he equipment. Last year he had installed 300 meters, showing ving of £5,000 during the last nine months. Besides a decreased rent consumption, he had also found a very great saving in e-shoes and in repairs generally; the meter also increased efficiency of the motorman, who would not accept an inefficient The possible disadvantage was an increased liability to acci- ts through jerky starting and stopping, and rushing hills. He d that the best men did not object to meters.

[R. Hamilton, Leeds, prefaced his remarks by stating that he not particularly favourable to the use of meters, especially re the tramway authority produced the current. The primary iness of a tramway system was to attract passengers and to vey them as cheaply as possible to their destination. If one apened the cost of doing so by losing passengers, this was an irely wrong method. If the motorman did not use current how ld he get his car along? and in the endeavour to save current advantage was to build up quickly, thus causing a jerky start a tendency to accidents. If the motorman was to save brakes must shut off his current and "coast" to his stopping place; must coast down hill at a rapid rate in order to get sufficient nentum to carry him along the level and up the next hill, and also constituted a danger.

[R. Spencer, Bradford, said that his system was one of the to use meters, and he had found them giving full satisfaction. course, quite apart from the question of meters, there are many er considerations affecting a comparison of drivers, and he found t long periods were necessary, even as long as 12 months, in r to obtain really satisfactory comparisons. At first he had nd differences of as much as 30 per cent. between various rers, but now the difference between highest and lowest on e routes averaged about 5 per cent. or 7 per cent.

[R. Ellis, Cardiff, said that although the running cost may be y low, still the use of meters would affect many economies; ough his department generated current and sold it to the ctric Lighting Committee at total inclusive cost of ·7d. per unit, y still considered it advisable to equip the cars with meters. y had 130 meters in use, and the returns showed an enormous ing in repairs and current consumption. He stated in contra- ion to Mr. Hamilton that the use of meters stopped sudden rting and sudden stopping of cars.

[R. R. G. Cunliffe, in replying, said that Messrs. Goodyear and ough had expressed themselves as being in disagreement with the ement that savings cannot be made on the larger undertakings al to those made by them on their smaller systems. This was, ertheless, the fact, and was due to the following reasons:—

(a) *Equipments.*—In the larger systems, owing to division into arate departments each controlled by an expert specialist and h well-equipped works and testing departments, the equipments maintained in a better condition than on a smaller system and margin for saving is not so wide. Thus, in Manchester, atively smaller savings can be effected in this direction.

(b) *Driving.*—There is far greater congestion on the large than on small system. As was shown in the paper, congestion greatly its the saving effected in driving, as the driver is controlled by umstances which he cannot alter, and has not got the free hand essary for obtaining the best results. This was illustrated by the ures given in the paper.

[R. Goodyer asked if there were no congestion in Berlin and nna. The President disagreed.

[R. Cunliffe said they did not wish to be understood to recom- nd the sole use of absolute values. Such values were not required f routine purposes, as relative values were sufficient for placing n and cars in their proper order. Correction for absolute ues did not change the order but merely changed each lt by a constant percentage throughout the list. In their ctice they used absolute values for the determination of trans- sion losses and for comparisons between different types of car l between different routes. In each case where this was done, ge numbers of results were taken and the correction applied to m in bulk and not separately, and the corrected figures did not ne before the men. The error of the volt-hour meter, small ugh it was, was allowed for in making the correction, and did enter into the corrected results. This error was definitely own from the calibration of the instrument. Experiments con- cted on Mr. Clough's system had borne out the experience that merous instances are available of cars being equipped with both pere-hour and watt hour meters in series, where both meters have en almost identical results with varying voltages, although the pere-hour meter has been known to be working accurately. In ry a car run for 50,000 miles showed less than 1 per cent. erence between the two meters. The paper mentioned not the gility, but the greater fragility of the watt-hour meter as com- ed with the ampere-hour meter. It was a matter of comparison which the ampere-hour meter had indisputably the advantage. was of interest to note that the prediction of a decrease in the ximum demand had been realised at Bury. The splitting up of ge systems recommended was essential to success, but this applied ually to all systems. Elaborate methods should be avoided. It ould be, of course, understood that they did not recommend rallel running where there was not sufficient space available for vantage to be taken of this method of driving. It was largely matter affected by local conditions.

THE ELECTRICAL CONGRESS AT TURIN.

(*Continued from page* 640.)

Sig. Guido Semenza's paper in Section II on the "Simultaneous Working of Several Central Stations, Feeding a Single Network," raised several interesting points. The author discussed the two alternatives, viz., that forming the system described by the title, and the sub-division of the network into independent sections, each with its own station. Parallel working, he considered, though good in theory, presented many difficulties in practice. An alternative adopted by the Edison Co., of Milan, was to have each feeder fed from several stations, with automatic cut-outs on each source, so that, in case of a failure at any station, the extra load was distributed over those remaining. This paper led to a good discussion, the general tenor of which was, however, decidedly in favour of standard parallel working.

A short but interesting communication was made to this Section by Sig. Elvio Soleri on the limits up to which cables can be employed for the transmission of energy. The general conclusions are that the possibilities of cable transmission are not exhausted by actual practice. Besides the price and the insulation question, that of surges is naturally very important and received full attention at this Congress. In this connection, Herr Leon Lichtenstein's paper on some experiments made on high-tension cables at the laboratory of the Siemens-Schuckert Co., at Nonnendamm (Berlin), is very instructive. The experiments described are chiefly in the direction of limiting losses by skin-effect and hysteresis, but there is at the end a note on the 60,000-volt feeders of the Bitterfeld-Dessau line, laid on the solid system by Messrs. Siemens-Schuckert. The Felten & Guilleaume Co. afterwards added a similar cable. These cables have been working six months for 10 hours per day without interruption. The author does not state what precautions are taken against the setting up of oscillations on this system. The frequency on these feeders, it is to be noted, is low, being only 15 cycles per second.

Herr W. Weicher's paper, "High-Tension Discharges in Relation to Shed and Hanging Insulators on High-Voltage Transmission Lines," is admirably illustrated with photos showing the effects which it is desired to guard against. A protective device is advocated, consisting of a metallic shade extending umbrella-wise from the top of the porcelain insulator. Arcs or discharges taking place from the line pass from one shade to the other, without causing damage to the insulator, and the shades also form an additional protection against rain. It is evident that these shades will be useful in the case of momentary discharges, but there is at least a question whether they would not be likely to encourage arcing. This system is especially advocated for suspended insulators.

Section III.

On September 15th, Sig. Campos presented to the Congress his paper on "The Propagation of High-tension Oscillations." After some remarks on "skin effect" and electromagnetic radiation, the author explained a method of artificially augmenting the loss of energy and the dissipation of high-frequency oscillations, by increasing the effective values of resistance and conductance. He instanced as remedial measures that of covering the line with a thin layer of high-resistance material, the use of self-inductance transformers with a secondary shorted through a resistance, or with the secondary shunted, or led through condensers in series with such a resistance. He pointed out the advantages which would result from a study of the phenomena produced, even on a reduced scale. This was one of the most practical papers on this subject, and was very well received. The question whether phenomena on extra-high-tension lines can be reproduced on a smaller scale is, of course, open to discussion, but, in conjunction with experience gathered on such lines in operation, the experiment could not but be helpful.

Section IV.

Lighting and Heating.—Proceedings in this Section opened on September 11th with M. Rossander's paper on "The Present Condition and Future Development of Electric Heating." This paper describes the construction of

various kinds of radiators and heaters, notably the "Thermophiles" of M. Herrgott, in the form of carpets or cloths having conductors running through them, presumably at a very low voltage, a form of radiator very little known in this country.

The cost of cooking by electricity is given at ·4 to ·5 KW.-hours per kilogramme of meat (Goisot), although, as the author remarks, other authorities vary considerably in their records. The above would be from ·2 to ·6 of a penny per pound, according as the price of the unit was 1d. or 3d. Herr Ritter gives figures of cooking effected at as low as ·1 KW.-hour per pound (beef), at which rate it would become a commercial possibility. Comparing electricity with gas, the author reckons that electricity, to compete in heating effect, should not cost more than ·415 of a cubic metre of gas, a comparison which would hardly work out in favour of the former except in localities where gas is 7s. 6d. per 1,000 ft. This comparison, however, is based on the heating of water. The actual price of electricity for cooking purposes the author estimates at ·7d. to 1·4d. An experiment has been tried by the Hartford Electric Light Co., of the United States, in which apparatus for cooking, made by the company, estimated to be capable of doing all the cooking for 3-5 people, are furnished with energy for a fixed charge of $3 (12s. 6d.) per month. This rate allows the supply, at the worst, a receipt of ·3d. per KW.-hour, even if the apparatus is in use 24 hours per day. An example is given of a house warmed by electricity (that of Dr. Ekstrom, near Stockholm) at no greater expense than the use of ordinary central heating, the energy in this case costing ½d. per KW.-hour. This system would, however, have skilled and constant superintendence in the instance given. It is a careful and comprehensive paper.

Mr. Leon Gaster (editor of the *Illuminating Engineer*, London, and delegate of the Illuminating Engineering Society of London) read his paper "The International Outlook in Scientific Illumination," on September 15th. He dwelt upon the necessity which exists for study of the problem of illumination, in all countries, a matter which is hardly receiving sufficient attention, although several Committees interested therein exist. These Committees are occupied either in the study of photometrical questions, or specialise on certain systems of illumination by gas or electricity. He then went into the work done by the Illuminating Engineering Society of London, and touched upon standardisation of units, so that not only should candle-power mean the same in various countries, but that it should show whether horizontal, spherical, mean hemispherical, or other intensity was indicated. He also noted the need for information on the question of measuring illumination. Tables of proposed symbols, put forward at different Congresses, are given at the end of the paper, and definitions of terms used in describing illumination. Mr. Gaster subsequently put forward a resolution requesting the "Illuminating Engineering Society" of London to form an International Commission on this subject, which resolution was carried unanimously, and constitutes the principal one emanating from Section IV as a result of this Congress.

Section V.

Proceedings in this Section opened on September 12th with M. G. Calzolari's paper on "Monophase and Three-phase Traction on Heavy-traffic Lines." The author, after treating the history of his subject, and examining, from existing examples, the characteristics of the two systems, both technical and economical, inclines in favour of three-phase traction, premising that electrification of railways will in future be confined to lines where it is necessary to increase the carrying capacity, steam proving uneconomical on account of slopes and long tunnels. The paper concludes with a description of the three-phase installation on the Genoa-Milan and Genoa-Turin lines, showing what heavy goods traffic may be dealt with by electric traction: with three 60-ton locomotives, a train weight of 550 tons (metric) can be hauled, or with a single locomotive 190 tons. This was a practical paper, clearly expressed as to commercial possibilities. It provoked an animated discussion.

Mr. L. Hoest read, on September 13th, his paper on the various methods of conveying the current to the collector on the car, by overhead wires, third rail, conductors in slots, &c., and the double catenary suspension of the L.B. & S.C. line. The author notes the overhead wire a the only method applicable to alternating currents.

Dr. Kummer's paper on the "Development of Motor Vehicles for Electric Traction on Single-Phase Lines," wa read, in his absence, by Mr Barnet-Lyon. This paper i largely a study of the relation between the weight of th locomotive or vehicle and the tractive effort of the motor which it carries.

Sig. A. Bezzi's paper on the "Application of Electricity t Submarines" provoked a good discussion. Tables of com parative output for weight are given for various cells. Wit the increase in size of the submarine, the size of the batter becomes considerable. The 1,000-ton *Mariotte* of the Frenc Navy has a battery of capacity 1,950 KW.-hours. Th weight of a battery of 1,000 KW.-hours, with Planté plate is given at 75·5 tons; pasted, 62 tons; iron-nickel, 42 tons and iron-nickel (Jungner), 43 tons. The number of di charges on these batteries is given as 250, 200 and 400 f the last two; the first figures appear very low. The Edis and Jungner accumulators are mentioned as not yet tried batteries of such large capacity. A comparison of th various systems of motor-control is also given.

Sig. G. Gyaros's paper "Notes on Electric Traction wi High-Tension Continuous Current," was read on Septemb 15th. The author notes the first railways on this syste that from Köln to Bonn, and the Indianapolis-Louisvi Line (1907). He also records the economy effected on th Washington, Baltimore and Annapolis line by the substituti of continuous for single-phase traction. He instances fi Hungarian lines, varying from 10 to 35 miles in lengt which are being equipped for this system by Messrs. Ga The highest pressure to be employed on these lines, for t overhead wire, is 1,500 volts. The author estimates th if the pressure could be raised to 2,500 or 3,000 volts, t continuous current would be in a position to compa favourably, for this purpose, with alternating current 15,000 volts.

Section VI.

Dr. Jewett's "Long-Distance Telephony" was, in absence, read by the secretary on September 11th. This an explanation of the system employed on, and the organisati of, a leading telephone line in the U.S.A. The princi characteristics are those of the Bell system.

Major W. A. J. O'Meara, who was acting as president this day, resigning the chair to Dr. Di Pirro, read his pa on the "Different Systems of Multiple Telegraphy." Thi a clear and comprehensive *résumé* of the characteristics the various systems, and their advantages from the point view of rapid transmission of the message. It conclu with a description of the diminished current Morse qua ruplex system, and the augmented current quadruplex, "increment" system.

On September 12th Dr. Valdemar Poulsen's "Wirel Telephony" was, in the absence of the author, read by t secretary. After describing the arrangement of circuit a receivers employed, the author estimates that it is possi to establish a satisfactory service over a distance of from to 120 miles, and gives instances of sending messages o distances of 162 and 330 miles (Esbjerg, and Los Angeles, S Francisco). On this paper the President (Major O'Mea remarked that there is every prospect of a largely increased u of wireless telegraphy in the future. M. Milon anticipated th the ships in a navy would ultimately communicate with o another in this manner, also small islands with t mainland.

M. H. Milon then read his paper "Automatic and Se Automatic Telephone Systems." This briefly describes t main features of the two systems, showing generally economy in working in favour of the automatic. It is a v clear *résumé* of what must necessarily, in practice, app intricate to non-experts, and encouraging to patience w present appliances, in hope of better things.

Prof. P. O. Pedersen's paper was read by the secretary September 15th. It is an investigation into the possibilit of secrecy in wireless telegraphy. This depends principa on the use of codes, although communication may be ma more difficult of interception by high-speed working. Hi speed would, however, appear to increase the possibility errors.

Dr. J. Erskine-Murray's paper on the "Efficiency of

Wireless Telegraph Apparatus" is a brief paper intended to act as a guide to those who study this question, both from the aspect of number of words transmitted and of consumption of energy. The principal factors which enter into the case are stated. This was read by the secretary.

Signor Bellini brought the meeting to a close with his description of the "Azimutal Hertzien Compas"—an instrument designed to show the position of a vessel by means of impulses transmitted to it from the shore, *i.e.*, a modification of wireless telegraphy.

(*To be continued.*)

ITALIAN ELECTRICAL UNDERTAKINGS.

The Turin Exhibition, and more particularly the holding of the International Congress of Applied Electricity in that town has again drawn attention to the development of the electrical industry in Italy. The report of the Chief Inspector of Industry and Commerce to the Minister of Agriculture and Commerce, containing statistical details of 63 tramway undertakings, notices of 2,000 installations described as "central works for the distribution of electrical energy," and similar particulars of a number of military supply works, was available to the delegates and others attending the Congress.

For purposes of consideration, the tramway systems may be divided into those having routes over 40 miles long, those having lines under 2 miles, and those of medium length. Of the first class, the largest is the Cuneo-Peveragno system, having 34 km. of double line and 56 of single (20 and 33 miles). The number of cars is 112. From the small proportion of motors to trailers, it would appear that this line is run as a railway with trains of vehicles having one locomotive or motor carriage. No details of generating plant are given in this instance.

The next in importance of length is the line between Antignano and Montenero, of the Livorno Tramways Co., having 64 km. of double and 13 of single line (total 46 miles run). This line has three 240-KW. Schuckert generators, and a 720-A.H. battery of accumulators. The number of motor-cars is 30, and 16 are classified as "reserve." The proportion of these reserves is apparently high on all these lines, and probably includes those under repair. The motors in this instance (two per car) are only 8 H.P. The maximum gradient is only 7·5 per cent. Another important line is that of the Milan city tramways, totalling 45 miles of single track. This is worked by the Edison Italian Electrical Co. It has five 500-KW. dynamos and two of 1,000-KW., and accumulators with the large capacity of 7,460 A.H. The number of motor-cars is 393 with 125 in reserve, including apparently a large number of special cars. There are also 204 trailers. The motors (two per car) are 37 and 25 H.P. The steepest gradient is only 3 per cent.

Milan also has four suburban lines of from 2½ to 9 miles, all running on 550-volt D.C., and fed by the same company.

Rome is served by four companies, the Societa Tramvie e ferrovie Elettriche being the most important. This has 24 miles of single-track line, with an 850-KW. dynamo and a 1,400 ampere-hour accumulator. The large proportion of accumulators in these installations is due probably to the use of water-power, which is the prime mover in this case. The cars are again classified with very large reserve; 13 motors and two trailers to 91 motors and 5 trailers in reserve. The motors are of 60 and 25 H.P. The Societa Romana tramways-omnibus has 2 miles of single and 1½ of double track, with an equipment of 130 cars running and 38 in reserve, with two trailers. The maximum gradient is 6·7 per cent., but on the funicular portion it is 47·7 per cent.

The line to Civita-castellana (Rome) has 32 miles of single track, and six motors and three trailers on ordinary service, with 11 and 16 respectively in reserve. The maximum gradient is 7 per cent. The motors are of 40 and 35 H.P., two and four of the former, and four of the latter being employed per car. This is a monophase system at 3,500 volts, 25 periods outside the town, and 550 volts in the town.

Turin has four sections, the town tramways (Societa Elettricita Alta Italiana and Tramvie Municipali), covering 3 miles double and 9 single, and 3 miles double and 2 miles single respectively. These have between them 145 motors in ordinary service and 35 in reserve, and 13 trailers. The motors are of 19 to 30 H.P., and the steepest gradiant is 17·5 per cent.

The Chivasso line has 21½ miles of single track, the Moncalieri 6, including 4¼ double. These have 20 and 13 cars respectively, with 27 and 22-H.P. motors, and no steep gradient. Ventimiglia has a line worked by an English company, the Riviera Electric Supply Co., and there are several French and Belgian companies. It is noticeable that Rome, Milan and Turin, all have overhead wire systems of distribution. An interesting line is that of Vesuvius, run at 570 to 750 volts by a 66-KW. gas-driven generator, the number of motor-cars being three, with two (25 and 50-H.P.) motors per car. The gradients are 8 per cent. for ordinary traction and 25 per cent. where a rack is employed. The length is 4 miles, and the car-miles run per day 54. The equipment is Vignoles, and distribution overhead. Other mountain lines are at Capri and S. Pellegrino.

The large distributing concerns which supply power for all purposes are exceptionally well situated in this country owing to available water-power. One of the largest is the Societa Anonima Elettricita Alta Italia, which had a steam generating station in Turin of 500 H.P. to start with, and now has a capacity of 25,000 H.P. from one hydraulic and two steam stations. It supplies principally Turin and neighbourhood.

The Societa Riviera di Ponente, in Liguria, has two hydro-electric stations (one near Ventimiglia, and one near Taggia), and a steam station at Savona, together capable of 22,000 H.P. The Italian Edison Society has at present 35,000 H.P., but is putting in a hydro-electric plant which will increase its capacity by 24,000 H.P. This company serves Milan and suburbs.

The Societa per Imprese Elettriche Conti has six generating stations, five of which are on the Ticino, and one on the Brembo, the total capacity being about 45,000 H.P. It also possesses a station of 12,000 H.P. at Magenta, and another hydro-electric station of 20,000 H.P. is in construction at Verampio (Lombardy).

The Municipality of Rome has under construction a station with Diesel engines of a capacity of 8,000 H.P., and a scheme for a hydro-electric plant at Castelmadama of 11,000 H.P.

At Naples, the Societa Generale per l'Illuminazione is constructing a steam station of 10,000 H.P., and another large hydraulic station is to be opened on the Volturno, which will furnish 12,000 H.P.

A variety of details are given in this report of military installations, but these are of comparatively small output. Amongst the commercial undertakings mentioned are the Societa Italiana for the manufacture of carbide of calcium, acetylene and other gas, disposing of 50,000 H.P. of electricity from hydraulic stations, of which the greater part is already available. The voltage on the transmission line to Rome will be 86,500. The length of this line is 74 km.

A similar company, called Societa Piemontese, in Valle d'Aosta, also manufactures ferro-silicate and silica.

A comparative table of cost of electricity for power or lighting is given. From this it would appear that lighting varies from 4d. to 10d., with an average of about 8d., and power 1d. to 4d., with an average of 2½d.

BREAKDOWNS OF MACHINERY IN 1910.

Mr. Michael Longridge's report to the British Engine, Boiler and Electrical Insurance Co., Ltd., for the year 1910 shows a notable recovery in the rate of increase in the insurance of steam, gas and oil engines as compared with the previous year. The proportion of gas engines to steam engines insured continues to increase, being now 25 : 20, and the size and power of the former are growing. The rates of breakdown among insured steam and gas engines were 1 in 9·7 and 1 in 10·8 respectively. Taking the steam engine breakdowns, valves and valve gear accounted for 26·6 per cent., spur gearing for 8·9, air-pump motions for 10·3, air-pump buckets and valves for 8·0, columns and bedplates for 7·5, main shafts for 5·8, and pistons, &c., for 5·3 per cent. of the breakdowns. In the case of gas and oil engines, valves and valve gear were responsible for no fewer than 42·8 per cent., connecting rods for 9·1, cylinders for 8·5, main shafts for 7·9, pistons for 5·1. All other items were under 5 per cent., except gas-producers, which caused 8·5 per cent. of the stoppages. While the valve-gear breakages show a great increase (29·6 in 1909), the breakages of cylinders have been almost halved (15·4 in 1909) and main shafts show a considerable reduction—both very important items.

Turning to electrical machinery, generator breakdowns numbered 1 in 16·5 D.C., 1 in 5·3 A.C.; motors 1 in 8 D.C., 1 in 12 A.C.; starters and controllers, 1 in 25·4. Of the generators insured, 94·5 per cent. were D.C., and of the motors, 83·5 per cent. D.C.; the proportion of A.C. machines insured is, however, steadily increasing, having risen from 3 per cent. in 1901 and 1902 to 14·5 in 1910. Armatures and rotors bulk most largely in the breakdowns, the proportion being 43 per cent. in the case of generators and 33 per cent. in the case of motors; next come commutators and slip rings, 25 and 26 per cent.; magnet coils and stator windings, 13 and 17; and rotating parts not carrying current, 13 and 9 per cent. Brush gear and terminals accounted for only 2 and 5 per cent. respectively, while stationary parts not carrying current caused 4 and 10 per cent. of the breakdowns. There is a distinct tendency for the proportion of armature and rotor breakdowns to diminish in proportion to the rest.

In starters and controllers 57 per cent. of the failures occurred in connection with the resistance coils, 12 in the contacts and switch arms, and 18 in the automatic apparatus, the rest being due to parts not carrying current. A closer analysis of the failures of motors, which form the large majority of the machines insured, shows that D.C. armatures and A.C. rotors are about equal in proportion of accidents (33 and 30 per cent.), a rather unexpected feature—in previous years the rotors have made a much better showing. Commutators, however, which are taken out separatively, show 29 per cent. as compared with slip rings 5 per cent. The stationary windings of D.C. motors, again caused only 15 per cent., as against A.C. windings 36 per cent. of the failures—and the latter figure is a great improvement over previous years. The stationary parts of A.C. motors also show up badly with 22 per cent., compared with 9 per cent. Dirt and neglect, age and deterioration, and bad work or design are the three heads under which fall most of the breakdowns of generators and motors.

Commenting on typical cases, Mr. Longridge suggests that it is unwise to use white metal in self-lubricated bearings; if the bearing heats and the metal melts, the rotor strikes the stator. Ball-bearings are preferable, and the company has found them seldom give trouble. The disastrous effect of saturating the windings with oil, through carelessness or otherwise, is pointed out; the insulation becomes charred and ruined.

Many breakdowns are due to carelessness in details—the lack of insulating bushes where cables to slip-rings are led through the shaft; failure to cover sharp edges in contact with, or proximity to, armature and rotor windings (especially at the ends of the slots); neglect to secure all conductors on rotating parts against vibration or relative motion; and the use of "dry" joints inside motor casings, instead of proper couplings or terminals.

A curious case was met with where one of a large number of shunt-wound motors was used for driving a large lathe, with a face-plate, 10 ft. in diameter, for turning heavy castings; the motor started and ran well, but sometimes, in the act of switching off, the main fuses blew. It was found that the starter had, in addition to the starting resistance, a regulating resistance in the shunt circuit, with which the speed of the motor could be increased 15 per cent. If the motor was running at top speed, with a heavy job in the lathe, and the starting lever was moved back, the excitation was increased while the machine was driven by the lathe considerably above the normal speed, so that the motor acted as a generator and returned current to the line of sufficient strength to blow the fuses. Had the attendant used the main switch instead of the starting switch to stop the motor, the trouble would not have happened. In addition, this use of the starter interrupted the shunt circuit at full excitation, thus straining the insulation of the field magnet winding.

The peculiar loss of insulation of electrical machinery in suction gas-driven installations receives notice. Breakdowns have occurred in such cases, due to the accumulation of a black, greasy deposit at the back of the commutator. This deposit, in one case, was found to consist of copper dust, 70 per cent.; mineral oil, 19 per cent.; vegetable oil, 11 per cent.: and traces of sulphur, sulphuric acid, &c. All the bare copper in the engine and dynamo room has been observed to assume a dark chocolate colour, wherever this trouble has been experienced—apparently due to the gas fumes, and it is suggested that the copper dust, which causes the breakdowns, is the result of attempts to clean the blackened commutator by rubbing it with emery or glass paper, whilst in motion. This seems to provide a possible explanation of the connection between producer gas and the copper dust, but fails to explain the origin of the oily matter which causes the dust to adhere to the surfaces with which it comes into contact, and Mr. Longridge points out that the problem requires further investigation.

As regards the insurance of boilers, economisers, &c., the net increase in the number insured was only 1 per cent. The diminishing rate of increase is ascribed to the reduction in the number of boilers in the country, due to economy in the use of steam, the replacement of small steam engines by gas engines and electric motors, and the increased evaporative power of the boilers used, as well as to the fact that most of the boilers in use are already insured, and the number of insuring companies has increased. A number of the usual horrible examples of corroded boilers are cited.

In an appendix to the Report, an account is given of a test of a 1,000-KW. turbo-generator, used for driving a spinning mill and weaving shed, formerly driven by ropes and shafting. The turbine was of the Zoelly type, running at 3,000 R.P.M., and driving a three-phase alternator of 1,250 KW. at 50 cycles. A surface condenser was used, with Edwards air-pumps and a Rees-Roturbo circulating pump, driven by a 35-H.P. motor. There were eight 210-B.H.P. motors with wound rotors and slip-rings, and three of 40 B.H.P.

The steam consumption (at 151—157 lb. per sq. in., superheated 184—224° F.) as the average of two tests, was found to be 15·9 lb. per KW.-hour, or 11·85 lb. per E.H.P.-hour. The author shows from other data that the turbine was more economical than any but exceptionally economical mill engines, and probably as economical as the best. He gives additional information showing that, after taking into account all losses in transmission, "there is little to choose between a turbine with a motor drive and an engine with a rope drive for loads of about 1,500 H.P."; but he points out that other considerations enter, such as upkeep, space and first cost. While not pursuing the matter to a definite conclusion, Mr. Longridge gives data which should prove useful to anyone who wishes to work it out for himself.

NEW PATENTS APPLIED FOR. 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,156. "Electrical cooking appliances." B. THOMAS and E. THOMAS. October 9th.

22,232. "Electrically-driven cash-counting receipting and registering till." MRS. H. GONEFROIN née HAMSPOHN. (Convention date, October 10th, 1910, Germany.) October 9th. (Complete.)

22,235. "Repairing of metallic-filament incandescent electric lamps." ALLGEMEINE CHEMISCHES LABORATORIUM OSKAR H. ARENDT. (Convention date, October 8th, 1910, Germany). October 9th. (Complete.)

22,238. "Electric signalling apparatus for telephones and the like." G. H. NASH and WESTERN ELECTRIC CO., LTD. October 9th.

22,254. "Making steam by electricity for all marine steam boilers and other steam boilers." G. S. HOLME. October 10th.

22,274. "Accident-preventing or life-saving apparatus for electric tramcars and like vehicles." T. A. BENNETT. October 10th.

22,276. "Combination locks for electrical lamps and like electrical fixtures." G. BARKER. (Midland Electrical and Manufacturing Co., United States.) October 10th. (Complete.)

22,280. "Mounting or supporting dynamos and electric motors." W. A. TRIER. October 10th.

22,281. "Electric batteries or accumulators." J. H. MAY and ELECTRIC POWER STORAGE CO. LTD. October 10th.

22,282. "Electrical lamps, more especially intended for use in mines." J. H. MAY and ELECTRICAL POWER STORAGE CO., LTD. October 10th.

22,315. "Electric heating apparatus." J. F. MONNOT. (Convention dat October 14th, 1910, France.) October 10th. (Complete.)

22,350. "Enclosed electric fuses." BRITISH ELECTRIC CO., U.S. Octob 10th.

22,356. "Loud-speaking telephonic apparatus." E. A. GRAHAM. Octob 10th. (Complete.)

22,372. "Means of enclosing electrical apparatus." A. H. CURTIS a ADAMS MANUFACTURING CO., LTD. October 11th.

22,397. "Construction of jack strips for telephone switchboards or the like. SIEMENS BROS. & CO., LTD., and E. A. PETITHORY. October 11th. (Complete

22,403. "Telescoping masts for aerial transmitting or receiving electr magnetic influences." SOC. n'ELECTRICITE MORS. (Convention date, Octob 13th, 1910, France.) October 11th. (Complete.)

22,414. "Electric light fitting." E. RYAN. October 11th.

22,426. "Portable electric signal lamps." A. J. STEVENS and A. J. LY October 11th.

22,427. "Telephone receivers." E. J. LOOSMORE. October 11th.

22,429. "Electric searchlights." L. PASQUALINI. October 11th.

22,435. "Means for electrically transmitting and receiving messages W. F. C. MICHAELIS. October 11th.

22,436. "Telegraphic apparatus." F. G. CREED and W. A. COULSON. Octob 11th.

22,441. "Method of using electric batteries for supplying lamps." CHEMISC FABRIK GREISHEIM-ELEKTRON. (Addition to 15,447/11. Convention date, M 24th, 1911, Germany.) October 11th. (Complete.)

22,443. "Signals for use in wireless telegraphy." O. ANGELINI. Octob 11th. (Complete.)

22,495. "Apparatus for generating heat by means of electric currents." H. KENT. October 12th. (Complete.)

22,500. "Terminal clips, wire attachments and the like." REX MOT MANUFACTURING CO., LTD., and H. SARGINSON. October 12th.

22,547. "Electric switches." H. F. BIGGE and F. R. BUTT. October 12 (Complete.)

22,548. "Electric arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (Gene Electric Co., United States.) October 12th.

22,550. "Metallic sheathings or covers for electric conductors." L. SUNDI LAND. October 12th.

22,558. "Telephonic apparatus." E. A. GRAHAM. October 12th.

22,582. "Telephonic transmitters, receivers, and other like diaphragm inst ments." A. MARR. October 13th.

22,624. "Distribution of electrical energy." P. V. HUNTER and W. L. SHA October 13th.

22,634. "Telephonic apparatus." E. A. GRAHAM. October 13th. (Co plete.)

22,635. "Manufacture of filaments or threads from viscous liquids or sol tions." H. J. PING and F. W. SCHUBERT. October 13th. (Complete.)

22,653. "Means for causing magneto-electric sparking machines to spa used in connection with internal-combustion engines when at rest." J. HUSBANDS. October 14th.

22,656. "Electrical measuring instruments having movable coils. J. RECORD. October 14th.

22,660. "Appliance for obtaining static electricity from either positive negative pole of the secondary of an induction coil." G. G. BLA October 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtain of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

ELECTRIC SWITCHES. R. V. Venner and R. C. Griesbach. 17,658. July 25th

REGULATING OR CONTROLLING OF VALVES OR THE LIKE BY ELECTROMAGNE MEANS. T. G. Rorke and E. Rorke. 22,397. September 27th.

MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. "Z" Electric Lamp M Co. and F. Hoge. 23,332. October 8th.

ELECTROMAGNETIC RELAYS. Siemens Bros. & Co. and L. D. M. G. Ferrei 24,003. October 17th.

ELECTRIC LAMPS AND REFLECTORS FOR THE SAME. D. J. L. O'Brien and R. Catts. 25,401. November 1st.

INTERCOMMUNICATION TELEPHONE SYSTEMS. Sterling Telephone and Elect Co. and G. Burney. 26,854. November 18th.

ELECTRIC CONVERSION. S. Cabot. 27,696. November 28th. (December 4 1909.)

FIXING IN POSITION OF SHADES FOR METAL-FILAMENT LAMPS, AND THE LOCKI OR FIXING OF THE LAMPS IN THEIR HOLDERS. W. G. Polack. 23,1 December 3rd.

PROCESS FOR THE PRODUCTION OF IRON BY ELECTRO-DEPOSITION. S. Cowp Coles. 28,226. December 5th.

1911.

ELECTRICAL PURIFICATION OF GASES AND APPARATUS THEREFOR. J. Y. Johns (Badische Anilin and Soda Fabrik.) 142. January 3rd.

ELECTRIC ARC LAMPS. British Thomson-Houston Co. (General Electric C 607. January 9th.

RELAY FOR UNDULATORY CURRENTS. R. von Leiben, E. Reisz and S. Strau 1,482. January 13th.

PORTABLE ELECTRIC TRANSFORMER APPARATUS FOR SUPPLYING CURRENT F MEDICAL PURPOSES. D. Ranschburg and D. Perlusz. 1,951. January 25

Flat-iron Sales.—The American *Electrical Revi* recently stated that according to estimates no fewer than 250,0 electric flat-irons were sold in the United States and Canada l year. "There are more than 10,000,000 homes within cent station territory, of which fewer than 2,000,000 have electric s vice; consequently the estimated sales last year approximate o iron to every eight homes."

THE
ELECTRICAL REVIEW.

OL. LXIX. NOVEMBER 3, 1911. No. 1,771.

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HE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

O BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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REIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. NTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: KAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter inden.

eques and Postal Orders (on Chief Office, London) to be made payable to . ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

EARNINGS AND HOURS OF LABOUR.

In the history of economic science, and in particular in the history of the immediate present, the time-lag between any event and its appearance in official chronicles is, of necessity, a long one. Even in that highly organised branch of statistical science, the monthly trade return, we find a period of approximately eight to ten days elapsing between the end of a month and the publication of summarised trade returns. In this instance a splendid organisation, compulsory returns, and simple methods of analysis, do well to let us have approximate returns so promptly. Where, however, investigations are made at wide intervals, where the making of returns is a voluntary pastime, and where the analysing of such returns is a matter of tedious complexity, a much larger time element naturally intervenes.

When, therefore, in this year of 1911, with its peculiar conditions of social stress, we received the Board of Trade Report on earnings and hours of labour in the metal, engineering and ship-building trades in 1906, the first natural inclination was to ask what 1906 had to do with us, and of what value such information could be in the solution of the problems of to-day. The value, however, of this statistical return of nearly 200 foolscap pages is not semi-archaeological. In itself it may be regarded as one slab in the tesselated pavement of complicated design along which our civilisation is marching. In the abstracts which we publish on another page we have regarded it as a statement of facts by itself without relation to other facts. Here we would like to refer rather to related phenomena. Summarising our own abstracts, we have outstanding a gross advance in money wages for those working full time in these industries, averaging 25·7 per cent., and ranging from 30·5 per cent. in the pig-iron trade, to 22·2 per cent. in ship and boat building and repairing and in railway carriage and wagon building. Taking the metal industries alone, what are the immediate relevant facts? Rise of money wages by itself means nothing—changes in purchasing value are modifying factors. Then again, changes in market prices of both the finished commodity and its main component raw materials are useful in the determination of how far labour is getting what the would-be syndicalist with a ruthless disregard of economics would term its fair share of the profits of the industry. Figures from the Census of Production returns, when we are able to compare a number of such, will be very helpful. In default of such, we instance the fact that the index number of prices of minerals rose from 67 in 1886, to 101 in 1906, and fell to 89 in 1910. During the same years the index number of food prices (Sauerbecks) fell from 72 in 1886, to 69 in 1906, and rose to 74 in 1910.

Over and beyond the changes due to alternations of

activity and depression there have to be reckoned the joint phenomena of interacting causes, some making for increased price in fuel, others making for a decreased amount of fuel per unit of output, while in regard to labour itself there are the results of labour-saving machinery tending to relegate large masses of unskilled labour into casual labour, which latter under process of accumulated unemployment produces the loafer classes. Against this loss at the one end of the scale we have the wider development of skilled trades in making such appliances and the selection of the more intelligent of the previously unskilled for the handling of such apparatus. There is thus a greater natural bias towards enmity between the unskilled and the skilled artisan than between the unskilled labourer and the employer. At first the demagogue fostered the former, as is chronicled in the history of our textile trades; latterly, he has fostered the latter. In so doing his actions are as intrinsically illogical as before. The employer has to hire his capital every bit as much as he has to hire his labour. The capitalist when all is said and done is merely the great mass of the people. Quite apart from individual investments in industrial companies there are the collective investments of all sections of the public through banks, insurance companies, or building societies, to say nothing of the vast circulations of capital by the State and municipal authorities.

Wages, after all, are but a counter in the game. The principal struggle is between the food producer and the food purchaser. Plenitude of foodstuffs means a large manufacturing output of clothes and the appurtenances which administer to the comforts of our civilisation. Glut and scarcity follow like sunshine and rain. If a fictitious value be given to the wages counter, we are, to use an expressive Americanism, "up against" a two-stage problem. First, the manufacturing countries producing at a cheaper rate will be enabled to purchase therewith more foodstuffs than the countries manufacturing at a dearer rate; and secondly, the well-fed virile country will dominate the weaker as certainly as carnivorous animals prey on the herbivorous.

Economic operations are distinct from surgical ones in that we cannot, under the action of a general anæsthetic, remove the abscess from a vital organ. Economic operations are slow and painful, and the patient retains full consciousness of pain throughout. We cannot beguile ourselves with any equivalent of Christian Science that there is such a thing industrially and nationally as the survival of the unfit. Altered environments must be recognised, and industrial survival will depend upon our adaptiveness thereto. It is good nationally that the individual standard of wealth should be raised, but it is better that this should be accompanied by its intelligent employment.

Money wages, as the return before us shows, rose very largely in the two decades ending in 1906. The food-purchasing value of the wages rose until 1901. During the past 10 years the food-purchasing value of the pound sterling has fallen. It is in this, in combination with the segregation of large masses of unskilled labour into the two groups of the semi-skilled operators of labour-saving appliances, and of the casuals drifting from the unemployed stage to the unemployable, that we probably have one cause of our present feverish industrial unrest. Pathologically an abscess sets up a high temperature in a patient which falls when the pressure is released, and the pus is drained away. Careful concerted national thought will enable us to get back to a fairly normal condition. Absolute equilibrium is impossible until we can conceive as aught but speculative a planet in which rainfall and sunshine were always constant, population was stationary, both numerically and in its demands, in which there was no exhaustion of soil, but crops were always the same, and supply and demand exactly balanced. For our industrial ills we want no quack remedies. We must, however, find our answer to the questions before us. The riddle of the Sphinx has to be answered, and answered correctly, or the Sphinx will turn and rend us. In framing the course of action which will be our answer, we must consider the evidence of statistician and sociologist. The return in question is a survey of one of the tiles wherewith we are either building stairs to lead us to higher things, or are paving a path of good intentions to the proverbial igneous and inglorious ending.

The I.E.E. Articles.

On Wednesday last week a notice issued to corporate members of the In tution of Electrical Engineers that extraordinary general meeting would be held on Novem 2nd to consider, and if thought fit, to pass a resolu approving and adopting new Articles of Association, of wh a copy was enclosed with the notice. It will be obser that exactly a week's notice was given, during which m bers must decide upon their attitude towards the proposals. Seeing that the latter include important cha in the conditions of membership, affecting existing as as prospective members, the period allowed for their diges (the minimum permitted by the Articles) appears absu inadequate, and unnecessarily so.

In fact, the whole proceeding has an air of precipitat the new Articles have been sprung upon members just viously to the commencement of the Session, and apparently to be got out of the way before an opportunit afforded for any question to be raised at an ordi meeting—when the number of members present would bably be 10 times as many as at an extraordinary ge meeting. The report of the Council in May last menti that the committee appointed to consider the altera required would shortly present its report, but othe threw no light on the subject.

We cannot but regard it as unfortunate that whenever Council has an important matter of this kind in han should be rushed through in a hurry; sometimes ha justified, as in the case of the purchase of the Instit Building, but as a rule there is no such urgency. The of this procedure is to create an impression on the min many members either that the Council regards the submi of such questions to the judgment of the Institution as a formality, or that it wishes to avoid free and open discu —which, in the case of a society whose members a widely distributed, can only be carried on effectively i columns of the technical Press—and therefore smuggle resolution through by a process which can hard described as artless. The former view is no doub more correct, for there is an unquestionable tendenc the part of the Councils of the big Institutions to b autocratic in their methods, and to assume an air of libility equalled only by that of a modern British Cal as though to say, "It is for us to think and act; fo to admire and approve." But this is an attitude inevitably leads to discontent and annoyance among members, and eventually provokes rebellion. It see us, therefore, that the wiser course would have be allow plenty of time for mature consideration of the proposals, and thus avoid all occasion for adverse critic

The chief innovations proposed are the introduction "Licentiate" class, between Students and Ass Members: the broadening of the basis of admission t membership, so as to embrace "persons of eminence" are not electrical engineers, and other changes which, opinion, are likely to lower rather than to raise the star of qualification: a general increase of subscription entrance fees by 25 to 50 per cent.: the embodim regulations for professional conduct; and changes i constitution of the Council, on which the Associate now be represented. These and other modifications articles would provide abundant material for commen we space at command; and it will be seen, we think the changes are such as should have been placed bef the members at least a month or six weeks before the called upon to vote on them.

Melbourne's Bold Policy.

Elsewhere in this issue we refer to a drastic reduction in the charg electricity at Melbourne (Vic.) whi the recommendation of the Electric Light Committe unanimously adopted by the City Council.

The new charges, which came into force last mon practically 25 per cent. less than the old ones, and basis of the year 1910-11, represent a sacrifice of £ in revenue. But the Committee believes that the d

nt of the undertaking during the current year, together vh the further increased demand which should certainly ult from these reductions, and the consequent decreased st of production per unit, warrant it in anticipating a sub-ntial credit balance for the year 1912.

It is impossible not to admire the optimistic feeling of the elbourne Council as to the future of its electrical under-king, which appears to underlie such unanimity in voting; elbourne deserves all success for adopting such a bold licy, even though—to English eyes—it may appear rather e sailing a little close to the wind.

Possibly Australian conditions differ from British ones, d the Australian civic representative may have more solid ounds for believing in the success of his own undertakings; en so, there is no doubt that the municipal authorities of is country would benefit their electrical undertakings in the d, if they could import a little more optimism into their siness methods.

As an instance of the "wobbly" methods of management ich undoubtedly hinder the progress of electricity under-kings in this country, one may mention the recent decision the Brighton Council to rescind a resolution two months l, abolishing meter rents to flat-rate consumers, and aking much-needed concessions in other directions; this uld have entailed a loss of £1,200 a year in revenue, if compensating advantages were derived from the change.

As things are, the electricity supply business in this untry expands, in spite of the unenterprising policy which, ith one or two notable exceptions, is adopted by the unicipal and company owners concerned. What would is business amount to, and what would be its effect on the ectrical manufacturing and contracting community if, for stance, similar development to that on the North-East ast occurred generally?

We have the engineering ability and the consumers, while oney can generally be found for a live business; we wait ly for a little faith on the part of those controlling the ectricity supply business.

The Trailer Car in London.

A matter of considerable interest to the numerous patrons of the L.C.C. tramways came up for discussion at the Council meeting on Tuesday. The uestion of using coupled cars or trailer cars on certain of ie Council's tramway routes has been to the fore for some ears, as a possible method of dealing with the enormous olume of morning and evening traffic, particularly, we elieve, on the Tooting route.

As a result of negotiations with the Board of Trade and ie Metropolitan Commissioner of Police, two self-propelled oupled cars were put into service, experimentally, on the uston Road and Hampstead Heath route in January last, being agreed that they should not be run between the ours of 10 a.m. and 5 p.m.

Subsequently, as the result of police action, the cars ceased unning on February 1st, but further negotiations resulted in heir being again put into service for a month, with greatly estricted hours of use. The Highways Committee states that he running of these cars was most satisfactory, but points ut, what we should have thought would be obvious, even to he Board of Trade and police authorities, that an accurate pinion could not be formed from a limited trial under such onditions.

Further experience was needed: The Board of Trade and Commissioner were again approached and asked to agree to louble-deck trailer cars being run on the Victoria Embank-nent to Tooting route, also to agree to smoking being ermitted in one of the single-deck coupled cars, the only esult being, however, an irrelevant reply from the Board greeing to further experimental running, under the previous estrictions as to time, on the Hampstead Heath route, which, moreover, was followed at a later date by a letter from the Commissioner of Police, asserting his opinion "that no advantages are likely to accrue which would in any way compensate for the obstruction and dangers incidental to the use of trailer cars."

While the Commissioner's views are, no doubt, based on mature experience of general traffic conditions, it is a little difficult to understand why two tramway cars should be more obstructive than any of the other numerous coupled vehicles which make use of the streets—indeed, short of an actual trial under normal service conditions, it seems rather premature to come to any definite decision on a matter of such importance to the tramway administration. Under the circumstances, the Council is justified in asking Parliament for specific authority to run both coupled and trailer cars on its tramways: it appears to be the only way in which a fair trial of the system can be ensured. Assuming that the traffic conditions are what they are represented to be, the only alternative method of meeting them is the costly one of adding more routes, a proceeding which could not be justified on financial grounds, where workmen's cars are concerned.

Empire Wireless.

The *Evening Standard* of October 27th is informed that negotiations have been concluded between the Postmaster-General and the Marconi Co. for a "chain of wireless stations round the world," which will make Great Britain the only nation in the world independent of cable communication with any part of the globe; to provide against cables being cut in war time, or one or other of the stations destroyed by bombardment, it is intended that the installation at each station shall be of sufficient power to send messages some 3,000 miles, and beyond one or more intermediate stations.

We are also told that £1,500,000 is to be the cost of this chain, by which important State and commercial secrets are to pass at all times without fear of interruption. The Post Office is to take control and provide subsidies of £10,000 a year for each of the 25 stations proposed to be erected, or an annual payment of £250,000. This will be one-sixth of the capital cost of the chain! Is it to be purchased on the instalment plan? The charge per word, but only over a given distance, is to be 1d., and a revenue of no less than £600,000 a year is anticipated; as the annual outlay is estimated at £200,000, one cannot help asking why is the huge subsidy required when such profits are in sight? We are also told that the estimated traffic is to reach 15,000 words per diem per station, or a total of 136,700,000 words for the 25 stations, which, including service words (say one-third more), will equal 80,000,000 words a year. Truly there will be a Babel of confusion in the air, which makes one wonder what will become of other installations, which are jammed badly enough at present.

To add to what may be termed sky talking, an American contemporary states that the high-power stations at Cape Cod and Wellfleet eject Press words into space continuously and repeatedly without cessation, so that whosoever cares to pick them up may do so, and be enabled, by piecing various pages together, to have an intelligible record. This we can understand, although it is somewhat in the nature of a puzzle as to how the cost is met, or who pays for this work. But the transmission of some 180 million words a day to fixed destinations in the face of physical and atmospheric difficulties, which prevail for hours daily at some places, with the risk of interception by enemies, ships and other stations, at a cost which would complete the chain of Empire cables does not, if the particulars as published are correct, appeal to us as being the sound way to meet the urgent necessity of a secret and reliable means of communication under British control.

Mr. Charles Bright, in the *Daily Graphic* and other papers of October 28th, calls attention to the present position of affairs. He states that the prevention of monopoly is one of the legitimate functions of a Government, and if the cable system is drifting into a combination, the question of ownership is a good deal altered. We think, however, the position of the Pacific cable is sound, and we have on previous occasions dealt with the question of compilation of accounts, and demonstrated that the project has really shown a profit. But what we cannot understand is that critics of the enterprise should take exception to the payment of so-called deficits—which are really in the nature of traffic guarantees—while the payment of £250,000 in subsidies to a wireless company is applauded. There is not the slightest doubt that a traffic guarantee is a most businesslike way of supporting telegraphic undertakings.

SOME RECENT TECHNICAL DECISIONS.

[BY OUR LEGAL CONTRIBUTOR.]

It is well for those who have to do with the electrical industry in all its manifold branches to make themselves acquainted with the more important decisions of the Courts. The questions addressed to the Editors, and answered in the "Legal Query" column of the Review, show that there is a desire for up-to-date information in many quarters, and the queries range over a wide area which is by no means entirely covered by the law relating to electricity. It may be convenient to review some of the most important decisions of the legal year, many of which have been reported in these columns during the last 12 months.

Many property owners have to rely upon the street hydrant for a sufficient supply of water in case of fire. In premises where there is much inflammable material it is essential that water shall be available at once. To enable the position of the hydrant to be determined, when the hydrant cover is concealed by snow, &c., a plate is put upon an adjoining wall. If this plate is moved or incorrectly placed there may be a great delay, and the fire may assume serious proportions. Who, then, is liable? In one case (Dawson *v.* Bingley U.D.C., 27 T.L.R. 308) it appeared that in a road which had not been taken over by the local authority there was a fire plug, which, however, at the material time was buried in the earth to the depth of 6 in. This had not been done by, or with the knowledge of, the defendants. A plate with the letters and figures "F.P., 22 ft. 3 in.," had been put up in the road by the defendants (who were also the water authority), but the plate did not correctly indicate the position of the plug. A fire having broken out on the plaintiffs' premises, the fire brigade arrived, but owing to the difficulty of finding the exact position of the fire plug, the efforts of the brigade to extinguish the fire were considerably retarded, and the damage to the plaintiffs' property was largely increased. In an action by the plaintiffs to recover damages from the defendants for breach of duty, it was held that the putting up of the denoting plate with misleading directions thereon was an act of misfeasance, and as it had caused damage to the plaintiffs, the defendants were liable.

Although the doings of the motorist are frequently considered in courts of petty sessions, he is not often brought up to the High Court. It is material to notice, however, that in one case it was decided that a conviction for failing to have a back plate of a motor-car illuminated during the period prescribed by Article XI of the Motor Car (Registration and Licensing) Order, 1903, is a conviction for an offence in respect of which endorsement of the convicted person's licence is required by Sec. 4 of the Motor Car Act, 1903.

In relation to contracts for large works, one must not overlook the important principle which has been laid down by the Court of Appeal as to arbitration. In effect the Court has said: "Where there is a clause referring disputes to the engineer of one party, and the dispute relates to the conduct of the engineer, he will not be allowed to decide it." In Freeman *v.* Chester R.D.C. (1911), I.K.B. 783, a contractor brought an action to recover the price of certain works constructed for a local authority under a contract which provided for the reference of disputes thereunder to the engineer of the local authority. In answer to a summons to stay proceedings under Sec. 4 of the Arbitration Act, 1889, the contractor challenged the conduct of the engineer in relation to the works, the question in dispute being whether the engineer had not precluded himself by his own admissions from asserting that the works had not been completed to his satisfaction, and that the period of maintenance had not expired.

The Court of Appeal (Cozens-Hardy, M.R., and Buckley, L.J.), affirming the decision of Lush, J. (in the exercise of the jurisdiction conferred upon it by the Arbitration Act, 1889), refused to order the action to be stayed. The Master of the Rolls did this on the ground that the cross-examination of the engineer was essential to the proper determination of the dispute. Lord Justice Buckley said that, although, in his opinion, the evidence failed to show that t engineer had unfitted himself to act as arbitrator, yet t fact that one Judge of the Court of Appeal was not "satisfi that there was no sufficient reason why the matter should r be referred" was a ground upon which another judge of c ordinate jurisdiction could concur in the view that t presence of a sufficient reason was not shown.

The principle that where there is a breach of contract, is the duty of the injured party to reduce the damages as far possible, is well illustrated in the case of British Westinghou Electric and Manufacturing Co. *v.* Underground Elect Railways Co. of London (1911), I.K.B. 575. In that c it appeared that the Westinghouse Co., having contracted supply certain electrical machinery to the railway compa delivered machines which failed to satisfy the c ditions of the contract as to economy of worki The railway company accepted the machines, reserv their right to damages for breach of contract, a subsequently, in order to avoid the expense of continued use of the machines, bought machines another manufacturer, with which they replaced those of Westinghouse Co. If the railway company had contin to use the Westinghouse machines, the loss which t would have suffered in consequence of the breach of c tract, namely, the amount by which the cost of working machines supplied during a period of years representing normal life of a Westinghouse machine would have exce the cost of working machines constructed in accordance w the contract for the same period, would have represente larger sum than the price paid for the substituted machi It was held that as the substitution of the new machi went in mitigation of the damages consequent on the bre of contract, the railway company were entitled to rec from the Westinghouse Co. the price paid for the machines; and none the less because those machines wer superior to those of the Westinghouse Co. that it would h been to the pecuniary advantage of the railway compan have effected the substitution at their own cost, even if machines supplied had been in accordance with the contr

There have been but few recent decisions under Factory Act. In one of these the question arose as to w was "cleaning machinery." It appears that by Sec. 13 of Factory and Workshop Act, 1901, it is enacted that a c must not be allowed to clean in any factory any part of machinery whilst the machinery is in motion by the ai steam, water or other mechanical power.

A child of 12 years was employed in removing partly hand and partly by means of a stick, from the rollers top board of a cap-spinning machine for spinning woo yarn, certain fluff formed in the course of spinning. If fluff was not removed the rollers would become choked the process would stop. The fluff was not mere refuse, had a saleable value, and was, in fact, sold. It was h that the child was "cleaning machinery" within meaning of the enactment (Taylor *v.* Mark Dawson & S Ltd.).

The extent of the provisions which require fencing also discussed in Jackson *v.* Mulliner (1911), I.K.B., It was there decided that Sec. 10 of the Factory and W shop Act, 1901, which enacts with respect to the fencin machinery in a factory, that "every hoist or teagle, every fly-wheel directly connected with the steam or w or other mechanical power" must be securely fenced, app to a hoist which is not connected with mechanical power.

Those who carry out large contracts are someti troubled by claims from local authorities for the payn of considerable sums in respect of damage done to the hi ways by extraordinary traffic. It was recently held that amount which can be recovered under Sec. 23 of the H ways and Locomotives (Amendment) Act, 1878, as amen by Sec. 12 of the Locomotives Act, 1898, is the exp caused by the damage arising from the extraordinary tr or excessive weight upon the highway, provided the dam has been such that it has caused extraordinary expense, in order that the expense may be extraordinary within meaning of the section, the highway rate of the dist must be substantially increased by the damage so a place an unfair burden upon the ratepayers.

The expression "highways in the neighbourho in the section means similar roads in a neighbourhood

nilar character to that in which the road with the traordinary traffic is situated. (Billericay Rural Council Poplar Union and Keeling.)

In the domain of patent law, the two following cases are portant. On an application for revocation of a patent the ground that the patented article or process is nufactured or carried on exclusively outside the United ngdom, the Comptroller of Patents, in computing the ent to which the article or process for which the patent s been obtained is, within the meaning of Sec. 27, Sub.-c. 1 of the Patents and Designs Act, 1907, manufactured carried on within the United Kingdom, ought not to quire whether what has been done in the United Kingdom, or is not, in derogation of the patentee's rights under his ent, or to exclude from the computation what has been ne by infringers of the patent in derogation of those rights. the same case it was declared to be doubtful whether c. 27, Sub.-Sec. 2 of the Act does not render lawful erything done while the patent is revocable, although it uld otherwise be an infringement. (In *re* Fiat Motors, d., Application.)

In a later case it was held that in considering whether a ent ought to be revoked under Sec. 27 Sub.-Sec. I, of the tents and Designs Act, 1907, on the ground that the atented article or process is manufactured or carried on lusively or mainly outside the United Kingdom," the urt is not bound to determine that at the precise moment en the petition was lodged, there was a manufacture of patented article or a carrying on of the patented process. temporary cessation of manufacture and a sale of stock in meantime will not prevent the operation of the sub.-tion, but where the manufacture and business are irely and permanently stopped, the section will not apply rely because the remaining stock is sold after the business come to an end. (In *re* Green's Application.)

LECTRIC OPERATION OF GOLD DREDGES.

the alluvial gold deposits a considerable amount of dging is carried on for the purpose of removing the spoil taining the gold from beneath the surface of the water, d within recent years the crude and old-fashioned dredges viously employed have been replaced by modern chines calculated to materially reduce the cost of operation. a good many cases electric power has been employed to ilitate the handling of the material. and by the courtesy the Yuba Construction Co., of Marysville, California, we



Fig. 1.—Dredger under Construction.

able to describe and illustrate the electrical equipment one of the largest gold dredges which has yet been ilt.

This boat, which is illustrated as it appeared in the urse of construction in fig. 1 was built for the Yuba nsolidated Goldfields, and a few of the dimensions may of interest. The hull itself is 155 ft. long, 68 ft. beam, d 12 ft. 6 in. deep. There is in the structure of the hull d housing something over 700,000 bd. ft. of timber, and the total weight of machinery and hull combined equals a displacement of 2,250 tons. The buckets have a capacity of 15 cb. ft. each, and there are 90 buckets in the line. The digging ladder is 135 ft. from centre to centre, of plate girder construction, 10 ft. deep in the middle, and of itself weighs 225,000 lb. The arrangement of the ladder and buckets is such that the boat will dig 65 ft. below the level

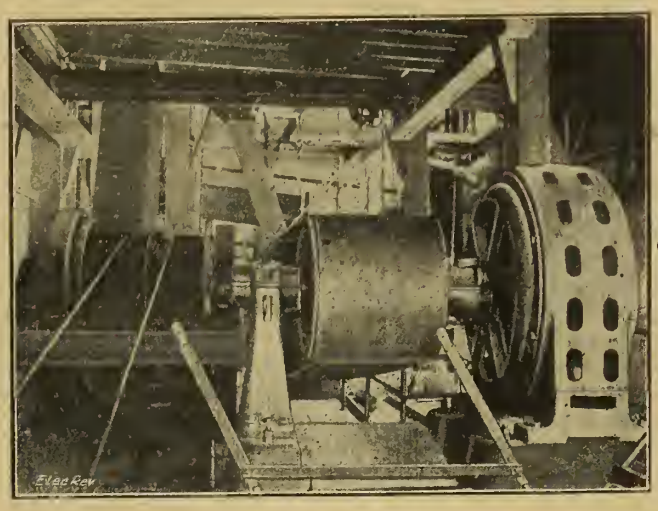


Fig. 2.—Digging Motor and Ladder Winch.

of the water in the pond on which it floats. The stacker ladder has 136 ft. centres, and the stacker conveyor belt is 42 in. wide, carried on the customary troughing idlers of the Robins type. The working capacity of this boat is approximately 300,000 yards per month.

It is rather a difficult matter to photograph the interior of a dredge, as the machinery is usually so crowded together that very little can usually be seen in a photograph except the immediate foreground and its contents. The illustrations, figs. 2 and 3, are, therefore, of peculiar interest as being taken under circumstances

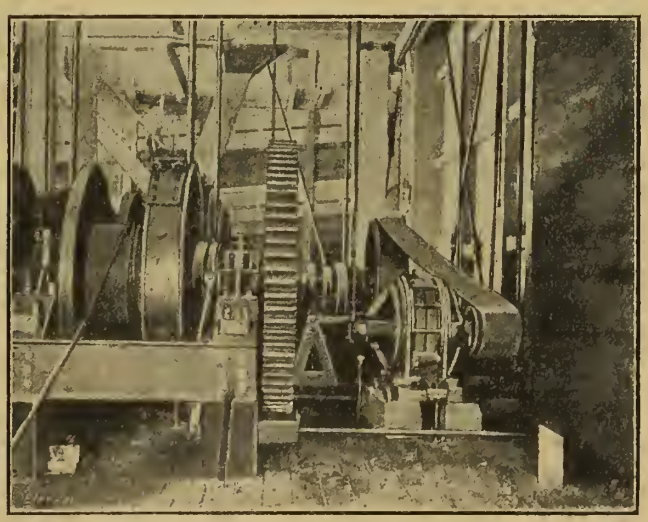


Fig. 3.—Main Winch and Motor.

of some difficulty. The former shows the digging motor connected with the ladder winch, and the counter shaft for the main drive, while the latter illustrates the motor connected with the main winch. The power for the operation of the motors is obtained from a high tension electric supply on shore by means of an armoured cable provided for the purpose, having a length of about 800 ft. On board the vessel the current is transformed to a suitable working pressure for the motors by three 200-kw., 4,000-volt primary to 460/230-volt secondary oil-cooled transformers. There is in addition a 10-kw. 4,000-volt to 230/115-volt oil-cooled transformer for lighting and auxiliary power. These transformers, together with the rest of the electrical equipment on board, were constructed by the General

Electric Co., of Schenectady. The switchboard consists of six 2 in. × 16 in. × 31 in. dull black slate panels, forming one complete switchboard 48 in. × 62 in., mounted on pipe supports 76 in. high. The panels are mounted with the usual voltmeters, ammeters and wattmeters, and are supplied with the latest type of remote control apparatus. The operation of this is controlled by a small type controller in the hands of the winchman. The main drive motor is a 300-H.P., 14-pole, 540-R.P.M. variable-speed induction motor, with an extra heavy duty reversible controller and resistance for continuous operation at from one-half to full speed. The motor is supplied with an outboard bearing and belt tightener rails. The winch motor is a 35-H.P., 12-pole, 600-R.P.M. constant-speed induction motor, with an extra heavy duty reversible controller and resistance for continuous operation at from half to full speed. There are three pump motors, the first of which, the high pressure pump, is operated by a 150-H.P., 12-pole, 600-R.P.M. constant-speed induction motor, with an oil-immersed starting compensator. The low pressure pump has a 75-H.P., 10-pole, 720-R.P.M. constant-speed induction motor with an oil-immersed starting compensator, while the auxiliary pump motor is driven by a 25-H.P., 6-pole 1,200-R.P.M. constant-speed induction motor. The screen is operated by a 75-H.P., 12-pole 600-R.P.M. constant-speed induction motor, while the stacker motor is of 60-H.P., of the 10-pole, 720-R.P.M. constant-speed induction type. In order to drive the tool-repairing equipment, a 2-H.P., 4-pole, 1,800-R.P.M. induction motor is installed. All these motors are suitable for 3-phase, 60 cycle, 440-volt current.

It has been found in previous experience that the motive power required for dredging plant has been frequently under-estimated, and the experience of the dredger builders mentioned, has shown that the main-drive motor particularly is at times very considerably over loaded. Where the ground is very hard it is necessary to install not less than a 400-H.P. motor for the main drive, and the motors mentioned above were selected as their size has been found to correspond more nearly with the actual requirements of such work. From the data given above a very good idea can be obtained of the important progress which electric power has made in this branch of industrial activity, and the application of electric power to gold dredging is, therefore, not without interest to British engineers.

CURING AN OILY COMMUTATOR.

By JOHN S. LEESE.

The escape of lubricating oil from the out-end bearing of the crankshaft of a four-cylinder vertical gas engine, direct-connected to a 100-KW. alternator, caused considerable annoyance in a plant over which the writer had supervision.

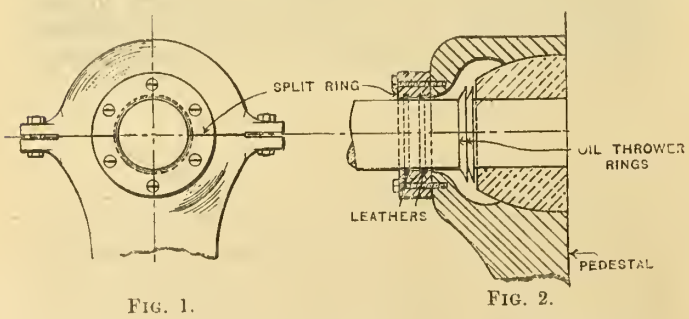


Fig. 1. Fig. 2.

The journal was provided with forced-feed lubrication, the pressure being maintained by an oil pump driven by a small eccentric which was bolted to the extreme end of the shaft, which was completely enclosed by an oil-tight cover. Two oil-throwing rings were turned on the shaft at the inner end of the bearing, and were of the usual V-type, but did not prevent slight films of oil from creeping over them, along the shaft and on to the commutator, over which they spread with consequent trouble. A temporary experiment wiper gear was fixed up on the shaft between the out-er bearing and the commutator, consisting of a piece of o leather belting surrounding the shaft. After the comm tator had been cleaned and the set run for a week with t wiper in place, no further accumulation of oil had manifest itself on the commutator or upon the shaft beyond the wip although quite a quantity was soaked up and dammed ba by the leather.

To make this cure a fixture a cast-iron ring was turn bored, faced and provided with two ¼-in. grooves on inside periphery, after which it was split, as shown in fig. In each groove was fitted a length of ¼-in. square raw-hi leather. The halves of the ring were then provided wi

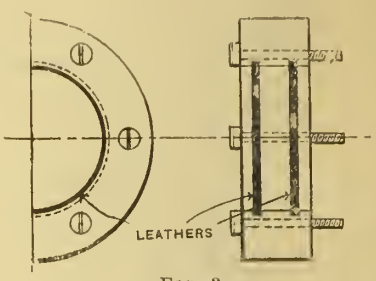


Fig. 3.

holes for three cheese-headed screws in each, which lat were tapped into the out-end bearing cap and pedes bottom brass bed, as indicated in figs. 1 and 2. The dev is shown fixed in position in these views, whilst fig. 3 sh half the ring with the screws and leathers in place. Perf success attended this effort, and no more oily deposits h occurred on the commutator.

VENTILATION OF ARMATURES.

By W. H. F. MURDOCH, B.Sc., M.I.E.E.

The question of ventilation of armatures being of imp ance to electrical engineers, it might well be conside from an electrical point of view, as indicated by Prof. W. Shaw, F.R.S., in his book, "Air Currents and the Law Ventilation."

With armatures the chief cause of resistance to the of air C is the resistance due to eddies, &c., the sur resistance being negligible in comparison with it.

If A is the aeromotive force, then —

$$C^2 = A/R,$$

since here the aeromotive force varies with the square the air current, instead of directly, as in electrical circ When an armature arranged with radial ventilating duct

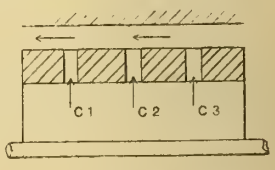


Fig. 1.

inside its casing, its section might, as a first approximat be regarded as a channel with ducts opening into it, a fig. 1. This figure represents the top of an armature radial ventilating ducts.

If such an armature was at rest, and a fan was arra to draw air through the ducts, it is at once apparent, a pointed out in the above book referring to ventilating sh that a large quantity of air goes through the first duct, through the second, and so on. If the resistances assumed equal in all parts of the air circuit, then one- goes through the first duct, one-quarter through the sec one-eighth through the third duct.

Now, when the armature revolves, each of these ducts an aeromotive force of its own (see "Ventilation of I

icity Machinery"), causing a flow into the space between ıe armature and the frame, so that the electrical analogue somewhat like fig. 2.

The resistance due to changing the direction of air in the assage is r in each case, and is assumed the same as in the ucts, since very little is known at present about it. The ittery represents the aeromotive force in each case in the ucts. It is clear that the air current in the first branch is ven by —

$$C_1^2 = a/2\ r.$$

In the second—

$$C_2^2 = a/3\ r, \text{ and so on.}$$

Consequently the ducts produce less effect the farther they e away from the exit. That being so, their resistance ıght to be modified by increasing the area or by giving

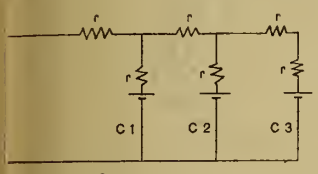


Fig. 2.

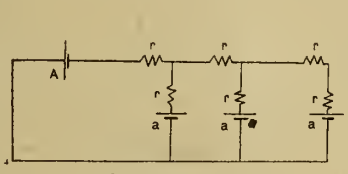


Fig. 3.

em increased aeromotive force. If the air is allowed to cape at both sides, as it usually is in the open-type achines, the ventilating action of the ducts will be more fective, since they are nearer the exit.

When a fan is allowed to draw air through the revolving mature, the electrical analogue is like fig. 3. Calling all e resistances r in this case, a the aeromotive forces in the ucts, and A the aeromotive force in the fan, we have for the ow in the first duct—

$$C_1^2 = A + a/2\ r,$$
$$C_2^2 = A + a/3\ r, \text{ and so on.}$$

We see, therefore, that the flow in the ducts is in the me ratio as previously, and gets less as the ducts are rther away from the fan, but is greater in the ratio—

$$A/a + 1.$$

Side openings in the frame may produce very deleterious fects unless care is taken. For instance, take the last ample considered, but with ventilating openings opposite ch armature duct having negligible resistance, see figs. 4 id 5.

Apply Kirchoff's Law, viz.: "The product of the ırrents into the resistances in any mesh of a network is ual to the sum of the electromotive forces."

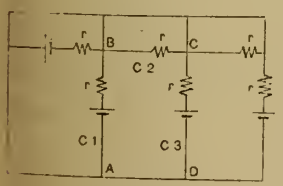


Fig. 4.

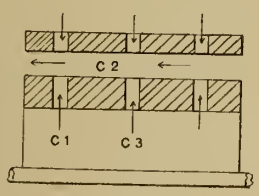


Fig. 5.

In this case the currents are squared and the aeromotive rces are to be considered.

Going round the mesh A B C D we have—

$$C_1^2 r - (C_1 - (C_2 + C_3))^2 r - C_3^2 r = a - a,$$

and a being the aeromotive forces in the ducts. mplifying—

$$2\ C_1 - (C_2 + C_3) - \frac{C_3^2}{C_2 + C_3} = 0.$$

If C_3 is regarded as small compared with C_2 then— $C_1 = C_2$, or C_1 the flow in the first duct is half C_2, the flow the channel. Again, if $C_3 = C_1$ we have—

$2\ C_1\ C_2 - 2\ C_1\ C_2 + 2\ C_1^2 - 2\ C_1^2 - C_2^2 = 0$, or $C_2 = 0$.

Hence in this case there would be no flow of air in the annel and no ventilation there. The flow through the ucts would probably be increased owing to the diminution resistance, but this would have little effect on the armature, the conductivity for heat *across* the laminations being very low indeed.

It seems to the author that the time has arrived to consider very carefully the effect of making openings in the frames, &c., of dynamos and motors. Just as in electric circuits, so in the air circuit, one may find that the fan or other source of aeromotive force is short-circuited and the ventilation very bad. At present the knowledge of ventilation of electrical machinery appears to be in a crude state.

NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

Calcutta.—In view of the visit of the King and Queen to this city, the Imperial Government has, through the newspapers, made known its intention to carry out a grand display of illumination on the night of January 8th. The citizens have been invited to co-operate, as far as possible, in the scheme of illumination, so that it may present a harmonious whole. As Calcutta intends to give its Royal guests a right royal welcome, the invitation of the Government is sure to be generously responded to, and, therefore, home illumination strip and lamp makers and general accessory suppliers should be on the look out for large demands on their stocks. The Calcutta Supply Co.'s voltage to consumers is 225, but at this pressure metal lamps are, for obvious reasons, not popular for temporary work; it is likely, therefore, that carbon lamps will be more in demand. There should be large stocks of these after the Coronation at home, and those who have quantities to spare, and who wish to dispose of them at a low rate, should advertise the fact.

Bombay.—There is also to be a generous illumination of the city and public buildings here for the Royal visit in December, but as no official notification has been issued as yet, the display is not likely to be so lavish as that of Calcutta. Moreover, the Parsees, who compose the greater bulk of the middle class and wealthy inhabitants, are not nearly so fond of candle-power shows as the Hindu or Mussulman, although their loyalty to their King and country is none the less thorough on that account.

The new Bombay Post Office installation is almost completed. This was a large Government contract given away, report says, without being put to open tender; this, if it be correct, is to say the least, very irregular, and may be the cause of great dissatisfaction among local contractors.

Bombay Government House installation appears to be having an overhauling for the King's visit. It seems a pity that the general effect of the beautiful grounds should be marred by a mass of overhead wires jumbled together on poles which are awry and unsightly; particularly as the peninsula on which the Governor's town residence is built, is one of Nature's loveliest spots on the West Coast of India.

The Bombay Hydro-Electric Co. have their offices on Hornby Road, and their chief engineer, Mr. Gibbs, has made this address his headquarters for the present. There is every reason to anticipate that Bombay will one day soon be proud of her mighty hydro-electric scheme, because of its utility, its promise of cheap energy, its magnitude, and not least, because of the grandeur of its conception by one of her foremost citizens.

The contract for the electrical plant for this big installation has, it is reported, been given to Messrs. Siemens Bros. Dynamo Works Co., and that for the hydraulic plant to Messrs. Escher, Wyss & Co., but the contract for overhead mains and poles has not been decided upon yet. As the electric plant has gone to England, and the turbines to the Continent, the overhead gear will probably go to America.

Hindu Temple Lighting.—To the orthodox Hindu an apparently daring experiment has taken place at the sacred Temple of Kali, at Calcutta. The local *Statesman* calls it, at first sight, an incongruous innovation, but it goes on to remark, "if, after all, pilgrims journey to the Temple by electric tram, the lighting of the Temple by electricity is but

a logical development, and shows how readily Hinduism accommodates itself to modern conditions." It is but a few years since an electrical installation was put in at the Juggernaut Temple in Puri; but, unfortunately, cholera broke out amongst the pilgrims very shortly after, and the *pundits* and local Brahmins, attributing this outbreak to the anger of the god for having his sanctity invaded by the European, caused the whole equipment to be dismantled forthwith.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Characters for Workmen.

I read with interest an article in your issue of 13th inst. on "The Burden of Giving a Character." I have no sympathy with the man who uses, or the employer who gives, a false character, as neither has much principle. I do not believe in a man being barred from securing a situation because he has done wrong (perhaps only once), as that might only drive men further into crime. If employers were forced to give a written character to employés leaving their service, together with the reason for leaving, a more satisfactory state of things might exist. In July last I received notice to leave my situation on a railway. I had been there eight years, and as the situation is a permanent one, I inquired the reason, and at the same time asked for a reference. I was told to refer any prospective employers to him (the chief engineer), and he would give me a good reference. I have now had nearly three months out of a situation. I have answered dozens of advertisements, and some have written for my last reference, and then I have heard no more. I have some employers' references, and could get dozens of references as to personal character from ministers, Church stewards and others, and yet the fact of having no reference from a place I was at eight years, hangs like a millstone on my neck. This same employer, A, would not give a written reference to a man who had been 10 years in his employ, and was sailing for Australia. It is time something was done in this matter.

Reformer.

The Demand for Technical Men.

In answer to Mr. Beckwith's letter, I should be pleased if he can tell me why firms do not advertise and offer a decent salary, if they are really short of good practical technical men?

I quite agree that the majority of B.Sc.'s are only worth about 30s., because I have found that the man who has taken high degrees has usually become such a bookworm that he has lost all his initiative, and has no confidence in himself, but if a man can obtain a high degree and retain his initiative, he usually proves a good man.

Surely it is too early for the Brush Co. to cry out about not being able to get competent men. During the last 15 years, hundreds of pupils must have passed through their hands, and if out of that number they have been unable to find sufficient good men to supply their works, then it does not say much for their system of training. I dare say their system is good, therefore they must know dozens of good men themselves, and could get them if they would only pay sufficient, but I dare say they want to retain the smartest men at 30s. to 40s. per week.

I suppose when Mr. Beckwith speaks of practical, theoretical men, he means men who have thoroughly mastered the first principles, without necessarily passing any examinations, and then improved their knowledge by taking a keen interest in their work and studying the technical papers, not text-books; and I maintain that if any firm require such a man, either in works or central station, and offer a reasonable salary, they will have at least a dozen capable men to choose from.

Until firms do advertise, you may be quite certain that they have all the men they require. If they cannot get the type of man they want at 30s. they will offer more, but they have found them very cheap so far. The Brush Co. are short of pupils; therefore they advertise.

Aving Sum.

Everybody desires more than he possesses, and especially anything that can be provided for him by means of pence collected from the general public. By taking advantage of this human trait, men combine to produce technical colleges, &c., and get themselves and friends appointed presidents and professors at big salaries. It is the only way they have of getting money more or less honestly. The education given is often as useful to a young man, as regular apprenticeship or indentures. I believe I am not the only one who has been employed in works where a parent gained an action against the employer, by reason of the paucity and monotonous character of the work of the firm, which was ordered to place the pupil with another firm at their own expense. But whatever facilities there may be for education, it is as sensible to expect that a good blacksmith who is always busy, will make a delicate wood engraver, as that mere labourers who can do a thing well if they are shown what to do, will be men who understand how and why the thing is done, can improve upon it, or the methods of doing it and instruct boys to do it, so that they can be themselves dispensed with. If employers want co-operation of theoretical and practical work, and its union in one man or girl at a wage of, say 25s. a week, they will get and deserve mediocrity. Even if their profits increase, and they are saved the trouble of managing their business for a time, they will probably find change or bankruptcy necessary later on. A college as well as a practical workshop education is doubtless necessary for employers, managers and designing draughtsmen, as it is to keep themselves up to date by studying the ELECTRICAL REVIEW, but how many managers and draughtsmen are required to supply the United Kingdom?

Edward D. Hearn.

Derby, *October 27th*, 1911.

LEGAL.

L.C.C. Tram Accident.

A COMMON JURY in Mr. Justice Bucknill's Court in the King's Bench Division on Thursday, October 26th, awarded a working man £50 as damages for injuries sustained by being knocked down by one of the L.C.C.'s electric tramcars in March of last year. The plaintiff, a man named Munns, was crossing the Holloway Road at 11.30 on a Saturday night, when, according to his account, the car struck him without having given any warning of its approach; but the evidence on the point was very conflicting, the L.C.C. witnesses stating that the man ran against the back part of the car, and was thrown down in consequence. The injuries were not very severe, and judgment was entered for him, with costs, in accordance with the jury's finding.

The Hythe Telephone Dispute.

IN the Chancery Division on Friday, October 27th, before Mr. Justice Swinfen Eady, Mr. Frank Russell, K.C., with whom was Mr. Cann, said he had a motion in the action of Dickens *v.* the National Telephone Co., Ltd., against the company seeking to restrain them from cutting off wires at Hythe. His Lordship gave him leave to serve short notice of motion on the company. The affair was urgent, but he understood that counsel for the company wanted time to answer the plaintiff's affidavit.

MR. PERCY WHEELER appeared for the company, and said that he had only received the plaintiff's affidavit within the last hour, and he had not had an opportunity of answering it.

His LORDSHIP: When is it proposed to sever the communication?

MR. RUSSELL: At once. I was going on to say that, unless my friend will give me an undertaking for a week not to sever communication during the week, I shall have to move now.

MR. WHEELER said he was quite willing to give an undertaking on these terms.

His LORDSHIP: What is the nature of the dispute?

MR. WHEELER said the nature of the dispute was whether certain wayleaves which had been granted to the company were to be continued or not. He was quite willing to give an undertaking in the terms of the notice of motion, not to cut, disconnect, remove, or otherwise interfere with any wire or line connected

with the plaintiff's premises. He was bound to add, however, the qualification "unless I am compelled to do so by the owner of any and whereon any post is standing."

His Lordship: An owner cannot compel you except by judicial process. I think there ought to be an absolute injunction with liberty to you to apply.

Mr. Russell said he could not accept the qualified undertaking.

Mr. Percy Wheeler said the Telephone Co. owned posts put up on other people's land under a licence, which the owner of the land might revoke at any time. He (counsel) only wanted to safeguard himself.

His Lordship: I will safeguard you by giving you leave to apply if circumstances rendering it necessary should arise.

The undertaking in the terms of the notice of motion was then given and accepted, and his Lordship allowed the motion to stand for a week.

A Fife Tramway Claim.

Sheriff Armour Hannay, at Cupar on Thursday last week, awarded £112 to a Methil butcher in an action against the Wemyss and District Tramway Co. Pursuer's case was that he was driving along the road and could not get off the track in consequence of his van wheels skidding on the tramway rails. There was a collision in which he was injured. For the company it was contended that pursuer ran into the car.

AUTOMATIC AERIAL ROPEWAY AT BURSLEM DESTRUCTOR WORKS.

We illustrate herewith an interesting little ropeway installation for the automatic disposal of hot clinkers and ashes from the destructor works at Burslem, which was designed and erected by Messrs. R. White & Sons, engineers, of Widnes.

Hitherto it has been the practice for the men serving the furnace house of the destructor simply to rake out the clinkers into iron barrows and wheel them by hand on to the clinker tip, some 50 yards or so away from the destructor house.

The distance, however, is rapidly increasing, and latterly it has become a severe tax on the men to have to run out of the heated atmosphere of the furnace house, in all weathers, wet or cold, and take the ashes away; the installation we now describe saves all this and enables the men to remain under cover at all times.

58 ft. above the bottom ground level, and the height of the terminal standard at R is 35 ft., so that there is an average height of about 40 ft. provided for tipping the material and levelling up the ground to the top level as shown in fig. 5.

The ropeway consists of a single steel cable 1 in. in diameter, of locked-coil construction, along which the carrier travels backwards and forwards by means of the double hauling rope (shown in the view) to which it is attached.

This main cable is anchored to the wall with a screw anchorage,



Fig. 1.—Tip-box in Operation.



Fig. 2.—Return Tower.

by which it can be tightened up when required, but owing to the locked-coil construction and absence of hemp core the "stretch" of the rope is practically nil. From here it passes over rope saddles of White's patent construction, which are supported by angle brackets bolted to the main uprights of the destructor, thence over the standard at S to the return tower R. Here it is bolted on to a special form of clamp which acts also as a rope saddle. Finally, it is connected to a ground anchor, with a screw tension thus forming a guy rope to the return terminal.

The hauling rope, which is spliced and endless, makes 2½ turns around the driving wheel, which is of the "fleeting" type with renewable segments on the tread.

From there it passes over suitable sheaves which are of White's special self-lubricating type, on to the standard S, to the end tower at R. Here it passes around sheaves, as shown in fig. 2, to one of which is attached a hanging weight, so that a constant tension is always put upon the rope to keep it up to its work. The rope then travels back over suitable sheaves to the fleeting wheel, but before finally arriving at this point, and joining on to itself, so to speak, the rope makes one turn around a wheel, which is connected by suitable gearing to a pointer working on a cast-iron box, which forms a protective cover around the gearing.

This pointer works on the top of a dial, which is marked out in figures corresponding to the length of the tipping ground, and is so arranged that, as the tipping proceeds, the length of run-out of the



Fig. 3.—General View of Ropeway.

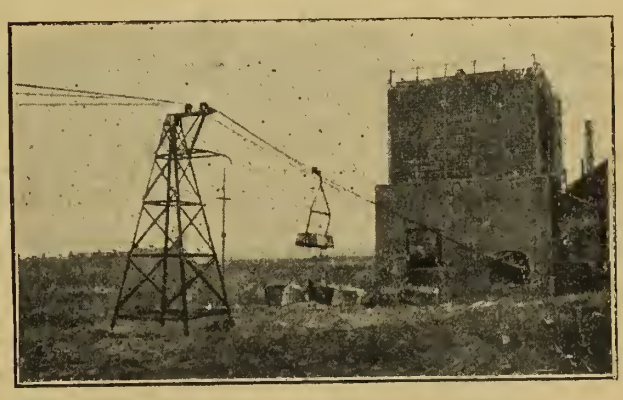


Fig. 4.—Standard and Destructor House.

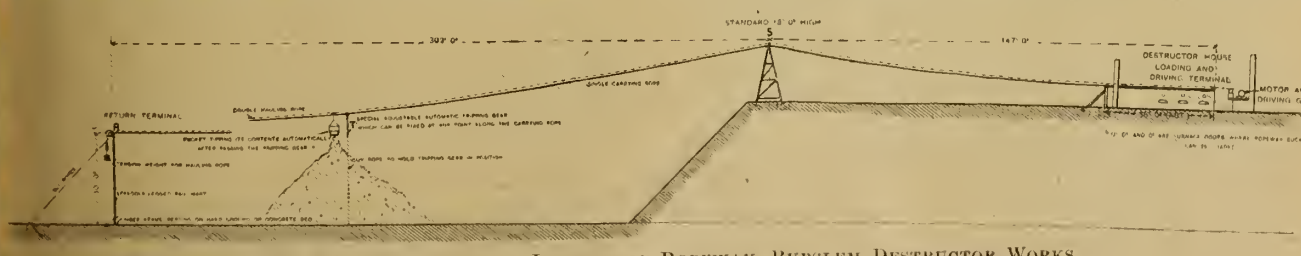


Fig. 5.—Diagram showing Lay-out of Ropeway, Burslem Destructor Works.

Fig. 5 is a line engraving showing the general lay-out of the ropeway, both inside and outside the destructor house, whilst fig. 3 is from a photograph of the same route. The destructor house itself is built on a bank, some 40 ft. above the normal ground level, and the whole of the bank from the destructor house to the first standard at S, has been made by the clinkers from the destructor. It will be seen how necessary it was to adopt mechanical means for the distribution of the ashes instead of manual labour.

The ropeway is 450 ft. long overall, and of this length 300 ft. is provided for tipping upon. The height of the standard at S is

carrier can be varied from time to time as required by putting the pointer over the figure representing the number of feet of run-out required. When this point is arrived at the pointer knocks over a switch lever and automatically stops the electric-motor driving the gear, thus making the arrangement quite automatic and independent of manual attention during the run-out.

On the tipping section of the main carrying rope an automatic tripper is provided, which is clearly shown in fig. 1, and is so arranged that as soon as the carrier, in its outward travel, arrives at this tripper, a lever on the carrier-box is knocked over and the box upsets, thus automatically throwing its contents on to the spoil heap without being touched by hand; fig. 1 shows the carrier automatically stopped, after tipping its contents, the smoke from which is clearly seen rising from the ground. Fig. 4 shows the same carrier on its way to the destructor house.

As tipping proceeds, and the bank is filled up to the required level, the automatic tripper is moved along the rope a few feet by slackening the two bolts clamping it to the rope. At the same time, the position of the pointer on the automatic cut-off gear is similarly altered, and tipping goes on in the fresh place, as before.

It will be understood that the *modus operandi* is as follows:—

The carrier being brought under the particular furnace from which the clinker is to be withdrawn (there are three such furnaces in this installation) is filled in the usual manner. The handle of the electric controller is moved over, and the loaded carrier travels forward without further attention. On arrival at the tripper the contents of the box are automatically tipped and, at the same moment, the carrier is automatically brought to a standstill, the box remaining upside down to keep out the weather whilst it is standing empty on the rope, until it is wanted again. In this case the reversing switch of the controller is moved over, when the carrier is again brought to its required position for loading its next load.

In practice the installation works exceedingly well, and is much appreciated by the men, relieving them, as it does, of one of their most arduous duties.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Oil-Immersed Starters for D.C. Motors.

A standard line of these starters has been developed by The Electric Construction Co., of Wolverhampton, for mining and factory use. They are of the slow-motion ratchet type, each

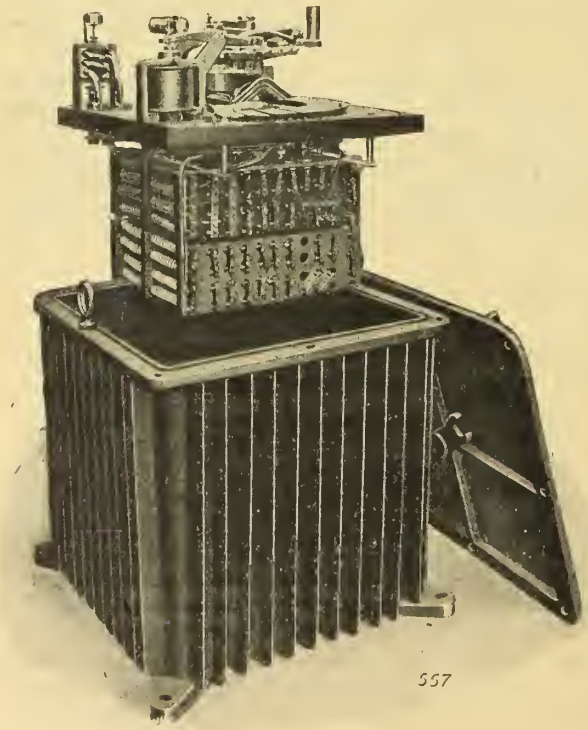


Fig. 1.—Oil-Immersed D.C. Starter, with Switch and Resistance removed from Tank.

stroke of the lever enabling the switch arm to be moved definitely and quickly one step at a time, so avoiding any hovering on the edges of the contacts which is the cause of so much destructive burning of the contacts in starters which are moved slowly. They are fitted with no-voltage, or no-voltage and overload releases, and the arrangement is such that it is impossible to get beyond the first contact should there be no voltage on the supply. Also, during the starting up operation, or when in the running position, the switch will release in the event of an overload or a no-voltage occurring, and it is impossible for the switch arm to be left on any position other than "off," or on the final contact with all resistance cut out making the switch practically foolproof.

The starting switch is mounted on the top of a slate base which also carries the resistance coils on the underside. The whole is immersed in oil. Any arcing which may occur takes place under the level of the oil, and all contacts are protected from dust and are therefore, maintained in a clean condition. The coils, being immersed in oil, have a large capacity for heat, and in the larger sizes the tank is provided with ribs to assist in the cooling of the oil.

A starting switch and coils can be removed from its case by the removal of four fixing screws and by withdrawing the cables. The terminals are raised from the slate above the level of the oil, so that the cables do not soak up the oil, and all contacts are renewable from the front of the slate. Starters without ratchet gear are also supplied, but only in the smaller sizes.

"Blo" Electric Hot-Air Douche.

The Sanitas Electrical Co., Ltd., of 61, New Cavendish Street, London, W., have just brought out an ingenious little appliance, the "Blo" hot-air douche, for producing a stream of hot air immediately. It consists of a small electric motor, which drives a rapidly revolving fan, combined with a heating apparatus. The whole is so designed and put together that it never requires oiling. The heating body, which is placed in the projecting tube, consists of a fine wire wound round a porcelain cylinder, constructed so that every part of the heater is continuously and evenly cooled by the air current produced by the fan. This makes the heater practically indestructible, but should it burn out, it can be changed in a few seconds without any tools. This clever combination renders it possible to obtain a very strong current of hot air immediately on connecting the "Blo" to any ordinary wall-socket or lampholder of the electric light mains. It is possible to regulate the heat by simply moving the "Blo" further from the object being warmed.



Fig. 2.—Electric Hot-Air Douche.

A triple switch is fitted to the "Blo," and on turning this switch to the right the motor at once starts rotating, and likewise the fan in this way a stream of cold air is derived. By turning the switch again to the right the heating body is switched in, and a very strong and constant stream of hot air is then instantly obtained. A further turn of the switch to the right stops the motor and also switches off the current from the heating body.

The "Blo" is manufactured in aluminium, and weighs only 2 lb. The consumption of power is low, and the expense of running is practically nil. Another pattern is made which can be used on any voltages from 100 to 250 volts, by inserting suitable resistance lamps in circuit with the motor and using a suitable heater.

The N.P.U. Circuit-Breaker.

Messrs. Nalder Bros. & Thompson, Ltd., of 34, Queen Street, E.C., have just placed upon the market a circuit-breaker which attracted a good deal of attention at their stand at Olympia. It is extremely neat and compact in design and of particularly robust construction; it is fitted with magnetic blow-out and loose handle, but carbon breaks can be supplied if preferred, and the breaker can be supplied in various forms, either as an over-load with or without time limit, reverse current, or over-load and reverse current breaker combined.

The tripping mechanism has received particular attention in design, and is entirely novel; it possesses the advantage of being extremely light to trip, so that there is no element of uncertainty. The effort required to release the breaker is very small, and at the

ne time there is not the slightest possibility of its opening identally.

Being of the loose-handle type, it cannot be replaced while the r-load is still on ; it can be tripped by hand, and therefore com-

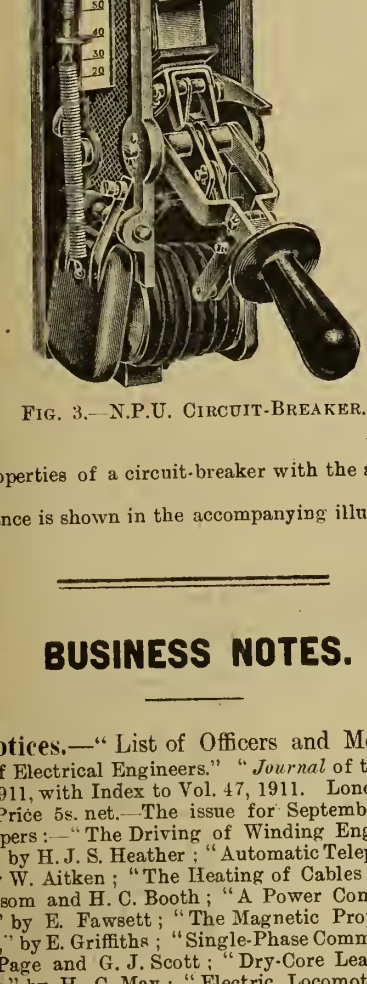


Fig. 3.—N.P.U. Circuit-Breaker.

es the properties of a circuit-breaker with the advantages of a itch.

Its appearance is shown in the accompanying illustration, fig. 3.

BUSINESS NOTES.

Book Notices.—"List of Officers and Members of the stitution of Electrical Engineers." "*Journal* of the Institution," ptember, 1911, with Index to Vol. 47, 1911. London : E. & F. N. on, Ltd. Price 5s. net.—The issue for September contains the lowing papers :—"The Driving of Winding Engines by Induc- n Motors," by H. J. S. Heather ; "Automatic Telephone Exchange stems," by W. Aitken ; "The Heating of Cables with Current," S. W. Melsom and H. C. Booth ; "A Power Company's Testing partment," by E. Fawsett ; "The Magnetic Properties of Man- nese Steels," by E. Griffiths ; "Single-Phase Commutator Motors," G. W. P. Page and G. J. Scott ; "Dry-Core Lead-Covered Tele- one Cables," by H. C. May ; "Electric Locomotives and High- nsion Direct-Current Railways," by A. Monkhouse : "Exhaust eam Turbines," by R. C. Plowman and E. F. Hetherington ; Manufacturing Costs," by A. R. Stelling ; "Electric Traction on ain Lines in Europe," by J. B. Sparks.

Metric Equivalent Tables. London : The Central Translations stitute. Price 6d. net.—This handy sheet of 50 useful tables, hich are very compact in form, provides for the entire range of uivalents that are likely to arise in commercial dealings between is country and countries using the metric weights and measures. he calclulations are based upon figures supplied by the Board of ade, and are guaranteed to be absolutely accurate. The price uivalents deal with feet, yards, square feet, square yards, cubic et, gallons, lb. (av.), cwt. and 40 cb. ft. measurement (useful for ecking freight charges). The prices are calculated at the par te of exchange—25.22 fr. to the £.

Gas Works Directory and Statistics, 1911-12. London : Hazell, atson & Viney, Ltd., 10s. 6d. net.—This is the thirty-fourth ition of a work which, while undoubtedly indispensable to those ncerned with the extensive gas supply undertakings and industry the conntry, is also of some service to engineers interested in ectricity supply, who may desire to know the gas conditions pre- iling in any particular town in which they may contemplate erations. At foot of the gas information there is given a note dicating whether, and if so, by whom, electric supply is provided.

Water-Works Directory and Statistics for 1911-12. London : azell, Watson & Viney, Ltd. 10s. 6d. net.—This is a book very milar in its arrangement to the one referred to above. The rious cities and towns are placed alphabetically, the authority, pital expenditure, population, date of works, death rate, output of ater, system of filtration, scale of charges, names of officials, and a od deal of other information being given.

Table of Equivalents.—A useful table has been issued by osenblum's Translation Bureau, which enables any English, etric or Russian measure and weight, and the money of any untry, with their equivalents, to be easily found in alphabetical der.

We have received a copy of a special "Railway Number" of the *ational Review (China)*, a paper which is published in China. It ntains a great deal of information which should be of interest to ost people when all eyes are turned to the Far East, watching the course of the rebellion of the people against the Manchu Dynasty. Its various articles, and the map of Chinese railways (constructed, constructing and projected), should, however, possess far greater interest and real value to firms in this country who are anxious to secure a share of the business that must be given out to foreign countries as the Chinese people move on toward modernisation as the result of the Westernising movement of recent years. The *Review* can be obtained (2s., post free) from the London agents : The Far Eastern Advertising Agency, Ltd., Craven House, Kingsway, W.C.

"*Bulletin* of the Association des Ingenieurs Electriciens." June-July, 1911. Brussels : The Association. Price 8 fr.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 10. October, 1911. New York : The Institute : Price $1.

"Small Switches, &c., and their Circuits." By W. Perren Maycock. 1911. London : S. Rentell & Co. Prioe 2s. 6d. net.

"Electrical Engineering." By Harold H. Simmons, M.I.E.E. Part I. London : Cassell & Co. Price 7d. net.

"Revue de l'Ingenieur et Index Technique." October, 1911. Brussels ; L'Institut Technique Industriel. Price 2.50 fr.

"*Journal* of the Franklin Institute." Vol. CLXXII, No. 4. October, 1911. Philadelphia : The Institute. Price 50 cents.

"Annales des Postes, Télégraphes et Téléphones" and "Formules Relatives aux Lignes Telegraphiques et a la Propagation du Courant," by M. Pomey. September, 1911. Paris : A. Dumas. Price 6 fr.

"Revue d'Electricité." Vol. XXVIII, No. 9. September, 1911. Brussels : Societe Belge d'Electriciens. Price 1.75 fr.

"Il Nuovo Cimento." October, 1911. Pisa : Societa Italiana di Fisica.

"Steam Turbine Design." By John Morrow. 1911. London : Edward Arnold. Price 16s. net.

"*Mechanical World* Pocket Diary and Year-Book for 1912." Manchester : Emmott & Co., Ltd. Price 6d. net.

"Fifteen Fiscal Fallacies." By G. W. Gough, B.A., F.S.S. London : Free Trade Union. 6d.

Opera House Electric Fittings.—For the new Opera House in Kingsway which is about to be opened, the whole of the electric fittings have been supplied by Messrs. Veritys, Ltd., against open competition. The contract was one of the largest of its kind placed in London for theatre installations. The fittings were expressly designed by the firm's own designers to harmonise with the interior architectural details and scheme of decoration, which is modern French Renaissance. There are a number of fittings in the various departments unobtrusively harmonising with the general scheme, these being cut-glass bowl fixtures with cast ornamental bands, finished in gilt, but the principal piece of work is a large centre light, believed to be one of the largest in Great Britain. It measures 9 ft. in diameter × 5 ft. deep, and is composed of crystal cut-glass panels, and when the 150 lights are "on," the effect should be very fine. It can be raised or lowered by a special winch, and one of its chief features is that if the glass be accidentally broken, it cannot fall. The fitting has 10 panels with a dish at the bottom. Each panel is enriched with deeply cut laurel festoons in the French style.

Hotel Installation.—Messrs. Osborne & Hunter, of Glasgow, have carried out the electric lighting, ventilation, &c., of the "Highland" Hotel, Strathpeffer.

Metallic-Filament Lamps—Price Reduction.—The Electric and Ordnance Accessories Co., Ltd., inform us that they are reducing the prices of their metal-filament lamps of voltages from 50 to 260, in accordance with a leaflet which they have just issued.

Turin Exhibition Award.— Messrs. R. Wolf, of 7, Laurence Pountney Hill, E.C., inform us that they gained three Grands Prix for their exhibits of superheated steam locomobiles and other machinery.

Private Meeting.—The Davis Electrical Co., Ltd., 17, Moor Street, Cambridge Circus, W.—A meeting of the creditors convened by the liquidator, Mr. G. Corfield, in pursuance of the Companies (Consolidation) Act, was held on Monday, October 23rd, at Armfields Hotel, Finsbury, E.C. Mr. Corfield presided, and explained that he had been appointed liquidator on the 6th October, at a meeting of the shareholders of the company, and he had since prepared a statement of affairs showing the company's position as at that date. The trade creditors amounted to £2,856, and liabilities on bills £447, making total unsecured liabilities £3,333. There were two series of debentures, the first for £2,000, £1,000 of which was issued to Mr. Davis in part payment of the purchase money of the business, and the other £1,000 to Mr. Levy for cash advanced. The second series amounted to £1,110, and were issued £600 to Mr. Levy for cash advanced in April and May last, and £500 issued to Mr. Davis in respect of advances and arrears of salary. On these debentures there was £213 owing for interest, making the total claims of the debenture-holders £3,317. The total assets of the company, including stock, £1,735, fixtures, book debts, &c, amounted to £2,886, showing a deficiency of £427 on the debentures. There were no assets available for creditors. The share capital of the company was £1,000 issued, so that with the above deficiency, and the amount due to creditors, the total deficiency was £4,786. The company was registered on October 2nd, 1908, and Mr. Davis, as director, was entitled to draw £500 a year salary, and Mr. Howlett £3 10s. a week. They had continued to draw these sums down to the date of the liquidator's appointment. The company had never made any profit. The only shareholders were Mr. Davis and Mr. Howlett. In the course of

the discussion which followed, creditors drew attention to the issue of debentures to Mr. Davis in respect of arrears of salary, and said it was a most extraordinary proceeding, having regard to the fact that he personally was all the time making favourable representations as to the position of the company, in order to obtain credit. In reply to questions, the liquidator said the company had continued to obtain goods right up to the end of September, but creditors stated that goods had been obtained as late as October 2nd. Some time after the solicitor had been consulted as to the affairs of the company, creditors generally expressed dissatisfaction at the conduct of Mr. Davis, who, they considered, had simply been increasing the value of his debentures at the expense of the creditors. They were, therefore, not prepared to accept the voluntary liquidation, but would propose that the company should be forced into compulsory liquidation. Mr. Corfield said before that step was taken there was a proposal which might render such a course unnecessary. He was instructed that if a committee of creditors was appointed, and the meeting adjourned for the purpose of allowing that committee to consult with Mr. Davis and his father-in-law, Mr. Levy, there was a possibility of some offer being made to the creditors by way of composition. After some further discussion, and without prejudice to the position of the creditors, a resolution was passed appointing a committee of the five largest creditors to confer as to the best course to be pursued in the interests of the unsecured creditors, and that the meeting stand adjourned for 14 days. The committee appointed consisted of Mr. Louis, of the Electrical Co.; Mr. Rook, of the Sloan Electrical Co.; and representatives of Messrs. Johnson & Phillips, McDougall & Co., Ltd., and the Wolfram Lamp Co. The following are the creditors :—

Wittuson, H., & Co.	£15	London Com. Elec. Stores ..	£52
Associated Battery Co.	20	Credenda Conduit Co.	36
Baxter & Caunter	17	Marsh, Son & Co.	31
B.T.-H. Co.	17	Kingolite Co.	40
Thorworth Agent, Carl	67	Hunter Electric Co.	26
Fisher & Ludlow, Ltd.	121	Deutsche Gesellschaft	153
Kremensky, Joh., Vienna ..	116	Radium Electric Co.	16
Electrical Co.	302	Schoen Bros.	32
Electric and Ordnance Co. ..	21	Sloan Electrical Co.	58
Conradty Co.	312	Siemens Bros. & Co.	142
General Electric Co.	29	Simplex Steel Tube Co.	26
Wardle Eng. Co.	15	Tucker, J. H.	17
Brown Patent Syndicate ..	15	Turner & Berger	40
Heatley-Gresham Eng. Co. ..	24	Union Electric Co.	27
Holophane Glass Co.	18	McDougall, Ltd., James ..	479
Kruger & Friedeburg, Berlin ..	57	Wolfram Lamp Co., Augsburg	78
Johnson & Phillips, Ltd. ..	150	,, ,, ,, ..	41
General Accessories Co.	23	Goossens, Pope & Co.	23
Gent & Co.	15		

Zoelly Marine Turbines.—Messrs. Escher, Wyss state that owing to the excellent results obtained with the torpedo-boat destroyers *Warrington* and *Mayrant*, both fitted with Zoelly turbines of 13,000 S.H.P., and built at Messrs. Cramp's Yard in Philadelphia, for the U.S. Navy, the latter have placed an order with the same firm for other four torpedo-boats fitted with Zoelly turbines. The turbines of each vessel are designed for 16,000 S.H.P.

Roumania.—On the prospects of trade in Roumania, the *Zeitschrift für Elektrotechnik und Maschinenbau* says :—As a minor market for electrical machinery and apparatus Roumania is deserving of attention. The imports comprise dynamos, motors, switches, inductors, dynamo accessories, accumulators and renewal plates, lighting apparatus, telegraph and telephone material, light and power lines, bells, electro-medical batteries, fuses and other electric accessories, single current cables, also armoured cable, both insulated and non-insulated. It is obviously difficult, if not impossible, to fix a price basis for the articles named, as their kind and quality are almost endless. The bulk of the supplies for Roumanian consumption is furnished by German, Austrian and Hungarian manufacturers, only a small portion coming from French, Belgian and English special firms. German and Austro-Hungarian firms have their own branches at Bucharest, and the others at least subsidise an agent, without whose co-operation the successful conduct of business is impossible. As competition is particularly keen among the firms named, local business heads are given the fullest powers with regard to outside prices, and especially where State or communal orders are under treaty. Private business usually depends more on the suitability of the price than on the quality of the goods or their manufacture, and under the present local circumstances helps to make State orders remunerative. With regard to the price of cable, the current quotation of copper naturally plays the chief rôle ; and for accumulators the prices vary according to size and capacity. Leclanché cells for bell services, in which articles a considerable business may be done, are sold retail at 1 to 1·50 fr. Other patterns fetch 1·50 to 3 fr. Arc lamps fetch 100 to 175 fr. Similarly there is a considerable call for glow lamps, the price of which ranges according to candle-power, from 0·40 to 3 fr. each. The electric current in Bucharest and in the provincial towns is relatively dear, and in consequence lamps offering the best results find the readiest market. Their retail price, according to candle-power and quality, is 2·25 to 20 fr. each. For the past three years the use of fans has shown steady progress, and owing to the activity in building operations, and the more exacting sanitary regulations, they are assured of a good future. The quotation of these articles is from 200 to 400 fr. ; table fans command from 75 to 200 fr. Silk cord, which has a big sale, is quoted according to appearance, quality and name at 3 to 5 fr. per kilog. As regards the Roumanian electrical industry, it is practically non-existent. The Administration of Posts, Telegraphs and Telephones in their works at Bucharest are the sole producers, and they make chiefly telephone apparatus. The principal electrical undertakings in Roumania are the following :—The Société Roumaine "Electrica," formerly Lahmeyer, founded in 1900 ; the modern light and power establishments of the petroleum area at Campina ; the Bucharest electric undertaking, which belongs to the concessionaires of the Belgian Tramway Co. ; the National Theatres generating station, the Bucharest Gas and Electric Co., which furnished the public lighting ; the electric works at the docks at Braila, Galatz and Costanza ; and the municipal generating stations of the principal towns—Craiova, Ploesti, Jassy, Costanza, Galatz, Braila and Berlad. The chief competing firms on the spot are :—The Allgemeine Electricitäts Gesellschaft, Berlin, which not long ago founded a Roumanian share company, and Siemens-Schuckert's Roumanian electrical company ; these two firms are the oldest and best placed and monopolise, so to say, the lion's share of all Government orders. Besides these, a new municipal electric company was formed about a year ago, which will from the spring of 1912 undertake the working of street tramways. The sustained progress of the native industries provides a steady stimulus to the trade in electric goods, &c., and for the possession of this market Germany, Austria-Hungary and France are keen competitors.

Catalogues and Lists.—The St. Helens Cable and Rubber Co., Ltd., Warrington.—Leaflet stating the advantages of their cab-tire sheathed cables for dangerous situations involving corrosion and hard wear, and quoting some extracts regarding same from our own pages.

The Eclipse Electric Co., 77, St. John's Road, Bootle.—Illustrated lists giving particulars and prices of the Harvey electric vacuum cleaners, and the Whipple electric tire pump.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Several advanced leaflets of their switchboard catalogue containing illustrations and full particulars of prices of "Walsall" motor starting panels, voltmeter switches, battery auto cut-in and cut-out, fuses, cell regulating switches, knife switches and fuse boards. Copies can be obtained by any reader on application.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester. 80-page catalogue (No. 11,012) giving illustrations, prices and brief particulars of a great variety of electric light supplies (including lamps and lampholders, ceiling roses, main and ironclad switches and cut-outs, switch and fuseboards, wall connections, wires and cables, conduit and fittings, &c.).

Messrs. Ferranti, Ltd., Hollinwood.—Very attractively produced brochure containing full particulars of the Ferranti electric heating and cooking apparatus, and stating prices of same. Electric irons, disk stoves, aluminium utensils, breakfast cookers, and some interesting and novel types of electric fires, are excellently illustrated.

The Edison & Swan United Electric Light Co., Ltd., 37, Queen Street, Cheapside, London, E.C.—Circular announcing reductions of prices of their "Royal Ediswan" metal-filament (tungsten) lamps, also introducing several new types in a small bulb than hitherto offered (standard bulb, 100-130 volts, 12 watts, approx. 9 British C.P., and 200-260 volts, 24 watts, approx. British C.P.). In a new 8-page list just published the company show these and other new lines, the illustrations appearing two-thirds full size. Two additional types of fancy lamps in small round bulbs for use in special positions are also listed. Other lines included in this list are tubular lamps, olive-shaped lamps, "Halite" candle lamps, "Tubolite" lamps, and "Kingolite" candle fittings. Prices are very distinctly shown.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Pamphlet entitled "Sunshine after Sunset," wherein appear illustrated particulars of the "Sunshine" flame arc lamps and spare parts, carbons, &c., for same, also projector arc lamps. A loose list of present stock of D.C. motors details their sizes, speeds and voltages.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, London, E.C.—Leaflet No. S 82, showing and giving prices of the "Globe-o-lite" illuminated signs. These signs are made with solid glass spheres let into suitably formed perforations.

The Essex Accumulator Co., 497 and 499, Grove Green Road, Leytonstone, London, N.E.—Twenty-four page catalogue containing descriptive information, illustrations and prices of the "De Luxe" car lighting sets, "Popular" car lighting sets, "Standard" type accumulators for motor cycle, motor car, and motor boat service, large portable cells for temporary lighting, and wireless telegraph work, Essex pasted plates, ignition coils, motor lamps, roof lights, hand lamps and other specialities. A second and smaller list deals chiefly with the "Essex" electric hand lamps, and electric fans.

Messrs. P. E. Chappuis & Co., 85, Fleet Street, E.C.—Circular showing reflectors made of metal cones lined with patent silvered corrugated reflecting surface, for shop window lighting.

The Maxa Co., 43-45, Cannon Street, London, E.C.—Small pamphlet entitled "Slack-Belt Driving : The Importance of Belts and Ropes," giving particulars of "Maxa" belt and rope dressing and preservative, its merits and directions for its use.

British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.—We have received a pocket memorandum book from this company, who have removed their mazda lamp sales office to the above address. The leather cover is embellished with the company's lamp design. The book has a "refill" pad of blank sheets and a calendar for the remaining months of 1911, and for 1912. A list is given inside of the many types of lamps made by the company, also the addresses of the 12 sales offices.

The Radium Electric Lamp Co., 82, Hatton Garden, London, E.C.—Price list of the "Radec" metal-filament lamps indicating that similar reductions to those announced by other firms have also taken place in the prices of these lamps.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Twelve-page booklet (No. 14) illustrating and describing their range of time signal apparatus, including correction indicator, time bells, deflecting needles, bells, and synchronising clocks.

HE BRITISH PROMETHEUS CO., LTD., Salop Street Works, hgate, Birmingham.—New 16-page booklet (No. 145) contain- particulars and prices of their new electric cooking apparatus hotel, restaurant, and domestic kitchens. All of the ranges, cupboards, ovens, and other apparatus are well illustrated.

IESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., 38 and 39, per Thames Street, London, E.C.—We have received a copy of new edition (the second, October, 1911), of the firm's excellent lectrical Supplies" catalogue. It consists of 300 pages of nirably arranged prices, illustrations, and sufficient explanatory tter, of a whole host of electrical materials which are austively indexed alphabetically at the front, with thumb index the various sections. Lamps (arc and incandescent), carbons, allation accessories, bells and accessories therefor, dry and wet s, conduits and conduit fittings, wires and cables, O.S. wiring tem, "Zed" fuses, distribution boards, knife switches, circuit akers and time limit devices, lightning arresters, instru- nts and meters, electric cookers and heaters, fans and small tors—these mainly are the classes of goods covered. The wiring es of the I.E.E. and a table of useful information concerning es and cables are given toward the close. The catalogue ubstantially bound and forms a very handy book.

IR. D. JAROSLAW, 5, George Street, Tower Hill, London, E.C.— w price list of mica, micanite, and "Asbestonite" insulating terial, also "Gnome" brand hard rubber (Stabilit). A current ck list of original cases of mica is included with the above lists an expanding binding cover.

VESTERN ELECTRIC CO., LTD., Norfolk House, Victoria Embank- nt, W.C.—The "Western Electric Handbook of Cables and pplies" is no ordinary catalogue. Part I, it is true, is devoted a detailed and illustrated account of the company's wires and bles, aerial and underground, for electric lighting and power, ephony, mining and other uses to which electric cables are plied, with specifications of conductors and insulation, and all ier necessary particulars; but Part II is a treatise on installa- n work, containing useful information on the laying and nting of the various types of cables, with numerous illustrations, ring tables and data, notes on illumination, the wiring rules of e I.E.E., and extracts from the regulations of the Board of Trade d the Home Office, the Phœnix Fire Office rules, the Report of e Departmental Committee on the Use of Electricity in Mines, d various reference tables, the whole forming a really handy d useful compilation of permanent value to the engineer engaged cable laying and maintenance.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster, W.—New edition of pamphlet No. B517 superseding the May, 10, issue. This contains an up-to-date and more or less popular scription of the O.S. wiring system and illustrates various plications of "Stannos" wiring. It also, on a number of ges, shows photographic illustrations of typical buildings in hich the system has been installed. Contractors who desire a mber of copies of this very presentable brochure, without the firm's me, for the use of their customers, should communicate to Caxton ouse, as above. . A second brochure (12 pages) (No. RS7, in ace of August, 1909 issue), gives a full and well-illustrated scription of the Siemens battery signal machine. We understand at whilst the general features of the machine are retained, odifications have been made by substituting spur-gearing for orm-driving, with the effect that the efficiency is greatly creased, the time taken to lower a standard signal arm with the w machine being less than half what it was with the old ttern, with the same expenditure of current. The life of the ttery is, therefore, lengthened.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, ndon, W.C.—A batch of Simplex literature has been received as llows:—Supplementary leaflet T.I. giving revised prices for mplex conduits, light and heavy gauges, which came into force 1 November 1st; "Elektroduct" is a new type of conduit, con- sting of a specially brazed tube with a smooth interior which can e made to more accurate dimensions than with a welded tube. A)-page booklet describing the Holophane system of illumination, iving tabular spacing data for lighting desks, &c., and prices and lustrations of reflectors, globes, galleries, reflector bowl and sphere ttings, &c. A 20-page priced booklet of electric ovens, cookers, ettles and other heating and cooking apparatus. A 28-page ooklet concerning electric radiators and convectors. In addition to he foregoing, there is a 144-page catalogue (new edition) of electric ght fittings. This, of course, contains a most varied collection of ttings of all classes, and for all positions—brackets, pendants, lectroliers, table lamps, candle-sticks, newel lights, and so forth. teference numbers and prices are indicated in every case. Signs, hop window lights, and various glass and other shades (including he "Spookie") bring up to the rear. We have no doubt that the iterature here mentioned will prove very serviceable to contractors nd consumer seekers. In most cases copies of the pamphlets in uantities can be obtained printed with contractors' names and ddresses.

MESSRS. F. G. EDEY & CO., LTD., 25, Warwick Lane, London, V.C.—List giving reduced prices of "Eclipse" metal-filament amps.

MESSRS. L. E. WILSON & CO., 20, Cross Street, Manchester.— New 8-pp. catalogue illustrating and describing the Thomson elec- ric pocket, inspection, police, military, cycle, reading and other lamps, and tabulating prices of same. Several improvements have been effected in the police lamp.

Bankruptcy Proceedings.—JOSEPH AUGUSTUS BAUER, 17, Gracechurch Street, E.C., trading as The Electrical and General Engineering Co.—An application for an order of discharge was made on October 24th to Mr. Registrar Giffard at the London Bankruptcy Court. Mr. W. P. Bowyer, Assistant Official Receiver, reported that the failure occurred in March, 1910, Mr. G. E. Corfield, I.A., being appointed trustee to administer the estate in bankruptcy. The liabilities were estimated by the bankrupt at £3,052; the assets valued by him at £455 had produced £245; and a dividend of 8¾d. in the £ had been declared. Since 1895 the bankrupt had carried on business in London as an electrical engineer under the above style. In 1899 he became a director of the "Electrical Corporation, Ltd.," in which he purchased £1,500 shares at par, in the hope that he would thereby obtain a lucrative position as engineer to the Corporation, in which hope, however, he was disappointed. In 1904 he sold to the Corporation for £500 cash and £3,000 in shares, a patent for an electric heater invented by him, but the Corporation went into liquidation in 1906. After the liquidation, he altered and improved the device for electric heaters, which he subsequently manufactured at 7 and 8, Great Winchester Street, E.C. Partly as the result of the failure of the Corporation, in connection with which he estimated his loss at between £1,900 and £2,000, the bankrupt was in financial difficulties in August, 1907, when he made a private arrangement with his creditors, under which a composition of 5s. in the £ was paid (with borrowed money) on liabilities amounting to about £1,400. Since 1901 he had also been director of the Metals Corporation, Ltd., and in July, 1908, became agent for, and director of, the Solium Electrical Co., Ltd., which had been formed to manufacture and sell a metallic-filament lamp, but it went into liquidation in October, 1909. For the purpose of the agency he took an office under the style of the Calux Electric Co., at 7 and 8, Great Winchester Street, E.C., and latterly also dealt there in electric lamps on his own account. He attributed his failure principally to losses in connection with the before-mentioned companies (£1,850), to law costs (£592), and to the loss of the agency. The books of accounts kept by the bankrupt appeared to disclose the bulk of his business transactions, though they did not record certain loans obtained from his father and his brother. The greater part of the losses in connection with the company appeared to have been incurred through transactions entered into by him previously to the arrangement with his creditors in August, 1907. With regard to the Solium Co., he had said that he was instrumental in its formation, and that he was appointed a director and sole agent of the company. He estimated his loss in connection therewith at £500, of which £250 represented travelling and other expenses, and £250 the price he agreed to pay for £1,000 vendors' shares in the company, of which sum £210 was returned in the statement of affairs as an unsecured liability. The remainder of the unsecured liabilities were business debts, including £1,560 due to cash creditors. As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities, and (2) a previous arrangement with creditors. His Honour unheld the report, and imposed the minimum term of suspension of two years. Order entered accordingly.

JEROME WALTER MAY, importer of electric light fittings, &c., trading at 33, Cock Lane, Snow Hill, E.C., as J. W. May & Co.—Under a receiving order made in this case, the first meeting of creditors was held last week at the London Bankruptcy Court before Mr. W. G. Williams, Assistant Receiver. It transpired that the debtor started the business in partnership with another person in May, 1908; the partnership, however, was terminated in January, 1909, and the debtor had since traded alone, but under the same style. He attributed the failure to robbery by employés; heavy household expenses consequent on illness; loss of trade owing to his inability to properly attend to business; bad debts and want of capital. No statement of affairs was submitted, but the debtor estimated his liabilities at £1,100, and the assets, apart from certain book debts, were stated to have been realised for £450 by the trustee, under a deed of assignment executed by the debtor on July 15th last. Mr. G. E. Corfield, accountant, Balfour House, Finsbury Pavement, E.C., was appointed as trustee to administer the estate in bankruptcy, assisted by a Committee of inspection.

At the Leeds County Court on October 27th a receiving order was made on a creditor's petition against OSWALD CARR, electrical engineer, of Oak Works, Headingley.

The Smaller Electrical Manufacturing Works in Germany.—In order to obtain a comprehensive evaluation of the extent of the minor or special trades devoted to electrotechnical production in Germany, the Verein Elektrotechnischer Special-fabriken, of Berlin, have made a series of inquiries over the past and present year, with results which, says the *Elektrotechnische Nachrichten*, have come as a surprise in technical circles. It appears that, exclusive of the several well-known large general manufacturing firms, there are 340 special electrotechnical manufacturing works, employing 73,000 workmen; these are exclusive of smaller firms, estimated at some 300, employing a few workmen each, but bringing the total of workmen employed up to 80,000. These figures represent at least one-half of the aggregate of those employed in the electrotechnical manufacturing industry. It is remarked that these figures are possibly somewhat exaggerated, as they are adduced as an argument against allowing the large general manufacturing firms to monopolise the exploitation of "überland centrale" and other big public undertakings.

Trade Announcements.—MR. G. BRAULIK has opened a branch office at Prince's Chambers, 16, John Dalton Street, Manchester, and has appointed Mr. Wyndham Wadsworth to represent him for Manchester and district. Mr. Braulik desires it to be known that he is now making and supplying under the Bremer-Westinghouse patent, his old type direct-current flame arc lamp, and immediate requirements can be supplied from stock, under the licence of the Bremer-Westinghouse patents.

MR. WM. MORGAN, electrician of Leytonstone, N.E., has

removed his business from Ester Road to large premises at 831, High Road

The business of Cowans, Ltd., will in future be carried on in conjunction with that of the Switchgear Co., Ltd., for which purpose a new company, under the name of Switchgear & Cowans (1911), Ltd., has been registered and financed. The business will be carried on at the Springfield Lane Works, which are well equipped with modern high-class machinery, capable of dealing with large orders expeditiously, now that ample working capital is available to keep proper supplies of standard stock to meet customers' requirements. Extra-high-tension equipments will be one of the specialities of the company. The new combination will be under the personal control of Mr. J. G. Statter, as managing director, who heretofore controlled the business of the Switchgear Co., Ltd.

Messrs. Drake & Gorham, Ltd., announce that, owing to increased turnover, they have taken an additional warehouse and offices at No. 1, Felix Street, Westminster Bridge Road, S.E., and in future their wholesale supply business will be conducted from that address.

Dissolutions and Liquidations.—Power Accessories, Ltd.—This company is winding up voluntarily, with Mr. S. P. Hutton, Rolt Street, Deptford, as liquidator. A meeting of creditors was called for November 2nd.

Economic Electric Co., Ltd.—This company is winding up voluntarily, with Mr. F. T. P. Deyes, 5, Cook Street, Liverpool, as liquidator. A meeting of creditors is called for November 7th. at Liverpool.

LIGHTING and POWER NOTES.

Abingdon.—In response to a memorial, a public meeting has been held to consider the advisability of establishing an electric installation in the town. A resolution, moved by Mr. T. Skurray, inviting the local Council to consider the question of carrying out a scheme of its own, rather than allow a private monopoly to take the matter up, was carried unanimously.

Acton.—The Metropolitan Electric Supply Co. has, with the acquirement of the Council's electricity undertaking, taken over the whole of the electricity Committee's staff, and Mr. J. Martin Blair, resident electrical engineer, has just completed the organisation of business premises in the centre of the town, which include a very fine and up-to-date showroom, displaying almost every kind of electrical apparatus. In view of the great number of factories, laundries, &c., in the Acton district, special attention is to be devoted to the facilities for extending current for power purposes.

Australia.—A difficulty has arisen between the Sydney City Council and the Leichhardt Council in regard to the former supplying current throughout the latter municipality. The City Council desired exclusive rights for the supply. The Leichhardt Council decided that the draft agreement submitted by the Balmain Electric Light and Power Co. would be acceptable if the amendments recommended by the Sub-Committee of the local Council were agreed to by the company.

The Launceston (T.) municipal electric light and power works made a net profit of £3,897 during the year which ended in July. This is the largest profit recorded since the current was first supplied 16 years ago, and £400 better than the previous year.—*Australian Mining Standard.*

Melbourne.—The E.L. Committee of the Melbourne Council has proposed, and the City Council agreed, to sweeping reductions in the price of energy for light, heat and power. The new charges are, briefly :—Lighting, 3½d. per unit, first 3,000 units per month, 3d. afterwards ; or, on M.D. system, 6d. and 1½d. per unit : power and heat, 1¾d. per unit, or, M.D. system, 2d. and ¾d. ; private arc lamps, based on 3½d. per unit ; public street arcs, reduced to £16 10s., and incandescents £4 per annum. The Committee has carefully considered the probable result of these reductions, and estimates a total reduction of revenue per annum, based on the 1910 figures, amounting to £22,691. Reference to the statement of accounts for the year 1910-11 will show that the reductions now recommended would exhaust the balance to credit of net revenue account for that year, after payment of all fixed standing charges, but the development of the undertaking during the current year, together with the further increased demand which would certainly result from these reductions, and the consequent reduction in the cost of production per unit, warrants the Committee in anticipating that the accounts for the year 1912 will show a substantial balance to credit of net revenue account, after payment of all fixed standing charges, to provide for the additional contribution to depreciation and renewals fund, and the contribution to the town fund which it has been the desire and the principle of the Council to make ; and which, in the Committee's opinion, should certainly be made by any successful municipal undertaking.

The Committee had hoped to be able to submit a recommendation for an allowance to users of metal lamps equivalent to the cost to the Council of renewals of carbon lamps (which are included in the cost of current), but has been unable to do so.—*Engineering and Electrical Record.*

Axbridge.—The work of providing electricity for town has been commenced by the Winscombe Electric Light Power Co., and it is hoped to have the supply available Christmas.

Baildon.—The U.D.C. has been informed that Wharfedale Electric Supply Co. has abandoned the proposal to powers to supply electricity in the Council's area.

Barking.—The engineer has been instructed to pro with the work of converting the existing 460-volt carbon lam certain streets to 230-volt metallic-filament lamps. He is al submit a further report on the running of trailer cars, as he i opinion that by doing this the Council would be able to cope heavy traffic at certain times, besides reducing the heavy wear tear of the present cars.

Barrow.—At the T.C. meeting on October 30th Electricity Committee reported the receipt of a letter from B. of T. forwarding consent to the placing of an overhead lir Biggar Bank, Walney Island.

Bettwys-y-Coed.—At the beginning of the pre lighting season the Urban District Council refused to accept North Wales Gas Co.'s tender for the approaching winter ligh owing to the company's demand for a higher rate per lamp, the result that the village has since remained unlit. The Co has resolved to go in for a new water supply scheme and ele light plant. Elsie Lake, situated at a higher elevation above village, is to be utilised for both purposes, the schemes being u the charge of Mr. E. Evans, the county surveyor for Carnar and Mr. W. Willoughby Lane, electrical engineer, Llandudno. L.G.B. inquiry was held on November 1st in connection with scheme.

Biddulph.—After considering the report of Mes Crews & Handford, Manchester, who were engaged to advis Messrs. Heath's scheme for supplying Biddulph with electricity lighting purposes, the U.D.C. has decided to take the necessary s for obtaining a prov. order.

Bootle.—In consequence of the increasing demand current for lighting and industrial power purposes, it has found necessary to extend the plant at the Corporation electri works. At the meeting of the Town Council on October 2 the Electric Power and Lighting Committee's recommenda on the report of the borough electrical engineer, on the prop extension of the plant and works, foreshadowed in his an report, was approved.

Bradford.—On Friday, last week, Mr. T. C. Ekin, of L.G.B., inquired into an application by the Corporation for sanc to borrow £16,940 for extensions of plant at the Valley P electricity works. The application was to provide extra machi in consequence of the increased demand for lighting and po On the day preceding the inquiry the load was 7,763 kw., as aga 6,860 kw. on the corresponding day of last year. The inquiry closed.

Bridlington.—The T.C. has decided to apply to L.G.B. for loans of £2,000 for mains, and £1,000 for services.

Brighton.—An electrical exhibition at the Aquari organised by the Corporation Electricity Department, was ope by the Mayor on Saturday last. Thanks to the efforts of borough electrical engineer, Mr. John Christie, a fully represe tive collection of electrical exhibits has been gathered toget special attention having been given to cooking and heat apparatus. As regards the latter, continuous demonstration baking are being carried out by Messrs. Green & Co., and Mes Muttons, a leading firm of restauranteurs, have their chef in stant attendance doing practically the whole of their cooking their restaurant in King's Road, in the way of roasting, baking, for serving cold. Mr. Christie is personally demonstrating use of apparatus, and we can only add that such practical meth of pushing electrical cooking, synchronising as they do with introduction of an unrestricted flat rate of a 1d. per unit for s purposes, deserve every success. The exhibition has been advertised locally, and we understand that there was a rec attendance on the opening day.

Bury.—At a meeting of the T.C. held on October 2 it was announced that the new electricity works would be offici opened about November 27th.

Carluke.—The Clyde Valley Electric Power Co. under consideration the advisability of extending its electric ca to Carluke. The nearest connection with its existing system i Wishaw, a distance of five miles.

Continental Notes. — Italy. — La Società Ligu Toscana d'Elettricità, which has a 6,000-h.p. steam-oper generating station at Leghorn, will shortly put in operat a new 6,600-h.p. plant, utilising the water-power of Lima, a tributary of the River Serchio. The transmission li extend close upon 70 miles, and will supply current lighting and power purposes to the towns of Lucques, Viareg Montecatini, Pisa and Leghorn. With the completion of the plant it is hoped to almost completely to do away with the cos coal, hitherto about £8,800 per annum. At the same time the station will be kept intact as a reserve to supply current pend the installation of other generating stations, the concession utilise water-power secured by the company extending to a tota about 25,000 h.p.

Dewsbury.—At a recent meeting of the Council a report of the year's working of the electricity works was presented. The total receipts were £11,821, against £11,065 in the previous year. The cost of generation had been '60d. per unit, as against '67d. and '66d. in the previous two years. Distribution and management costs were '39d., making the total cost '99d. per unit. The sale of current had been 1,298,058 units, against 1,209,657 ; the number of lighting consumers was 494, against 454 ; and of motors 164, against 138. The increase in lighting supply had been 9 per cent., and in power 6 per cent., while tramway supply, in consequence of economical working, had decreased by 3·8 per cent.

Donaghadee.—The Urban Council has decided to proceed with the electricity scheme for lighting the town. At the last meeting of the Council the town clerk was instructed to apply to the B. of T. for the necessary permission to erect overhead wires. The scheme includes the pumping at the proposed waterworks which is to be carried out by electrical power.

Douglas (Isle of Man).—Mr. Handcock, of Messrs. Handcock & Dykes, of London, who has been appointed to report on the question of an electricity supply for the town, outlines a scheme, the estimated capital cost of which is £24,789. The price of current should be such as to give an average annual revenue of 5s. 9d. to 5s. per 25-C.P. lamp installed, which is a reasonable price. The Council is advised to proceed at once with the electric light undertaking.

Dukinfield and Mossley.—The B. of T. has authorised the placing of certain overhead lines in Dukinfield and Mossley by the Tramways and Electricity Board for the transmission of energy.

Edinburgh.—By an outbreak of fire in one of the two water-cooling towers at present in course of construction at the Corporation electric lighting station in Dewar Place, considerable damage was done last week. The tower was nearing completion, and keen disappointment is expressed by the Corporation engineer at the delay, and the mishap that has caused it. While the fire raged the tower became a mammoth chimney, and the fire brigade had great difficulty in dealing with the outbreak.

Govan.—It is proposed to introduce electric light at Hawkhead Asylum. and on this account it was suggested that a deputation from the District Lunacy Board should visit certain asylums in England and inspect their lighting systems. At a meeting of the Board last week the proposal was criticised, one member claiming that high-pressure incandescent lighting was superior to electricity, and another that there were many points to consider before they rushed into an expenditure of £6,000 or £7,000. The Board agreed to send a deputation.

Great Harwood.—A special meeting of the Council was held on Monday to consider the advisability of applying to the B. of T. for a provisional order to enable the Council to supply electricity to the town under the Electric Lighting Acts.

Holmfirth.—The U.D.C. has decided that application be made immediately to the L.G.B. for sanction to borrow £8,000 for electric lighting purposes, and that the consent of the B. of T. be sought for the construction of overhead electric transmissions in the urban district.

Ilford.—The Electricity Committee has decided to grant the following concessions to consumers of current: (1) 5 per cent. discount on all bills promptly paid ; (2) reduce the cost of current for heating and cooking to 1½d. per unit for the first 100, and 1d. per unit for the second 100. With regard to the price of current for lighting, the Committee states that it could not make any reduction, as this corresponded favourably with the average price charged by the London Borough Councils and companies.

India.—The Rangoon Electric Tramway and Supply Co., Ltd., which was formed in 1905 to electrify existing steam tramways and provide a supply of electricity for general use, has a power station on the banks of the Rangoon river. This contains an equipment of vertical Curtis turbines, two of 700 KW., one of 1,500 KW., and one of 2,500 KW. capacity, constructed by the B.T.-H. Co., and supplying three-phase current at 2,300 volts ; also a 500-KW. Belliss traction set and a 500-KW. motor-generator to link up the A.C. & D.C. systems, together with steam-driven exciters. The condensing plant is of the barometric type supplied by Mirrlees. Watson & Co., while steam is supplied by Babcock boilers, each battery of boilers being provided with its own steel chimney. The three-phase transmission is by means of underground cables to various transformer sub-stations, from which a L.T. four-wire three-phase distribution system radiates. The pressure across the outers is 200, and across one outer and neutral 115 volts ; the original distribution system, a single-phase one, has been displaced by the above owing to the demand for motors. Each sub-station is fed by its own feeder, but the various sub-stations are also interconnected. The L.T. lines are carried overhead ; in view of the Government regulations it was not found possible to run the H.T. cables in this way, although it was originally intended to do this. In addition to the three-phase distribution, a proportion of the lighting has been carried out on the constant current system. The main thoroughfares are lighted by arc lamps run in series from constant current transformers, damaged lamps being automatically cut out of circuit, while the transformer adjust the necessary altered pressure. Smaller streets are also equipped in the same way, but with incandescent lamps.

Jarrow.—At the annual meeting of Palmer's Shipbuilding and Iron Co., Ltd., at Newcastle-on-Tyne, on the 27th ult., Lord Furness, the chairman of directors, in moving the report, referred to developments they wished to make at the Jarrow works. At the steel works they wanted to put in a gas producer plant. involving a capital outlay of £15,500. There were also alterations and extensions required to the cogging mill to cost about £41,700, which improvements would effect a net annual saving of about £19,000. Similarly, and this was the most important project they were anxious to tackle, by an outlay of £158,230 on a power scheme to utilise their blast furnace gases, and, allowing 10 per cent. interest and redemption, they looked to make a net saving of £23,000 per annum.

Leigh-on-Sea.—The U.D.C. has decided to ascertain whether electricity in bulk can be supplied to the Council by Southend-on-Sea T.C.

Liverpool.—As a sequel to the labour troubles in Liverpool, an illuminated certificate of thanks, bearing the city arms, has been issued on behalf of the city, by the Lord Mayor, to the voluntary workers at the power station when the employés went on strike. It reads: "City of Liverpool. I hereby certify that (name) rendered assistance as a voluntary worker at Lister Drive electric power station during the strike in August, 1911. On behalf of the Tramways and Electric Power and Lighting Co., I tender to him the thanks of the Committee for the valuable services rendered by him to the Committee and the commnnity at large." The certificate is signed by Mr. Mason Hutchinson, Lord Mayor.

London.—Poplar.—A report has been received from the engineer with reference to the proposed improvement of the public lighting of the borough. In this report he states that experimental lighting has been in progress for some time past by the installation of flame arc lamps in the East India Dock Road and Bow Road, and large candle-power incandescent lamps in North Street, Bridge Road, East India Dock Road and Campbell Road. The result had been successful from an illuminating point of view, and he suggested that the future policy in regard to public lighting should be considered on the following lines:—(1) Flame arc lamps to replace the whole of the existing open-type arc lamps in East India Dock Road and Bow Road ; (2) 600-C.P. incandescent lamps to replace 10-ampere open-type arc lamps other than those in East India Dock Road and Bow Road ; (3) 300-C.P. incandescent lamps to replace all 7½-ampere open-type arc lamps ; (4) all gas lamps to be replaced by electric incandescent lamps as soon as practicable after the mains are extended to those thoroughfares where only gas is now available ; (5) as the efficiency of metal lamps will undoubtedly improve, the candle-power to be increased in proportion to increase in the efficiency of the lamps ; (6) the standing charge for public lighting supply to be reduced from £13 to £11 per KW. from April 1st, 1912 ; (7) that the whole of the improvements contemplated be paid for out of future economies realised in lamp maintenance and the supply of energy. The total amount of loans raised on account of electric public lighting was £15,441, of which £6,524 had been repaid at March 31st. last. A sum of £8,916 still remained to be repaid, and no further indebtedness was proposed to be incurred on this account. Owing to a reduction in charge for energy, a saving of £710 was effected last year, compared with the last four years. The proposed reduction in price for next year would amount to £383, and still further reductions were contemplated in the following year, and he was of opinion that these reductions and further economies to be effected by conversion from gas to electricity, &c., would provide a sum sufficient to pay for the whole of the improvements outlined, without resorting to further borrowing, or entailing any further charge upon the rates. After considering this report, the Electricity Committee states that it is of opinion that the proposals of the engineer would effect considerable improvements in public lighting without increasing the present cost, and it recommended that the total cost of public lighting in respect of existing lamp columns be limited to a maximum of £10,850 per annum during the three years ended March 31st, 1915, and, that, during that period the improvements indicated in the foregoing report should be carried out, including the reduction of the charge for public lighting from £13 to £11 per KW. from April 1st, 1912. This was agreed to at the Council meeting held on the 26th ult.

Fulham.—The Electricity and Lighting Committee reports that in March, 1908, the Council adopted a scheme for the provision and maintenance of arc lamps on the rental system at the rate of £8 16s. per lamp per annum, on the basis that the lamps would be used for a period of 800 hours during each year. This the Committee states had been found to operate against the scheme in those cases where the shop hours are such that the light is not required for such a length of time, and it proposed to consider whether the scheme could not be revised to obviate the difficulty. In the meantime the Committee had had an opportunity for installing seven arc lamps, provided a fixed charge of £8 per lamp per annum was made for an estimated use of the lamps for 700 hours per annum, and it was of opinion that this modification of the scheme should be agreed to in this instance. A recommendation was submitted accordingly.

Southwark.—The Electric Lighting Committee has decided to replace the obsolete mechanical stokers with the newest type of chain-grate stoker at the estimated cost of £1,180, and prices are to be obtained from the leading makers for supplying same.

On Monday last a new Belliss-G.E.C. mixed pressure turbo-generator was officially started up by the Mayoress, at the Council's generating station. The set is of about 600-KW. capacity, and conpled to a D.C.-three-phase machine—the A.C. feature having been

embodied in view of a possible linking-up scheme. It is confidently anticipated that this machine, in conjunction with the new condensing and cooling tower installation, will materially improve the generating costs.

St. Pancras.—The Electricity and Public Lighting Committee reports having communicated with the L.C.C. with regard to allowing the Borough Council to place free advertisement tablets of the electricity undertaking on the County Council's tramcars in exchange for permission to fix tramway direction signs on the B.C.'s lamp columns. A letter had been received in reply, refusing consent. The Committee has therefore decided that the application of the L.C.C. to fix tramway direction signs on the Council's lamp columns should not be entertained.

Stepney.—The Council has decided to take up a loan of £15,700 from the L.C.C. for the laying of mains. Mains are to be extended to Parnham Street, Limehouse; Skidmore Street, Mile End Old town; and Pennington Street, St. George-in-the-East.

Mansfield Woodhouse.—The Mansfield T.C. has decided to obtain particulars of the cost of giving a supply of current to the town, and to ascertain the probable number of consumers.

Mexico.—The *Mexican Herald*, of September 20th, states that more than 1,000 men are at work on the River Conchos dam, and reservoir, which it is announced will be completed by June, 1913. The power generated will be transmitted to the Parral Naica, Santa Barbara, Santa Eulalia, and other mining districts of Chihuahua. Water will be stored along the course of the Conchos for a distance of 30 miles, the reservoir varying in width from 4 to 5 miles. The total cost of the work is estimated at about £1,530,000. The undertaking is being carried out by the Mexican Northern Power Co., a Canadian company.—*Board of Trade Journal.*

Reddish.—Steps are being taken to induce the Stockport T.C. to extend the E.L. mains to Reddish.

Salford.—At the T.C. on October 26th a report was presented by the Electricity Committee with reference to the proposed borrowing of £15,550 to cover the cost of the provision of two new turbo-generator sets with the requisite fittings at the Frederick Road generating station, and a scheme for the alteration and extension of the existing plant at a cost of £20,000, the latter sum to be provided out of the reserve fund of the undertaking. It was stated that in 1902 the consumption of energy for lighting purposes was 795,000 units, and for traction 458,000. At the present time there were generated 2,160,000 units for lighting purpose and 7,000,000 for motive power. It is estimated that the alteration to the engines will effect a saving of £4,040 per annum in coal alone. A resolution was passed adopting the scheme and authorising the expenditure of £35,500, and directing application to be made to the L.G.B. for sanction to borrow £15,500.

South Africa.—The *South African Mining Journal*, commenting on the rumours which have been about regarding the Rand Mines Power Station at Rosherville, points out that, generally speaking, operations are being carried on smoothly and efficiently. If trouble exists it is due to the estimates of requirements falling short of the actual demand, which is far in excess of what was considered probable. The Rosherville plant is now supplying some 16,000 H.P., and it is asserted that the contracts entered into are being fulfilled, but to supply the whole demand would require an output of 36,000 H.P. A certain amount of competition has occurred between purchasers, and some mines have reverted to steam in favour of others which have no facilities for steam generation. About 20,000 H.P. of compressed air plant is operated by the turbine plant at Rosherville, and electrically at the Robinson Deep. The construction of the Vereeniging plant now commenced, will help to meet the widespread demand for electrical power.

Queen's Town (Cape Province).—After a long delay the electric lighting scheme has at last received the sanction of the Provincial Council, and the final details of the scheme which were sent by Mr. Bellad-Ellis to the Government for the approval of the Government electrical engineer, Mr. Denham, have been passed by that official; we understand that the work will now proceed forthwith.

Stoke-on-Trent.—During the past year the four electricity undertakings of the Corporation have sold 5,056,998 units. Of this, private consumers' lighting took 1,527,764 units; motors and heating accounted for 3,076,084; and street lighting represented 453,150. Compared with the previous 15 months, the sales of energy, &c., from the Burslem Works last year show an increase of 178,208, the total being 1,471,805. The surplus or "profit" on the working for the year 1910-11 was greater than that for the 15 months 1909-10 by £49, while the costs per unit were less. The net receipts per unit fell below 1½d. After repayment of sinking fund, and of meters and services, Burslem made a profit of £676, which the Committee recommends the Council to allocate to the reduction of the suspense account (over £3,000). The net receipts totalled £8,746, against £8,137 in the preceding 15 months.

For the first time the output at Hanley exceeded 2,000,000 units, the exact figure being 2,042,356. Breakdowns cost about £750, but a net profit of £406 has been transferred to the reserve fund. The net receipts were £18,008, compared with £16,697 last year. The supply increased at the Longton Works by nearly 90,000 units, bringing the output sold up from 306,186 to 395,796 units. The total net receipts were £4,224, against £3,530 last year. The profit of £382 has been transferred to form a reserve fund. The increase of output at the Stoke Works was nearly a quarter of a million units, and for the first time the output exceeded 1,000,000 units. The figures were 1,147,041, against 899,356 last year, an increase of 247,685. The net total receipts were £7,050, against £5,522 last year. A loss in the undertaking in 1909-10 of about £350 has been changed to a profit of £276, which will be devoted towards wiping out the previous year's loss.

The T.C. has received from the L.G.B. sanction to the following loans:—£13,094 for H.T. cables; £30,641 for additional plant and £7,285 for buildings. The balance of a sum of £60,000 is to be applied for, for contingencies.

Swansea.—The T.C. has decided to light a portion of Sketty Road with 300-C.P. metal-filament lamps, in place of gas.

West Bromwich.—The sales from the Corporation's electricity undertaking for the quarter ending September 30th amounted to £3,888, compared with £3,261 for the corresponding period of last year, an increase of £627, which equals 19·23 per cent.

Wolverhampton.—On behalf of the L.G.B., Mr. H. R. Hooper on Tuesday held an inquiry into an application by the Corporation for sanction to borrow £11,000 for extensions to the buildings and plant at the electricity station. The town clerk explained that from the reserve fund £10,000 would be taken to provide the storage battery, and the present application was in respect only of the building in which to house it. The inquiry was unopposed.

TRAMWAY and RAILWAY NOTES.

Ashton.—The B. of T. has appointed Mr. Ernest Moor K.C., to act as arbitrator in the dispute between the tramway employés and the authorities in the Ashton district. The object of the men is to obtain uniformity of pay and working conditions on the three tramway systems in the area. Their demands include 9½ hours day, and that all overtime be paid for at the rate of time and a quarter, six days' holiday per year with pay, instead of three days as at present, adequate meal times, and maximum wages of 32s. 6d. per week for motormen and 27s. 6d. for conductors. The arbitrator has provisionally fixed November 7th as the date of the inquiry.

Australia.—The leading recommendations of the report of the Royal Commission appointed by the Victorian Parliament last year, to consider the tramway and railway problem of Melbourne and its suburbs, are stated as follows:—

"That the purchase of the existing tramways operated by the Melbourne Tramway Co. be undertaken as early as practicable.

"That the whole of the metropolitan tramway systems (private and publicly owned) be vested in and operated by a municipal tramways trust.

"That the cable tramways be converted electrically, route by route, as extensions from the present cable termini and overcrowding of the routes necessitate.

"That the overhead span wire system be adopted, and through and sectional fares be provided.

"That the suburban railways be electrified, and the best expert advice be obtained as to the most suitable system to be adopted in view of recent developments.

"That a large and up-to-date State power supply be established capable of providing all the electricity required for railways, tramways, and other public and private purposes at low rates."

With respect to the recommendation last mentioned, the Commissioners estimate the total electrical power required for Melbourne and suburbs at 90,000 H.P. They therefore urge that a central power house be established, capable of supplying all the electrical energy required by the railways, tramways, factories, and electric lighting of the metropolis, and that the central power house, high-tension transmission lines, and converter stations be under the control of the Railways Commissioners, and that the three items of electrical equipment should be located so that they can best supply the whole of the services in the metropolitan area. The cost of converting the existing cable and horse tramways to electric lines, and constructing 80 miles of additional track, is set down at £2,550,718. If power were supplied from the State (railway power house, this cost would be reduced by £170,000. Electrification of the suburban railways is only recommended on condition that the work should be undertaken only after an exhaustive inquiry by some eminent authority, to determine, among other things, whether the direct-current or the single-phase alternating-current system should be adopted.—*Engineering and Electrical Record.*

Birmingham.—About 2,000 men employed by the Corporation to work the municipal tramways are discontented with their conditions of service, and a memorial has been forwarded to the Tramways Committee asking for the following terms: (1) Time and half for all Sunday duty and bank holidays; (2) time and half for all time over nine hours per day; (3) double time for Christmas Day and Good Friday; (4) each day to constitute a day's work; (5) guaranteed 48 hours per week for spare men; (6) conductors when finishing duty on the road to be allowed time to go to the depôt to pay in; (7) every employé to reach the maximum rate of wages on entering the third year of service; (8) no employé to be suspended until he has been to the head officer, unless it be a very serious offence; (9) lighter uniform for summer; (10) discontinue publishing the names of men in the depôt for energy consumption, which causes discontent amongst the men; (11)

pector to report any employé for an offence unless the man is ified at the time of the offence ; (12) formation of a Conciliation ard. Although the Corporation men only are affected, it is derstood they have the sympathy of the employés serving the ious companies running cars in the Midlands. No reply has yet n received from the Committee.

Bradford.—At a meeting of the City Council last week, vas decided that application should be made to the B. of T. for a v. order authorising the use of railless tramcars on several streets l thoroughfares in the city.

Continental Notes.—Russia.—The Russian Ministry of ys and Communications is reported to have decided on the ctrification of all the railways in the St. Petersburg district. e water-power of the River Wolkhoff, in the Government of vgorod, will, it is said, be utilised in the generation of the essary electrical energy.

Norway.—According to a recent report to his Government by the ited States Consul-General at Christiania, the "Kristiania Elek- ke Sporvei, Valkyriegade No. 21," Christiania, propose to make unnel to enable the street tramways of the town to reach even- lly a neighbouring amusement resort on a hill three miles away. *Board of Trade Journal.*

Austria.—The *Financial News* correspondent says that, at the eting of a special committee of the Traffic Commission of enna, held last week, concerning the construction of a Vienna derground railway, the French proposal forwarded by a French up, headed by the Société Centrale des Banques de Provinces and Omnium Lyonnais des Chemins de Fer et Tramways, was well cussed, together with the proposal of the German-Austrian group. was decided to recommend the Traffic Commission to start nego- tions with the French group, which estimates the cost of the erprise at about 100,000,000 fr.

Germany.—The *Vossische Zeitung* learns that the technical ails for the electrification of the Berlin municipal tramways have en completed in the Ministry of Public Works, and that the nister hopes to be able to carry out the works next year. The ney vote is expected to be carried by the Finance Minister next ring.

Douglas (Isle of Man).—In a report to the T.C. ative to the advisability of electrifying the tramways, Mr. ndcock advices that no immediate steps should be taken in the tter, and suggests that a further report should be presented on e completion of the proposed E.L. undertaking. The overhead tem is advised, together with the relaying of the track with 0-lb. rails. The cost is estimated at from £80,000 to £85,000.

Ealing.—The Ealing Chamber of Commerce, members which recently visited Leeds and Bradford, is urging the T.C. establish a system of railless traction as a means of securing tter communication between Ealing Broadway and the outlying tricts.

Edinburgh.—After a two hours' discussion, the rporation Tramway Committee has decided to postpone making application to Parliament for power to use railless trolley hicles. It was explained that the new motor-'bus of the petrol- ectric type which has been introduced into London, has been found overcome many of the disadvantages of the motor-'bus as it has therto been known. In the light of this knowledge, further con- deration was claimed to be necessary.

Glasgow.—A lengthy, and sometimes acrimonious, dis- ssion again took place at the T.C. meeting on points of tramway ministration on a proposal by Mr. Lyon, who asked that the ramways Committee should be empowered to draft a new agree- ent by which the responsibilities of the general manager would lessened, and those of the Committee increased. Mr. Lyon inted out that he knew of cases of men in the service of the partment being unfairly and unjustly dismissed. Mr. Dalrymple, e manager, might not know of those cases, and he suggested that l such instances should be heard by the Committee. He asked at employés should have the right of appeal to a neutral body. n moving the previous question, Bailie Russell, convener, argued at the present agreement had worked very satisfactory all along. r. W. G. Anderson asked what would happen if the 7,000 employés the department came to the Committee with individual griev- nces. The position would be worse than that of the Railway ommission—they would have to sit permanently. The amendment as adopted by 34 votes to 21.

The T.C., at an early meeting, will be asked to consider an nportant recommendation by the Tramways Committee. This is suggestion for the re-opening of the tunnel, vehicular and pedes- rian, under the Glasgow Harbour—through arrangement with the roprietors—but that through tickets be issued by tramway cars rom the top of Finnieston Street and *vice versâ*, allowing passengers o travel by car in Finnieston Street and by the tunnel to Planta- ion, descending and ascending by the elevators and walking hrough the tunnel.

Halifax.—At a special meeting of the T.C. last week, a esolution of the Tramways Committee, asking for authority to arry out doubling of the track, at a cost of £10,715, was adopted. A notion was moved that tenders be invited by advertisement for arrying out the necessary works. It was eventually decided that hc words referring to advertising for tenders be deleted.

Hove.—A special meeting of the T.C. was held on Friday last week, and discussed for two hours the question of obtaining powers to run railless trolley vehicles ; in the end an amendment referring the whole question to the Legal and Parliamentary Committee for report, was carried. Mr. Fraser, who opposed the proposal, explained that it was not imperative for them to proceed to promote a Bill, and if they did they would be doing immense good to Brighton in their project ; apparently this view of the matter decided the Council in its peculiar attitude. The Brighton Council has decided to promote a Bill to work railless vehicles on the east and west routes, at present served by motor-omnibuses.

Hull.—The assessment of the Corporation tramways in the parishes of Holy Trinity and St. Mary has been increased from £13,541 gross to £22,945, and from £8,052 net to £11,973. The Council will appeal against the increases, which total £13,325.

London.—Stepney.—The B.C. has circularised the other Councils with regard to the decision of the L.C.C. to seek Parliamentary authority permitting the overhead trolley system of electrification for working the existing horse tramways which run from the West India Docks to Cassland Road, Hackney, notwithstanding that the authorisations of the B.C. in whose boroughs the tramways are laid have not been obtained as provided by Sec. 23 of the L.C.C. Tramways (Electrical Power) Act, 1900. The B.C. stated that the overhead trolley system had been successfully adopted in certain localities of the metropolis, but that this was the first occasion on which the L.C.C. attempted to obtain authority to ride rough-shod over the heads of the local authorities, empowered by Parliament to give consent to its adoption. The Council further stated that should success attend the efforts of the L.C.C., it seemed obvious that a precedent for ignoring in future the wishes of the metropolitan Borough Councils, whose views on the overhead trolley system ran counter to their own, would be established, and they hoped that the various Councils would do all in their power with a view to continuing the salutary veto conferred upon them by Sec. 23, and that they would communicate with the members of Parliament and the L.C.C. representing them, to rigorously oppose the attempt made to override the wishes of those responsible for local administration.

L.C.C.—On Tuesday last the Council, by 61 votes to 51, decided to postpone consideration of the proposed St. Paul's Bridge tramway scheme, pending the production of a report on the merits and total cost of the scheme. It appears that the scheme, owing to the Home Office insisting on a wide approach on the south side of the river, would cost not less than three-quarters of a million pounds, as against £350,000 originally suggested.

The Council passed without discussion the Highways Committee's recommendation that Parliamentary powers be obtained for the running of coupled and trailer cars on the Council's tramways. The negotiations with the B. of T. and the Commissioner of Police regarding this matter are summarised in a leaderette in this issue.

Oxford.—The decision of the City Council, rejecting the trolley system of tramways, mentioned last week, was come to after considering a letter from the National Electric Construction Co., who are under a contract to complete the tramways before 1912. The company pointed out that Bournemouth had rejected the combined system of trolley and conduit, as proposed for Oxford, and emphasised the difficulty of raising capital for such a scheme. The voting was 46 to 6 against the Tramways Committee's proposal to negotiate for a trolley system.

Paisley.—It is announced that the negotiations between T.C. and the Paisley District Tramways Co. regarding the arrangement of a flat rate of charge for electric current in substitution of the present arrangement under the arbiter's award have come to a successful conclusion. Representatives from the Tramway Co. have had several meetings with a Sub-Committee of the Council in the endeavour to adjust matters, but up to the present without much success. At the last meeting Mr. D. Johnstone Smith, on behalf of the company, suggested as an appropriate rate ·893d., or in round figures, ·9d., the Corporation, however, wishing this raised to ·952d., no definite conclusion was arrived at. It is now stated, however, that both parties have agreed to a flat rate of ·975 of a penny per unit, and that the arrangement will be retrospective, dating back to August 17th of last year, when the arbiter's finding came into force.

Sheffield.—As from October 30th passengers intending to ride on the top compartment of the Corporation cars are requested to pay their fares as they get on the cars.

South Africa.—A special meeting of the Boksburg T.C. was held recently to consider the report of the Tramway Committee with regard to the construction and installation of a railless electric traction system of trams for Boksburg. The recommendation of the Committee, that a railless system of electric trams be installed, at a cost not exceeding £17,000, was adopted.

Maritzburg.—The tramway system was recently interrupted for many hours, owing to the very heavy thunderstorm, the insulators being destroyed by the heavy discharges, causing the staff to work all night to effect repairs. The lights of the G.P.O. went out and candles had to be used, while telephone shocks were numerous, but no casualities were reported.

South Shields.—At a meeting of the T.C. on October 25th the Tramways Committee submitted a long report, in the course of which it recommended that the tramway employés be granted an increase of wages of ½d. an hour, and that the bonus scheme, introduced as an incentive to motormen to use their best endeavours to economise in the use of current, should be abolished. The tramways manager, in a report, stated that the bill for electric current last year showed the enormous reduction of 16 per cent. as compared with

the previous year, amounting to £900, and this he attributed to the bonus scheme. Mr. Henderson moved the adoption of the report, contending that the reduction in the consumption of energy was due to the increased skill of the motormen, and no energy would be wasted if the bonus scheme were abolished. Mr. Batey, in seconding the report, said there was no objection to continuing the use of the meters on the cars, so that the manager could tell whether any particular man was wasting energy or not. The deputation of the motormen who put their case before the Committee proved, as a result of this bonus system, a tendency on the part of the motormen to stop their cars as seldom as possible, and to rush hills. Alderman Wylie, chairman of the Tramways Committee, who opposed the proposed abolition, objected to the interference of the men in the management of the undertaking. The men said they did not mind the meters, but they did not want the bonuses; but the bonus was the key to the whole situation. Without the bonus the men had no interest in keeping down the consumption of energy. So far as the utility of the scheme was concerned, he might tell them that they had one driver who cost the department 12s. per week more for energy than another man working the same route. He moved that the bonus scheme be retained. Mr. Dunlop said only 12 men on the whole system had got the bonus and the merit badge. After a long discussion, the amendment to retain the bonus was lost, and then the question was referred to the Council in Committee.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephony.—The number of localities now served by automatic telephones in America is 131; of these networks, 30 have fewer than 100 stations, 94 more than 100, and six have the following numbers:—San Francisco, 16,500; Los Angeles and Oakland, 24,000 and 8,000 respectively; Grand Rapids, 11,000; Columbus, 14,000, and Portland (Oregon), 12,000. The network at Chicago is under construction. The aggregate of subscribers is 200,000. On the Continent of Europe this system is in use in the following cities: Hildesheim, Altenburg and Munich, in Germany, and at Graz and Cracow, in Austria. At Amsterdam a semi-automatic system is in course of installation. At Munich the Bavarian Postal Authorities intend gradually to transform the existing manual offices, so that in a few years' time the automatic system alone will be used to serve the 20,000 or 30,000 stations. In Austria it is intended to substitute the semi-automatic system for the manual in the central offices at Vienna. In this country the system is being tentatively tried by the Post Office.

France.—For some months past (says *Le Temps*) a lively activity has been shown in the establishment of wireless stations in French oversea possessions. Stations are in course of construction at Konakry and Tabou, in West Africa; six stations are being built on Lake Chad (Central Africa), two stations on the Congo, stations at Kien An and Hanoi, in Indo-China, and two portable stations. In Madagascar a large station is being built at Diego-Suarez, and the stations at Mayotte and Majunga are being refitted with the "singing-spark" system. About 8,000,000 fr. are being expended on these several works.

Germany.—A wireless station is in course of construction at Königsburg, in Prussia. The wireless station at Chingtau, in the German possession in China, built in 1906, is to be re-equipped with the "singing-spark" system, the range being also increased from 200 to 600 km. The cost is estimated at 150,000 marks.

New Cable.—The cable ship *François Arago* recently left Calais for Libreville, to lay a new submarine cable between that port and Pointe-Noire.—*Journal Télégraphique.*

Norway.—The Storthing has voted for the extension of the telegraph system, 53,000 kroner; for telephone construction, 817,200 kr.; and for a wireless station near Bergen, 80,000 kr., as well as 300,000 kr. for the erection of wireless stations near Hammerfest and on Spitzbergen. The total vote amounts to 1,250,200 kr.—*Electro.-Nachrichten.*

Russia.—The Government has drafted a Bill regarding the reorganisation of the wireless telegraphic system under State control.

Sweden.—A wireless coast station has been established at Gothenburg, on the German system, for public service. It has a range by day of 1,200 km., and by night of 2,000 km. The tariff is 14 cents per word, and the lowest charge for a telegram is 1·40 fr.

Telephone Rents.—Sheriff Mackenzie, in the Glasgow County Court, has issued an important judgment in connection with an action by the National Telephone Co. against a local firm. Pursuers asked for £5, being the annual subscription which became payable by defenders on April 20th, 1911, for an instrument and telephone circuit, according to an agreement entered into between the parties, dated April 22nd, 1903. The defence, in effect, was that the National Telephone Co. had entered into a contract with the Post Office for the transference of their business to the Post Office as at December 31st, 1911, and that they were therefore not in a position to carry out their contract with the defenders. His Lordship gave decree for the sum sued for, with 15s. costs.

The Telegraphic Union Memorial.—The *Journal Télégraphique* for October 25th reports the proceedings of the international jury appointed by the Swiss Federal Council to adjudicate upon the 106 designs submitted in the second competition for the erection of a monument at Berne to commemorate the foundation of the Telegraphic Union. The jury, by a majority, awarded the first prize to the design of G. Romagnoli of Bologna; the second, third and fourth prizes, of 6,000, 5,000 and 4,000 fr. respectively, were allotted to the designs of Chev. G. Bianconi, of Turin; Als. de Bucle and V. Vaerwyck, of Ghent; and J. Muellner, of Vienna; and a sum of 1,250 fr. was awarded to each of two French and two German schemes. In conformity with the verdict of the jury, the Federal Council resolved to entrust the execution of the work to the winner of the first prize.

The Telephone Transfer.—In the Parliamentary Paper Mr. Duncan Miller asked the Postmaster-General whether, after the transfer of the National Telephone Co.'s undertaking to the Post Office, the Post Office would pay local rates on the undertaking or an equivalent contribution in lieu thereof based upon the annual value of the undertaking as appearing in the valuation roll. Mr. Herbert Samuel replied that the Government was prepared to authorise some contribution in lieu of rates on the National Telephone Co.'s undertaking after December 31st next, but the precise basis of the contribution had not been settled.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. Oil branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

Victoria.—November 28th. Ebonite earpieces, calculagraph and insulators for the P.M.G. See "Official Notices" October 6th.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone materials for the P.M.G.'s Department. See "Official Notices" October 20th.

Canada.—Lethbridge.—November 24th. Municipality. Power station equipment, comprising boilers, economiser, steam turbo-generator, condenser and sub-station equipment; 10 per cent. deposit with tender. Plans, &c., from A. Reid, superintending engineer, Lethbridge.

Darwen.—Re-ventilating St. John's Church by the electrical fan system. F. Ramsbottom and J. T. Ainsworth, wardens.

Dublin.—November 9th. The Corporation is inviting tenders for electrically-driven centrifugal pumps for the Ringsend pumping station.

November 6th.—General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" October 13th.

Great Western Railway.—November 7th. Stores for a year. See "Official Notices" October 6th.

India.—November 14th. The Secretary of State for India is inviting tenders for rails and fishplates and electric crane &c. Director-General of Stores, India Office, Whitehall, S.W.

London.—L.C.C.—November 6th. Stores for a year. See "Official Notices" October 20th.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains. (2) power station, car-shed and repair-shop equipments: (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Norway.—January 31st, 1912. The Norwegian military authorities in Christiania are inviting tenders for the supply of 1 sets of field telephone apparatus.

Radcliffe.—November 7th. Two 300-kw. rotary converters and transformers, and E.H.T. switchgear for the U.D. See "Official Notices" October 20th.

Salford.—November 27th. Two 1,000-kw. direct-current turbo-generators, for the Corporation. See "Official Notices" to-day.

Sheffield.—November 13th. One 5,500-kw. steam turbine, condensing plant, pumps, pipework, &c., and alternator and exciter, for the Corporation. See "Official Notices" October 13th.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks Bangkok. Particulars, Local Sanitary Department, Bangkok.

pain.—Tenders have lately been invited by the municipal authorities of Valencia del Mombuey (province of Badajoz) be concession for the electric lighting of the town during a d of four years.

retford.—November 13th. Electric mains and accesfor the U.D.C. Mr. R. Rowland, electrical engineer (returndeposit of £2 2s.).

windon.—November 22nd. One 250-KW. Diesel oil ne generating set, accessories, switchgear, &c., for the Corpora- See "Official Notices" to-day.

ruguay.—February 6th, 1912. Tenders are invited ne Port Authorities at Monte Video for the supply of 13 electric es, together with 600 metres of steel rails. For further culars, see this column last week.

arrington.—November 17th. Telegraph materials carbons, for a year, for the Cheshire Lines Committee (form 5). Stores Superintendent, Cheshire Lines, Warrington.

CLOSED.

ccrington.—The T.C. has accepted the following ers :—

Messrs. Ferranti, Ltd.—Switchgear for sub-station, £143.
British Westinghouse Co., Ltd.—300-K.V.A. three-phase transformer, £180.

Belgium.—Ten concerns—four German, three Belgian, French and two British (the British Insulated and Helsby es, Ltd., and W. T. Henley's Telegraph Works)—last week mitted tenders to the Belgian Post and Telegraph Authorities russels for the supply of a quantity of six-conductor submarine e, the lowest offer being that of the Société des Ateliers de tructions Electriques, of Charleroi.

helmsford.—The T.C. has accepted the tender of the tric Supply Corporation, Ltd., for a 1½-H.P. motor and direct-led centrifugal pump, at £33.

lastings.—In the list of tenders for the lighting of the kbouse in last week's issue, *Sherland* Bros. was a mistake for *ratt* Bros.

eigh.—The Electricity Committee has accepted the tender the Astley and Tyldesley Colliery Co., for 40,000 tons of best at 9s. per ton delivered at the electricity works, and during period covered by the present contract at 8s. 6d. per ton.

ondon.—L.C.C.—The Highways Committee recomds for acceptance the tender of Messrs. Kirk & Randall for the tion of buildings for a permanent-way depôt at Poplar, at 325.

OUTHWARK.—The B.C. has accepted the tender of the Western tric Co., Ltd., at £85, for the supply of 220 yards of ·2 cable.

TEPNEY.—The following tenders were received by the tricity Committee for a transformer for testing high-tension es in connection with Wapping sub-station :—

Johnson & Phillips, Ltd.	£60
Brush Electrical Engineering Co., Ltd.	61
British Electric Transformer Co., Ltd.	(accepted) 72
Siemens Bros. Dynamo Works, Ltd.	95

lansfield.—The T.C. has accepted the tender of the rwood Colliery Co. for coal for the electricity works for a year.

lorecambe.—The T.C. has accepted the tender of Mr. V. Pearce for doubling the tramway track to Bare, at £3,773.

Westinghouse Contracts.—The following are some of important orders recently received by the British Westinghouse tric and Manufacturing Co., Ltd. :—

Sir Wm. Arrol & Co., Ltd.—One 60, two 50, six 35, two 12, five 10, and four 2½-H.P., 220-volt motors and spares.
Hulse & Co., Ltd., for Japan.—Various type "G" motors and panels.
Strakers & Love.—One 174-H.P. slip ring motor and liquid starter.
Royce, Ltd.—Two 25, two 15, two 10, and two 6-H.P., 400-volt, two-phase, 50-period motors and control gear.
Linde British Refrigeration Co., for Bristol Dock, Avonmouth.—Two 45, two 7½, and three 7½-H.P. 500-volt "G" motors.
War Office, for Gibraltar.—One 20, one 15, one 12, three 10, and two 7-H.P. motors.
Gold Coast Machinery and Trading Co., Ltd.—Two 70 and three 15-H.P. 200-volt, two-phase, 50-period A.C. motors and control gear.
Wigan Coal and Iron Co., Ltd.—Six 30 and three 10-H.P. motors and control gear.
Cowans, Sheldon & Co., Ltd.—Four 30-H.P. motors and control gear.
Huddersfield Corporation.—Transformers and switchgear.
Barcda State Railway.—Transformers and switchgear.
Rhymney Iron Co.—Transformers.
Greenock Corporation.—Two 500-KW. rotaries, transformers, switchgear, &c.
Staveley Coal and Iron Co.—One 400-K.V.A. transformer and six type [illegible] pillars.
Bury Corporation.—Transformers.
Bradford Corporation.—Transformers.
Tennant & Barrs.—One electric winder.
Stothert & Pitt, for Bristol Docks.—Equipment for nine 2-ton electric cranes for Avonmouth, nine 40, nine 12, and nine 6-H.P., 500-volt motors, control gear and spares.
Rochdale Tramways.—Eleven brake equipments.
Walter Bros. & Co., for Botafogo Mill.—Electrical equipment for Fabrica de Tecidos Botafogo.
Brush Co., for Rochdale Tramways.—Twenty-four controllers.
Babcock & Wilcox, Ltd.—One 400-KW. rotary converter and switchgear.
C. W. Fairweather.—One 550-H.P. A.C. motor starter, &c.
East Indian Railway.—One 32-KW. A.C. generator, exciter, switchgear, &c.
Tennant & Barrs, for Ford Paper Works, Ltd.—One 65-H.P. 250 F.B. motor controller and resistance, and one 70-K.V. transformer, panel and wiring.
Noyes Bros., Sydney, for Dunedin.—Six car equipments.

Newport (Mon.).—The tender of Messrs. A. G. Arnold and Son, Newport, has been accepted for the electric light installation at St. John's Church.

Stafford.—The T.C. has accepted the tender of Callender's Cable Co., at £2,010, for the supply and laying of 3,000 yards of electric cable, the cost of the cable being £1,671.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has accepted the tender of the British Westinghouse Co., Ltd., for the supply of a 3,000-KW. turbine.

Stoke-on-Trent.—The T.C. has accepted the tender of the Shelton Iron, Steel and Coal Co., Ltd., for Great Row slack to the Hanley electricity works for a year, at 8s. 5d. per ton.

Wolverhampton.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., at £155, for the supply of a cross-over with rolled-steel rails and manganese centres, for Victoria Street.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, Novemher 4th. At 7 p.m. At Caxton Hall, Westminster. Reception hy the President, Sir J. J. Thomson, and Lady Thomson.

Society of Engineers (Inc.).—Monday, November 6th. At 7.30 p.m. At the I.E.E. Paper on "Two-Cycle Engines," hy Mr. R. W. A. Brewer.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, Novemher 7th. At 7.30 p.m. At the University, Manchester. Paper on "The Mechanical Design of Direct-Current Turbo-Generators," hy Mr. R. Roberts.

Rontoen Society.—Tuesday, Novemher 7th. At 8.15 p.m. At the I.E.E. Presidential address.

Institution of Civil Engineers.—Tuesday, Novemher 7th. At 8 p.m. Presidential address by Dr. W. C. Unwin, and presentation of medals and prizes.

British Electrical and Allied Manufacturers' Association.—Thursday, November 9th. At 2.30 p.m. At 36, Kingsway, W.C. Meeting of the Council.

Institution of Electrical Engineers.—Thursday, November 9th. At 8 p.m. Presentation of premiums, and paper on "Modern High-Voltage Power Transformers in Practice, with Special Reference to a 'T' 3-unit System," by Mr. W. T. Taylor.

Institution of Electrical Engineers (Birmingham Local Section).—Friday, November 10th. At 7 for 7.30 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society.—Friday, November 10th. At 5 p.m. At the Finshury Technical College. Papers on "Physiological Effect of an Alternating Magnetic Field," and "Demonstrations of Acoustical Experiments, New and Old," hy Prof. S. P. Thompson, and other papers.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued :—

Monday, November 6th.—"A" Company. Company work, 7 to 9.30 p.m.
Tuesday, Novemher 7th.—"B" Company. Company work, 7 to 9.30 p.m.
Wednesday, Novemher 8th.—Gymnastic classes, 7 to 10 p.m.
Thursday, Novemher 9th.—"C" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.
Friday, November 10th.—"D" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.
Saturday, Novemher 11th.—Fort Coalhouse, week-end run. The party will parade at Fenchurch Street Station at 3.10 p.m. Dress: Service dress, greatcoats, haversacks and belts; no arms will he taken.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Electrical Fatality.—An inquest was held at Southwark upon the body of George Salter Windeatt, aged 29, who died from injuries received at the City of London generating station, Bankside, where he was employed. Windeatt had been in the employ of the company for 14 years, and it appeared from the evidence that he went to work as usual on October 10th, and, while "making dead" a switchboard on one of the top galleries, he was heard to fall. He was found lying in front of one of the switches, with his clothes alight. On the way to Guy's Hospital, he said, "I know how it happened; I took out the wrong length." On examination of the board it was found that he had quite correctly pulled out two lengths of wire, but he had omitted to pull out the switch. The gear was therefore still "alive." He was not wearing the india-rubber gloves which were necessary. Death took place a few hours after his admission to the hospital, and was due to extensive burns and shock.—The jury returned a verdict of "Death from misadventure."

Accident.—An evening paper says that just before mid-day on Tuesday, an arc lamp outside a cinematograph theatre near Oxford Circus fell and injured a man on the head. He was taken to the Middlesex Hospital.

Lighting of Workmen's Dwellings at Eccles.—We have received from Mr. H. W. Angus the following abstract from his report to the Eccles Electricity Supply Committee: The second year's supply of electrical energy to the Corporation Road houses was completed on September 30th last, and I have pleasure in giving the following detailed particulars of the metered quarterly consumptions of electrical energy, which have been charged for on one of our standard rates, namely, on the first hour's supply per day at 7d. per unit, and all further supply at 2d. per unit:—

Quarter ending.	Total B.T.U. consumed.	Max. recorded rate of supply demanded.	Units at 7d.	Units at 2d.	£	s.	d.
Dec. 31, 1910 ...	428	·700 B.T.U.	64	364	1	18	0
March 31, 1911 ...	345	·683 ,,	62	283	1	3	4
June 30, 1911 ...	178	·692 ,,	63	115	2	15	11
Sept. 30, 1911 ...	199	·725 ,,	66	133	3	0	8
	1,150				£14	17	11

The Health Committee has paid £14 17s. 11d. for the electrical energy consumed by their tenants during the 12 months. On the other hand, the income received by the Health Committee from their tenants was as follows:—12 houses at 6d. per week for 12 months, £15 12s.; less empties during the year, 23 weeks at 6d. per week, 11s. 6d.—£15 0s. 6d. The Health Committee have therefore made a slight profit on the transaction. This result, which is a repetition of the satisfactory result obtained during the first 12 months' supply, strongly confirms the original object for which this experimental lighting has been carried out, namely, to demonstrate that the cost of electric lighting need be no obstacle to its general adoption in small dwelling houses.

With reference to the cost of lamp renewals which the tenants of the houses have paid for, this has not been a great expense, as only eight new lamps have been supplied to the tenants of the 12 houses during the 12 months. The cost of these lamp renewals works out at an average of 1s. 8¾d. per annum for each tenant.

Electric Railways in Sweden.—It is estimated that the waterfalls in the possession of the Swedish State represent a total of 700,000 H.P., and this fact has tended to create considerable interest in the question of the introduction of electric traction on the State railways. Electrical working on the Northern Frontier Railway from Gellivare-Kiruna to Riksgransens, which will be 80 miles in length, is to be completed in 1914, and if expectations entertained in regard to it are fulfilled, the conversion of other State lines will be carried out. The State already owns a power station at the Trollhatten Falls, which has been equipped with plant of 80,000 H.P., and it would be possible to supply power from this station to the railways in West Gothland, Bohuslan and Dalsland. Instructions have already been given by the Government to the special water-power authority and the electrical department, to investigate the question as to the transformation of the Gothenburg-Alingsas section, which has a length of 28½ miles. The railways in the neighbourhood of the capital are also thought likely to be converted to electric traction in the near future, and the preliminary works in connection with the erection of a power station for this purpose at Eltkarleby, which is about 90 miles distant from Stockholm, are being actively pursued at the present time. The station is to be equipped with plant, having an output of 40,000 H.P. As far as concerns the Northern Frontier Railway previously mentioned, work is being carried on at high pressure in regard to the line, the power station at Porjus, and the line to connect Porjus with Gellivare. The railway forms a link of a projected line which would proceed from Oestersund to Gellivare, and would be 560 miles long. The schemes provides for the utilisation of various waterfalls in connection with the working of the railway, of which the most southern portion—Oestersund-Strom—is already in course of construction for a length of 68 miles.

Electric Driving of Textile Factories.—In a Presidential address to the Belfast Association of Engineers at their opening meeting last week, Prof. Stanley dealt with the subject above-named, and spoke of the remarkable development which had taken place during the current year in the application of the individual electric drive. Last year not more than 300 motors, he said, had been used for this purpose; now they were being installed in large Lancashire, Yorkshire and Scottish mills in hundreds. Since January one electrical manufacturing firm had supplied about 2,000 motors for this purpose, and had in hand inquiries involving a further 5,000. In Germany there were over 50,000 looms driven by individual motors, and this system was also largely adopted in America. Recent progress was entirely along the lines of individual drive, which was, with some few exceptions, most suitable for every class of textile machinery, but peculiarly so for loom driving. There was no doubt that the three-phase alternating-current motor was far superior to the direct-current motor for most classes of textile machinery, spinning or weaving. Printing machinery was probably best suited by direct-current motors, and spinning frames by single-phase repulsion motors. If the distributing mains of an electric supply company were not available, the best prime mover to adopt was the steam turbine, whose even turning torque, transmitted faithfully by the induction motors, would enhance both the quality and quantity of the finished material. In any case the induction motor would give a far steadier drive than any other method. These motors were now made totally enclosed, and therefore not interfered with by dust or nap. They ran on ball bearings, and could if necessary be cooled by air draught in floor ducts, so as to avoid any interference with the requisite humidity of the atmosphere in which they worked, as in spinning rooms. If the full benefits of electric drive were to accrue, care must be taken that each machine was fitted with a motor of the exact size suited to its requirements. After enumerating the unquestionable advantages of electric driving in connection with the lay-out and running of a mill, Prof. Stanley stated that the increase in production as the result of electric driving in one Lancashire mill was estimated from results at from 12 to 18 per cent., and the quality of the yarn was also improved. The time was ripe, he thought, for starting a large central electric power supply in the centre of industry in the north of Ireland, as electrification of the factories was bound to come and to come soon. The adoption of electric driving would lead to a revolution in the design of some textile machinery—especially looms—within the next five years. We are indebted to the *Belfast News Letter* for the foregoing extract from the address.

Tests of an Oerlikon Turbo-Generator.—A 3,000-K turbo-generator, supplied by the Oerlikon Co. to the Société Lyonnais des Forces Motrices du Rhone for their stand-by station at Cusset, was recently tested, and the results may be of interest. The generator was specified to give a normal continuous output of 3,000 KW. at a power factor of 0·65, and 3,500 KW. for two hours with the same power factor. The turbine was constructed to run at 1,500 R.P.M. with steam at 220 lb. pressure per sq. in., at a temperature of 350° C. The condensing plant was of the Parsons-Westinghouse Co.'s make, consisting of a surface condenser and rotary air, circulating and force pumps, coupled direct to a 72-B.H.P. Oerlikon steam turbine running at 1,500 R.P.M. The steam consumption includes that of this small machine.

Four tests were made, two at half load, one at full load, and one at 20 per cent. overload. The steam pressure was about 210 lb. in each case, and the temperature about 350° C. The vacuum varied from 97·8 per cent. at the lower loads to 97·1 at the highest. Other data are as follows:—

	½-load.	*½-load.*	*Full load.*	*1½-l*
Total steam consumption in lb. per hour	20,827	20,779	38,799	45,7
Three-phase output in KW.	1,555·8	1,594·9	3,165·6	3,57
Power factor	0·675	1·0	0·665	0·71
Steam consumption per K.W.H. at above power factor (excluding excitation) in lb.	13·37	13·02	12·25	12·5
Power consumption for excitation in KW.	18·48	18·57	21·12	22·8
Steam consumption per K.W.H. at power factor unity, including excitation, but excluding condenser power, in lb. ...	12·38	12·32	11·62	12·1

Except in the second test, the power factor was unusually low and the comparatively low efficiency of the small auxiliary turbine also affected the results adversely; the latter took at full load 6 per cent., at half-load 6 per cent., and at overload 2·9 per cent. of the total steam consumption. Making due allowance for the power factor, condensing plant, and excitation, the corrected values given in the last line of the above table, it is claimed, represent the lowest steam consumption figures as yet recorded under similar conditions; and this in spite of the fact that the generator, built for a p. f. of 0·65, had to be abnormally large compared with a machine designed for a p. f. of 0·8.

Institution and Lecture Notes. — NORTHAMPTON INSTITUTE ENGINEERING SOCIETY.—On October 20th a paper entitled "Electric Lamp Filaments" was read before the Society by Mr. N. E. Paine. The author detailed the processes employed in the manufacture of the modern carbon and metal filaments. The manufacture of Nernst filaments was also described, followed by the results of tests on and costs of lamps per 1,000 C.P.-hours, working including the cost of lamp, work out as follows, reckoning electricity at 3d. per unit: Carbon, 13·8d.; tantalum, 7·0d.; tungsten, 4·1d. The next meeting of the Society will take place to-day (November 3rd) at 5.45 p.m., when Messrs. T. R. Houston and F. G. Pain will read a paper on "Diesel Engines."

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—The first meeting of the session was held on October 19th, when Mr. W. Cramp delivered his inaugural address as chairman. About 200 members and friends were present.

Mr. Cramp announced that it was proposed to hold a conversazione on December 15th, which would be organised jointly between this section of the I.E.E. and the Manchester Association of Engineers. As a means of broadening the scope of the discussions on the various papers, it had been arranged to have a joint meeting with the Liverpool Engineering Society, at Liverpool, on November 15th, when a paper would be read by Dr. Marchant on "The Function of the Laboratory in the Training of an Engineer," and also with the Manchester Association of Engineers on January 27th, 1912, when a paper would be read by Mr. Alfred Myers on "Electrical Furnaces." It was hoped that the joint meetings would benefit the members to a greater degree by allowing a better discussion from the different points of view of the members of the three societies.

The meeting afterwards took the form of a smoking concert, which was much enjoyed by those present.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—The annual meeting of the Association will be held at the Borough Polytechnic, S.E., to-morrow (November 4th). The annual report of the Council, which will be considered at this meeting, deals with the large increase in the membership of the Association during the past year, and with the work done during that period. Brief

ıve been formed in Ireland and Wales, so that the activities of e Association now spread over the whole kingdom. After the nsideration of the report a discussion will be initiated on the ɔard of Education Examinations in Science, by Mr. C. F. Smith, anchester School of Technology, and Mr. J. Wilson, Battersea ɔlytechnic. To this discussion visitors are invited. Particulars n be obtained from the Hon. Secretary, Mr. P. Abbott, the Polychnic, Regent Street, W.

Association of Mining Electrical Engineers.—The first eeting of the Session in connection with the Notts. and Derbyshire ranch was held at Nottingham on Saturday, when a visit was id to the Corporation electricity works. Mr. W. Maurice (Prelent), speaking subsequently, stated that the Association had a embership of about 900, and he confidently anticipated that before e year ended it would have reached 1,200.

At a meeting of the Yorkshire Branch at Leeds University, on ıturday, Mr. E. K. Scott referred to the danger of over-legislation garding the application of electricity to coal mining. He said ıat unless care was taken the new Mines Bill, so far as it concerned ectricity in mines, might have the effect of the Electric Lighting ct of 1882, and scotch all progress. It would shut down some of e collieries of Yorkshire, which could not be worked except by ectrical machinery. Prof. Bowen, of Leeds University, gave an ɔlanation of the Holmes-Ralph gas-detecting portable electric mp, and Mr. E. K. Scott afterwards read a paper on the use of ectricity in the manufacture of high explosives.

The Institution of Civil Engineers.—The Council has ade the following awards in respect of papers published in Section of the *Proceedings* for the Session 1910-11: Telford Premiums Messrs. S. M. Dixon, M.A., B.A.I. (Birmingham), H. J. F. Gourley, Eng. (London), J. Holden (London), A. Rogers (Horsell), A. E. riffin (Hong Kong), F. C. Lea, D.Sc. (Birmingham); and a Crampn Prize to Prof. W. E. Dalby, M.A., B.Sc. (London). It has so awarded the Indian Premium for 1911 to C. E. Capito (Ahwaz, ɛrsia), and the Webb Prize to F. W. Bach (London).

Faraday Society.—A special meeting is to be held on ednesday, November 8th, at 8 p.m., at the Institution of Electrical ngineers, Victoria Embankment, W.C., when Dr. Edward G. cheson, of Niagara Falls, will give an account of his researches. he address will be accompanied by experiments. Dr. Acheson has ɛen invited to dine with the members of the Society at 6.30 p.m., efore the meeting, at the Holborn Restaurant. Non-members will ɛ admitted by ticket, to be obtained by application to the Secre-ıry, 82, Victoria Street, Westminster, S.W.

Institution of Electrical Engineers (Glasgow Students' ection).—Mr. W. W. Lackie addressed the members at the ɔening meeting of the session, dealing with the transformation of ıergy in coal to electrical energy. He stated that, after allowing for sses, they found that not more than 250 B.TH.U. per lb. of coal ere available in the form of electrical energy. Their present ɔnsumption in the T.C. works was about 3 lb. of coal per unit, so ıat they got 9·5 per cent. of the energy of the coal at consumers' rminals. To transform the electrical energy in 2 lb. of coal, and eliver it in the form of electrical energy to a consumer in lasgow, meant, at the present time, an initial expenditure of £50, ıd an annual expenditure by way of interest and depreciation of 4, as well as £3 12s. 5d. for running costs. It was often said ıat if they had a Niagara Falls at their doors, they would have a uch cheaper supply of electrical energy; but they would realise ıat the water-power drive merely eliminated the coal bill, and ften meant the laying of high-tension mains considerable distances. ı some generating stations where there was a continuous steady ɔad all day long, and larger units than they had in Glasgow, there as a consumption of 2 lb. of coal per KW.-hour, and this would ıean that the amount of energy at consumers' terminals would be ıcreased from 9·5 to 14·2 per cent.

Institution of Electrical Engineers (Yorkshire Local ection).—At the Hotel Metropole, Leeds, on Wednesday, Novemer 15th, Mr. T. Harding Churton, the chairman, will deliver his ıaugural address.

Junior Institution of Engineers.—On October 30th a paper n "Notes on Design and Construction in Gas Works" was read by ır. George Evetts. The presidential address of Commendatore G. Marconi, LL.D., D.Sc., on "Engineering Considerations in Wireless Telegraphy," is to be delivered on November 28th. Tickets for the ıeeting are obtainable from the Secretary, 39, Victoria Street, Westminster.

Wallsend Exhibition.—An Industrial Exhibition is ɛeing held on November 8th, 9th and 10th in the Skating Rink, Wallsend, the largest hall on Tyneside. We understand from Mr. I. W. Clothier, hon. secretary, that it is sure to be of particular nterest to electrical engineers who happen to be in the district.

Inquiry.—A correspondent asks for the addresses of nakers of iron or steel sheets for transformers.

Durable M.F. Lamps.—Messrs. Pope's Electric Lamp Co., Ltd., have received a letter from a customer who voluntarily says that their metal-filament lamps "have given great satisfaction, and *their great strength* is proved by the way hey stood in a fire in this city. When the joists burnt, the roof ınd contents of three floors crashed down on to the first floor; on he ground floor there were a number of Pope metal-filament lamps ıanging from the ceiling, and they stood the tremendous jar so well (*and they were cold*) that none were in any way damaged." As a result this customer is now installing Pope lamps in theatre ıattens and footlights, considering that if they would stand that ire, they will stand any rough theatre treatment.

The Royal Mint.—The forty-first annual report of the Deputy-Master and Comptroller, the Right Hon. W. G. Ellison Macartney, shows that during 1910 the coinage in the precious metals considerably exceeded that of any previous year. The rapid increase in the demand for gold coin in recent years resulted in the production of more than 27,000,000 pieces, a figure 5,000,000 in excess of that of any previous year, and large concurrent home and Colonial demands for silver, notably for West Africa, brought the total number of silver pieces struck to nearly 52,000,000, or nearly 11,000,000 more than any former total. In all about 153,000,000 pieces were produced, and the net profit on the operations of the Mint for the year was over £1,500,000.

In the newly-erected silver melting house gas has been adopted as a fuel in place of coke, and a saving of 2d. (in the case of gold) per cwt. melted has been effected, the present cost being 5d. per cwt. melted, as against 7d. when coke was used. The crucibles are found to stand on an average 50 per cent. more heat.

The memorandum of Mr. Rigg, superintendent of the operative department, states further that preliminary experiments have been in progress since 1909 as to the best type of furnace to adopt, and that gas, oil and electric furnaces were tested.

The latter type was not found practicable, as, even had the cost of working such a plant as the requirements of the Mint demanded not been prohibitive, the difficulty of recovering the entire charge daily for accounting purposes, and the inability to stir the alloy effectively—an essential condition in the case of bullion for coinage—would have rendered this type of furnace unsuitable.

The oil furnaces, burning both petroleum and creosote oils, tested, were tried under a variety of conditions, and with air pressures varying from 2 lb. to 25 lb. per sq. in. Although it seemed clear that, at present prices, the oil fuel is more economical than coke, the higher economy usually necessitates a higher pressure for the efficient atomising of the oil, and the noise caused thereby constitutes a grave objection to the process, while the need of an extensive storage for the maintenance of a continuous supply presented serious difficulties.

In the experiments with ordinary town's gas, a variety of systems was tested involving the use of gas at ordinary and high pressure, combined with variations in the pressure of air. The problem presenting itself for solution was the reduction of the combustion chamber to the smallest practicable dimensions, so as to concentrate the heat on the crucible of metal. The experiments undertaken clearly indicated that efficient combustion, combined with comparative silence, depended very largely on the correct formation of the burner nozzle and the fire-brick extension thereof. The type of furnace adopted was designed in the Mint, and the burner ultimately decided on was made by Mr. S. N. Brayshaw, of Manchester. Gas is taken from the main at ordinary pressure and mixed with air at 2 lb. per sq. in. pressure. The noise from these burners can be reduced sufficiently to be unobjectionable, and the furnace linings compare very favourably with those used for coke in regard to durability.

The new silver melting house has been provided also with two entirely electrically-driven travelling cranes of 5 and 10 cwt. capacity respectively, and is lit by four Westinghouse silica lamps. In connection with the recent Treasury Authority, whereby the Mint is required to undertake the preparation of dies and plates for the printing of adhesive stamps, an electro-depositing plant has been installed. Up to the present all plates are of copper deposit and iron-coated, but nickel is to be substituted, and preparations are in progress for carrying out this change.

The general increase in the work of the department in the year under review has occasioned an increase in the number of motors in use from 73 to 86, and the average monthly output of the main generators has risen from 22,841 units in 1909 to 26,193 in 1910.

The memorandum of Dr. T. K. Rose, chemist and assayer, states that during the year the electrolytic method for the determination of traces of lead in brittle gold has been adopted.

If proper precautions are taken, the platinum anode is distinctly coloured by lead dioxide when 0·02 per 1,000 of lead is present. The quantity of gold required for the analysis is only 10 grammes.

A German Peat-Electric Plant.—At the East German Exhibition in Posen, recently held, there was exhibited a peat gas plant in working, built for the Görlitz Machine Works and Iron Foundry. The gas was extracted from the turf by a specially devised generator and supplied direct to a gas engine. From investigations made by Prof. Baer, of the Royal High Technical School, of Breslau, it appeared that at a price of 4 marks per ton of turf, the KW.-hour, measured at the switchboard, would cost only 0·6 pfennig. At a lower rate for the turf, obtained by the use of machinery, viz., 2 marks per ton, it is calculated that the cost per KW.-hour might be lowered one-half, viz., to 0·3 pfennig.

Osnabrück, in Hanover, is one of those places where the feasibility of electric lighting by means of turf gas is being demonstrated, the town being lit by current generated at the turf-gas station at Schweger Moor, 28 km. distant. It is intended to extend the supply to Wittlage, Damme-Bersenbrück and Diepholz.

Level-Crossing Fatality.—In the case of the death of Miss S. Johnson (27), nurse, of New Brighton, who was killed at Hall Road Station, on the Liverpool-Southport electric section of the L. & Y. Railway, a verdict of "Accidental death" was returned at the inquest on October 30th, and the jury added the opinion that the laxity of the company in not prosecuting persons who had openly broken the by-laws by passing over this level-crossing (where the young woman was killed), and so given a tacit consent to such a breach, might have conveyed to deceased that she had a right to go over the crossing.

A Long-Suffering Lamp.—A user recently informed the British Westinghouse Electric Co. that he had had one of their 25-volt 16-c.p. metallic-filament lamps in use for nearly three years, near a gas oven: the fumes from the latter had eaten completely through the brass cap, showing a degree of venomous animosity that one would hardly have expected even from gas; but the filament of the lamp is still intact, and the glass bulb has not been blackened at all.

A Rubber Testing Plant.—The North-British Rubber Co., of Edinburgh, whose manufactures are well-known in the electrical trade, have just equipped a new electrical laboratory at their works. It is an important department of the new building just erected for laboratory experimental purposes. The most interesting feature in the electrical department is the installation of high-tension resistance apparatus for testing the dielectric strength of the numerous products they make in connection with the electrical industry. Here, rubber gloves and vulcanite goods, of which the Castle Mills give a large yearly output, are subjected to insulation resistance tests, all of these products being guaranteed to withstand the voltage specified. This apparatus is capable of giving a test up to 20,000 volts pressure, the current being generated in the power house attached to the laboratory. A suction gas engine drives two dynamos of high and low voltage, and supplies electric light, and also power to the motors for testing machines, mills, &c., in the experimental department, and stirrers, &c., in the physical and chemical laboratories.

Tramway Claim in the House of Lords.—In the House of Lords this week the case of Leaver (pauper) *v.* Pontypridd Corporation was heard. It was an appeal by the widow of a painter, whose death she alleged was due to the negligence of the driver of a tramcar belonging to the respondent Corporation. The defence was that there was no evidence of negligence. As reported in the *Standard*, the action by the widow was tried at the Cardiff Assizes. At the close of the plaintiff's case, the defendants' counsel submitted that no negligence had been shown on the part of the driver. Mr. Justice Pickford rather thought that was so, but he left the case to the jury, so as to avoid the cost of a new trial, and reserved his decision as to the evidence for further consideration in London. The jury, after hearing the defendants' case, awarded the widow £275. On further consideration, the learned Judge held that there was no evidence of negligence on the part of the driver, and entered judgment for the defendants. The Court of Appeal affirmed his decision; hence this appeal to the House of Lords. The Lord Chancellor said that he thought the appeal must succeed. Negligence was a question for the jury, not for the judge, and if he had been a juror he thought he should have agreed with the jury that there was evidence of negligence on the part of the driver. Drivers of tramcars on a narrow road such as that between Pontypridd and Treforest, where this accident happened, ought not to take risks, but should stop and make sure that there was a clear way before attempting to pass something on the road which left the margin of only a few inches. If a jury found in any reasonable way that the accident was due to the driver's negligence it was the duty of the Courts to sustain the verdict of the jury. The other noble and learned lords expressed concurrence, and the appeal was accordingly allowed.

Motor-Car Lighting.—An interesting exhibit at the Motor-Car Exhibition at Olympia is a new electric lighting equipment shown by Messrs. S. Smith & Son, 9, The Strand, London, W.C., and produced by them in conjunction with the British Thomson-Houston Co., Ltd., of Rugby. The equipment, with the exception of the instruments, is of British design and construction. The dynamo differs from those at present on the market in that it is of an ordinary type with no subsidiary poles or mechanical governors. The patented electrical control is an ingenious piece of mechanism, and a constant output of 8 amperes is supplied to the accumulator whether the speed of the motor be 12 miles or 50 miles an hour.

Appointments Vacant.—Assistant electrical engineer for the P.M.G.'s Department, Melbourne (£520 to £600); electrical engineer, for the Bispham-with-Norbreck U.D.C.; assistant superintendent of railway telegraphs, for the Government of South Nigeria (£300). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Perth Corporation Electricity Committee has agreed to increase the salary of MR. LAMBERT, the engineer, by £25, in view of the rearrangement regarding the tramway management.

At the Fleetwood Council's Electricity Works, on October 26th, MR. J. M. GARSTANG, senior shift engineer, who is leaving to take up a better position with the Cleveland and Durham Electric Power Co., was presented by colleagues with a leather kit bag. Mr. W. Humphreys, on behalf of the staff, made the presentation.

The employés of the Oldham Electricity Works have presented a clock, barometer, and pocket wallet to MR. W. J. CARTER, on his marriage. Mr. Carter has been appointed chief assistant engineer at the Batley Electricity Works.

MR. J. R. WILSON, second engineer-in-charge at the Ilford electricity works, has been promoted senior engineer in place of Mr. H. H. Arthur, resigned. MR. G. A. PARTINGTON, switchboard attendant and assistant fitter, has been appointed fourth charge engineer.

MR. J. H. CAWTHRA, borough electrical engineer, South Shields, has resigned that office, having been appointed to an important position on the staff of the Victoria Falls and Transvaal Power Co., Ltd.

General.—MR. LANE'S TESTIMONIAL.—The first smoking concert of the Electro-Harmonic Society, now in its twenty-sixth season, held on Friday evening, the 20th ult., was marked by the presentation to Mr. W. E. Lane, the popular hon. secretary, of a hand some cabinet of table cutlery, &c., as a recognition of the esteem and regard in which he is held by the members, and to celebrate the occasion of his recent wedding. Mr. Robert Kaye Gray, the chairman, made the presentation, and in a few eloquent and well chosen remarks paid a high tribute to the manner in which Mr Lane had carried out his secretarial duties, which involved so much voluntary labour and time on his part. Mr. Lane, in reply, said that on this memorable occasion in his life he could hardly plead that the whole affair had rendered him speechless with surprise for it had for some months been an open secret that he was about to join the noble army of martyrs, yclept Benedicks, and he became aware that a few of his older friends in the Society intended to mark the event by some recognition of his long connection with Electro Harmonic functions, it being just 10 years since he was appointed hon. secretary to the Society. The growth of membership during those years by over 100 per cent. naturally augmented his duties to a considerable extent, especially so far as financial matters were concerned, but he was happy to say that the discharge of these duties was of no consequence to him compared with the great and genuine pleasure which the Society had, for more than a quarter of a century, regularly afforded an ever-increasing number of members and their friends. His long connection with the Society has been a source of unfeigned gratification to him, and his relations with the Committee, the treasurer, and especially with the music directors, had been of the friendliest and happiest nature, and he did hope that it was generally felt by all that he had always endeavoured to the best of his ability to carry out his duties to their complete satisfaction, the interests and welfare of the Society being his one and only object. The handsome testimonial with which he had been presented that evening would be one of his most highly prized possessions, and would serve to remind him of many, many never-to-be-forgotten Electro-Harmonic evenings, and also go to show that he was happy in numbering many more friends than he ever thought he possessed. The gift would be cherished not so much on account of its intrinsic worth, valuable though it was, as for the kindly feeling which prompted it. He finally expressed his grateful thanks to the Committee, the subscribers and the organisers of the testimonial and to the chairman for the graceful and touching manner in which his services had been eulogised—services which to him had ever been a labour of love, and which he hoped to be allowed to continue for so long as he was called upon to do so. Mr. Lane then resumed his seat amidst great applause. One amongst Mr. Lane's manifold duties, we noticed, was, perhaps purposely, left untouched. We know from long experience that the collecting of subscriptions from forgetful members is not a wholly congenial task, and if, after repeated applications, Mr. Lane has felt compelled to show the iron fist within the velvet glove, we are sure that it has never been done with the smallest intention of hurting in the slightest degree the personal feelings of the defaulting member, be he never so hardened a sinner.

We learn that MR. W. C. MOUNTAIN is retiring from the firm of Ernest Scott & Mountain, Ltd., and proposes to devote himself to consulting electrical and mechanical engineering in connection with mining installations, also inspections, valuations, settlement of claims, arbitration in commercial disputes relating to electrical and engineering matters, &c. During the last few days he has been appointed arbitrator by the Coal Trade to represent a number of the principal counties of England in connection with the use of electricity in mines. Mr. Mountain has been appointed consulting engineer to the Warwickshire Coal Co., Charlaw and Sacriston Collieries, Houghton Main Colliery Co., Burradon and Coxlodge Coal Co., Ltd., Hamsterley Colliery Co., James Ross and Co., and several others. He has taken offices at Sun Building, Newcastle-on-Tyne. Mr. Mountain's practical experience in colliery and works electrification, and general engineering work, runs back over some 36 years. It may be remembered that he acted as electrical expert to the Mining Association of Great Britain in connection with the 1905 inquiry into the use of electricity in mines. He will carry with him into his new operations the good wishes of a host of electrical friends

The *Times* reports that SIR JOHN and LADY GAVEY were among the passengers in the R.M.S.P. *Amazon*, which left Southampton on October 27th for Brazil and the River Plate.

IR. J. R. GARNER, for eight years works manager of the Electric Ordnance Accessories Co., Ltd., Aston, Birmingham, has gned in order to take up a similar position with the Lancashire namo and Motor Co., Ltd., Manchester. On Friday evening, ober 27th, a farewell smoking concert, held at the King Edward el, Aston, was made the occasion of a presentation to Mr. ner by the departmental heads, outside selling staff, foremen certain of the staff (about 200 in all), of a specially-designed -top desk, as a mark of the esteem and respect they had gained him during his able control of the manufacturing side of the ness. The presentation was made by Mr. J. D. Morrison (secre- and commercial manager), who prefaced the actual present- n by a eulogistic account of Mr. Garner's character and his y good points—points which had gained for him everybody's ect, and had raised the company from the "slough of despond" highly satisfactory position in the electrical industry. Mr. rison was ably supported by Mr. A. Watkins (chief inspector 10 years), who, as an instance of the feeling for Mr. Garner in works, showed how the pattern-makers had given up their re time to make a model (or, as the foreman pattern-maker ed it, "a pup of the real desk") of the desk. The formal pre- ation was then made, the desk being represented by the above- tioned model. At the same time, Mr. Morrison asked Mr. Garner ccept, on behalf of Mrs. Garner, a silver rose bowl. In his y, Mr. Garner expressed his appreciation and thanks.

R. CECIL PARTRIDGE, the present traffic manager, has been pointed manager of the Central London Railway. Nine years ago Partridge entered the service of the company as assistant fic superintendent, having previously been with the Great tern Railway Co. for 12 years.

he marriage took place on Thursday, October 26th, at Egre- t, of MR. THEODORE S. SCHONTHEIL, the eldest surviving son Mr. Simon Schontheil, Ph.D., and a member of the firm of lam & Schontheil, of Cardiff, electrical engineers, with s Mary Constance Jones, the younger daughter of the late W. Price Jones, of Liverpool. Mr. Harry Ellis, the deputy electrical engineer of Bradford, was the best man.

R. R. H. WILLIS, of the British Electric Plant Co., Alloa, has appointed Secretary of the East of Scotland Branch of the ciation of Mining Electrical Engineers in room of MR. THOS. IDSON, Edinburgh, who has received an appointment in Southern ria.

Smoking Concert and Social was held on Saturday evening last he Crow's Nest Hotel, Newcastle-on-Tyne, to bid farewell to GEO. T. TODD, who is severing his connection with Messrs. . Holmes & Co., electrical engineers, Newcastle-on-Tyne, with m he has been connected for a period of 23 years. Mr. Todd king up a position of responsibility with Messrs. Javori & Co., chant shippers, Manchester. The chair was occupied by Mr. J. nley Graham, and on behalf of the staff, Mr. W. A. Clatworthy ially presented Mr. Todd with a mahogany roll-top . The firm also presented Mr. Todd with a solid silver tea ice. Songs, &c., were rendered by members of the staff and r friends, and a very enjoyable evening was spent, a most ty send-off being given to Mr. Todd.

wing to the increase of Messrs. Mawdsley's business in the cashire district, MR. G. B. LOWE has relinquished his other icies, and will in future devote the whole of his services to the of their "Zone" patent dynamos and motors manufactured at ley.

R. H. MAYER, the principal of the late firm Messrs. H. G. er & Co., has joined the staff of the Globe Electric Co., Ltd.

bituary.—MR. J. C. FULLER.—We regret to record leath of Mr. John Crisp Fuller, which occurred last week, in his year. Mr. Fuller's name is well known in connection with his romate battery. Born at Bristol in 1821, he came early to lon when the railways were beginning to spread their lines over country, and when the newly-formed Electric and International graph Co. had just commenced its operations. From that time t down to a few weeks ago he had taken a keen interest in rical matters, and his name has become known to electrical neers in all parts of the world. In the early days he came into contact with telegraph pioneers, most of whom pre-deceased and he took constant pleasure in the fact that he was associated temporary assistant with Michael Faraday. About the year Mr. Fuller joined the Electric and International Telegraph Co., when the transfer to the Post Office took place, he received a ue from the company as a souvenir of the work he had done in roving their batteries. Among others with whom he worked Mr. Edwin Clark, Mr. Latimer Clark, and Sir William Preece. the details of the electric telegraph system had to be studied worked out as the scheme developed. The batteries were ys a troublesome and important matter. At first, what was d the Sand Battery was used with zinc and copper elements sulphuric acid, but it was found troublesome and ineffective. Fuller adopted the Daniell sulphate of copper battery, and nged it in the trough form which is so well known on English ways. This battery was used until Mr. Fuller invented the romate battery, when it gradually went out of use. One of results of his early studies of batteries was the invention of the em of battery working then called the Universal battery system, which one set of cells worked a whole group of circuits. This . in later years has been greatly extended, and all large centres now worked by it. Very few of the younger generation ectrical engineers however, know, when they speak of a Common ery, that it emanated from the fertile brain of Mr. Fuller. growth of electric telegraphs as a commercial enterprise con- stantly called for new appliances, and Mr. Fuller's inventive faculties had full scope. His first patent for batteries was taken out in 1853. He invented a gravity form of manganese cell, and his leather division sulphate cell has continued to be used until last year or so. All the details of the early electric telegraph system came under his attention. Although he was not engaged laying the early submarine cables, the landlines and apparatus at the sea shore were under under his supervision. In about 1857 he assisted Messrs. Silver & Co. (the founders of the India-Rubber, Gutta-Percha and Telegraph Works Co.) in applying india-rubber to telegraph purposes. Here he designed the machines and methods for covering wire, and made vulcanite insulators, of which vast numbers were used at the time. Later, and previous to founding his own firm of electrical engineers, he assisted Mr. W. T. Henley, the submarine cable manufacturer. At this time he invented and patented the mercury bichromate battery, which is so largely adopted in all English-speaking countries, especially America. This battery came at a time when only the sulphate with its one volt was known. The bichromate cell with its 2 volts, inexhaustible quantity and economy of number of cells and space, came as a boon to all telegraph workers. But we understand that although this battery has been so largely used in America, Mr. Fuller never derived any pecuniary benefit from its use there. He had a very varied and active life, and at the age of 90 was still able to take a share in the control and management of the business of Jno. C. Fuller & Son.

MR. W. C. MARTIN.—Mr. Wm. C. Martin, senior partner of the firm of Messrs. Wm. C. Martin & Co., electrical engineers, Glasgow, died at his residence in Glasgow on Sunday morning. For the past two years Mr. Martin had been in indifferent health which militated against his giving much personal attention, either to his own or to public business, though he was out and about on Friday last. As a young man he entered the service of the Telephone Co., of London, and in 1882 took up a position with the British Electric Light and Power Co. In 1883 he went to Glasgow, and ten years later started in business for himself, identifying himself with all branches of electrical engineering. It was, however, in work aboard ship that the firm specialised, and they secured and carried through contracts for electrical installations on the Cunard liner *Mauretania* and many other liners and vessels. He was a member of the I.E.E. and of the Institution of Engineers and Shipbuilders in Scotland. For the past three years Mr. Martin served as a representative on the Town Council, where he rendered much service in connection with the tramways and electricity departments of that body.

The death occurred on Saturday of MR. THOS. DEWHURST, at Blackburn, in his 67th year. Mr. Dewhurst joined the old Magnetic Telegraph Co. in 1858, being stationed at Preston. He entered the Post Office service at the time of the transfer in 1860, and went to Blackburn as clerk in charge of the telegraph department in 1878. In 1893 he became superintendent of the telegraph department, a position he held until his retirement in 1898.

We regret to learn of the death, at his residence in Leeds, on Sunday morning, the 29th ult., of MR. J. S. MACGREGOR, permanent way engineer for Messrs. Thermit, Ltd. Mr. MacGregor, who was known to many of our readers, had been unwell for some time, and had been confined to his house for the past six months.

CITY NOTES.

B.E.T. Reorganisation of Capital.

WE recently suggested that Mr. Garcke would be well advised in taking representative shareholders in the B.E.T. Co. into the confidence of the board, and we are glad to notice, from a circular dated October 28th, which has been addressed to the proprietors, that the directors have conferred with certain representatives in regard to the scheme, which has already appeared in these columns, and upon which we have made some comments. The result of the conference between the shareholders and the directors has been productive of a modified scheme, which will be submitted for approval at the adjourned meetings to be held on November 3rd, as already arranged. It will be remembered that one of the principal defects in the original scheme consisted of the interference with the present rights of the shareholders as to equality of capital, which under the new scheme are undisturbed.

The following represents the provisions of the modified scheme :—

Each £10 6 per cent. cumulative preference share	To be exchanged for	£2 10	0	6 per cent. cumulative preference stock	No priority to capital.
		£5 0	0	7 per cent. non-cumulative preference stock	
		£2 10	0	6 per cent. preferred ordinary (non-cumulative) stock	
		£10 0	0		

Non-interest bearing income certificates it is proposed to issue to the amount of £266,371, being the arrears of dividend upon the existing preference shares. These certificates it is intended to issue to the registered holders of such preference shares on November 3rd, 1911, in proportion to the number of preference shares held by them respectively. They are to be redeemable out of the profits available for dividend and remaining in each year after payment of the dividends upon the cumulative preference and non-cumulative preference stock to the extent of an amount equal to that paid by way of dividend for that year upon the preferred ordinary stock of the company and *pari passu* therewith. The amount so available for the redemption of the income certificates is to be applied to the purchase of such certificates in the market, or by tender, in either case under par or by drawings at par.

Each £10 ordinary share	To be exchanged for	£5	0	0	6 per cent. preferred ordinary non-cumulative stock	No priority to capital.
		£5	0	0	Deferred ordinary stock entitled to all profits in any year after the cumulative preference, non-cumulative preference, income certificates, and preferred ordinary stocks	
		£10	0	0		

As we have stated on previous occasions, the possibility of any dividend for distribution among the preferred and deferred ordinaries seems to us remote, and unless Mr. Garcke can secure promotion profits and render productive the large amount of unproductive investments which the company possesses (£1,679,007), the scheme seems to be doomed to disappointment. Shareholders do not want intangible vistas or prospects, nor do they require promotion profits in preference to a steady reliable income from investments sufficient to pay a reasonable dividend upon the share capital of the undertaking.

Having regard to the transcending importance of depreciated values, and of the reserves, the only remedy appears to be that of cutting down the capital of the company in a manner equitable to the interests of the share classes concerned.

The scheme now proposed is not a remedy. As the present nominal capital of the company is £4,000,000, divided into £2,000,000 in £10 preference shares, and £2,000,000 in £10 ordinary shares, it will be seen that if the new arrangement be carried out, the capital will become :—

£500,000 cumulative preference stock.
£1,000,000 non-cumulative preference stock.
£1,500,000 preferred ordinary stock.
£1,000,000 deferred ordinary stock.

£4,000,000

Marconi's Wireless Telegraph Co., Ltd.

Mr. G. C. Isaacs presided at Watergate House, Adelphi, W.C., on Wednesday last week, over an extraordinary general meeting of the above company. The chairman having apologised for the absence of Mr. Marconi, who was abroad, said that the meeting was called for the purpose of considering, and, if thought fit, passing a resolution to increase the company's capital by 250,000 ordinary shares of £1 each, ranking *pari passu* with the ordinary shares of the company previously authorised and issued, to enable the directors to turn to the fullest account the fresh opportunities offering in this industry. In Russia, and in the East generally, there was a big field for development, and they had secured the controlling interest in the Russian Co. of Wireless Telegraphy and Telephony, which had been in existence for some two or three years, and was carrying out large contracts for the Russian Government, and negotiating for further contracts of considerable magnitude. Captain Adrian Simpson, a member of the company's staff, had been appointed managing director of the Russian company, and Mr. Marconi and he himself were joining the board. In other parts of the world they are conducting negotiations which should mature in the early future, and would require considerable financial resources. They were satisfied that the additional resources for which they asked the authority would be productive of such increased profits to the company that both the preference and ordinary shareholders would be substantially benefited. They were in active negotiation with the British Government in connection with the great scheme of Imperial wireless stations, and hoped that the near future would enable them to announce that the construction of these stations was about to be commenced. They had just received a cable from Chile informing them that their offer for the construction of a number of stations for the Chilian Government had been accepted. They had been able to arrive at a settlement of all their differences with the Lodge Muirhead syndicate, and would henceforth have the advantage o Sir Oliver Lodge being associated with their company as a scientifi adviser. By this arrangement they had broken the back of th litigation through which it was necessary for them to pass ; ther remained little more to be done in that direction in this country If the meeting approved the resolution which he woul formally submit, and if it were confirmed at the meetin summoned for November 9th next, the directors would quickl proceed to make the necessary arrangements for the issue, fixing th premium at which the new capital would be issued. Shareholde might, however, rely that these terms would provide for a reaso able substantial bonus to both preference and ordinary shareholde alike. He moved—"That the capital of the company be increas by the creation of 250,000 new ordinary shares of £1 each, to l issued on such terms and conditions as the directors think fit, suc shares to rank *pari passu* in all respects with the existing 500,0 ordinary shares of £1 each."

Major Flood Page seconded the motion.

Mr. Goodway asked if the whole of the capital was required be used at one time.

The Chairman said that was a question he could hardly answ at the present time. It must be left to the directors to do what w necessary at the time.

Mr. F. M. Davies asked if any of the capital was going to used for the practical isolation of the company's stations at Pold and Glace Bay.

The Chairman said he could best answer that question by sayi that a portion of this new capital would undoubtedly be used f creating a telegraphic service with a number of stations and un which the stations at home would undergo certain changes.

Mr. Davies said his object in asking was that he looked upon t American trade as a gold mine. He had tested the stations two consecutive days, and one message took five hours to cross a the other 30.

The Chairman said in so far as the wireless system was concern their messages went across practically instantaneously, and only difficulty they had to contend with was the landlines. T was a question which was receiving their very careful attenti and it was, of course, of very material importance. Until t could complete arrangements in connection with the landli they were unable to get any continuous or reliable improvemen the dispatch of messages so far as the landlines were concern He had received messages which came over in 50 minutes, bu depended on the landlines.

Mr. Davies said it depended on their enemies. They had a g mine in the American trade, but everything was in the hand their enemies, so far as the land wires were concerned.

Mr. Hodgson asked what proportion of the new issue woul given to the preference and what to the ordinary shareholders.

Mr. Goodway remarked that he had used the Atlantic ser and found it very satisfactory, although, of course, there were ti when messages were delayed. He found that if he sent ov message early in the morning he got a reply by six at night, they did not want anything more rapid than that.

Mr. O'Brien observed that as a London stockbroker he used system, and it was perfectly satisfactory.

Mr. W. J. Purdie said he had been in communication with a number of users of the wireless system, and in all cases they expressed satisfaction.

The Chairman said that with regard to Mr. Hodgson's ques both classes of shareholders would be in the same position.

The resolution was then carried unanimously.

An extraordinary general meeting will be held at Wate House, York Buildings, W.C., on Thursday, November 9th, the resolution passed at the extraordinary general meetin October 25th will be submitted for confirmation as a sp resolution.

Auckland Electric Tramways Co., Ltd.

The fourteenth ordinary general meeting was held on Mond the Electrical Federation Offices, Kingsway, Mr. C. G. Tegetmei the chair.

The Chairman, in moving the adoption of the report, gratulated the shareholders upon the continued progress prosperity of the company. The traffic receipts had amount £210,167, notwithstanding that there had been no increase in route mileage during the year. That £210,167 was an incre £22,754 over the previous 12 months, and showed the very figure of £9,000 per mile over the whole of their 23 route mi line. The passengers carried increased from 29 millions millions. The increased spending power of the community, this evidenced, must be ascribed to the growth and the pr of Auckland, which it had been his good fortune to refer previous occasions. With the progressive policy of the Auckland Council and the other local authorities in the development exceptional natural advantages that Auckland had been fav with, they might confidently anticipate that this growth an gress would be continued. The large increase in the traffic re had naturally been accompanied by a considerable increase expenses, and though there had been no extension of their during the year they had, in order to meet the requirements community, run a very much larger number of car-miles. expenses were undoubtedly high, a very large portion of them sisting of wages, and it had to be borne in mind that the wages, and also the cost of material in Auckland, were very

ger than we were accustomed to in this country. On the other nd, the higher scale of wages that prevailed in all industries in w Zealand was reflected in increased tramway travelling. Thus ckland, with its population of approximately 100,000, spent per head in tramway traffic, an amount which was probably r times as much as would be considered a satisfactory figure in s country. They carried the whole of the population about times in the course of the year. The profit and loss account wed that on maintenance and repairs they had spent the large n of £40.227, of which £21,880 was spent upon their rolling ck and £8.170 upon the upkeep of the permanent way. In lition, they spent a further sum of £5,339 upon renewals, the ter amount being chargeable to the depreciation account, which s created for the purpose of meeting the varying expenditure of s nature from year to year. The expenditure on renewals during year was comparatively low, but with the increasing age of ir undertaking, they must expect that item to have an increasing dency, and that they would have to meet very considerable outlay the near future. The time, of course, came when the work repairs and maintenance of plant and equipment and per-nent way had to give place to complete renewal. The cost must ne out of revenue, and it was essential that they should have umulated out of past reserves a sufficient fund to meet the enditure when the need should arise. Out of the surplus of last r they had provided for renewals in the future to the extent of 0,000, and they believed they were providing adequately for the ewals and reconstructions that would have to be carried out in ure years. With the £20,000 transferred from last year's enue, the depreciation account would stand at £58,577. The fit and loss account also included the rental and percentage of fit paid to the Auckland City Council under the deed of delega-n, amounting to £4,718. The total sum accruing to the Auck-d City Council out of the company's profits since the commence-nt of their operations had amounted to nearly £30,000, and he ught the City Council must regard it as satisfactory that that ult had been attained without any risk or outlay on their part. ir debenture and other interests amounted to £16,877, and after viding for that and all other expenditure chargeable to revenue, y had a surplus of £43,574. With the £6,073 brought forward, y had a total of £49,647 available for distribution. They pro-ed to transfer out of this sum £15,000 to the reserve d. The dividend on the preference shares required 000, and they recommended that £24,500 should be lied in the payment of a dividend on the ordinary res at the rate of 7 per cent., of which an interim dend at the rate of 3 per cent. for the year was paid last May. capital expenditure amounted to £65,148, the largest portion which was spent upon additions to the rolling stock and ensions of the power-house plant. At the date of their last ance-sheet they had 91 cars in stock. During the year they ed eight and at the close of the year 16 more cars, orders for ich had been given many months previously, were approaching pletion. In view of further requirements for the future with the possibility of similar delay, they ordered in e last 10 more cars, which were now in an advanced stage of struction. At the present date they had 111 cars in stock, and he course of a few months that number would be increased to , which represented an increase of 34 cars in less than two rs. He referred more particularly to this question of rolling k, because the Auckland City Council thought it fitting last gust to serve them with a 60 days' notice under the deed elegation of their intention to take action against the company espect of an alleged shortage of cars. They disputed that there been any shortage of cars. The extensions to their power-house it had also been of considerable magnitude. At the last meeting old them that they had ordered a 1,000-KW. set which would g their plant capacity to a total of 3,750 KW. That set was ped to Auckland some months ago, and was now probably ted and at work. That gave them ample provision for present ls and for the near future, but in view of the marked expansion he traffic, they had thought it wise to take a very liberal mate of their future power requirements, and they had placed rder for another 1,000-KW. set, which was in course of con-ction, and which he hoped would be shipped to Auckland in the se of another month or two. Another matter involving con-rable capital expenditure had been the provision of car-shed mmodation for the large increase in the number of their cars. ery extensive enlargement of their Epsom depôt had been ied out at an approximate cost of £20,000. At the last ting he referred to the Tramways Amendment Bill which been introduced by the New Zealand Government into Houses of Parliament, and which had been the subject considerable controversy. The Bill eventually became , and under its provisions very wide powers in connec-, with the operation of the tramways were vested in the ernment. They had not yet seen the regulations to be issued by Government under the Act in the form they would ultimately e, but they had no reason to anticipate that they would be of a racter to prejudicially affect the working of their undertaking. e the passing of the Act they had obtained the necessary roval of the Government to the adoption of the air brakes with ch they proposed to equip the whole of their cars, and the work nstallation had now been practically completed, at a cost of ,000. The various items of capital expenditure had necessitated raising of further capital. Their last previous issue of capital in 1909, when they placed £50,000 in ordinary shares. Since n their capital expenditure had amounted to nearly £130,000. y had been saved the issuing of capital to the full extent of r capital expenditure by using their reserve funds for the pur-e, but since the close of the financial year they had made an issue of 50.000 new preference shares. For the future they had £100,000 of debenture stock available for issue, which placed the company in a very strong financial position. The item, real estate in Auckland, appeared in the balance-sheet at £2,008. In the previous balance-sheet it was £19,601, and it consisted of freehold property known as Alexandra Park, upon a portion of which their Epsom car-shed was built, and the freehold site of their other car depôt. During the year they had sold the portion of the Alexandra Park property which was not required for the purpose of the company's business at a price which gave them a surplus of £1,761. That surplus had been transferred to the reserve fund, which now stood at £66,671. A recent valuation of the sites of their two car depôts, which formed their real estate in Auckland, showed a very considerable surplus over the amount at which the item appeared in the balance-sheet. With regard to future probable extensions of their lines, they might expect that as the outlying districts of Auckland developed, extensions would be urged upon them. The original concessions acquired by the company consisted of 18 route miles of line, the first portion of which was opened for traffic in 1902, and they had now over 23 miles of line in operation. At the present time an extension of about one mile in the Mount Albert district was being constructed, and other extensions of somewhat greater length were in contemplation. He was glad to say that the prospects for a continuance of the favourable results shown last year were good. In concluding, the chairman paid a tribute to the services of the local directors, and said that, at the request of his colleagues, he intended going out to Auckland next month to discuss the company's affairs with the local board and the general manager.

Mr. C. S. Hilton seconded the motion, and the report was adopted.

United Electric Tramways Co. of Caracas, Ltd.

Col. Ivor Phillipps, M.P., presided at the offices, Dashwood House, Old Broad Street, E.C., on October 31st, over the fifth ordinary general meeting of the above company. The proceedings were purely formal, and the report was adopted on the motion of the chairman.

The report stated that during the 12 months ended June 30th, 1911, the operations of the local company (La Compania de Tranvias Electricos de Caracas) were as under :—

	1910-11.	1909-10.	Increase.
Gross receipts	Bs.1,088,981	Bs.1,048,805	Bs.40,176
Operating expenses	627,037	603,843	23,194
Net receipts	Bs.461,944	Bs.444,962	Bs.16,982
At Ex.: Bs.25·25 to the £ ..	£18,295	£17,622	£673

After adding Bs.16,637·05, the balance of profit carried forward from the previous year, to the above net receipts for the year, providing for the mortgage interest payable to this company—viz., £10,200 (= Bs.257,550), and setting aside Bs.50,000 to reserve and renewals funds, the local company are enabled to carry forward Bs.171,031, as shown in that company's balance-sheet, of which a copy was attached to the report. The increase in operating expenses is due to the following causes :—Increased traffic, cost of improving the permanent way and rolling stock, which experience has shown to be necessary, a compensation claim for personal injury, and the higher cost of sending remittances to England. The following table of statistics compares the result of the 12 months 1910-11 with the corresponding period 1909-10 :—

	1910-11.	1909-10.	
Passengers carried	3,752,723	3,573,620	Inc. 179,103
Car-miles run..	899,867	844,905	Inc. 54,962
Percentage of operating expenses to gross receipts	57·58	57·57	Inc. 0·01
Receipts per car-mile	Bs.1·21	Bs.1·24	Dec. Bs.0·03
Operating expenses per car-mile	Bs.0·70	Bs.0·71	Dec. Bs·0·01
Number of cars	41	41	—
Miles of track..	16¼	15¾	Inc. ½

A new short branch line constructed during the year was opened for traffic in the last week of June, and the working is showing satisfactory results. In compliance with the terms of the trust deed, £900 has been placed to the sinking fund for the redemption of mortgage debenture stock, and £1,050 first mortgage debenture stock has been purchased in the market and cancelled. Mr. Wallis reports that all the company's property is maintained in first-class order, and that the prospects for the present year are very bright.

Germany.—The Berliner Electricitätswerke Gesellschaft, of Berlin, reports a net profit of £536,313 for the last financial year, as compared with £492,467 in the preceding 12 months.

London Omnibus and Railway Amalgamation.—The directors of the London General Omnibus Co., Ltd., on Wednesday provisionally sanctioned proposals for amalgamation of the company with the Metropolitan District Railway Co., and the Underground Electric Railways Co. of London, Ltd., the joint capital being £33,000,000.

Western Telegraph Co., Ltd.—After transferring £140,000 to the general reserve fund, and £10,000 to the land and buildings depreciation fund, the directors recommend a final dividend of 3s. per share, making a total dividend of 6 per cent. for the year ended June 30th, and also the payment of a bonus of 2s. per share, both free of income-tax.

Quebec Railway, Light, Heat and Power Co., Ltd.

The annual report for the year ended June 30th, 1911, of this company, which owns the whole of, or the majority of the stock of the following companies:—The Quebec Railway, Light and Power Co.; The Quebec Jacques Cartier Electric Co.; The Quebec Gas Co.; The Frontenac Gas Co.; The Quebec County Railway Co.; The Quebec and Saguenay Railway Co.; and the Canadian Electric Light Co., shows that the gross earnings for the year were $1,280,127, as compared with $1,127,952 in 1910, an increase of $152,174. The operating expenses were $661,907, as compared with $644,564 in 1910, an increase of $17,343. The net earnings were $618,220, an increase of $134,831 over 1910. After adding miscellaneous income from subsidiary companies' earnings prior to July 1st, 1910, and deducting fixed charges of $456,329, two dividends payable July 15th and April 15th, 1911, amounting to $199,990, organisation expenses of $10,681, and less sundry interest earned of $11,109, there remains a surplus of $62,329.

Quebec Railway, Light and Power Co. (City Division).—The mileage on this division has been increased 26/100 miles. Extensive repairs and renewals have been made and the roadway is in excellent physical condition. Sixteen new cars of the modern "Pay-as-you-Enter" type and 10 open bench cars of standard type were purchased and put in service during the year. Two large sweepers and two snow scrapers were also added. With the enlargement of the car barns at St. Malo, the company has now ample room to accommodate its rolling stock. Provision has been made at these barns for additions to the rolling stock and for the enlargement of these barns when rendered necessary.

Montmorency Division.—During the year the mileage has been increased by 3½ miles of double track road from Beauport to Kent House Park. This extension runs through a thickly settled district and it will be almost immediately remunerative. About two miles of main line have been re-laid with 80-lb. steel rails, the old rails taken up being used for sidings at various points. Additional tracks have also been laid in the yards at the Quebec terminal to facilitate the handling of the increasing freight traffic. The main line has been rebonded during the year with type E.A. electric welded rail bonds, which has greatly increased the efficiency and enabled the maintenance of a much improved service. The roadway is now in excellent physical condition. Forty-eight gondola freight cars, 60,000 lb. capacity; 15 box freight cars, 60,000 lb. capacity, and two passenger motor cars of standard 400 class, have been added to the equipment during the year, while one electric locomotive No. 6, constructed in the company's shops, has been in operation for some time with good results. A new sub-station has been constructed at Ste. Anne de Beaupré, and the following additional equipment installed therein:—One 500-KW. motor-generator set with exciter and transformers. A new transmission line has also been constructed from Montmorency Falls to Ste. Anne de Beaupré, and the voltage increased from 10,000 to 25,000 volts, thus effecting a considerable saving. The company's hotel at Montmorency Falls Park, known as "The Kent House," has been enlarged and refurnished throughout. A number of new attractions have been added to the equipment of the Montmorency Falls Park, and some of these have already proved profitable as well as serving to induce people to visit the park.

Quebec County Railway Co.—The construction of this railway was commenced in July, 1910, and the road opened for operation in September, 1910. The earnings of this line have fully warranted the expenditure incurred in its construction. The line runs from Maple Avenue westward through St. Cyrille Street in Montcalmville, and through private right-of-way and streets in the Municipality of St. Columba de Sillery to the top of Sillery Hill, a distance of 2½ miles, and is double-tracked throughout its entire length. The line passes in close proximity to the St. Patrick's and Mount Hermon Cemeteries, which are visited daily by a large number of people. Under agreement a through service is operated over the lines of the city division to the post office in Quebec.

Power and Light Division.—The work of consolidating the various power supplies at the Queen Street sub-station is being proceeded with. It is expected that this work will be completed in a few weeks' time, and in addition to enabling the company to utilise power from any one or all of its hydraulic stations a considerable saving in labour and other charges, will be effected. During the year a contract was entered into with the Municipality of Ste. Anne de Beaupré for street lighting for a period of 10 years, and a 10-year renewal contract for street lighting was closed with the town of Levis. A renewal for 10 years for the supply of power to the Levis County Railway was also completed at a somewhat increased price. The overhead lines have been extended in various districts to take care of the increasing business.

A feature of the financial report is the substantial increase in gross earnings of $152,174, with an increase in operating expenses of only $17,343. The various extensions, improvements and economies made during the year will only commence to bear fruit during the present year, and will be reflected in the next annual report. It is expected that the company's new office building, which is being erected in the heart of the city at the corner of Crown and St. Joseph Streets, will be ready for occupation very early in the New Year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the three months ended September 30th.

Mexican Light and Power Co., Ltd.—The daily Press states that an offer will shortly be made of £1,000,000 5 per cent. second mortgage 50-year bonds.

Sunderland District Electric Tramway, Ltd.

The sixth annual general meeting of this company was held October 26th, at Winchester House, E.C.

The Chairman (Mr. H. R. Hogg), in moving that the rep briefly mentioned in our last issue, be received and adopted, mentio that Mr. Charles Eves, chartered accountant, was appointed Rece by the Court on the suit of the prior lien and of the first mortg debenture-holders almost immediately after the last meeting, three of the directors—Mr. C. S. Cockburn, Mr. Charles Eves Mr. A. U. Green—retired from the board, leaving only two—Hon. R. Parker and himself—to look after the interests of the sh holders. It had been held by the Court that the Receiver could be appointed manager also, so the board endeavoured to meet difficulty by electing Mr. Reginald Taylor to one of the vacant s The track-miles open and in use were 16 miles. The directors formulating a scheme for the reorganisation of the company, they hoped shortly to be able to lay it before the shareholders debenture-holders for their consideration. They trusted that scheme would do away with the expensive course the Receiver now to adopt, and in the end, replace the business in the han the shareholders. As the result of strikes in the coal and ship trades, to which the work of the company was mainly restricte business had fallen off rather considerably during the past year. the board had given its sanction to the Receiver's request to more cars, and money would be required for the renewal of and rolling stock, so that, though the income on traffics improved, it would require a good deal of economising yet to ends meet.

The motion was unanimously agreed to.

Prospectus.—*The Toronto Power Co., Ltd.*—list was to close on Wednesday in an issue of £821,917 consoli guaranteed debenture stock (4½ per cent.) of the Toronto P Co., Ltd., guaranteed unconditionally, both as to principal interest, by the Toronto Railway Co. The price of issue was 9 cent. The prospectus stated:—"The present issue of debe stock is being made to provide funds required in consequence arrangement which has been effected, whereby the Toronto Ra Co. and the Toronto Electric Light Co. (the two great comp using electricity in Toronto) and the Toronto Power Co. an Electrical Development Co. (the companies which supply them electricity) have been brought under one administrative co and will in future be worked practically as one enterprise, th removing from the former companies all anxiety with reg their supply of power, and providing the latter with a d permanent market for a large proportion of their output. A tinuance of the earnings of the combined enterprises is ensured; considerable economies are being effected, and profits can be reliably estimated."

Rio de Janeiro Tramway, Light and Power Ltd.—A *Times* correspondent at Rio de Janeiro, under October 12th, writing respecting the Rio de Janeiro Tramway, and Power Co., Ltd., a Canadian company whose securities ar in England to the extent of some £10,000,000, says:—" time to time the English Press has been furnished from her reports as to the intentions of a rival concern which propo compete with the Light and Power Co. in the supply of e energy to Rio de Janeiro. Something over a year ago th that another concession similar to that of the Light and Pow had been granted by the Prefect of Rio caused some co The right of the municipality of Rio de Janeiro to make th cession was contested by the Light and Power Co., which ob from the Courts an injunction preventing its realisation. be interesting to the many shareholders of the Light and Co. to hear that a few days ago a definite decision was g this question annulling the rival concession."

Companies Struck Off the Register.—The foll companies have been struck off the register, and are accor dissolved:—

Formby and Freshfield Electric Light Co., Ltd.
Houldsworth Patent Roller Bearings Co., Ltd.
Light and Heat Exhibition (1895), Incorporated.
Macclesfield Electric Lighting and Power Co., Ltd.
Penarth Tramway Syndicate, Ltd.
Phœnix Electric Heating Co., Ltd.
Rotary Engine Co., Ltd.
Standard Turbine Co., Ltd.
Trade Exhibitions Co., Ltd.

The following companies will, unless cause is shown to t trary, be struck off the register within three months, a accordingly be dissolved:—

Aluminium Manufacturing Co., Ltd.
British Electric Co., Ltd.
Rubberite, Ltd.

New St. Helens and District Tramways, Ltd. accounts for the year ended June 30th show a profit, in £390 brought forward, of £2,622. The directors recom dividend of 2½ per cent. on the preference shares, leaving be carried forward.

Metallic Seamless Tube Co., Ltd.—At a meet the shareholders held in Birmingham on Friday, October dividend was declared of 7½ per cent. on the ordinary shares final dividend at the rate of 6 per cent. upon the preference for the year ended June 30th last.

Hobart Electric Tramway Co., Ltd.

HE report of the directors for the year ended December 31st last hows that the company's business continues to exhibit a steady xpansion under nearly all heads, and the gross revenue for the bove period amounted to £29,724, which is the largest total the ompany has yet received, and marks an increase of practically 2,000 as compared with 1909. A comparison with the gross eceipts for the year 1900 shows that the company's income has ore than doubled during the intervening ten years. For the first alf of the current year the gross receipts are well in advance of ose for the corresponding period of last year. The profit on obart working account amounted to a total of £12,361. Deduct-g therefrom debenture interest and London expenses, and adding mount on hand after payment of last year's dividend, there emains a balance to the credit of revenue account of £10,752. The ard declared a dividend at the rate of 6 per cent., free of income-x, which was paid on July 1st last. They recommend that £5,000 e now transferred to the insurance, compensation, debenture pre-ium and general reserve fund, raising that fund to a total of 10,000, and that the balance be carried forward to next year's count. An additional generator set was ordered from Messrs. emens Bros. Dynamo Works, Ltd., and has been duly installed. block of freehold land with the buildings thereon adjoining the mpany's premises in the rear was purchased for the sum of 6,095, including cost of transfer.

The annual meeting was held at 353, Mansion House Chambers, C., on Wednesday last week, the Hon. Alfred Mattei presiding.

The CHAIRMAN, in moving the adoption of the above report, said e steady growth in traffic and other receipts was still continuing. r the first 37 weeks of this year their tramway receipts amounted £21,108, as against £19,303 during the same period last year, presenting an increase of £1,805 for less than three-quarters of the ar. There was, therefore, little doubt that last year's record uld be easily beaten by the same date of 1911. Their net profit for e year on working amounted to £1,236, and after paying benture interest, &c., there was left a total for division of £8,610. ey had in addition a sum of £2,142 on hand representing divided profits brought forward from the previous year, and adding these they had a total of £10,752 to be dealt with. strengthen the position of the company they decided to commend the transfer of £5,000 to their general reserve nd, so that it would now stand at £10,000. This still left them th upwards of £5,000 to dispose of, so they felt themselves fully tified in declaring a dividend of 1 per cent. more than they did t year, viz., 6 per cent., which, with income-tax, would absorb ,562. This would leave them with about £2,200 to be carried ward to the present year's accounts It would be quite unneces-y to go on adding as much as £5,000 to their reserve every year, that even supposing the company did no better than last year, y ought soon to be in a position to consider the question of ther increasing the rate of dividend on the shares. They had the same time taken the opportunity of improving their plant, ir permanent way and rolling stock, and the expenditure of rgy per car-mile run had been reduced as compared with 1909. conclusion, the chairman referred to the desire which had been pressed at a meeting of the citizens of Hobart to acquire the mways, which question, he said, had also been taken up by the bart City Council and referred to in the Tasmanian Parliament. y proposition made to them to sell would be very carefully con-ered by the board, and if found to be of such a character as they re likely to accept, a general meeting would be called to consider matter.

MR. D. BARCLAY seconded the motion, and the report was pted.

Cuba Submarine Telegraph Co., Ltd.

E eightieth ordinary general meeting of the shareholders of the ve company was held on Wednesday last week, at the offices, Old Broad Street, E.C., Mr. George Keith presiding.

he CHAIRMAN, in moving the adoption of the report (ELEC-CAL REVIEW, page 654), said that the traffic passing over the pany's cables during the half-year had been well maintained, although the month of April showed some falling off, which ght be attributable to the early harvest, it was more than nterbalanced by the good results of some of the other months. e half-year's traffic receipts amounted to £18,554, or an increase £434 as compared with the corresponding period of 1910, while total income amounted to £20,774, or an increase of £598. On other side, the London expenses were somewhat less owing to re-arrangement of the staff, but the expenses at stations were 38 more in consequence of the increased cost of the maintenance lines, mainly due to the erection of a new cable house at Batabano, ich replaced the old one which was completely wrecked and shed away during the cyclone in October of last year. The total rking expenses came out at £6,455, or £255 more than in the responding half-year. The result of the half-year's business a profit of £14,318, out of which £2,500 had been added to special reserve against loss on investments, and £4,000 had n added to the general reserve fund for the maintenance and ewal of the company's property. After providing for the dend on the preference shares, the directors recommended pay-nt of the usual dividend at the rate of 6 per cent. per um on the ordinary shares, and increasing the balance iel forward by £19 to £7,294. The depreciation in the value of the securities was well provided for by the special reserve set aside for that purpose, and the general reserve fund now stood at £124,000. That fund would presently bear the cost of the new cable now being manufactured, which was to be laid between Cienfuegos and Cape Cruz. The vessel with the cable was expected to sail about the middle of next month, and they hoped the new cable would be successfully laid and in working order by the end of the year. The cable would re-establish direct duplicate communication between Havana and Santiago, which would ensure the efficient transmission of through traffic to and from the West Indies. Opportunity would also be taken of the vessel being at Cuba to effect some repairs to the existing cables which, when completed, would leave the company's entire system in perfect working condition. As regarded the current half-year, business generally remained quiet but satisfactory. The latest advices they had received indicated that the present sugar crop was likely to be the largest in the history of the island, and if it commenced early in December, as was expected, he thought the prospects of the company for the present half-year were very favourable.

MR. C. W. PARISH seconded the motion.

MR. ARONSON said he thought the reserve fund had been piled up sufficiently to admit of the ordinary shareholders receiving an increased dividend. He would also like to know how much of the fund would go towards paying for the new cable.

The CHAIRMAN remarked that he thought 6 per cent. was a very good dividend for the company to pay under all the circumstances, and the suggestion to increase it had been made at a very inopportune time. They were about to draw on the reserve fund to the extent of, perhaps, £40,000, and it would be the duty of the directors, while maintaining the present dividend, to try and build up the fund again to the figure at which it now stood.

The report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List :—

Para Electric Railways and Lighting Co., Ltd.—Further issue of 5,000 6 per cent. cumulative preference shares of £5 each fully. paid, Nos. 129,001 to 134,000.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last, at the rate of 7 per cent. per annum, payable on November 15th. Major-General R. H. Mahon, C.B., C.S.I., late Director-General of Ordnance in India, has joined the board of directors of the company.

Ruston, Proctor & Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, less tax, on the ordinary shares for the half-year ended September 30th.

Kaministiquia Power Co., Ltd.—The directors have declared a dividend at the rate of 3 per cent. per annum on the common stock for the quarter ended October 31st.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange certainly cannot complain this week of lack of interesting features. In many markets there is a great deal more doing, and the voice of the buyer is again heard in the land. Possibly the most sensational item of the last few days is the huge rise in London General Omnibus stock, but there have been other features of considerable public interest, and the Home Railway Market is receiving more attention than it has done for many a long day past.

Home Railway stocks were put up with a rush in consequence of second thoughts proving bullish in regard to the Railway Commission's report. Two or three small, but strong, syndicates were formed to take in hand those stocks in particular where a known bear account existed, and purchases on behalf of these groups were supplemented by a good deal of buying which, in Stock Exchange phrase, was none too good. That is to say, the buyers were punters operating simply for differences—men who at the first indication of prices slipping back rush in pell mell to take their profits. Hence, on talk by some of the Labour leaders about a "General Strike," prices came down with a run, though they have again begun to recover.

Amongst the stocks that benefited most by the boomlet in Home Rails were Brighton Deferred and Metropolitan District Ordinary. The former stock was seized upon by one of the syndicates already mentioned; the latter came into conspicuous prominence by reason of the dramatic rise in London General Omnibus stock. Bus stock has risen over 30 points in less than three weeks, going well above 150, before reverting to 145, which compares with 69 as the lowest price touched this year. The buying is said to be based upon demand from a well-known financial house in London, which wants to get control of the company in order to enter into a working agreement between it and the Tube Railway Companies, the latter guaranteeing a dividend of 10 per cent. upon the London General Omnibus stock in consideration of the company consenting

to link up with the Tubes. Some official announcement is imminent, and the point which everyone will look to with the most interest is who the guarantor of the 10 per cent. may be.

On this suggestion, District Ordinary rose 2 points last Saturday morning, but in the subsequent decline which took place upon dissemination of the idea that a general strike may even yet be declared, the price fell back again to 30¾, leaving it 4¾ higher on the week. Metropolitan Consolidated rose 2½, because obviously any arrangement that will afford substantial benefit to the District, must also be to the advantage of the older railway. Central London Deferred rose 2 points, and City and South London again put on ½ in sympathy with the big jumps in the two other undergrounds.

Naturally, the dramatic rises in Districts and Metropolitans led to inquiries for Underground Electric issues, and the company's 6 per cent. Income Bonds rose 5 points, while the £10 shares at £2 are 7s. 6d. higher.

Also in sympathy with the movements just mentioned, London United Tramways Preference rose ⅛ to 3¼. Metropolitan Electric Trams 4½ per cent. Debenture stock at 101½ is ½ up. The principal feature, however, in this department is a rise of 12s. 6d. in British Electric Traction Preference, the modified scheme of the board which was put forward on Monday bringing in a good many buyers, on the assumption that the latest scheme will be permitted to pass without any particular opposition, and that it is a fairer arrangement than the scheme originally proposed. The Ordinary shares are also harder, and the Company's Second Debenture stock at 78 *ex* dividend is 3¼ higher on the week, allowing for deduction of the interest. We think there is no doubt that the differences between the various parties who have been wrangling over the British Electric Traction scheme will now be composed; and although it is early days yet to say how the company will progress under the new construction of capital account, it is reasonable to suppose that its chances are brighter. Still the question of capital reduction must be faced, it seems to us, sooner or later, and the sooner the better.

Electricity Supply issues at home are characterised by further strength in County of London Ordinary and Preference, which show rises of 7s. 6d. and 5s. respectively. The Ordinary have risen within the last few weeks from 7 to 8½, the reason being principally the recognition of the fact that the company's management is in hands at once capable and enterprising. Moreover, the Ordinary shares have been showing a big yield on the money, and people are now turning their attention to City of London Ordinary, which this week have risen ⅛. On the other hand, Charing Cross Ordinary lost a similar fraction, the price slipping back to 3¾.

The Mexican group is decidedly strong, in regard to both the supply and tramway sections. Mexican Light and Power Common rose no less than 5½ points. An issue of 5 per cent. Second Debenture at 87 is being prepared for immediate offer. The Preference put on 2½, and Mexican Electric Lighting bonds rose 1½. In the other department, Mexico Trams are 3½ up and the 6 per cent. bonds show a gain of 1. Rio Trams put on 2 points to the accompaniment of rumours that the dividend will again be raised before very long. Sao Paulo Trams are 1 up. Electrical Development of Ontario bonds at 91 are 1½ higher. Toronto Power 4½ per cent. Debentures remain at 101, unaffected by the new issue that proved a success, the lists closing at 1 o'clock to-day, Tuesday. Shawinigan Water Capital stock is the only one in this section which has gone back. The demand for foreign railway, tramway, and industrials generally is brisk, and the activity in Home Railway stocks has not prejudiced the movement for buying foreigners. Incidentally, a little story may be mentioned of a client whose broker the other day advised him to buy London General Omnibus stock at 134. The client answered in a defiant wire: "British things no good, sell £500 'Bus." The instructions were, of course, carried out, and within a few hours the patriot found himself with a stiff loss. (There is no moral to be drawn from this.)

In the Telegraph market Marconis are still by far the most animated security, and the price rose to 2 19/16 as a result of the meeting, but reacted to 50s. later on. Great Northern Telegraphs continue to mount steadily, and are 15s. higher on the idea that the company must be coining money out of the Chinese news. Direct United States Cable lost the 5s. which they picked up last week, but the Anglo-American group is practically unchanged. A little New York selling depressed American Telephone and Telegraph stock, the news that the United States Government is about to proceed against the Steel Corporation being a nasty shock to those with money invested in American companies that might be accused in the same sort of way. Amazon Telegraphs are harder, and nobody paid any heed to irresponsible reports of a rising of the natives in the company's territory. West Coast of America eased off a trifle, though the 4 per cent. Debentures put on ½. Telephone issues are quiet. National Deferred fell ½, some of the holders getting a little quaky as the company's existence draws so near its time for expiry. The First Preference are also a little easier, but the Preferred stock is ½ higher. Monte Video Telephone Ordinary and Preference recovered their dividend deductions, and other Telephone shares are steady.

In the Manufacturing division, Babcock & Wilcox rose 3/16, despite the Cabinet changes, which are supposed to herald an era of slowing down in naval construction. Edison & Swan fell a similar fraction, because of the disappointment which we noticed last week that the company should not have declared a dividend on the Ordinary shares. Telegraph Constructions rose 20s. in sympathy with the general firmness of Telegraphs as a whole.

The Anglo-Argentine Tramways new issue of 5 per cent. Debenture stock was well subscribed, and the price has been pretty firmly established at ½ to 1 premium for cash.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Oct. 26	2,699	+ 162	21	33,490	+ 1,918	..	..
Ayr	,, 23	388	— 7	21	9,800	+ 82	8	..
Bath	,, 28	1,663	+ 86	43	36,779	+ 1,072	..	..
Birkenhead.. ..	,, 29	2,146	+ 106	30	85,177	+ 1,327	13·7	..
Birmingham Corp.	,, 21	18,470	+4,491	29	242,256	+43,892	56·4	..
Blackburn	,, 25	2,231	+ 190	30⅞	36,574	+ 3,127	14·6	..
†Blackpool Corp. ..	,, 26	538	— 14	..	54,196	+ 7,058	..	..
Blackpool-Fleetw'd	,, 28	635	— 89	17	23,450	+ 1,928	..	..
Bolton	,, 22	4,867	+ 243	30	76,105	+ 5,073	26	..
Bournemouth ..	,, 25	3,196	+ 204	30	68,052	— 916	22	..
Bradford	,, 21	10,843	+ 722	29	164,730	+11,819	56	1
Brighton	,, 29	1,783	— 18	30	34,687	+ 2,024	9·5	..
Bristol	,, 27	12,258	+1,060	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 20	494	+ 35	42	9,274	+ 86	3·65	..
Barnsley	,, 20	388	+ 36	,,	7,702	+ 554	..	..
Barrow	,, 20	620	+ 140	,,	18,696	+ 1,722	5·87	..
Devonport ..	,, 20	1,026	+ 142	,,	21,102	+ 3,057	8·85	..
Gateshead ..	,, 20	2,135	+ 40	,,	43,906	+ 2,357	11·25	..
Gravesend ..	,, 20	420	+ 14	,,	9,079	+ 292	6·5	..
Greenock.. ..	,, 20	1,457	+ 321	,,	30,772	+ 4,235	7·25	..
Hartlepool ..	,, 20	514	+ 53	,,	11,648	+ 1,038	6·72	..
Kidderminster ..	,, 20	191	..	,,	5,061	+ 288	..	..
‡Leamington ..	,, 20	352	— 76	,,	7,672	+ 401	..	..
Merthyr	,, 20	425	+ 15	,,	8,864	+ 132	2·9	..
Metropolitan ..	,, 20	17,379	+1,837	,,	372,515	+55,708	22	..
Middleton ..	,, 20	643	+ 29	,,	14,594	+ 1,187	8·5	..
Mid.Joint Com'tee	,, 20	8,474	—3,567	,,	226,045	—17,653	..	..
Oldham—Ashton	,, 20	1,203	+ 89	,,	24,305	+ 933	9·13	..
Peterborough ..	,, 20	244	+ 20	,,	5,511	+ 536	5·31	..
Potteries	,, 20	4,245	+ 292	,,	81,835	+ 7,669	29	..
Rothesay	,, 20	118	— 6	,,	9,811	+ 62	2·75	..
Southport ..	,, 20	544	+ 25	,,	13,149	+ 510	8·17	..
S. Metropolitan..	,, 20	1,615	..	,,	37,151	+ 1,917	..	..
Swansea	,, 20	2,254	+ 57	,,	48,449	+ 2,789	12·5	..
Tynemouth ..	,, 20	349	— 27	,,	11,688	+ 409	3·75	..
Weston-s-Mare ..	,, 20	126	+ 26	,,	7,957	+ 1,042	3	..
‡Worcester ..	,, 20	546	— 5	,,	12,674	+ 561	5·75	..
Wrexham ..	,, 20	214	+ 20	,,	4,316	+ 203	..	..
Yorks. Wool. Dist.	,, 20	2,173	+ 116	,,	44,569	+ 2,926	17	..
Miscellaneous ..	,, 20	419	+ 26	,,	9,084	+ 546	..	..
					..	..	11·7	..
Burnley	,, 28	2,711	+ 212	..	9,020	+ 595	6·65	..
Burton-on-Trent ..	,, 29	562	+ 45	30	40,046	+ 3,411	22·5	..
Bury	,, 30	2,425	+ 116	30	66,470	+ 5,625	..	..
Cardiff	,, 26	4,687	+ 164	26	97,120	— 97	15	..
Chatham and Dist.	,, 26	1,609	— 123	43	21,772	+ 558	9·9	..
Cork	,, 29	971	+ 6	43	54,477	+ 3,963	11·7	..
†Croydon	,, 27	1,698	+ 17	28	6,648	+ 639	..	..
†Darlington.. ..	,, 21	216	+ 2	30	8,245	+ 632	4·36	..
Darwen	,, 27	529	+ 29	30	8,268	+ 1,228	4·75	..
†Dover	,, 29	222	+ 15	29	110,899	+10,831	54·2	..
Dublin	,, 27	10,851	+ 379	..	28,085	— 714	15	..
Dundee	,, 25	2,249	— 101	23	33,605	+ 1,713	7·9	..
East Ham	,, 28	2,102	+ 3	30	11,024	+ 809	5·5	..
Exeter	,, 27	646	+ 19	30	413,959	+28,426	98	..
Glasgow	,, 28	40,220	+3,816	..	..	..	..	..
Hastings	,, 30	1,706	+ 13	..	60,426	+ 6,618	29·5	..
Huddersfield ..	,, 28	3,785	+ 185	30	87,895	+ 4,441	14·5	..
Hull	,, 28	6,154	+ 651	30	4,085	+ 80	..	..
Ilkeston	,, 26	288	— 9	30	14,215	+ 819	10·5	..
Ipswich	,, 28	781	+ 23	30	3,955	+ 336	4·25	..
Kilmarnock.. ..	,, 21	378	+ 8	23	58,466	+ 1,889	39	..
Lancashire United	,, 25	2,621	+ 123	43	223,356	+14,863	108	..
†Leeds	,, 21	7,410	+ 486	29	..	..	..	..
Leicester	,, 28	4,958	+ 318	..	16,376	+ 1,147	8·7	..
Leith..	,, 28	1,082	+ 61	23½	481,800	+14,504	116	..
Liverpool	,, 21	23,288	+ 839	42	1,282,915	+79,621	141·6	..
‡L.C.C.	,, 18	87,191	+1,697	..	285,186	+ 9,256	..	..
London United ..	,, 28	11,400	— 322	..	757	— 26	3·5	..
Lowestoft	,, 28	359	+ 2	4	494,846	+26,772	188	..
Manchester	,, 28	32,460	+1,409	30	130,524	+ 9,866	14·5	..
Newcastle	,, 28	9,027	+ 994	..	21,162	+ 863	14·5	..
Newport	,, 21	1,318	— 22	29	60,845	+ 2,615	28·75	..
Oldham	,, 29	3,838	+ 207	31	12,673	— 33	5·5	..
Pontypridd	,, 28	826	+ 9	30	71,376	+ 6,098	15·25	..
Portsmouth.. ..	,, 21	3,914	+ 148	29	24,062	+ 1,820	..	..
Preston	,, 25	1,502	+ 3	30	20,668	+ 1,683	12	..
Rotherham	,, 26	1,365	+ 85	29⅝	145,712	+ 6,547	..	..
Salford	,, 28	9,636	+ 339	29	200,212	+12,847	40	..
Sheffield	,, 31	12,940	+ 748	31	88,748	+ 4,861	22	..
Southampton ..	,, 25	2,235	+ 223	30	24,671	+ 3,515	..	..
Southend-on-Sea ..	,, 25	1,046	+ 107	30	19,515	+ 2,048	..	..
South Shields ..	,, 28	1,161	+ 27	30	4,950	+ 550	..	..
Swindon	,, 25	323	+ 27	..	9,221	+ 1,251	..	..
Tyneside	,, 25	1,085	+ 199	17	94,816	+ 5,106	..	..
Wallasey	,, 28	1,984	+ 174	39	23,965	+ 1,678	9	..
Walthamstow ..	,, 28	1,324	— 24	30	80,181	+ 7,276	15·25	..
West Ham	,, 19	5,312	+ 269	29	80,174	+ 1,880	25	..
Wolverhampton ..	,, 25	1,924	+ 105	30				
Cen. London Rly...	,, 28	10,143	—1,281	17	77,270	—14,028	6·32	..
City & S. Lon. Rly.	,, 29	6,599	+ 149	17	52,774	— 53	7·26	..
Dublin-Lucan Rly.	,, 27	236	— 16	17	2,793	— 48	7	..
G.N. and City Rly.	,, 28	2,986	+ 54	17	23,600	+ 482	3·5	..
L'pool Overh'd Rly.	,, 29	2 848	+ 106	..	25,970	+ 1,370	6·8	..
Llandudno-Col. Bay	,, 27	315	— 1	47⅛	14,718	+ 556	..	..
London Elec. Ry. Co.	,, 28	27,920	+1,715	17	208,800	+ 5,805	21·21	..
Mersey Railway ..	,, 28	4 020	+ 49	17	32,014	— 1,494	4·5	..
Metropolitan Rly.	,, 29	88,920	— 227	17	277,774	— 5,852	24·6	..
Met. District Rly.	,, 28	28,400	+1,080	17	184,086	+ 8,126	24	..
Anglo-Argentine ..	,, 28	97,152	+3,128	..	2,097,198	+184,428	..	..
§Auckland	Sept.	15.905	+1,310	3	48,872	+ 8,617	28·8	..
Bombay (B.E.T.) ..	Sept. 29	5,989	+ 592	39	111,171	+ 6,798	..	..
§Brisbane	August	24,650	+2,700	8	163,520	+18,725	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 28	8.451	+ 2,337	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	20·4	..
§Kalgoorlie, W.A...	Sept.	3,691	..	..	31,528	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Oct. 15	1,489	+ 48	..	28,141	+ 2,840	..	..
§Montevideo ..	Sept.	23,246	+1,886	11	278,519	+16,540	..	..
Perth (W.A.) ..	Oct. 27	3,415	+ 684	..	69,288	+15,672	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Oct. 31st.	Rise + or Fall —	Present Yield p.c. £ s. d.
urnemoutb & Poole, Ord. .	10	5⅓	5†	7¼— 8¾	..	6 5 9
Do. 4½ % Pref..	10	4½	4½	8¾— 9¼	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10¼— 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
ompton & Kensington, Ord...	5	10	9†	7⅞— 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞— 7⅝	..	4 7 6
ntral Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
aring Cross, West End & City	5	5	5†	3½— 4	— ⅛	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 4⅞	..	4 12 4
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	3¾— 4½	..	5 5 11
Do. Do. 4 % Deb... ..	100	4	4	94 — 98	..	4 1 8
elsea, Ord.	5	5	4†	3⅞— 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
y of London, Ord.	10	7	6†	12½— 12⅝	+ ⅛	5 10 11
Do. 6 % Cum. Pref.	10	6	6	11¾— 12¾	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
unty of Durham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
unty of London, Ord... ..	10	5	4†	8⅛— 8⅞	+ ⅜	5 14 3
Do. 6 % Pref.	10	6	6	11 — 11½	+ ¼	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb. ..	Stock	4⅛	4⅛	99 —102 xd	..	4 8 3
mundson's, Ord.	5	Nil	Nil	⅜— ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	82 — 85	—1	5 5 11
lkestone	5	6	6†	4½— 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
ve	5	9	8†	6¾— 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6⅝— 7½	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Eleo. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electrio, Ord.	3	2	.	1⅝— 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½— 4⅝	..	6 3 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3½— 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	100 —105	— ½	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½— 87½	..	4 0 0
Midland Electrio Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½— 4	..	5 0 0
Do. 5 % Pref., Non. Cum. ..	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	8	6†	..	..	..
Oxford	5	7½	6†	6⅛— 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	..	1⅜— 1⅝	..	Nil
South London, Ord.	4	5	..	2⅝— 3	..	6 13 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref...	1	7	7	1 1/16— 1 1/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord...	5	5	..	½— 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord, ...	5	10	10†	7⅞— 7¼	..	6 7 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅞— 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

elaide, 6 % Pref.	5	6	6	5⅛— 5⅜	..	5 6 8
lcutta, Ord.	5	8½	..	6⅞— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
lgary Power, 1st Mort. Bds.	100	5	5	96½— 98½	+ ½	5 1 6
nadian Gen. El. Com. ..	$100	7	7†	107 —110	+1	6 7 3
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
rdoba Lt., Power and T., Ord.	1	3	..	23/32— 27/32	..	3 11 1
Do. 5 % Deb.	100	5	..	93 — 96	+1	5 4 2
ec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
ec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
ec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90½— 91½	+1	5 9 3
lgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16— 1/16	..	Nil
Do. 6 % Pref.	1	6	6	1/16— 1/16	..	8 14 6
ministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	+ ½	4 16 2
dras, Ord.	5	..	.	2⅝— 3⅛	..	..
lbourne, 5 % 1st Mort. Deb.	100	5	5	96 — 98	+1	5 2 0
rican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	+ 1½	5 11 1
rican Lt. & Power, Common	$100	4	4†	91½— 93½	+5½	4 5 7
Do. 7 % Cum. Pref.	$100	7	7	107 —109	+2½	6 8 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power ..	$100	7	8	177 —182 xd	+ 1	3 16 11
Nortbern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	34 — 36	..	13 17 10
River Plate, Ord.	Stock	10	.	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	118 —120	—1	3 6 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103½—105½	..	4 5 4
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	Nil	11⅞d.	32/32— 33/33	— 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½—108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

azon Telegraph	10	Nil	..	7¾— 8⅛	+ ½	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
erican Telep. & Teleg., Cap.	$100	8	8†	137 —139	—1	5 15 1
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
glo-American Telegraph ..	Stock	3¾	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110¼—111½	— ¼	5 7 10
Do. Def.	Do.	30/-	..	26 — 26½	..	5 13 2
glo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
ili Telephone	5	7	..	6⅞— 7⅛	..	4 18 3
mmercial Cable, Stlg. 4% Deb.	Stock	4	4	86½— 88½	..	4 10 5
ba Telegraph	10	6	6†	10 — 10¾ xd	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18 xd	..	5 11 1
rect Spanish Telegraph, Ord.	5	4	4†	3½— 3⅔	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8⅝— 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
rect United States Cable ..	10	4½	..	7¾— 8¼	— ¼	5 9 1
rect W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½—101½	..	4 8 8
stern Telegraph, Ord. Stock	Stock	7	5†	136 —139	..	5 0 9
Do. 8½ % Pref. Stock.. ..	Do.	3½	3½	83 — 85	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	101 —103 xd	..	3 17 8
stern Extension	10	7	5†	13½— 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
st and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
bbe Telegraph and Trust ..	10	5⅞	6	10½— 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12¼— 13⅜	..	4 9 9
eat Northern Telegraph ..	10	18	5†	31½— 32½	+ ¾	5 9 11
lo-European Telegraph ..	25	13	5†	56 — 58 xd	..	5 12 1
ckay Companies Common ..	$100	5	5†	87 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	73 — 76	..	5 5 3
rconi's Wireless Telegraph	1	5	..	2 7/16— 2 9/16	+ 1/16	..
Monte Video Telephone, Ord. ..	1	6	6	1⅝— 1 11/16xd	+ 1/32	5 12 11
Do. 5 % Pref.	1	5	5	1⅝— 1 11/16xd	+ 0d.	5 6 8
National Telephone, Pref. ..	Stock	6	6†	103½—105½	..	5 13 9
Do. Def.	Do.	6	6†	117½—119½	— ½	5 6 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾— 10¼	— ⅛	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾— 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16— 5 7/16	..	4 9 11
Do. 8½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do.	4	4	99 —101	..	3 19 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	103 —104	..	4 6 7
Oriental Telep. and Elec. ..	1	8	..	1 3/32— 1 5/32	..	4 16 7
Do. 6 % Cum. Pref.	1	6	6	1 3/16— 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5†	9 — 9½	..	4 4 3
Submarine Cables Trust ..	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16— 7 7/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 5/16— 1 5/16	— 1/16	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98½—100½	+ ½	3 19 7
West India and Panama Teleg.	10	1½	..	2¼— 3	..	2 10 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜— 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	6†	13⅜— 13⅞	..	5 0 11
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	105½—108½	..	3 13 9
Do. 4½ % Fdg. Bonds.. ..	$1000	4½	4½	99 —102	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 31st.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅜ — 1⅝	..	Nil
Do. 6 % Pref.	10	1½	1½	1¼ — 4¾	+ ⅜	3 3 2
Do. 5 % Deb.	100	5	5	93 — 96	+2	5 1 2
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 80 xd	+3¼	5 12 6
Central London Railway, Ord.	100	3	3†	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	+2	3 16 11
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1¾†	31 — 32	+ ½	4 13 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102 xd	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	7/16 — 1½	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅜ — ⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	3 — 3½	+ ⅛	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 31st.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol.	100	1⅛	2†	43½ — 44	+2½	3 2 6
Do. Surplus Lands	100	2½	3†	65 — 67	+1	4 2 1
Do. 3½ % Deb.	100	3½	3½	88 — 90	..	3 17 9
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	30½ — 31	+5	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101 xd	—1	3 19 3
Do. 4½ % First Pref.	100	3½	4½†	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5½	5†	27/32 — 31/32	..	5 12 4
Do. Def.	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100½—102½	+ ½	4 7 10
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Potteries, Ord.	1	2	..	7/32 — 11/32	..	..
Do. 5 % Pref.	1	5	5	2/32 — 3/32	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	⅜ — ⅞	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 7/16 — 2⅛	+ ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	64 — 66	+5	1 10 4
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅛ — 2⅜	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 1

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 3/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4⅜ — 4⅝	..	5 2 7
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 8 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	100 —102	+½	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	7 — 7⅛ xd	+ 1/16	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	142 —146	+1	5 9 7
Do. Pref. Ord.	100	6	6	121 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108½—111½	..	4 9 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103	..	4 5 4
Calcutta Trams, Ord.	5	6	..	5⅜ — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	..	7/16 — 5/8	..	Nil
City Buenos Aires Trams (1904)	5	5	2½†	5⅝ — 5¾	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98 xd	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	⅜ — ⅝	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Elec. Trms, Prf.	1	6	6	23/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼ xd	+1/32	4 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16
Do. 5 % Deb.	100	5	5	96 —100	..	5 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 92	..	5 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0
Mexico Trams Com.	$100	7	7†	121 —123	+3½	5 13
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19
Do. 6 % Bonds	100	6	6	100½—102½	+1	5 17
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 — 7⅜	..	6 15
Do. 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅜ — 1⅝	..	2 7
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5¾	— ⅛	5 9
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9
Rio de Janeiro Trams	$100	4½	5†	118½—119½	+2	8 15
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	..	4 17
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 3
Sao Paulo Tram, Lt. and P.	$100	10	10†	181 —186	+1	5 7
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 13
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95⅛ — 97⅛	..	5 2
Un. Elec. Trams Monte Video	5	6	7	5⅝ — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 5
Do. 5 % 1st Deb.	100	5	5	99 —102 xd	— ½	4 18
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	..	4 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/32 — 11/16	..	Nil
Do. 6 % Pref.	1	9	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	26	24†	15/16 — 1 5/16	+ 3/16	4 8 6
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	1	10	8†	6½ — 7¼	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6½	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4¾	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	¼ — ⅜	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —102	+1	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	7/16 — ½	..	Nil
Do. 7 % Pref.	2	Nil	..	⅜ — ⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9⅜xd	..	7 13 10
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3 7/16 — 3 9/16	— 1/16	4 18 3
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10
Dick, Kerr	1	5	..	3/32 — 7/32	..	5 14
Do. Pref.	1	6	6	15/16 — 1 1/16	..	5 12
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	..	3/32 — 1/32	—1/32	N
Do. fully paid	5	Nil	..	1¼ — 2¼	..	N
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5
Electric Construction	2	Nil	2½†	1/8 — 3/16	..	6 13
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7 4
Greenwood & Batley, Pref.	10	7	7	7¾ — 8¼	..	8 6
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	9 — 9½	..	5 5
Do. Deb.	100	4	4	86 — 91	..	4 7
Henley's, Ord.	5	15	10†	11⅞ — 12⅜	..	5 15
Do. Pref.	5	4½	4½	4 7/8 — 5 1/16	..	4 5
Do. Deb.	100	4½	4½	106½—108½	..	4 3
India-Rubber, G. & T.	10	10	..	13½ — 15½	..	6 5
Do. Pref.	10	5	5	9¼ — 10⅜	..	4 10
Telegraph Construction	12	20	10†	36 — 38	+1	6
Do. Deb.	100	4	4	100 —102	..	3 15
Willans & Robinson	1	Nil	..	3/32 — 5/32	..	N
Do. Pref.	5	Nil	..	¼ — ⅜	..	N
Do. Deb.	100	4	4	55 — 65	..	6 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

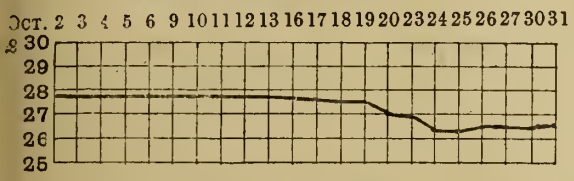
The yields are in all cases calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

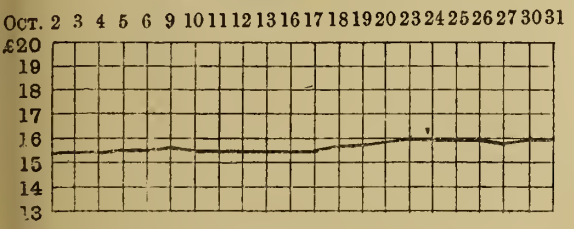
METAL MARKET.

Fluctuations in October.

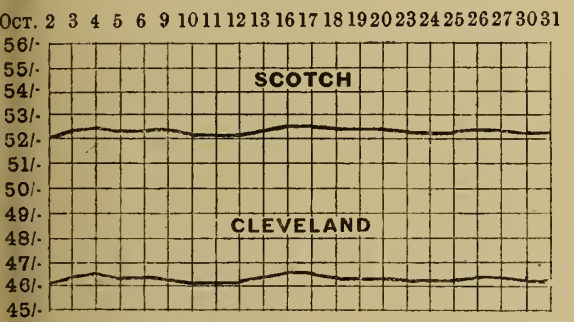
SPELTER (G.O.B's.).



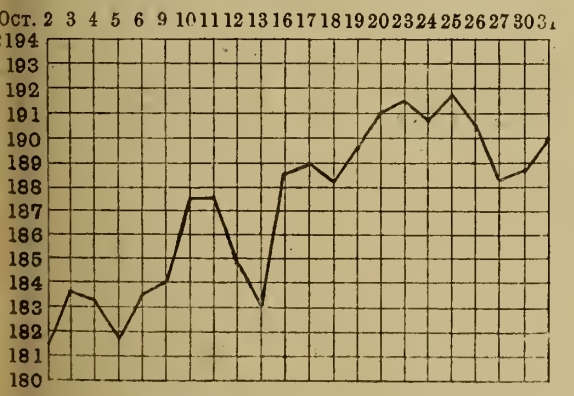
LEAD (ENGLISH).



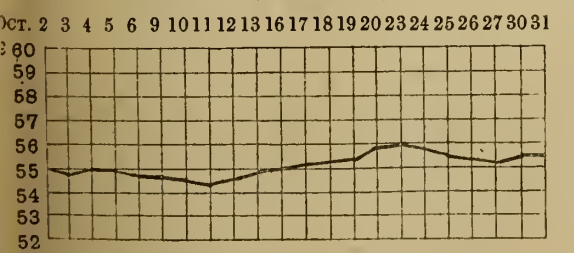
IRON.



TIN.



COPPER (G.M.B's.).



Warrington Electricity Supply.—The Electricity Committee considered a letter from the Lancashire County Bridgemaster with reference to the supply of electric current for the working of the proposed new Sankey Canal Bridge, and decided to reply that the Committee was not prepared to undertake the working of the bridge, but offered to provide cables and power for that purpose on rent by the County Council of the usual charges. When the matter came before the Warrington T.C., Alderman Smethurst said the County Council had never shown any favourable disposition towards Warrington, with regard to the building of the bridge, and he did not see why Warrington should come to its aid. The T.C. supported the Committee in this decision.

PROCEEDINGS OF INSTITUTIONS.

Corrections for the Effects of Atmospheric Conditions on Photometric Flame Standards.

By W. J. A. Butterfield, F.I.C., J. S. Haldane, M.D., F.R.S., and A. P. Trotter, M.Inst.C.E.

(Abstract of a paper read at the Meeting of the International Photometric Commission at Zürich, July, 1911.)

The effects of variation of the pressure, degree of humidity and vitiation (deficiency of oxygen and excess of carbon dioxide) of the atmosphere on the luminous intensity of flames cannot be determined from the variations naturally occurring in an ordinary photometric testing room, except, perhaps, by deduction from the data obtained in a very prolonged series of observations made with exceptional care concurrently with extremely accurate determinations of the composition of the air. The investigation may be carried out in a much shorter space of time and with greater trustworthiness if the observations are made in a room or chamber provided with means by which one set of conditions may be varied at will to any desired degree, almost or wholly independently of the other two sets of conditions. The authors have made the investigations, of which the results are reported in this communication, in such a room or chamber.

Use was made of a steel compression chamber, designed primarily for physiological research on "caisson disease" or diver's palsy and mountain sickness, which had been presented to the Lister Institute of Preventive Medicine by Dr. Ludwig Mond, F.R.S.

A small electric lamp was used as a standard.

An Osram lamp intended to give 10-candle power at 10 volts was tried, and was supplied by six accumulators controlled by an adjustable resistance. But a comparison with the pentane lamp showed that the colours of the lights differed too widely to make accurate photometry possible until the light of the electric lamp had been reduced to about one candle. It was hoped that a metallic-filament lamp thus used would have an enhanced "life," or, in other words, would vary less by ageing than if worked at 10 candles. But the result was disappointing.

In the second series of experiments, a large battery being available, a Fleming-Ediswan photometric lamp standard was used, giving 10 candles at 60·05 volts with 0·7577 ampere. This gave no difficulty.

The procedure followed in making the testings led ultimately to corrections being deduced, all of which were independent of the work or formulæ of other observers.

The experiments made to determine the corrections for variations of atmospheric pressure were all carried out in the steel compression chamber. The range of variation of pressure for the

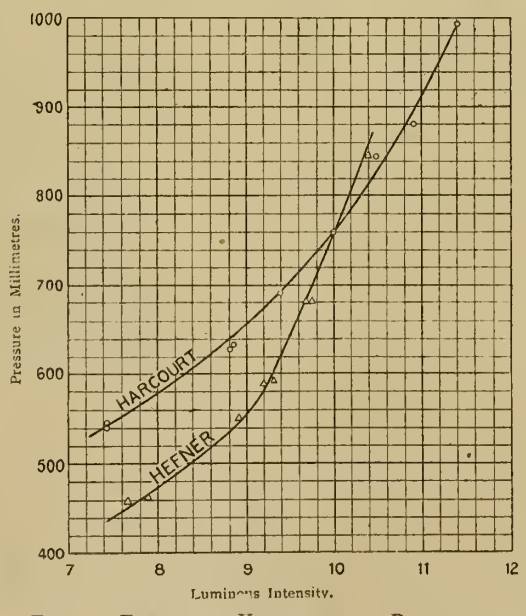


Fig. 1.—Effect of Variation of Pressure.

observations was from about 450 to 1,000 mm. (or from about 17¾ to 39½ in.). The results of the observations were ultimately corrected for the variations in the proportions of aqueous vapour and of carbon dioxide in the air, and the corrected figures thus obtained have been plotted, and give the curves shown in fig. 1. The curves show that the relation between atmospheric pressure and the yield of light is not constant or expressed by a straight line. The falling-off in the light with reduction of pressure is much greater at the lower than at the higher pressures.

The curve for the Harcourt lamp is, however, nearly a straight line for the range of 700 to 850 mm., and shows that within these limits the light increases or decreases by 1 per cent., with an increase or decrease respectively in pressure of 12·5 mm., or that a variation of 10 mm. in pressure is attended by a variation in the same sense of 0·8 per cent. in the light afforded by the lamp. These figures agree exactly with the correction deduced by C. C. Paterson, which may, therefore, be accepted as correct for

variations of pressure at about the neighbourhood of normal. In regard, however, to the effect of variations of pressure elsewhere, the authors have failed to find a rational equation to the pressure curve for the Harcourt lamp, and prefer to give the curve of the differential coefficient (shown in fig. 2) rather than an empirical formula. By the use of this curve, the correction which should be applied to the Harcourt lamp for barometric variations at any place at which the mean barometric height is considerably below 760 mm. may be deduced.

The curve for the Hefner lamp is likewise nearly a straight line for the range of 700 to 850 mm., and shows that within these limits the light increases or decreases by 1 per cent. with an increase or decrease respectively in pressure of 25 mm., or that a variation of

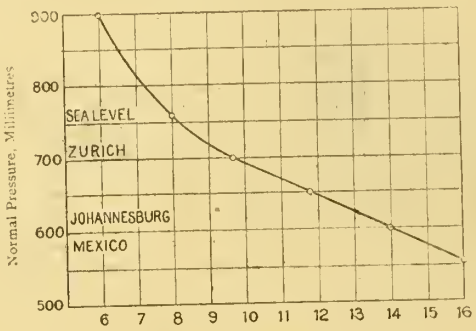


Fig. 2.—Curve of Correction Factor.

10 mm. in pressure is attended by a variation in the same sense of 0·4 per cent. in the light afforded by the lamp. These figures differ from the correction deduced by Liebenthal from observations of the variation of the light of the Hefner lamp, caused by the natural fluctuations of the barometer between 735 and 775 mm., according to which a variation of 10 mm. in pressure is attended by a variation of only 0·1 per cent. in the light. Paterson mentions that he found for 10 mm. variation in pressure 0·2 per cent. variation in the light.

The authors ascertained the proportions both of aqueous vapour and of carbon dioxide in the air during the observations, and applied corrections to eliminate their effects, while the greater range of barometric change which they had at their disposal reduced the effect of unavoidable errors of observation on the final result. For these reasons, they believe that their figure of 0·4 per cent. should now be accepted in preference to Liebenthal's 0·1 per cent. for the effect on the light of the Hefner lamp of a change of 10 mm. in barometric pressure in the neighbourhood of 760 mm.

The experiments made to determine the effect of variations in the humidity of the air on the light afforded by flames were carried out partly in the steel chamber already described and partly in a small room at the Electrical Standards Laboratory of the Board of Trade.

Sets of observations on the Harcourt lamp showed that a change in the temperature *per se* of the air from 8° C. to over 20° C. had no definite effect on the light afforded. The results showed that the light of both the Harcourt and Hefner lamps decreases by 1 per cent. for an increase of 0·16 per cent. in the aqueous vapour in the air, or that an increase of 1 per cent. in the aqueous vapour in the air is attended by a decrease of 6·25 per cent. in the light of the lamps. Liebenthal found 5·5 per cent. for both lamps, while Paterson has found 6·6 per cent. for the Harcourt and 6·0 per cent. for the Hefner lamp, as the decrease in the light caused by 1 per cent. increase in the aqueous vapour in the air.

Experiments to determine the effect of diffcrent degrees of vitiation of the atmosphere on the light afforded by flames were made. Taking the proportion of carbon dioxide in the air as the sole measure of vitiation caused partially by breathing, but mainly by combustion of paraffin hydrocarbons or town gas, it was found that 1 per cent. decrease in the light of the Harcourt lamp was caused when approximately 0·035 per cent. of carbon dioxide was present in the air, and in the light of the Hefner lamp with 0·045 per cent. Or the presence of 0·01 per cent. of carbon dioxide in the air was attended by a reduction of 0·29 per cent. in the light of the Harcourt, or of 0·22 per cent. in the light of the Hefner lamp.

General Formulæ for Corrections.

The corrections found for the Harcourt and Hefner lamps may be applied thus:—

Let A = the accepted normal percentage of aqueous vapour in the air.

Let C = the accepted normal percentage of carbon dioxide in the air.

" P = the accepted normal pressure of the air in millimetres.

" a = the prevailing percentage of aqueous vapour in the air when the lamp is in use.

" c = the prevailing percentage of carbon dioxide in the air when the lamp is in use.

" p = the prevailing pressure of the air when the lamp is in use.

Then the actual light (I′) of the lamp at the time, expressed in terms of its light (I) in normal conditions will be found with sufficient accuracy for all practical purposes from the equations:

For the Harcourt lamp:—

$$I' = \frac{100 - \left(\frac{a - A}{0{\cdot}16} + \frac{c - C}{0{\cdot}035} - \frac{p - P}{12{\cdot}5}\right)}{100} \text{ I.}$$

For the Hefner lamp:—

$$I' = \frac{100 - \left(\frac{a - A}{0{\cdot}16} + \frac{c - C}{0{\cdot}045} - \frac{p - P}{25{\cdot}0}\right)}{100} \text{ I.}$$

The Mechanical Installation and Upkeep of Permanent Way on Railways.

By T. J. Gueritte, B.Sc., M.Soc.C.E. (France).

(*Abstract of paper presented to the* Society of Engineers (In*September*, 1911.)

Thanks to the progressive policy of the Great Western Railway trial has lately been made of the system of mechanical permane way construction which has been in use in France since 1903. T system was devised by M. Albert Collet, M.Soc.C.E., of Paris.

The method can be employed without the least interruption traffic on railway lines already in use, another important adv tage being that the ballast is so thoroughly compacted that tra can be run at full speed on the track immediately after the ope tion of packing, thus avoiding delay during the period of a w or more in which trains are required to slow down when pass over sections that have been repacked by hand labour. It is worthy of note that the mechanical packing is far more last than that effected in the customary manner.

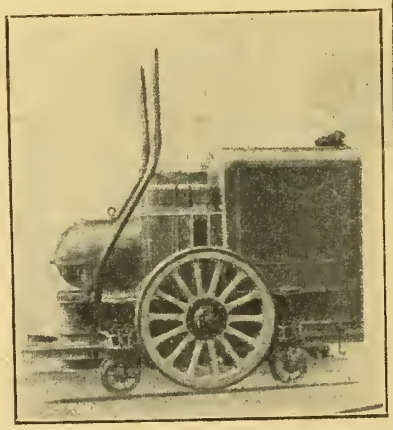
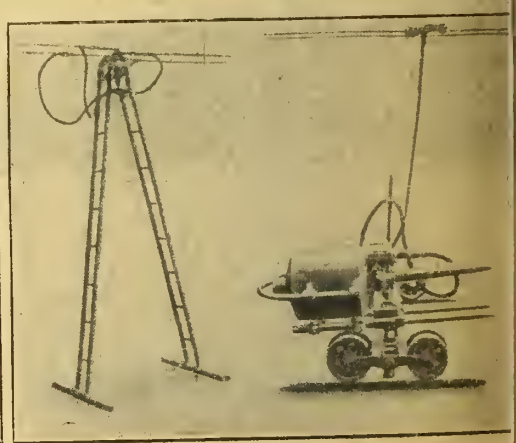


Fig. 1



Figs. 2 and 3.

The Collet plant includes a portable electrical generating s series of standards with power transmission cables, and a var number of machines operated by electricity and supplied current from the cables mentioned. The machines are place sequence, conformably with the successive operations required performed. They are drawn along the railway line as work ceeds, and as they consist of small units they can readily be l and removed from the tracks, to avoid interference with traffic

The electricity generating set (fig. 1), which is mounted u carriage provided with shafts and wheels for traction by roa with small flanged wheels for travelling on rails, includes a p internal-combustion motor of from 23 to 45 H.P., according t extent of the installation, direct-coupled to a dynamo of co ponding power, which gives continuous current at 240 volts. tanks are included, one for petrol and the other for wate storage capacity being sufficient to ensure continuous workin the period of from 5 to 10 days without recharging. A w cooling apparatus is fitted between the petrol motor and dyn and all working parts are hermetically closed by an airtight hood. Provision is made for transverse motion as an alter to longitudinal movement along the railway lines. A l apparatus, akin to a screw jack, is fitted to the carriage, and aid of a crank one man can cause the entire plant to rest upon the large wheels or upon the small flanged wheels, the being mounted so that they can be rotated on their axes throu angle of 90°.

ne of the movable standards for carrying the power transmission es is shown in fig. 2. Each standard carries 165 ft. of cable posed of two high-conductivity copper wires of 7/32 in. diameter. tension of the transmission line being controlled by the rest at the top of fig. 2. Insulation loops are fitted as shown in the e view, and the current traverses the support through by-pass es.

ny required number of standards are set up and connected by e at distances of 165 ft. apart, in order to provide for operating

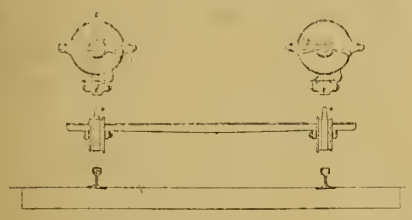


Fig. 4.

mechanical plant, and it has been found that two trained men install 4,100 ft. of transmission line in one day.

ach of the machines employed for boring sleepers, drilling , inserting bolts and screws and packing ballast is operated n electric motor of 5 H.P., mounted on a small bogie and ished with a trolley for the collection of current from the transmission cable. By adopting a standard type of able motor for the various machines, maintenance is simplified, the number of spare parts to be kept in stock is reduced to a imum.

g. 3 is a photographic view of a motor, in which the driving t is shown broken off. The trolley collects current from the smission line, the cable takes current to the switch close to the

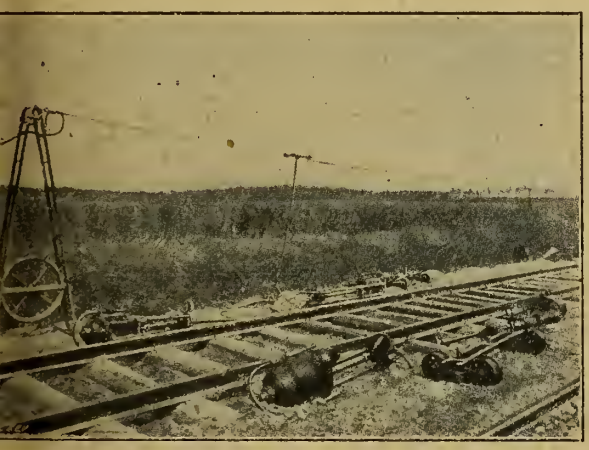


Fig. 5

or, by which is driven the shaft connected at the other end with machine to be driven. The underframe, on which the motor is nted, has a step bearing receiving the supporting pivot of the e. The latter is formed of two articulated pairs of ball-bearing els connected by a cross frame enabling the two pairs of wheels e spaced conformably with the gauge of the railway track. It be noticed that as the various machines are employed in pairs, for each line of rails, the complete bogie carries two motors, as esented in fig. 4.

ach motor is fitted with arms by which it can be readily d from the supporting pivot, while the bogie carriage can also

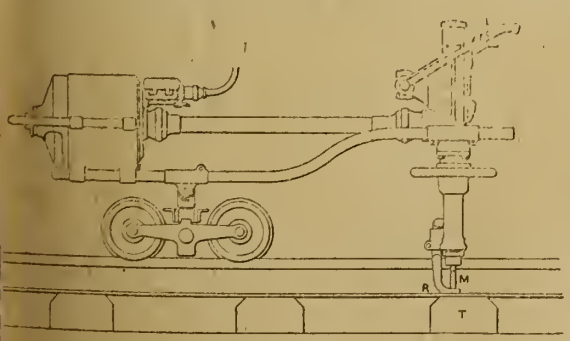


Fig. 6.

lifted from the track without difficulty. This is a very ortant point, as it is absolutely necessary on railways already in ice that the line shall not be obstructed. As each motor only ghs 3 cwt., and the bogie weighs 2 cwt., the work of taking all machines out of the way can be performed quickly, and they be just as easily put back and again set to work. It takes about minute thus to clear the line.

Fig. 5 shows the track cleared for the passage of a train, the generating set and the power transmission line being already off the track but in close proximity thereto.

Fig. 6 is a view of the boring machine, connected with the portable electric motor by the horizontal driving shaft. The apparatus is designed for boring holes in sleepers when clamped either to the rail, as in fig. 6, or to a chair, and any inclination can be given to the boring spindle to suit requirements. The tool M penetrates the sleeper T to a depth governed by the stroke of the lever L; the spindle rotates at 1,500 R.P.M., and the hole is bored in two or three seconds in the hardest varieties of timber. The apparatus is capable of boring about 250 holes an hour. Fig. 7 represents the machine used for inserting and extracting screws and bolts. The frame C, carrying the motor and screwing machine, is balanced on the supporting pivot of the bogie carriage, and the universal joint K ensures the requisite mobility, enabling the head of the screw to be engaged even when presenting itself

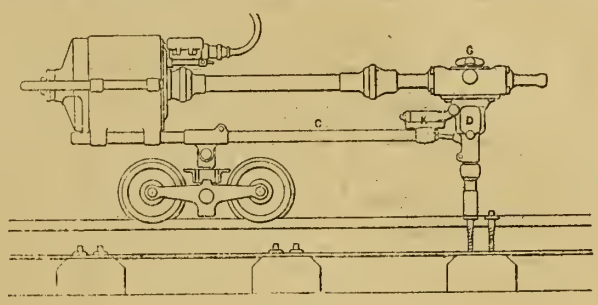


Fig. 7.

obliquely. The hand wheel G provides for reversing the direction of rotation so that the operations of screwing and unscrewing may be performed at will.

This tool develops considerable effort, so as to overcome the resistance of bent or rusty screws, and in order to prevent injury to the fibres of the timber an automatic release D stops the work as soon as any screw is driven home. The machine is operated at 550 R.P.M., and by its aid 500 screws can be inserted or extracted per hour. The weight of the head is 1 cwt., and of the complete apparatus, including motor and bogie carriage, 4 cwt. 3 qrs.

Fig. 8 shows a most useful machine employed for drilling holes through the web of double-headed rails. In this case only one machine is used on the track instead of one machine on each rail as before described. The machine is supported on the pivot P of the bogie carriage, and can be swung round for operation on either rail. It is clamped by the device shown at H, the drill F being fed by the hand wheel V. The twist drill runs at 200 R.P.M., and is capable of making 40 holes per hour, or about 10 times the number that can be drilled by a workman with a hand ratchet drill. The machine weighs 1 cwt. 21 lb., or 5 cwt. 14 lb. complete with motor and bogie carriage.

The machine for packing ballast is the most important of the various machines included in the plant. It consists essentially of a small ram actuated by the alternate compression and release of a powerful spring; the shaft rotates at 400 R.P.M., compressing a spring equivalent to a weight of 440 lb., enclosed in the head, the ram making 400 blows per minute. The machines are usually employed in two sets of four on either side of the sleepers, the in-

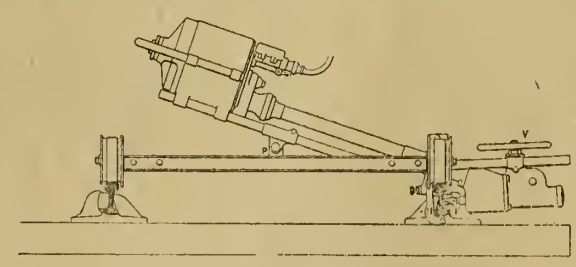


Fig. 8.

clination of the ram being such that the ballast can be compacted beneath the sleepers to form a sound and lasting foundation. Experience shows that absolute uniformity of the filling is secured throughout the whole length of the sleeper, and that the solidarity of the rammed material is so remarkable that trains can be allowed to travel at full speed on the track immediately after the completion of ballasting.

The output of two sets of four machines averages from 60 to 100 sleepers per hour, according to the thickness and nature of the stratum of ballast.

Adzing machines are made which can deal with from 1,000 to 2,000 sleepers per day of 10 hours. The cut is made by a high-speed milling cutter, which avoids marking and injury to the wood caused by the tools used in adzing machines of the usual fixed type.

An adzing machine also has been designed for re-adzing sleepers in cases where nothing would be gained by removing them from the track.

The process of re-adzing occupies only from 5 to 10 seconds, while a man with hand tools usually takes from 5 to 10 minutes to do the work imperfectly.

Other very useful appliances have been used with much advantage in conjunction with the permanent-way machines previously

described, and mention may be made of the workshop van, which is intended to accompany as closely as possible the mechanical railway plant, providing accommodation for the storage of spare parts and for workmen engaged in repairs.

The method has definitely passed the experimental stage, as shown by the fact that although it was only first applied in a tentative way as recently as the year 1903, the total length of railway track which has been laid and relaid by means of the mechanical plant described now amounts to more than 1,300 miles.

Institution of Post Office Electrical Engineers.

On the 16th ult., Major W. A. J. O'Meara delivered an address at the opening meeting of the session of the Metropolitan Centre. After referring to the impending transfer of the National Telephone Co.'s business to Post Office control, and the possibility, therefore, of a substantial increase in the membership of this Institution, he dealt with the education or training of engineers and the value of degrees, quoting Sir William Ramsay's remark before the British Association: "In England, we have made technical education a local, not an Imperial, question. Instead of half-a-dozen first-rate institutions of University rank, we have a hundred . . . . and the training given is not that for captains of industry, but for workmen and foremen."

He said that the fallacious idea prevailed far too widely in this country that the functions of an engineer corresponded to those of a foreman, and it was in the interests of, and should be the aim of, engineers to remove this wrong and sometimes mischievous impression. There were, it was true, "quack" engineers in this world, as there were "quack" doctors, but with this distinction, that while the medical profession had secured legal protection against "quackery," such protection had not, unfortunately, been secured by the engineering profession. A great amount of injury had been done, and was still being done, by "quack" engineers, and he considered that some system of registration should obtain; before a young man was admitted to practice as an engineer he should be required to submit some suitable proof of his qualifications for the profession. This raised the question of the value to be placed upon the possession of scientific degrees, a subject upon which there was a marked division of opinion. It seemed to him that what the commercial world was looking for was something in the nature of a hall-mark indicating the quality of the probable practical efficiency of the embryo engineer. The employer really desired that the student turned out from our educational establishments should bear some mark which would indicate not only the amount of his theoretical and practical knowledge, but also his real power to apply this knowledge to the work which the young engineer might be called upon to undertake, rather than a degree indicating examination-room performances. The requirements for the degrees conferred under the present system were largely based on considerations more limited than those in the contemplation of the manufacturer or other employer, and it was not surprising, therefore, that so much disappointment was felt in commercial circles with the degrees which were being so liberally bestowed, and which, necessarily, were almost wholly granted in respect of academic attainments of a certain order. The solution of the difficulty could be effected if for the present requirements for a degree there could be substituted some means for marking down a man's qualifications in such a way as to include not only his theoretical knowledge, but also his ability to apply it readily and effectively in a mundane organisation, in which it must be recognised that human beings, and not the materials used, constituted the factor of prime importance. In condemning the system under which degrees were granted, it was necessary to guard against the danger of a wholesale condemnation not only of the system itself, but also of all those on whom these degrees were conferred. Until the present system was modified, it seemed to him that the degree must be accepted as an indication mainly of certain scholastic attainments, and that the employer must himself be content to undertake the task of assessing the value of the personal and practical qualities of each aspirant engineer. Everyone who had any knowledge of the practical side of engineering fully recognised that owing to the advances which had been made in recent times, and to the large sums of money involved in engineering schemes, it was more and more necessary that the proper class of young men should be drawn into the profession; he was persuaded that no surer way to do this existed than that of properly appreciating the status and the value of the work of engineers. Sir James Inglis, doubtless, had this matter in mind when, some three years ago, in his Presidential Address before the Institution of Civil Engineers, he pointed out how important it was that the engineering work in Government Departments should be entrusted only to highly trained engineers. It was to be hoped that at no distant date his views on this subject would be very widely shared by all those in the highest authority.

If a full recognition of the status of engineers was to be secured, not only must each individual engineer display adequate professional and general knowledge, but the whole body of engineers must also actively co-operate to obtain the creation of a governing body to effect an efficient control over their profession, and thus to protect adequately their own interests and those of the public generally.

Wilton Works Electrified.—The factory of the Royal Carpet Co. has been fitted with an electrical installation by the British Westinghouse Co

THE ELECTRICAL CONGRESS AT TURIN.

(*Continued from page 723.*)

Section VII. (Accumulators, Electrometallurgy, &c.).—On September 13th Sig. Remo Catani opened proceedings with his paper on "The Direct Production of Steel from Ores by means of the Electric Furnace." The author first points out the advantages of the electric furnace over more complex methods, and describes the Stassano, Harmet, Chaplet-Néo, Lash, and Roechling-Rodenhauser methods, giving figures showing comparative yields. The conclusions come to are not, however, very definitely in favour of the electric furnace,

On the same day Dr. Guggenheim read his paper on "The Relative Yields of the principal Induction Furnaces employed in Steel-making." The furnaces taken are the Kjellin, and the Roechling-Rodenhauser. It was a scientific paper.

The proceedings on September 15th were opened by the reading of Dr. Erlwein's paper on "Electrical Methods of Purifying Water." The author notes the Webster and Hermite methods of direct hydrolysis, and Kellner's hypochlorite system, also that of Siemens and Halske. He then describes ozonising systems and the use of ultra-violet rays and compares the two systems from the points of view of economy and effectiveness. This paper was very well illustrated. While it seems hardly to do justice to the importance of purification by hypochlorites of sodium and magnesium, or to touch upon the later forms of apparatus it is valuable as giving particulars of the methods of using Cooper-Hewitt lamps for the purpose.

Sig. Luigi de Andreis followed with his paper, "The Sterilisation of Water for the Aqueduct of Rovigo." This is a description of a De Frise ozonising plant laid down for the town of Rovigo, which considered it necessary to sterilise the water derived from the Adige and the Po in flood times. In this installation a Diesel engine (35 H.P.) is employed. The voltage of the current used for the discharge is 7,000 volts at 900 periods per second.

Herr von Recklinghausen followed with his paper on "Sterilisation of Water Supplies by Ultra-Violet Rays." The author shows how, in company with Messrs. Heraeus and Helbronner, he studied the effects of these rays upon bacteria, and announces the installation of sterilising works on this system at Isle-sur-Sorgne. Saint Malo and Amiens have also decided to adopt it for their water supply. In the discussion, Sig. de Andreis inquired if the destruction of the bacteria was traceable to the action of ozone. Messrs. Erlwein and Recklinghausen replied that no trace of ozone could be detected in the water leaving the sterilisers.

The reading of the Accumulator papers is not recorded in the *Bulletins* of the Sessions. Dr. Beckmann's paper was on "The Position of Stationary and Portable Accumulators in the Electrical Industry." This is a comprehensive *résumé* of the various uses to which accumulators are put on lighting and traction systems, as well as on automobiles and for train lighting.

M. J. A. Montpellier's paper on "Alkaline Iron-Nickel Accumulators" describes the Edison and Gouin types. He estimates the iron-nickel accumulator as capable of giving 8 to 20 watt-hours per kilogramme of weight, as against the lead accumulator's five or six.

Section VIII. (Taxation, Legislation and Charges).—The first paper taken in this section was that of Mr. E. Ericsson on "Legislation on the Transmission of Electric Energy." In this paper the leading features of the laws on the subject in all countries are touched upon, forming a very useful work of reference. The author concludes that little legislation is better than too much.

Mr. Barnet Lyon followed with a paper identical in title and containing a similar *résumé*. The author favours the system of a central advisory Committee, something on the lines of those under French and Swiss Law.

Dr. Schreiber's paper, "Legal Enactments on the Generation and Distribution of Electricity in Austria," was read in abstract by the secretary. From this paper it would

pear that Austria suffers (if that be the correct term) m too little legislation on the subject. Dr. Schreiber's per is a timely effort in the direction of seeing that the le does not start out, in the usual manner, on a career of inite complication.

On September 13th M. Sartori contributed his paper on The Load Factor." This paper runs briefly through the merous uses for electrical energy and goes also into the estion of charging. At Lausanne, it appears, a tariff is force which sells at a varying rate according to the time day and the time of year. A double meter is in use, ich is very little more complicated than an ordinary ter for two tariffs. This is not described, but given a iable instrument of this kind, this certainly seems an cellent method of flattening the peak.

M. Mario Bonghi then gave his paper on "A Comparative udy of Direct and Indirect Taxation on Electricity in rious Countries." This paper points out that direct xation prevails only in Spain, Italy and Germany. Of ese, the Italian tax is the heaviest. M. Boughi proposes, a basis for the new law in process of discussion, that the ce charged, and not the kilowatts or candle-power, be a sis of taxation, thus encouraging hydro-electric enterses.

On September 15th, Sig. Ponti read his paper on Rational Methods for the Commercial Measurement of ectricity." This paper advocates keeping the loadtor principally in view in framing tariffs. The paper was y well received.

Dr. Arno's paper (alluded to by Sig. Ponti), entitled "A Solun of the Problem of Buying and Selling Electrical Energy," cluded the proceedings in this section. The paper alludes he system of double measurement which takes into account power factor, and charges for energy at a varying tariff ordingly. This system does not, however, appear to take o account the mistrust of the consumer towards a system which he can understand very little, or the possibilities of reased expense in the testing of such a meter. The meter ve advocated, changing the tariff for different times of the , is much more comprehensible to the user.

(To be continued.)

THE STANDARDISATION OF MOULDED COMPOSITIONS USED IN HE MANUFACTURE OF ELECTRICAL MACHINERY AND APPARATUS.

By HAROLD D. SYMONS, A.M.I.E.E.

OULDED compositions now play quite an important part the insulation of electrical apparatus. There are, how-r, so many different materials on the market that where thing like a large use of them is made it becomes irable to standardise them into various classes.

The manufacturers of such materials, for commercial sons, designate them by trade names, prefixing by letters numbers the grade or quality having certain properties. e number of products that may be classed under the term moulded compositions" is now large, and the selection of e suitable for any particular purpose is more frequently termined by the physical and mechanical conditions it ust fulfil than by its electrical properties. Whilst slight ferences in physical and mechanical properties exist with ferent compositions, the methods of manufacture and gredients may be so varied that it is quite possible for ferent manufacturers to produce materials to meet any ven conditions without infringing patent rights. The ection of a material for any given purpose therefore quires discrimination and careful judgment, for though ppliers are generally prepared to give results of tests, the ade name is no guide in determining the characteristics of material, and it becomes essential to judge the merits of mpositions for individual cases.

This may, of course, be largely reduced by submitting to nufacturers the qualities desired, but these are frequently ficult to define, and samples are submitted in shape and form quite unsuitable for test. Where anything like an extensive use of moulded compositions for widely different purposes is made, this entails considerable work, and the author ventures to put forward a classification which has produced not only a great saving in time, but the elimination of failures due to the use of unsuitable materials.

Whilst moulded compositions may be sub-divided broadly into two classes, viz., those used for insulating purposes, and those used as arc-proof materials, numerous occasions arise where the material must not only be a good insulator, but withstand the action of an arc in a moist situation without deterioration. These conditions are very severe, but frequently occur in practice; this general classification, therefore, is not sufficiently discriminating to be adopted for standardisation purposes, and further sub-division must be made adequately to meet all conditions. It affords, however, a "broad" outline, and modifications in the physical properties required, in the class used for insulating purposes, afford the other satisfactory subdivision.

The standardisation is based entirely on the properties required, and is quite independent of the ingredients or process of manufacture.

The definition of mechanical properties is difficult, for they can, as a rule, only be specified in general terms; in the classification, however, conditions that the finished pieces must fulfil have been included, which will indicate the strength of the material.

Class 1.—This class will not be adopted for directly insulating voltages higher than 500, but must have a dielectric strength of not less than 5,000 volts for a thickness of $\frac{1}{10}$ in. The material need not be arc-proof, but should not be easily damaged by an arc or readily burn. It must be impervious to moisture, unaffected by cold mineral oil, and not soften below 70° C. The material must be sufficiently tough and hard so that no moulded piece shall be in any way damaged by falling from any position, by its own weight, through a distance of 4 ft., on to a stone or brick floor. Moulded pieces containing metal parts should withstand a fall of 2 ft., without the metal portion becoming loose or seriously cracking the material.

Class 2.—This material will be used for insulating voltages up to and including 3,000, and must have a dielectric strength of not less than 20,000 volts for a thickness of $\frac{1}{4}$ in. The material must not be greatly damaged by an arc and must not support combustion. It shall be unaffected by water, dilute acid and alkali, and impervious to mineral oil at 50° C. The softening temperature shall not be less than 100° C., and the material shall be so hard and tough that no moulded piece shall be in any way damaged by falling from any position by its own weight through a distance of 6 ft. on to a stone or brick floor. Moulded pieces containing metal parts shall withstand a fall of $2\frac{1}{2}$ ft. without the metal portions becoming loose or seriously cracking the composition.

Class 3.—This material will be used for insulating voltages up to 3,000, and must have a dielectric strength of not less than 20,000 volts for a thickness of $\frac{1}{4}$ in. The material need not be arc-proof, but must not be greatly damaged by an arc and not support combustion. It shall be entirely unaffected by seven days' immersion in water, dilute acid and alkali, and be impervious to mineral oil at a temperature 10° C. below the temperature at which it commences to soften. It shall be quite unaffected by temperatures lower than 130° C., and not soften below 150° C. The material shall be so hard and tough that no moulded piece shall be in any way damaged by falling from any position by its own weight through a distance of 10 ft. on to a stone or brick floor. Moulded pieces containing metal parts should withstand a fall of 4 ft. under similar conditions without the metal portion becoming loose or seriously cracking the composition. Besides withstanding these tests, the material shall be sufficiently tough and hard to allow a machine-cut thread to be made without difficulty and to take a high friction polish.

Class 4.—This material will not be used for directly insulating voltages higher than 1,000, but must have a dielectric strength not less than 5,000 volts for a thickness of $\frac{1}{10}$th in. It shall withstand the action of an arc without softening and not support combustion. It shall be moisture-proof and, preferably, impervious to mineral oils. It must be unaffected by temperatures lower than 100° C., and shall be sufficiently tough and hard to be sawn, drilled or turned, though it need not be so tough as to take a machine-cut thread.

Class 5.—This material may be used for directly insulating voltages up to 3.000, and shall have a dielectric strength of not less than 20,000 volts for a thickness of $\frac{1}{4}$ in. It shall not soften at less than 100° C., must be entirely waterproof, and, preferably, unaffected by dilute acids and alkalis. It must be capable of taking a high friction polish, which should be permanent, and, preferably, unaffected by oil. The material shall be sufficiently hard and tough for any moulded piece to fall by its own weight from any position through a distance of 6 ft. on to a stone or brick floor, whether containing metal portions or not, without fracture or undue damage. It need not be arc-proof, or non-inflammable, though it should not support combustion.

Class 6.—This material will not be used primarily for insulating purposes; it must be absolutely non-inflammable, and withstand the action of an arc without softening or crumbling. It need not be impervious to moisture, acids or alkalis, but it is desirable that

the material should not readily absorb oil. The material must be sufficiently hard and tough for any piece to fall by its own weight from any position through a distance of 2½ ft. on to a stone or brick floor without cracking or undue damage. It must be capable of being sawn and drilled without cracking ; the colour is immaterial.

The foregoing classification will meet nearly all conditions arising in practice, and any exceptional conditions that must be met will naturally be outside any general standardisation.

The following indicates the types of pieces the different classes are suitable for :—

Class 1.—In general, this material will only be suitable for small pieces, and will not be adopted for pieces containing any large metal parts. Such pieces as bushes and insulating caps not exceeding 2 in. diameter, small handles, small terminal blocks, knobs, plugs and push buttons will be included in this class.

Class 2.—This material is suitable for large bushes, terminal blocks and pieces that are called upon to withstand rather rough handling, or required to insulate rather a high voltage.

Class 3.—This material is suitable for washers, spools, large bushes and any piece that must withstand compression. The composition that will meet this specification will be mechanically almost equal to vulcanised fibre and have higher insulating properties.

Class 4.—This material is suitable for small switch and circuit-breaker bases, insulating partitions between circuit-breakers on switchboards, and almost any purpose requiring material in sheet form. In general, the properties of materials in this class render them suitable only for flat pieces.

Class 5.—This material is suitable for switch handles, terminal plugs, for use on switchboards and pieces that must withstand much handling in service.

Class 6.—This material is suitable for arc shields and division plates.

The different materials can be tested and allocated to one or more of the classes for convenience in purchasing. It will be seen that materials that will meet the conditions of Class 2 would be suitable for Class 1, but the grading has been established with due regard to the question of cost, and a material to meet the conditions required by Class 2 will be higher in price than a material satisfactory for Class 1. The range of materials suitable for Class 1 is greater, and the pieces that it is possible to use it for have not to withstand the conditions Class 2 is designed to meet. In designing pieces it is well to consult suppliers' lists of standard products, for in some cases a slight modification in design will enable a manufacturer's standard piece to be adopted, and the expense of a mould saved.

The desired finish, whether dull or polished, and the colour should always be definitely specified.

With regard to the testing of moulded composition pieces there is need of considerable standardisation, for the results obtained are affected considerably by the method of test. The suggested standardisation also renders it necessary to modify slightly the tests for each class, but some tests may be universally adopted for all classes. So far as the dielectric strength is concerned, it should be clearly understood that the value specified shall be the minimum obtained, and the test may be made either on a sheet of the material or on a moulded piece with the electrodes placed in any position most convenient for obtaining a breakdown.

The dielectric strength test shall be made on the material as received, except in special cases as hereafter dealt with, and not after immersion in water or any other fluid. Only in cases of necessity, where the surface leakage is so considerable as to prevent a breakdown value being obtained, shall the dielectric strength test be made with the sample immersed in oil. Should the diclectric strength be very close to the minimum specified, the surface should be thoroughly freed from any varnish treatment and the test repeated. It is essential that the material itself shall not be dependent on any surface treatment for the insulating properties required. Insulation resistance measurements, except in rare instances, are not of great value. When such a test is made it should be carried out with the same precautions as have been suggested for testing the dielectric strength. Insulation resistance measurements are sometimes of value in indicating the amount of absorption of water or moisture, but the difficulty of obtaining samples of different materials in such a form as to enable comparative tests to be made led the author to abandon this test as a general one.

Testing the capability of a material to withstand the action of an arc is a test the result of which it is very difficult to define satisfactorily. Whatever conditions are adopted, identically the same method in every detail should always be used. A convenient method for conducting this test, adopted by the author, is to set two ½-in. diameter copper rods horizontally at such a distance apart that the air gap will break down at about 10,000 volts ; the sample is then placed with a distance of ½ in. between its surface and the top of the rods ; the voltage is raised till an arc is struck between the ends of the rods, and this is maintained for 30 seconds ; the apparatus used must be the same for every test, and be so arranged as to protect the arc from draughts. A material suitable for Class 6 should withstand this test without softening, crumbling or cracking. The extent to which the other classes will withstand the action of an arc can only be judged by comparison.

Absorption tests, by immersion in water, acid, &c., are, of course, affected considerably by the size and shape of the piece and the length of time of immersion. The following outlines a standard method of test that is practicable, and gives accurate and comparative results :—

The sample should weigh approximately 25 grammes, and the dimensions of the piece should be such that the maximum length (or maximum outside measurement) shall not be greater than one and a-half times the minimum breadth (or minimum outside dimension). Any surface treatment should be removed before test. To judge whether a material is moisture-proof, immersion for 24 hours is sufficient, but where it is essential that the composition should be absolutely impervious to water, immersion should be continued for not less than three days, and may be maintained for 10. Superfluous water should, of course, be removed, and the sample should be weighed immediately on removal from the water.

Material suitable for Classes 2, 4 and 5 should absorb less than half of 1 per cent. during 24 hours' immersion, Class 3 less than 1 per cent., and Class 6 preferably less than 12 per cent., but may absorb 25 per cent. during 24 hours. Class 3 should in seven days absorb less than ·2 of 1 per cent.

The effect of acids and alkalis can be judged by immersion in dilute solutions. Whilst different materials are affected differently by different acids, it is desirable to standardise solutions, and immersion in N/10 solutions of sulphuric acid and sodium hydrate for 24 hours will render all tests comparable, provided the same precautions with regard to the shape and size of the sample outlined for the water absorption test be adopted.

All these absorption tests should be made at temperatures between 15° and 20° C. The effect of oil on a material can be judged by immersion in the same way, except that immersion in cold oil should be for not less than seven days at the end of which time there should be no discoloration or softening of the material. A sample that must withstand hot oil should withstand immersion for six hours at 10° C. lower than the temperature at which it commences to soften without any tendency to become soft or spongy. The size, shape and weight of the piece should be the same as for the other absorption tests, though it is often so difficult to remove the last trace of oil from the surface that no accurate increase in weight can be taken.

The softening temperature is one that is very difficult to determine accurately, and it is essential that a standard method of test be adopted and always employed. A convenient method is to suspend a ¾-in. cube in which a hole has been drilled, and a thermometer bulb inserted, in a small heater, and raise the temperature at the rate of 10° C. per hour. Such a gradual increase in temperature allows the material to become heated throughout its mass, and the thermometer accurately records the temperature of the material. Moulded compositions vary so greatly in their behaviour under heat that the examination for softening is difficult ; the softening of a material tested as suggested may be judged by fair pressure of the thumb and finger any tendency to tackiness or softening is defined as "the temperature at which softening commences," and for practical purposes may be considered as the softening temperature.

A more difficult method of determining the behaviour of this class of materials under heat is to obtain rings of standard dimensions, place them under the pressure of a definite weight, and raise the temperature to a given maximum figure in a given time, allowing to cool under the same pressure, and measuring the amount of distortion in diameter. Whilst this test, carefully carried out, gives co-

parative figures, it is difficult to obtain some materials in a form suitable to allow of the test being made, and also the method by which the piece tested was formed affects the result.

Whether a material is inflammable or not is a matter for personal judgment, but in the suggested classification where material has been defined as "must not support combustion," it is intended to allow that though it may burn when held in a flame, it shall not continue to do so on removal, which is reasonably non-inflammable for ordinary purposes.

Tests for mechanical properties have been specified in the classification, and for all practical purposes these meet requirements. Comparative figures may be obtained by making small beams of the composition of standard cross-section, which are tightly held in a clamp at one end, and weights are gradually added to the other end until the piece is broken. The method of manufacturing the material and pieces, however, affects the result. Chemical examination is of service in judging the ageing properties of a material.

From the foregoing remarks on tests, &c., many modifications as to methods will suggest themselves, but sufficient has been written to form a basis for standardising according to individual requirements.

Strain insulators for tramway and railway work have been omitted from this standardisation, as these require a separate classification altogether.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE Canadian Pacific Railway has recently acquired water powers on the Adams River in British Columbia, which will probably be utilised in connection with the electrification of sections of its line in the mountains. The available power is said to be about 100,000 H.P. altogether. A proposal is on foot to combine several electric street railway lines, so as to result in a scheme reaching from Toronto to Detroit, a distance of about 220 miles.

Water power exists in almost every part of the Dominion, and nearly every week one sees announcements of some new developments being undertaken in one province or another. In some places, where plenty of power is available, the only obstacle to its use is lack of any surrounding population, but judging from the manner in which new towns are springing up and the amazing rate at which, according to the recent census returns, existing towns are growing, this state of things will remedy itself in due time.

An example of some of these increases in population will be of interest in this connection as British manufacturers are striving, and not unsuccessfully, for a share of the trade which results from such increases. In the last 10 years the number of inhabitants of—

Calgary, Alberta,	has risen from	4,097	to 43,736
Vancouver, B.C.	,,	27,000	to 100,333
Brandon, Manitoba	,,	5,620	to 13,837
Sidney Town, N.S.	,,	9,909	to 17,617
Lachine, Quebec	,,	5,561	to 10,778
Montreal, Quebec	,,	267,730	to 466,197
Ottawa, Ontario	,,	59,928	to 86,349
Port Arthur, Ontario	,,	3,214	to 11,216
Moose Jaw, Saskatchewan	,,	1,558	to 13,824

Not all towns, of course, show such phenomenal growth, but the fact remains that Canada's population is rapidly increasing, and owing to the enormous natural wealth of the country, in everything that goes to satisfy human requirements—food, minerals, timber, power, &c.—she will continue to attract ever-increasing numbers of people for many years to come.

It is good to see that the unwearied efforts of the ELECTRICAL REVIEW to waken up British firms to the possibilities of trade here, are at last bearing fruit in no unmistakable manner. In picking up Canadian engineering papers to-day, one feels almost at home among the numerous British advertisements, so generously are these scattered through their pages.

British competition, too, is evidently making itself felt here. Only a few days ago the writer was asking a prominent member of the staff of one of the largest electrical manufacturing firms in this country for a few items of interest for this column, and he was met with words to this effect :—"Don't send any more news of contracts pending to England than goes there at present; we are getting quite enough competition lately from that quarter, as it is."

Such a remark is pleasant to hear, as it clearly shows that the home firms are to be reckoned with in spite of having to contend with both freight and duties. There is no doubt that the representatives of many British firms have come to stay, and it should be noted here that good workmanship, quick and (more important still) certain, delivery, which are greatly appreciated, are qualities attributed at present to such firms. It is to be hoped that the standard now set will not be lowered.

EARNINGS AND HOURS OF LABOUR OF WORKPEOPLE IN THE UNITED KINGDOM.

THE Board of Trade recently issued a report (Cd. 5,814), being the sixth volume of a series dealing with the results of an inquiry as to the earnings and hours of labour of workpeople engaged in the metal, engineering and shipbuilding trades in 1896. The earlier volumes have dealt with textile, clothing, building and woodworking, public utility and agriculture. The present one covers information respecting 744,557 persons out of the estimated aggregate number of 1,500,000 persons employed. Of those for whom returns have been obtained we would note the following numbers :—Engineering and boat-building, 368,552 ; electrical, telegraph, &c., apparatus, 14,770 ; wire drawing and working, 8,185 ; scientific instruments, 1,760. Of the 744,557 workpeople regarding whom returns were received, 67·5 per cent. were time workers and 32·5 per cent. piece workers.

While we would commend the expenditure of the sum of 2s. to each of our readers who may be interested in economics or statistics, we now present a brief selection of the figures of chief interest to our readers.

The following table gives the average earnings of men of and above 20 years of age returned as working full time in the last pay week of September, 1906, together with the percentage number of such men whose earnings fell within the undermentioned limits :—

Industry.	Under 20s.	20s. and under 30s.	30s. and under 40s.	40s. and under 50s.	50s. and under 60s.	60s. and above.	Average earnings for full time.
Engineering and boiler-making ...	9·1	32·9	38·4	13·8	3·7	2·1	32s. 5d.
Electrical, telegraph, &c. apparatus	3·1	35·2	33·9	19·5	5·5	2·8	34s. 7d.
Wire drawing and working	7·1	30·6	26·9	19·2	12·0	4·2	35s. 7d.
Scientific instruments	1·2	17·0	47·5	24·0	7·2	3·1	36s. 10d.

We have not dealt above with iron and steel, or with tin-plate workers, but would mention that 12·3 per cent. of the men engaged in the manufacture of iron and steel earn £3 per week and upwards. In the tin-plate industry, 13·0 per cent. earned £3 per week and upwards. At the other end of the scale must be mentioned 18·2 per cent. engaged in tube-making, earning less than £1 per week. For this last named industry, the average full-time earnings for a man are 28s. 3d.

It should be explained that "men" means male wage-earners of 20 years of age and upwards. The average earnings of lads and boys, women, and girls (*i.e.*, females under 18), for the four special trades mentioned, were as follows :—

Industry.	Lads and boys.	Women.	Girls.	All workpeople.
	s. d.	s. d.	s. d.	s. d.
Engineering and boiler-making	9 7	13 1	8 2	25 11
Electrical, telegraph, &c. apparatus	10 7	14 1	8 9	23 7
Wire drawing and working	11 5	13 2	7 3	26 4
Scientific instruments...	9 6	12 8	6 9	26 7

The foregoing, it must be remembered, are *full time*, and make no allowance, on the one hand, for broken time, or on the other hand, for overtime. Some trades are naturally intermittent in their

demands, and some men, therefore, may work for more than one employer.

An interesting table sets out the changes in the average wages, 1886—1896. Where comparison is practicable, we have the following figures for adult male wage-earners for a full-time week in each of these two years :—

Industry.	Average earnings for full time. 1886.	1906.	Percentage increase.
	s. d.	s. d.	
Pig-iron	26 6	34 7	30·5
Tin-plate	33 5	42 0	25·7
Engineering and boiler-making	25 9	32 5	25·9
Ship and boat building and repairing	29 3	35 11	22·8
Railway carriage and wagon building	25 2	30 9	22·2

The following table sets out the hours of labour (exclusive of meal time and overtime), together with the average number of holidays per annum in each of the four special trades mentioned :—

Industry.	Average number of hours constituting a full working week.	Average number of holidays per annum.
Engineering and boiler-making	53·1	13·7
Electrical, telegraph, &c., apparatus	52·4	11·2
Wire drawing and working	54·8	9·6
Scientific instruments ...	52·6	11·5

Some very interesting details, which space prevents our giving even in abstract, deal with the manufacture of pig-iron and the good remuneration of certain grades of metal-workers. The detailed figures relating to each industry give the variations in payment of different grades of labour in different districts, while other tables show the monthly variations in aggregate number employed in 1906 as well as the wages paid in each month. Yet other tables analyse in greater detail the distribution of wage-earners in grades of as low as one shilling per week. Others deal with piece work earnings, and others give in detail earnings in different districts.

Into the preparation of this volume of the report there must have gone an enormous amount of preliminary work,

TURIN EXHIBITION AWARDS.

The following are among the British firms who have received awards for their exhibits at Turin Exhibition, and to whom we offer our congratulations :—

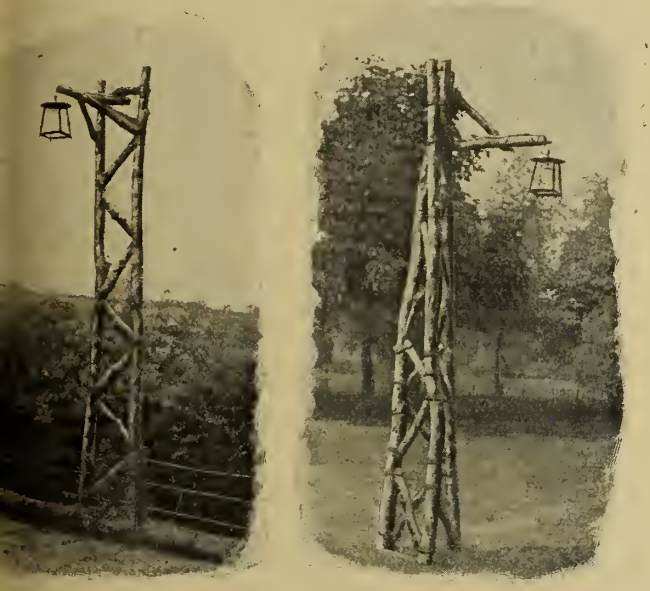
Alfred Herbert, Ltd., Classes 23 and 24, Grand Prix ; Classes 25 and 26, Grand Prix.
Alley & McLellan, Ltd., Class 38, Gold Medal.
A. Reyrolle & Co., Ltd., Classes 28 and 29, Grand Prix.
Babcock & Wilcox, Ltd., Classes 19 and 20, Grand Prix.
Blackstone & Co., Ltd., Classes 19 and 20, Diploma of Honour ; Classes 21 and 22, Gold Medal ; Class 87, Grand Prix ; Classes 98 and 99, Silver Medal.
British Ackley Brake Co., Classes 39 and 40, Gold Medal.
British Vacuum Cleaner Co., Ltd., Classes 21 and 22, Diploma of Honour ; Classes 72, 73 and 74, Grand Prix.
Campbell Gas Engine Co., Ltd., Classes 19 and 20, Grand Prix ; Classes 28 and 29, Grand Prix ; Class 87, Grand Prix.
Castner-Kellner Alkali Co., Ltd., Classes 106 and 107, Grand Prix.
Chance Bros. & Co., Ltd., Classes 9, 10 and 11, Grand Prix.
Clayton & Shuttleworth, Ltd., Classes 19 and 20, Grand Prix ; Classes 21 and 22, Gold Medal ; Class 87, Grand Prix.
Coventry Chain Co., Ltd., Classes 60 and 61, Diploma of Honour.
Crypto Electrical Co., Ltd., Classes 28 and 29, Gold Medal.
Doulton & Co., Ltd., Classes 72, 73 and 74, Grand Prix.
Edgar Allen & Co., Ltd., Classes 25 and 26, Gold Medal ; Classes 39 and 40, Grand Prix ; Class 108, Gold Medal.
E. Green & Son, Ltd., Classes 19 and 20, Grand Prix.
F. Darton & Co., Classes 6, 7 and 8, Gold Medal ; Classes 9, 10 and 11, Gold Medal ; Class 13, Grand Prix.
Hadfield's Steel Foundry Co., Ltd., Classes 35, 36 and 37, Grand Prix.
Hans Renold, Ltd,, Classes 19 and 20, Grand Prix ; Classes 21 and 22, Diploma of Honour ; Class 38, Grand Prix ; Classes 60 and 61, Grand Prix.
Holden & Brooke, Ltd., Classes 19 and 20, Grand Prix.
John Fowler & Co. (Leeds), Ltd., Class 87, Grand Prix.
John J. Griffin & Sons, Ltd., Classes 9, 10 and 11, Gold Medal ; Classes 15 and 16, Gold Medal ; Class 32, Diploma of Honour ; Classes 33 and 34, Gold Medal ; Classes 112 and 113, Grand Prix.
Johnson, Matthey & Co., Ltd., Classes 112 and 113, Grand Prix.
J. and H. McLaren, Classes 19 and 20, Grand Prix ; Classes 35, 36 and 37, Grand Prix ; Class 87, Grand Prix.
Lancashire Dynamo & Motor Co., Ltd., Classes 28 and 29, Gold Medal.
Marconi Wireless Telegraph Co., Class 31, Grand Prix.
Marshall, Sons & Co., Ltd., Classes 19 and 20, Grand Prix ; Classes 35, 36 and 37, Grand Prix ; Class 87, Grand Prix.
Morgan Crucible Co., Classes 28 and 29, Grand Prix.
Muirhead & Co., Ltd., Classes 28 and 29, Diploma of Honour.
Nalder Bros. & Thompson, Ltd., Classes 33 and 34, Grand Prix.
National Gas Engine Co., Ltd., Classes 19 and 20, Grand Prix.
Negretti & Zambra, Classes 9, 10 and 11, Grand Prix ; Class 13, Grand Prix.
Ozonair, Ltd., Classes 28 and 29, Gold Medal ; Class 32, Grand Prix ; Classes 43 and 44, Gold Medal ; Classes 67 and 68, Grand Prix ; Classes 69 and 70, Grand Prix ; Class 75, Diploma of Honour ; Classes 83 and 84, Grand Prix ; Class 101, Grand Prix ; Class 102, Diploma of Honour ; Classes 112 and 113, Silver Medal ; Class 114, Silver Medal.
Pulsometer Engineering Co., Ltd., Classes 9, 10 and 11, Gold Medal ; Classes 112 and 113, Diploma of Honour.
Reason Manufacturing Co., Ltd., Classes 33 and 34, Gold Medal.
Reavell & Co., Ltd., Classes 19 and 20, Gold Medal ; Classes 21 and 22, Diploma of Honour.
Richard Garrett & Sons, Ltd., Classes 19 and 22, Grand Prix ; Classes 35, 36 and 37, Grand Prix ; Class 38, Grand Prix ; Class 87, Grand Prix.
Richard Hornsby & Sons, Ltd., Classes 19 and 20, Grand Prix.
Robert W. Paul, Classes 33 and 34, Grand Prix.
Ruston, Proctor & Co., Ltd., Classes 19 and 20, Grand Prix and Diploma of Merit ; Classes 21 and 22, Gold Medal ; Classes 35, 36 and 37, Grand Prix and Special Congratulations ; Class 87, Grand Prix.
Silica Syndicate, Ltd., Classes 112 and 113, Grand Prix.
Simms Magneto Co., Ltd., Classes 60 and 61, Gold Medal.
Sir W. G. Armstrong, Whitworth & Co., Ltd., Classes 60 and 61, Diploma of Honour.
Synchronome Co., Classes 6, 7 and 8, Diploma of Honour.
Thermal Syndicate, Ltd., Classes 106 and 107, Grand Prix ; Classes 112 and 113, Diploma of Honour.
Underfeed Stoker Co., Ltd., Classes 19 and 20, Grand Prix ; Class 75, Gold Medal.
Venner Time Switches, Ltd., Classes 28 and 29, Gold Medal ; Class 30, Silver Medal.
Westinghouse Electric Co., Ltd., Classes 28 and 29, Grand Prix.
W. & T. Avery, Ltd., Classes 6, 7 and 8, Gold Medal.
The Cambridge Scientific Instrument Co., Ltd., exhibited Classes 9, 10, 11, 13, 14, 31, 33 and 34 ; but were *hors concours.*

ELECTRIC LIGHTING IN A CARDIFF PARK.

Roath Park, the largest of Cardiff's parks, is situated at one the tramway termini ; it comprises several separate parks extend $1\frac{1}{2}$ miles in length. The most popular section is the Lake, Botanical Gardens. The lake covers 25 acres, and here botani fishing and swimming can be indulged in. Music is provided frequently in the summer season, and the thousand odd ch around the band-stand are well patronised. A park with attractions is, naturally, a source of revenue to the Tram Department, and the Tramways Committee has several times r grants in aid towards the expense of bands. It has been u during the last few years to close the lake to the general pu on occasions during the season and let it out for the purpos holding fêtes and swimming galas in connection with va local clubs, and the Park Committee came to the conclusion the money spent by the promoters of galas on Chinese lan and similar decorations, would willingly be given for much effective electrical illuminations. In addition, it was felt th was a pity to close the park at dusk when music could be enj in the cool of the evening. A scheme was therefore prepare the city electrical engineer, to the park superintendent's req ments, which provided for about 30 pillars in the different w the lighting of the bandstand, and arrangements for tempo decorative strip-lighting amongst the trees, outlining the l stand, &c., and a supply to a floating band-stand ; the strip-ligh was only in use on the special occasions referred to.

There was every possibility of the lighting being conside extended, and as the mains were some distance away, the first sc provided for H.T. feeders and transformers, but this dropped on the score of expense, although the arr ment now includes an extension of the L.T. mains with cable to a central distributing point, so that in the futu necessary, a change over can be made by running back some distance to the nearest H.T. feeder. The switch pillars co D.P. fuses, a S.P. knife switch to each circuit, and a meter i line. A drop in pressure was anticipated, so a small auto- former giving a permanent boost in five-volt steps up to placed in the base of the pillar. The circuits now connecte deal with 10 KW., and when the demand exceeds this, a H.T. s will be necessary. The work carried out has as far as possibl in keeping with the surroundings, and the facts that the instal would be handed over to the parks superintendent, and numbers of people—including small boys—frequent the park been kept in view. There are three circuits running fro pillar, and from here all lights can be switched on. The stand lighting has switches controlling it, and switches a

ovided for strip lighting; the three circuits can all be looped through straight-through disconnecting fuse boxes. This useful at times in many ways which will occur to our readers. The supply is two-wire (200 volts) with paper-insulated cable laid rect in the ground, and wire-armoured rubber-covered cable for e lamp services. All fusing is carried out with Siemens Zed type ses, so that the renewal of a fuse of correct size by any of the



Rustic Lamp-posts at Cardiff.

ark men is a simple matter. In the ground near the base of each illar is fixed a small service box, fused on one pole, with a link on he other side. The service cable ends in an "Indispenso" connector, so that the lamp fitting, which is just hung on a hook, can e removed for the winter, &c. Connections can also be taken off hese connectors for strip lighting in festoon between pillars. It vas first suggested that ornamental cast-iron pillars should be used, nt there were many difficulties in the way of making a satisfactory nd economical job; several designs for wood pillars were sub-



Another Design of Wood Lamp-post.

mitted to the Parks Committee, and three different designs are now in use (see figs.). The bandstand was outlined with about 600 small candle-power lamps, and about 500 lamps, spaced 2 ft. centres, were used along the park paths. The permanent lighting for the band-stand was carried out with stem pendants and Holophane shades. All movable material is transferred to the stores during the winter. The parks superintendent has reported that music was continued during the evenings for six weeks longer than the usual period on account of this lighting. To keep people within the bounds of the lighting area dwarf railings are thrown across the various paths. Whilst the revenue obtained from this lighting is not large at present, it is a load that can be easily dealt with and will no doubt develop; indirectly, it is of much benefit to the general public and the tramways department.

We are indebted to Mr Arthur Ellis, the manager of the Cardiff electricity and tramway undertakings, for the above particulars.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

RUSSIA.—In connection with a Bill which it is proposed to introduce into the Russian Duma for the encouragement of the manufacture in Russia of agricultural machinery and implements, it is proposed to admit duty free upon request foreign-made machinery and stands necessary for the equipment of works manufacturing agricultural machinery of the four following categories: (*a*) Portable engines for steam threshing machines; (*b*) threshing machines; (*c*) reaping and sheaf-binding machines; (*d*) reaping machines with automatic ejectors.

NORTHERN NIGERIA.—The Customs Tariff (Amendment) Proclamation of 1911 provides that, from January 27th, 1911, the rates of duty leviable on goods imported into Northern Nigeria shall be the same as those levied in Southern Nigeria.

DENMARK.—The Customs authorities have recently issued the following decisions regarding the duties to be levied on certain safety plugs:—

Safety Plugs of Porcelain and Brass.—When possessing the characteristics of manufactures of porcelain in combination with metal	·70 krona per kg.
When none of the component parts can be regarded as giving their characteristics to the goods	7½ % *ad val.*

N.B.—Krona = 1s. 1⅓d.

UNITED STATES.—The following revised circular relative to the inclusion of commission, &c., in Consular invoices for goods shipped to the United States of America has recently been addressed by the Treasury Department to officers of the United States Customs:—

The Department is advised that it is the practice of some shippers not to include in their Consular invoices commissions and other charges paid to them as agents for services in purchasing and shipping goods, while it is the practice of other shippers to include in their invoices such charges.

As this difference of practice is confusing to the appraising officers, you are hereby instructed that a strict compliance with the provisions of Article 669 of the Consular Regulations of 1896 should be required.

Article 669 of the Consular Regulations requires that shippers of goods subject to an *ad valorem* rate of duty, wholly or in part, or to a duty based upon their value, must in all cases set forth separately in the invoice:—

1. The net price of the merchandise, free from all charges of commission, packing, &c., or, in case of merchandise shipped on consignment, the actual net market value thereof in the principal markets of the country from which the shipment is made, by its weight, measure or quantity.
2. The cost of transportation to the port of shipment.
3. The amount of packing charges, including boxing, tilloting, packing, cartons, &c.
4. Insurance, commissions, discounts, legalisations, and all costs of any kind, nature, or description incurred in preparing the goods for the market of the United States, separately set forth.

When, however, it is impossible for the shipper to give the information required under the third and fourth heads, or any of them—as, for instance, when such charges or any part of them are non-existent or unascertained at the time of shipment, or are to be paid by the consignee—such items may be omitted, the cause of omission being stated instead.

For statistical purposes, exporters should specify in invoices of merchandise, free or subject to a specific rate of duty, all costs, charges, expenses, &c., separately from the actual cost of the goods.

Motor Exhibition at Baku.—The International Exhibition of gas and oil engines, electric motors, compressors and automobiles, which was originally to be opened at Baku in September of this year, has been postponed until April 1st, 1912. Tariff-free import of exhibits is to be allowed, provided the machinery is re-exported within a period of six months. The permanent German industrial Commission on Exhibitions has been carefully investigating the conditions, and has come to the conclusion that, although Baku offers a good market for certain types of machinery, it would hardly pay German firms to take up the question of exhibiting there to any great extent. In the case of the larger firms, their own agents on the spot can decide whether an exhibit would be of value, whilst smaller firms who wish to get a footing in the country will probably not find the exhibition of as much advantage to them as the introduction of a good agent. The visitors to the exhibition will be for the most part local people. At the same time the Commission has received private information, chiefly from manufacturers of oil engines suitable for boring operations, strongly advocating German participation.—*E.T.Z.*

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,740. "Means of controlling electrical and physical instruments." J. W. Record. October 16th.

22,757. "Regulation of alternating current machinery and means therefor." Siemens Bros. Dynamo Works, Ltd. (F. E. Thrupp, India.) October 16th. (Complete.)

22,759. "Electrolytic apparatus." A. E. Knowles. October 16th.

22,771. "External contact electric bell push." G. E. Lehrs. October 16th.

22,779. "Electric lights." A. W. Gast. October 16th. (Complete.)

22,799. "Trolley heads for overhead electric tramways." G. E. Wadsworth and H. Pridham. October 16th.

22,803. "Calling circuits for automatic telephone systems." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 16th. (Complete.)

22,804. "Selecting devices for telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 16th. (Complete.)

22,805. "Subscribers' instrument set for automatic telephone exchange." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 16th. (Complete.)

22,868. "Means of jointing and bonding between lead-covered or lead-covered and armoured electric cables, and cast-iron, wrought-iron or mild-steel sleeves or joint boxes." R. B. Mitchell and F. J. Cooper. October 17th.

22,882. "Electrical means for the synchronism of talking machines, musical instruments and the like, with animated pictures, and the like." G. H. Cricks, J. H. Martin and C. A. Bannister. October 17th.

22,887. "Accumulators or the like for different purposes and arrangements therefor for different purposes." G. J. Epstein. October 17th.

23,890. "Electric-current generating and motive-power machine." W. S. Frost. October 17th.

22,895. "Electrical switches." C. L. Terry and P. Townsend. October 17th. (Complete.)

22,914. "Electric switch mechanisms." P. A. Newton. (Gray National Telautograph Co., United States.) October 17th. (Complete.)

22,983. "Intercommunication telephone systems." British Insulated and Helsby Cables, Ltd., W. A. Aitken, H. Cooper and C. Remington. October 18th.

22,987. "Dynamo-electric machines." E. R. Clarke. October 18th.

22,988. "Electric light fittings." Simplex Conduits, Ltd., and T. Birkett. October 18th.

22,992. "Electrical heating devices." J. F. Monnot. (Convention date, November 12th, 1910, France.) October 18th. (Complete.)

23,015. "Dynamo-electric machinery." Hon. Sir C. A. Parsons and A. H. Law. October 18th.

23,025. "Negative electrodes for electrolysis, cataphoresis and osmosis." Dental Manufacturing Co., Ltd., and A. B. Tugman. October 18th.

23,056. "Controlling of electric motors from some other room than the one in which motor is fixed." J. Bond. October 19th.

23,080. "Coin-freed mechanism for telephones." M. Pledath. October 19th.

23,118. "Telephone transmitters." G. H. Nash and Western Electric Co., Ltd. October 19th.

23,122. "Calling apparatus for telephones and the like." P. W. Wall. October 19th.

23,162. "Electrical switches or contact make-and-break devices." R. R. Smith and F. B. Cox. October 20th.

23,172. "Field telephone and telegraph set." A. J. Stephens. October 20th.

23,180. "Methods of heating rooms by electricity." A. H. Barker. October 20th.

23,182. "Electro comb with spring controlled yielding teeth and alternate poles." G. Meyer. October 20th. (Complete.)

23,185. "Imitation X-ray illusion." A Coke. October 20th.

23,191. "Electric vibrators." A. H. Nicholson. October 20th.

23,240. "Sparking plugs applicable for internal combustion engines." P. L. Johnson and F. J. S. Kilgour. October 21st.

23,261. "Storage battery electrode." W. Morrison. October 21st. (Complete.)

23,265. "Construction of electrical accumulator." P. Marino. October 21st. (Complete.)

23,283. "Means for varying the inductance of electric circuits." G. Schieferstein. (Addition to and divided application on 12,978 of 1911, May 30th.) October 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Dynamo-Electric Machinery. R. A. Holbech. 15,587. June 29th.

Apparatus for Transcribing Telegraphic Characters. A. O. Urban. 22,697. September 30th.

Electric Motors for Transmitting at a Distance Angular Movements Overcoming Considerable Resistances. R. Girardelli. 22,714. September 30th. (November 23rd, 1909.)

Apparatus for Sterilising Liquids by Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen. 23,077. October 5th.

Transmitting Apparatus for Wireless Telegraphy. J. A. Fleming. 23,242. October 7th.

Electrical Connectors. J. C. Royce. 23,445. October 10th.

Single-Phase Alternating-Current Motors. B. Parker-Haigh. 26,984. November 21st. (Cognate application, No. 9,957 of 1911.)

Carbon Brushes for Dynamo-Electric Machines. S. Beeton and Morgan Crucible Co. 27,162. November 22nd.

Electric Arc Lamps. A. Blondel. 27,989. December 1st. (April 21st, 1910. Addition to No. 4,677 of 1906.)

Apparatus for use in the Electrodeposition of Iron. S. O. Cowper-Coles. 28,592. December 8th.

Automatic Multi-Fuse Electric Cut-Outs. R. Romeu. 28,810. December 12th.

Vapour Electrical Apparatus of the character known as Mercury-Vapour Lamps or the like. Brush Electrical Engineering Co. and A. E. Salisbury. 28,991. December 14th.

1911.

Electrical Device for Receiving and Transmitting Telegraphic and Telephonic Messages. E. D. Glendall. 3,630. February 13th.

Generation of Electric Energy. J. Maes. 5,457. March 4th.

Anodes for use in the Electrolytic Treatment of Alkaline Salt Solutions. A. K. T. Estelle. 5,734. March 7th. (March 9th, 1910.)

Electric Motors. Anschutz & Co. 5,866. March 8th. (November 18th, 1910.)

Variable Frequency Commutator Dynamo-Electric Machines. Akt.-Ges. Brown, Boveri et Cie. 7,061. March 21st. (April 11th, 1910.)

Spark Plugs. H. E. Maher. 7,108. March 21st. (April 28th, 1910.)

Control of Alternating-Current Electric Motors. E. F. W. Alexanderson. 8,149. March 31st. (April 2nd, 1910.)

Method and Apparatus for the Intensifying of Weak Alternating Electric Currents. R. Goldschmidt. 8,978. April 11th. (April 11th, 1910.)

Electric Furnaces for Treating Metal Filaments and a Method of Manufacturing the same. G. Ludecke and Imperial Lamp Works (Brimsdown), Ltd. 8,996. April 11th.

Rainproof Ventilator for Arc Lamps. Körting & Mathiesen Akt.-Ges. 10,886. May 5th. (May 6th, 1910.)

Machine for the Continuous Electric Welding of Seams. W. E. Evans. (Allgemeine Elektricitäts Ges.) 12,585. May 24th.

Telegraph Instrument for Receiving Messages by Perforating Strips and at the same time Reproducing them in Type-Printed Characters. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 15,13[illegible]. January 28th.

Electric Arc Lamps. Ges. für Maschinen und Metall Industrie. 15,730. July 16th. (July 6th, 1910.)

Equalising Arrangements for Electrical Distributing Systems. L. Strasser. 168. January 3rd.

Dynamo Connection. H. Leitner. 709. January 10th.

Automatic Electrical Signalling Apparatus for Railways. Automatic Electric Block Signalling Co. and R. P. Brousson. 1,048. January 14th.

Manufacture of Metal Filaments for Electric Lamps. W. C. Heraeus Ges. and C. Trenzen. 1,544. January 20th. (Convention date not granted.)

Electric Furnaces. J. H. Reid. 1,609. January 21st.

Electric Cut-Outs. H. Hirst and F. M. Chapman. 1,914. January 25th.

Compounding of Commutator Dynamo-Electric Machines. Akt.-Ges. Brown, Boveri et Cie. 4,256. February 20th. (February 19th, 1910.)

Apparatus for Treating Liquids with Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen. 4,895. February 27th.

Operation of Electrical Clock Installations. H. Arod Elektricitäts Zahlerfabrik Ges. 7,862. March 29th. (January 7th, 1911.)

Electric Switches. Pintsch's Patent Lighting Co. and C. H. Vidal. 9,005. April 11th.

Device for Indicating an Earth or Ground Connection of an Electric Line. G. Giles. 9,745. April 21st. (April 21st, 1910.)

Calling Circuit Arrangements for Automatic and Semi-Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges. 14,144. June 14th.

Trade with Italy.—Some useful hints for the furthering of trade with Northern Italy are set forth by the *Elektrotechnische Nachrichten*. Before linking business connections or entrusting agencies to native houses, home firms should, says the German paper, exhaustively inform themselves of the credit standing, and business aptitudes of the prospective agents. Such information in the majority of cases cannot be supplied by the Consulates owing to the great extent of Milan and the diversity of the businesses. Exact information with regard to unknown firms is only obtainable by the Consuls employing other means. The Consulates accordingly fall back on one or the other locally established trade information bureaus. By this method, however, no limit is set to expense, and the Consular intervention tends to much loss of time. German firms are advised, as a better course, to apply direct to such bureaus, of which the following are recommended:—The Schimmelpfeng Institute, 5, Passagio Carlo Alberto, or the branch of the Leipzig Kreditreform Union, the Associazione Kreditreform, 5, Via A. Manzoni. It is further said:—Lists of the names of the retailers in a particular branch of trade which the Consuls are often called upon to supply, cannot, in the generality of cases, be supplied by them, owing to the multiplicity of the names. Such information is furnished by the firm E. Finetti & Co., 2, Passagio Galleria de Cristoforis.

Norwegian Nitrate Undertakings.—It was recently mentioned that one of the leading German chemical companies acting for itself and two other chemical firms who are jointly interested, had decided to dispose of most of the share held in two Norwegian power and nitrate companies. It is estimated that the share is represented by £1,250,000, and on the completion of the transfer to the Norsk Hydro-Elektrisk Co., the total German interests will be reduced to £250,000. Various statements are forthcoming by way of explanation of the withdrawal of Teutonic influence from the undertakings concerned. On the one hand, it is stated that the retirement is due to the obstruction which German capital and work meet with in Norway. On the other, it is declared that the Germans desire to distribute the very considerable risk over a larger number of persons. A further assertion is that the large amount of capital invested in the power and nitrate enterprises could only produce a less remunerative yield than the capital invested in the German chemical works. At any rate, the withdrawal of Teutonic interests is all the more remarkable, as the completion of the Norwegian nitrate scheme is said to be in sight. The works are to place nitrate on the market next year, and it was recently reported from Christiania that the first section of the Rjukan Falls works was nearing completion.

Electrolytic Copper-Refining in Norway.—A company has applied for a concession to work and eventually purchase the Aamdal copper deposits at Skafse, in the district of Telemark. The company has a capital of about £14,000, subscribed by Norwegians. It is intended to use an electrolytic process of extraction invented by Mr. V. Hybinette, who is understood to be a Swedish engineer.—*Board of Trade Journal.*

THE
ELECTRICAL REVIEW.

Vol. LXIX. NOVEMBER 10, 1911. No. 1,772.

ELECTRICAL REVIEW.

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HE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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Cheques and Postal Orders (on Chief Office, London) to be made payable to . H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE I.E.E. ARTICLES.

THE justice of our comments on the procedure of the Council of the Institution of Electrical Engineers, in allowing the members only one week in which to consider the proposed new Articles of Association, was amply vindicated by the proceedings at the meeting on Thursday last. From the first, it was clear that the Council realised that a mistake had been made, and that the immediate adjournment of the meeting had been resolved upon as the best way out of an awkward dilemma. The President explained that so large a number of criticisms and proposed amendments had been received, that it was impossible to proceed with the discussion profitably until these had been analysed and reduced to order, and therefore he suggested that the meeting should be adjourned to a date not earlier than November 30th, which again justifies our suggestion that a month or six weeks should have been allotted in the first instance. Some allusion was made to "precedents" in this connection; previous notices had been of one week's duration—therefore the same allowance was made on this occasion. The futility of such an argument is obvious; the whole purpose of the revision of the Articles is to *depart* from precedents—to adopt innovations and to introduce reforms. It was explained to the meeting that a Committee had been revising the Articles for two years, and that the Council had had them under consideration for nearly six months; yet one week was thought sufficient for the members to assimilate them—a striking compliment to the intellectual qualities of the members, indeed, but a somewhat backhanded one.

Before the adjournment of the formal proceedings was accepted by the meeting, several members requested the Council to give an assurance that the next special meeting should be held not in the afternoon, but at an hour which would enable members to attend it, for it was pointed out with truth that half-past four was a most inconvenient time for the majority of the members, many of whom were, in fact, completely debarred from attendance at that hour. It was also suggested that the summons to the meeting was worded in such a way that it was not legally competent for the Articles to be discussed and amended in detail, but that they would have to be accepted or rejected *en bloc*. These points appeared to have received no consideration on the part of the Council, judging from the perturbation evinced by the latter and the hurried consultations which ensued. Perhaps "precedent" was here again the culprit. Assurances were readily given in both cases, but it was impossible to resist the impression, in spite of the unfailing patience and good humour of the President, who did all that could be done to maintain harmony, that the whole affair was in a

muddle, and half-an-hour elapsed before the motion for adjournment was passed by a majority.

Representatives of the Press are not admitted to the general meetings of Corporate Members, except in their private capacity—a fact of which some members of the Council were apparently unaware—but the President consented to circulate the official report to the technical journals, and we are thus enabled to publish elsewhere in this issue a condensed account of the informal discussion which took place after the adjournment. Many of the new Articles were severely criticised, particularly those dealing with the new classification of the members and the introduction of the class of "Licentiates," and the new rates of subscription. It was suggested that the Institution was attempting to be both a scientific and a commercial body at once, a course which was impracticable. The Licentiate class is intended to include those who, while engaged in electrical engineering, are not sufficiently qualified for the class of Associate Member; the class of Associates will be reserved entirely for persons connected with the industry, who are not electrical engineers by profession. The title of the former would be spelt out in full, the initials being obviously undesirable, and it was argued that the consequence would be that the public would inevitably regard a "Licentiate I.E.E." as the highest class of electrical engineers, just as L.R.C.P. is in practice—often justly—equivalent to M.D. The Council appears to meditate the addition of non-electrical persons, not only in the class of Associates, but also in that of Members, having taken powers to admit them at discretion, and it was to this, as well as to the creation of the Licentiate class and the power to exempt candidates for Associate Membership from examination, that we referred in our last issue, as showing a tendency to lower the standard of qualification.

The most interesting item in the proceedings was the statement made by the hon. treasurer, Mr. Robert Hammond; had this been issued in the first instance with the proposed new Articles, undoubtedly there would have been far less opposition to the latter, and one or two members expressed regret that this course had not been followed. The statement was issued to members on Tuesday this week, together with the announcement that a second informal meeting will be held on the 16th inst., to discuss the suggestions received up to yesterday; but as the report of the proceedings at the first meeting appears only in the Press, obviously only those who were present and their associates will be aware that the President asked for all suggestions to be sent in by Thursday morning, and there will probably be a second crop after this week-end.

In view of the general desire that the Institution should enlarge its scope and increase its activities, we think there can be no question that in the main the new proposals deserve the favourable consideration of the members.

In certain details, undoubtedly, there is need of amendment; in particular we may point to the designation of "Licentiate," the representation of the Associate Members on the Council, the mode of election of the latter, and sundry new powers to be vested in the Council. The increase of subscription, regrettable though it be, is apparently inevitable, and it is, of course, perfectly true, as Mr. Hammond pointed out, that it was clearly foreshadowed in the last Report—though his claim that *everything* in his statement had appeared in that Report was greeted with cries of "No While the Institutions of Civil and Mechanical Enginee receive an average subscription of £2·59 and £2·41 respe tively per member, the Institution of Electrical Engineers r ceives only £1·76. The increasing value of membership of t I.E.E. must be taken into account in connection with th question, as well as the several new developments which a under consideration. There is much to be said in favo of a differentiation between town and country membe especially since the former have become possessed of t advantages afforded by the Institution House, which are n shared by the country members. But it is impossible f us to afford more space to the matter in this issue, a further comment must be deferred.

Co-operation. A pleasant little function which to place last week, and to which we allu in another part of this journal, gave rise to certain sugg tions which are of considerable interest at the moment to electrical industry. Co-operation was the plan put forw as a possible means of improving the condition of electri trade, and there is little doubt that, short of a compreh sive financial proposition, which would sweep the vari firms into one or two groups, there must be c siderable advantage to be gained from some understand both in regard to manufacturing and selling. The operative idea has at least the merit of simplicity; moreo it is one which could be carried out with very little distu ance either to the financial arrangements or the *personnel* the various companies. We do not think for a moment th is claimed to be a new proposition, for, as a matter of f co-operation does exist in a very real form in the Uni States of America. In that country there has been a v definite understanding among the great manufacturers fo considerable time past, but, what is of equal importa there has also been a very close relationship between the ma facturers and the traders. In this country there has b very little arrangement among the big manufacturers ex the cable makers, and there never has been that supp of the merchant which we consider is so desirable in interests of the industry. The cable makers have arrive what we think is an eminently sensible scheme to regu prices, and they have undoubtedly gained much advant from it, but at the same time they have not been altoget wise in neglecting the factor. The attitude of the cable ma towards the merchant is practically based on the theory t he is no better than the small wiring contractor. Su that must have appeared to the members of the C.M.A somewhat illogical, for we presume that the credit of factor is better than that of a wiring firm; not that we for a moment suggesting anything against the integrity the contractor, but as a rule he has to wait for his mo and in consequence his payments are somewhat slow. H is a marked instance of the lack of co-operation, and result is that the factor, not obtaining support from home manufacturer, is thrown into the arms of the for firms, and thenceforward he helps to exploit a cable wh comes from abroad. In the days of his prosperity suc procedure in no wise disturbs the cable maker, but it n not be overlooked that the electrical industry is subjec extraordinary changes, and there may yet come a time w the manufacturer will regret that he did not give n support to the man who sells.

Apart from cables, there are other directions in whic appears to us that there is ample room for co-operation. are quite aware that there are difficulties, especially in l suing a co-operative policy abroad. Some of the n eminent of our manufacturers have other interests, wh absolutely preclude them from sending British-made arti into our Colonies and to foreign countries; but even t drawback might be met by a little readjustment and arra

t. There is still a strong belief in British apparatus in y places abroad, and there is even a stronger belief in the onality of the British man of business.

s we have already indicated, the alternative to co-opera- is financial control, and there are many far-secing persons consider that the only real solution to the problem. are not anxious to see anything in the shape of an elec- l trust, but we are quite aware of the advantages of a cial rearrangement and understanding among the larger panies. Such a reform, we think, is hardly likely to e from inside, mainly because personal feeling and pre- es would block the way; and, unfortunately, the direc- of electrical manufacturing companies, with certain urable exceptions, know next to nothing of the details ne business which they are supposed to direct. In respect, unfortunately, the electrical industry does liffer very materially from other industries.

would appear, therefore, that if there were to be any cial adjustments, they would have to come from outside; curiously enough, the electrical industry seems never ve attracted men of commanding ability and personality ne same way that have other industries, such as ship- ling and other branches of engineering. It is, perhaps, altogether surprising, for electrical trading is highly nical, and it has never yet had sufficient return to make tractive to men of large affairs. Yet the financial ests involved in the manufacture of electrical machinery appliances are very considerable. The capital invested ot be much less than 40 millions, and this should pro- an adequate field for a financier of the very highest type. inly, if the electrical industry had been supported by same type of men who control shipping and iron, it d have taken its proper place among the great industries nis country, because such men could have carried the and ambitions of the electrical industry into the highest ters of the land; they could have secured the gnition of Parliament, the sympathy and co-operation of banking interests, and the sympathy and kindly est even of the Throne. Why should not we receive same measure of succour as the German manufacturer? position of the electrical industry in Germany to-day is to the remarkable support of the bankers, and to the y co-operation of the highest in the land. The German eror himself, with his keen commercial insight, has gnised the enormous importance of the electrical industry ne advancement of his country, yet in no respect are manufacturers inferior to the products of Germany, and ours is the Cinderella of all the industries.

is when we have pondered over these things, that we ome any suggestion that may help to put electrical ests into the position which is their just due.

British Electrical erannuation Fund.

The Managing Trustees of the British Electrical Superannuation Fund which was created by the British Electric Traction Co., Ltd., has just issued the actuaries' report upon the experience of the fund ng the 5½ years from July 1st, 1905, to December 31st,), and upon the valuation of its liabilities as at the latter

may be a mixed question whether superannuation funds , on the whole, satisfactorily from the points of view of contributors and the fund itself the requirements of uate provision for old age. In such concerns, it may bserved, as railways, in which permanence of employ- t and consequent continuity of membership are the inant characteristics, which lead to long and faithful ice, they are, of course, in vogue.

he creation and organisation of such a fund by a com- of the nature of the B.E.T. is an event not of frequent rrence, and therefore of some interest. At the beginning ne period named there were 198 members of the Fund, 184 persons entered; but eight persons died, and 122 drew from membership, thus leaving 252 surviving as bers on December 31st, 1910. During the immediately eding period, there were 101 withdrawals out of a total 99 members. It will thus be seen that for such a comparatively small membership the number of withdrawals, or, in other words, the number of persons leaving the service of the companies affiliated with the fund appears, at any rate, to be significant and striking. The effect of such withdrawals is, of course, advantageous to the fund, inasmuch as the persons leaving the service of the companies which are parties to the fund *ipso facto* cease to be members of the fund, and only the sums which the persons themselves have paid into the fund are refunded to them, *i.e.*, without interest.

The fund, therefore, eventually benefits by the interest on their contributions at the expense of the persons concerned, and in addition, by the contributions which are not returnable, which the companies have paid, and are required to pay, to the fund in respect of such of their employés as join the fund, as well as by the interest thereon.

The investments appear at cost in the actuarial valuation balance-sheet at £36,794, at which sum they stand in the audited balance-sheet of the fund. No doubt they are, as is common, of the nature, and in the proportion, of each class of security prescribed by the trust deed if there be a provision to that effect. On those which were officially quoted at the date of the valuation there was, it is stated, an average depreciation of 4 per cent., the unquoted investments, which consist mainly of debentures of electric traction and lighting companies, being taken at cost; but there follows the somewhat curious statement:—"And we are assured by the secretary from his general knowledge of these securities and from the experience of the fund in similar dealings that these may throughout reasonably be taken at cost." This is open to criticism, though the actuaries have made an investment reserve fund of £1,840, being 5 per cent. upon the assets taken at cost price. It would be interesting to learn what the actual result would be if the whole of the investments were put into the hands of a broker for sale.

The valuation balance-sheet shows an estimated surplus of £379, and the actuaries state that they consider that the future prospects of the fund are satisfactory actuarially and financially, though in paragraph 12 they "see no reason why the solvency of the fund should not be maintained in future years," and they impress upon the managing trustees "that this will be largely dependent upon the proportions of members ultimately retiring on pension allowances at 60 and in later years."

It may be added that the report, to be of any service to an intelligent reader, should have been accompanied by the data and valuation tables which the actuaries have prepared, and to which they refer in paragraph 8 of their report.

Electrical Information from Abroad.

We wish to draw special attention to several articles appearing in the following pages of this issue, regarding electrical affairs in other countries. Our Indian correspondent, whose notes are, as we have good reason to know, read with great interest in various parts of India, as well as by electrical traders and engineers at home, has something to say regarding the peculiar conditions with which contractors are sometimes called upon to comply in that part of the world. A special correspondent in Chile forwards information with reference to an important hydro-electric concession which has just been granted. In view of the fact that hitherto German capital has influenced the course of many large electrical undertakings there, the writer places the notes at the disposal of British engineers, so that they may have an early opportunity of weighing up the proposition. A third matter in this issue which calls for close study is the article on the conditions prevailing in Brazil, and the opportunities which that wonderful market offers to our investors and traders. This is the first of a series of articles from the pens of two gentlemen who have spent many years in Brazil, and know their subject from practical experience. They are at present in this country, and by these articles, and in other ways, they are anxious to assist the British electrical and engineering manufacturer in strengthening his hold upon a rapidly growing market where, if their own and others' expectations are realised, there will be electrical trade to the extent of millions sterling to be done annually before many years are past.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Quartz in Electric Heaters.

Referring to the letter from Messrs. Paterson & Co. in your issue of the 27th ult., I am not concerned to discuss with them any question of credit for the introduction of the heater that is sold under my name. I may perhaps be allowed to say that, whereas I am conscious of having expended a very considerable amount of time and energy in the design and introduction of these heaters, I am not conscious of having received any assistance from Messrs. Paterson & Co., even as competitors.

What I particularly wish to point out is, that I have never met anyone who has ever seen the apparatus of which your correspondents speak, unless it be laboratory apparatus, totally unlike my heaters.

Messrs. Paterson & Co. make several statements that I do not for a moment believe could be substantiated, and it is evident that they have no idea of the large amount of quartz tubes my company is using—over 5,000 ft. a week.

This time I am out for cash and not for credit, and am quite content to accept Messrs. Paterson & Co.'s verdict that no credit for the success of my heater is due to me. It may well be due to my company's selling agents.

It was James Swinburne who said that any fool could make an invention, but it takes a clever man to work out the details, and a genius to sell it.

C. Orme Bastian.

London, E.C., *November 6th*, 1911.

The Demand for Technical Men.

Having been greatly interested in the correspondence which has lately taken place *re* the above, I have been impressed by the fact that although there have been several writers on the subject, no one seems to have made any attempt to review the cause which is dragging down all branches; I shall be glad, therefore, to be allowed to voice a point which appears, from my experience, to be a considerable factor in the case, and that is the fact that the engineers are trained in one branch, yet seek situations at the termination of their training in a difficult branch from that in which they have been trained. Take, for example, a student who, after leaving college, goes into the workshops of a good firm; he receives a fine training in the manufacture of electrical plant, the testing, and possibly the erection of it; at the termination of this he enters a central station, usually as a switchboard attendant. There he remains, and possibly he becomes a shift engineer, with the result that he has been for several years on practically routine work; he has, perhaps, only had an odd occasion or two to make use of his workshop training, and possibly, never at all; he has had no experience on top of his manufacturing training, and no experience on the outside working such as the mains, and commercial management, which are the life of the station. This man then turns his attention to trying to get back again to the manufacturing side, but either he cannot get back, or, in face of his inexperience, he has to take a very humble position in a works, and then by the time he is 30 years of age he finds himself in the position of having spent the years which should have been the foundation of his career in such a disjointed manner, that he is unable to secure a good sound job. I am of the opinion that those who are calling out against the lack of suitable men, are those who find they cannot get hold of a man who has supplemented his training by experience in the branch wherein he was trained. I don't wish to open up the old discussion as to the central station training, but will say that until engineers realise that it is necessary for the success of a trading concern that the assistants should have had that experience, we shall continue to see central stations fighting to make a profit out of a concern which would in the hands of business people be a huge success. It should be remembered that in civil engineering, which is the top branch of the engineering profession, the training includes a term in a civil engineer's office, and if one is going to make a success of his profession, he has to specialise and keep to one branch. A man trained in a borough surveyor's office would stand a poor chance of obtaining a good appointment at dock building, but it appears that a central station engineer must be trained in some other branch, and if a man is no good at the end of three years' training in a central station, then he would be no good with any other class of training, or otherwise the engineer under whom he has been is no good. Therefore, if the profession is to obtain a better wage for its servants, the engineer should receive his training in that branch which he intends to follow.

Observer.

[But that is precisely the difficulty—so ably dealt with by Mr. Cramp in his excellent address to the I.E.E. (Manchester Local Section); the student hardly ever knows with any reasonable degree of certainty in what branch of the industry he will eventually settle down. As regards central station work, we have for a long time warned the many applicants to us for advice on making a start in life, that they should avoid entering an electric generating station. No greater mistake could be made.—EDS. E.R.]

A Reliable Rectifier Wanted.

No doubt many contractors and owners of cars have experienced the want of a reliable piece of apparatus at a small outlay for charging one or two ignition accumulators for motor-car work off an alternating-current supply. It is surprising what a number of such outfits have been put on the market by firms of repute and have been afterwards gradually withdrawn, owing to their unreliability. An outlay of £10 to £15 for a motor-generator set, regulating resistance and ammeter is usually out of the question.

All the electrolytic valves and rectifiers of the "Battery" type that I have had experience with have proved unreliable under working conditions, and if any of your readers can assist me by informing me of any really satisfactory arrangement on the market, I shall be very much obliged, and I am confident many others will be pleased to hear of the same.

J. R.

The Institution of Electrical Engineers.

Having secured the adjournment of last Thursday's extraordinary general meeting of the Institution of Electrical Engineers, it is necessary for those who are not satisfied with the proposed changes in the articles of association to take concerted action for their amendment. It seems desirable to direct attention only to the main alterations which would be produced by the new articles, as, if amendments on principle can be secured, the minor amendments of detail which they would necessitate could be left in the hands of the Council. It is to be hoped that the procedure at the adjourned meeting will be arranged to allow this course to be adopted, as no advantage can be gained by wasting the time of the meeting discussing and voting upon a multitude of minor amendments which are simply dependent on the decision reached regarding the points of importance.

The first question is that raised by Articles 4 to 8 covering the qualifications for membership. Broadly, the effect of these articles is to increase the existing tendency of the Institution to become more a trade association and less a professional body. To check this it is necessary to move Sections C and D of Article 12 which govern the admission of non-professional men to full membership, and to insist on the deletion of Article 15, which creates the new class of "licentiates." Apart from the name (which is a minor matter) there seems to be no need for this class, as those eligible will fall naturally into one or other of the existing classes of students, associates or associate members. The addition of more classes is, in itself, most objectionable for two more or less opposed reasons.

On the one hand, it involves labelling members with a title indicating their qualifications too minutely, and, on the other hand, it can only tend to the complete loss of the v

ll our Institution titles in the eyes of a public which not be expected to appreciate the fine distinctions which be apparent to members of the profession.

he next series of important changes are in Articles 26 0 dealing with subscriptions, &c. It is to be presumed t the Council will satisfy existing members that the itution has the legal right to increase their subscriptions, it is to be hoped that they will publish a financial state- nt showing the necessity for the increase, giving par- lars of the additional income anticipated, and the manner hich it is proposed to expend it. Many of us feel that subscriptions which we now pay are greater than is ranted by the advantages we enjoy, and the least that can expected, if we are asked for more, is that necessity uld be clearly proved. In this connection, it may be arked that no such necessity was shown by the last ual report of the Council, and that one of the reasons e given for an increase in subscriptions—that it would e the prestige of the Institution—shows a complete ure to grasp the meaning of prestige in a professional y. Apart from these points the alteration in the rates compounding needs explanation; this alteration implies t the old rates were on an unsound financial basis, in ch case it is remarkable that existing members are asked increase their subscriptions, but existing members who e compounded are not called on to pay the difference ween the old and new compositions. The most important nt in connection with the subscription rate is, however, t there should be discrimination between town and ntry members. Mr. Hammond's contention last Thurs- that the existence of the local sections obviates this essity cannot be maintained in the face of the acquisition the Institution building, however plausible it may have n when we had no proper home of our own. Feeling on question is strong amongst provincial members, and it be difficult for the Council to justify the increase to n, however successful they may be with town members.

Finally, we come to Articles 44-54, dealing with the com- ition and election of the Council. As regards the com- ition, it need only be remarked that the non-corporate ociates are over represented, and that the proportion ween associate members and associates on the Council uld be 4 to 2 or even 5 to 1 instead of three of each. e methods proposed for the election of the Council were ed by Mr. Hammond on Thursday to be intended to make election more democratic, but actually can hardly fail have exactly the opposite effect and to lead to the ncil becoming entirely co-opted. The opportunity to inate candidates *after* the publication of the list of the ncil's nominees should be restored, and the provision in icle 49 that under any circumstances 50 per cent. of the councillors shall be the nominees of the old Council uld be deleted. It would be advantageous to provide t the Council's nominees shall exceed the number of ancies so that there would necessarily be a ballot, and the ination of other candidates would be less invidious. y great importance attaches to the question of the tion of Council if members wish to retain a real control the Institution, the more so in view of Articles 66 and 69 (if these are allowed to stand), the first providing t the Council can effect loans, and the second that they incorporate kindred societies without sanction by a eral meeting.

I can only plead the importance of the subject as an use for so long a letter, and in conclusion would repeat t concerted action must be taken at once if these articles not to be adopted unamended. It is very greatly to be retted that the Council did not submit a draft to all mbers and invite criticism and amendment some months ore they proposed the formal submission of the articles to general meeting. Radical changes should not be made hout the *considered* support of the majority of members, three years' deliberation of a committee sitting in ate is no substitute for open discussion. It is un- tunate if the method actually adopted by the Council es on some of us a course apparently directly hostile to ir proposals, but the blame for this result cannot be laid our doors.

Maurice Solomon.

Birmingham.

The alarm with which the proposed new articles of association of the Institution of Electrical Engineers have been received by the members all over the country, and the informal discussion in London, have proved that there is a wide difference of opinion between the Council and the general body of members. The Council have agreed to an open discussion, which no doubt will result in a large number of amendments being sent in. As, however, hundreds, and possibly thousands of amendments cannot be taken into consideration, the purpose of the deferred discussion will be frustrated unless some definite method is adopted beforehand to reduce the number of amendments to the vital points only, leaving matters of detail to be put at the meeting in London.

As points affecting the future policy of the Institution, on which a vote should be given, I would propose the following:—

1. Inadvisability of creating the new class of Licentiates. (Par. 4.)
2. Necessity of keeping the Institution a strictly scientific and professional body. (Par. 12D.)
3. Increase of fees. (Pars. 26 and 27.)
4. Examinations. (Par. 16.)
5. Nomination and election of Council. (Pars. 49, 51 and 52.)

Under the present by-laws the Local Sections have no power to vote or pass any resolution in respect to the affairs of the Institution, and, therefore, whatever votes are taken will have to be forwarded direct from the members to the secretary. In order to enable any member to gauge the strength and the direction of the opinion of the body of members, I would suggest that copies of the resolutions passed on the above points should be published in the technical Press, together with the number of the members in favour.

R. Orsettich, M.I.E.E.

Birmingham,
November 6th, 1911.

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in the Manufacture of Incandescent Electric Lamps.

By J. E. Randall.

(*Abstract of paper read before the* Illuminating Engineering Society, *Chicago, September*, 1911.)

Lamps with carbon filaments have been supplied without any change in appearance for over 11 years. Within that period one notable improvement was introduced, namely, the metallised filament.

No changes have been made in the processes of manufacture. The best lamps of 10 years ago were as good as the best of the present year. The average has arisen due to the elimination of defectives.

All conditions favourable to advancement of the regular carbon-filament lamps were of similar assistance to the Gems. A discovery in connection with the preparation of the carbons for these lamps resulted in a decided improvement in 1909. Heretofore, wattages lower than 50 had not been made successfully. Recent experiments show that wattages as low as 30 can be made. The Gem lamp shows a sufficient superiority in quality over the regular carbon-filament lamp to justify its more extensive use.

The osmium lamp marks the beginning of development of metal-filament lamps. It reached a successful commercial stage in Europe.

The tantalum, nearly coeval with the osmium, is worthy of mention as an example of an article upon whose production years of research had been spent, and upon whose design lavish experiments had been made. When first offered to the public, its design was finished and its qualities were thoroughly known.

This lamp was the first real drawn-wire lamp, and its development required a construction of the filament supporting element different from any that had been used heretofore. The same design has been followed, with slight modifications, in the drawn-wire tungsten filament lamp.

The superiority of the metal tungsten for a lamp filament was immediately recognised because of its extremely high melting point. The brittleness of the pressed filament, especially when it is cool, has been a serious drawback to the general use of the lamp. The attachment of the filament rigidly to the circuit connections and to the intermediate connections between the filaments has probably been the chief cause of filament breakage in these lamps. The arced joint, while it was perfect electrically and

mechanically, held the filament ends rigidly. Any jar to the lamp tended to make the filament vibrate and usually to break close to the joint. The schemes that were devised for avoiding this filament breakage were legion, but the author believes he is safe in saying that the loose contact at the bend of the filament, with a support that was rigid, made the hardiest lamp of the pressed filament type.

One of the most successful devices for preventing the breakage of filaments was that of introducing a short piece of piano wire between the centre rod and the stem seal. This supported the filament structure with remarkable flexibility and prevented breakage from blows on the lamp in almost any direction. A slight blow upon the base of the lamp was invariably fatal, and this one weak feature served to prevent the general introduction of this method of support.

The pressed tungsten filament is not ductile when cold, no matter by what process it may have been produced. It was natural, therefore, that immediate effort should be made to develop a quality of tungsten sufficiently ductile to be wrought into the form of wire, and in 1911 ductile tungsten has been produced on an extensive commercial scale.

It is generally believed that the presence of carbon in tungsten is the cause of its brittleness. One well known process for making pressed tungsten filaments does not involve the use of carbon, yet filaments produced by this process are as brittle as are filaments made by the use of carbon. As a matter of fact, the best pressed tungsten filaments have been those made by processes involving the use of carbon, yet they contain an amount of carbon so small that it can only be detected by the most delicate tests. For instance, filaments which are known to contain less than 0·005 per cent. carbon are no more ductile than those which are found to contain 0·1 per cent. The elimination of carbon tended to reduce the length shrinkage of filaments when lamps were burned. Filaments produced in 1908 and 1909 sagged excessively, and the filaments often short-circuited due to this sag; the slack producing this sag was necessary because of the filament shrinkage. During the year 1909 decided improvements were made in this respect, and the basis of these improvements was the more complete elimination of carbon from the tungsten filament.

Progress during 1909 and 1910 did not indicate a material decrease in the fragility of the pressed filament. It was evident, therefore, that to make the tungsten-filament lamp a universal lamp, it would be necessary to have the filament in the form of wire which was sufficiently ductile to be wound, when cold, upon a spider structure. The drawn tungsten wire has met this need. While the wire before being placed in the lamp is amply ductile for the purpose of winding upon the spider and for all other manipulations needed in making the lamp, it loses much of this ductility when current is passed through it in a vacuum. The methods of supporting the wire on the spider, and of attaching it to the circuit terminals are, therefore, important factors in the hardiness of the lamp.

The wire may be considered to consist of pure tungsten. Chemical analysis does not find other elements. The ratio of resistance hot to resistance cold is as high as can be found in any other form of the metal. The specific gravity is higher than that found for the pressed filament. The current and the candle-power peaks are low.

The structure of the metal appears to be fibrous. It changes to the crystalline form during the burning life of the lamp. This change may occur in some portions of a filament and not in others. Frequently, after the full burning life, small sections of filaments will be found that show ductility.

Tests indicate that the wire is less brittle at every stage in the life of a lamp than are pressed filaments. The surface is the same in appearance, after the lamp has been burned, as that of a pressed filament. It looks as if the wire had been cracked into irregular pieces, and as if a cement of the same material had filled up the cracks. No fissures at the surface and no cavities in the body have been found.

While the wire, before being placed in the lamp, may be ranked with the toughest steel in tensile strength, ductility and elasticity, the decay of these properties after it is in the lamp makes it necessary to handle these lamps with reasonable care in order to prevent breakage. Breakage in transportation and handling compares with that for carbon-filament lamps.

Another feature in which the drawn wire is superior is the wide range of sizes suitable for use. A piece of wire may be drawn to a size suitable for a 6·6-ampere series-burning lamp, or it may be drawn to a size suitable for a 20-watt 110-volt multiple lamp. It will, when drawn to the proper diameter, be equally satisfactory for the largest or the smallest lamp. In addition, the wire may be shaped into helices, spirals or zig-zags; thereby concentrating the light-giving element into a small volume. The latest automobile lamp is an example.

The number of contacts between the filament and supports, including terminals, as well as the size and material of these supports, will affect the performance and physical hardness of a lamp.

The following results were secured from three series of tests in each of which more than 300 drawn-wire tungsten-filament lamps were used:—

Number of contacts	11	13	15
Comparative strength, by pendulum test—			
Copper	91·5	100	96·5
Molybdenum	—	—	93·0
Comparative performance at normal efficiency—			
Copper	99·4	100	96·1
Comparative life at extreme temperature—			
Copper	107·0	100	87
Molybdenum	—	—	103

The lamps were standard in voltage and all were 40 watts. The were identical except in the number of filament contacts. T results of the first and second tests confirm one another indicating that 13 contacts are most satisfactory.

While no record is shown for molybdenum-support lamps normal efficiency, such lamps were tested, but their performan was much poorer than the corresponding copper support lamps.

The comparative lives at extreme temperature show that contacts are better than 13, and that 13 are better than 15. A that 15 molybdenum contacts are better than 13 copper, b inferior to 11 copper. These results are not in consonance wi the results at normal efficiency. It is reasonable to believe th tests at, or near, normal efficiency indicate more accurately behaviour of lamps in service than do those at high temperatu It has been observed that the wire in lamps burned out when high temperature remains more ductile than the wire in lam burned out at normal temperatures. The early failure of 15-cont lamps would not be explained by mechanical weakness. The wi usually "burned out," or melted, between the supports. melting of the wire at the point of highest temperature has rea controlled the life record of this test. The diameter of all cop supports was the same. The diameter of the molybdenum 40 per cent. of that of the copper. Supports of copper hav diameters 30 per cent. smaller and 30 per cent. larger than the used in the above tests both showed a lower strength by pendul test. The author cannot explain why this should be so, but tests were convincing.

If progress in lamp development may be gauged by the high filament temperature at which each new lamp will show a gi performance, one has a rational measure. For example, if 90 cent. of the theoretical candle-power hours are developed in 1 hours' burning, candle maintenance and mortality both conside the advance from the raw carbon-filament lamp so the tungs filament lamp will show something as follows:—

Raw carbon-filament lamp (cellulose carbon) ...	100
Treated carbon-filament lamp	119
Metallised carbon-filament lamp	149
Tantalum-filament lamp	206
Osmium-filament lamp	270
Tungsten-filament lamp...	359

This comparison excludes many items, and is not a compa of commercial values, although it is a comparison of the important element in commercial values, namely, the en wasted in doing equal work.

The Institution of Electrical Engineers.

The Proposed New Articles of Association.

Limitations of space preclude the publication here of proposed Articles, but the following are the principal mod tions:—

The membership is divided into two sections: Corporate Mem comprising Honorary Members, Members and Associate Mem and Non-Corporate Members, comprising Associates, Licentiate Students. "Foreign Members" no longer appear as a se class.

The abbreviated titles of Corporate Members are unchanged distinctive titles of Non-Corporate Members are given in followed by the letters I.E.E.

The qualifications of Members are verbally altered, bu materially varied, except that temporary unemployment is be deemed a disqualification, and that gaining the senior pre for a paper no longer constitutes sufficient qualification f transfer of an Associate Member. The admission of "perso eminence" who are not electrical engineers by profession is f provided for, with limitations to the number of such member

The qualifications of Associate Members are similarly mod the gaining of a premium no longer qualifies an Associat transfer to this class. "The Council may require candidat Associate Membership to pass an examination, or in their disc grant exemption therefrom in approved cases."

Associates are to be persons of good education who are no trical engineers by profession, but, in the opinion of the Coun so connected with the applications of electricity that their adm as Associates would conduce to the interests of the Institutio

Licentiates are to be at least 23 years of age and of good tion, either electrical engineers by profession or employed engineering or scientific capacity in the applications of elect whose admission as such would, in the opinion of the Counci duce to the interests of the Institution.

Students are to be not more than 23 years of age when e and are to be either students of electrical engineering at one universities, colleges or schools recognised by the Coun pupils, apprentices or assistants under agreement under a co member; or persons trained as electrical engineers and em in positions of minor responsibility. The Council may requir to pass an examination, or, in their discretion, exempt them from.

Proposals submitted to the Council for transfer from one another are in future, if approved, to be presented for as in the case of new members.

The entrance fees are raised as follows: Members, 3 to 5 gu Associate Members and Associates, 2 to 3 guineas; Licentia pay 1 guinea.

Subscriptions are raised as follows: Members, 3 to 4 g Associate Members admitted to that class after December 31s 2 to 3 guineas; ditto, before that date, 2 to 2½ guineas; Ass

ne as Associate Members; Licentiates will pay 2 guineas, udents up to 19 years of age, 1 guinea; above that age, neas. Members residing abroad, on the register at er 31st, will pay 3 guineas (formerly 2 guineas, and Foreign rs £1). Associate Members and Associates residing abroad same as at home.

compositions formerly cost 40 guineas for all classes but s; in future any member (not a student) may compound annual subscription by the payment of 20 times the subscription, subject to deductions for subscriptions already before.

v article embodies rules for "Professional conduct," similar adopted by the Institution of Civil Engineers, breaches of vill be dealt with by expulsion, or as the Council may think

onstitution of the Council is modified by the omission of ident-Elect, and the addition of the immediate Past-Chair- each Local Section. Of the 18 ordinary members of Council, to be Members, three Associate Members and three es.

to March 1st, any 25 Corporate Members may nominate alified persons to fill vacancies about to occur in the Council mber 30th; at least four weeks before the annual general the Council must present a list of persons nominated by id if any other persons have been nominated, a ballot list, which are nominated by the Council and which from out- o be sent to the Corporate Members and Associates at least ays before the annual general meeting. The number of elected from the list must not exceed or be less than the requisite to fill the vacancies. The persons elected take October 1st.

ion is made for holding examinations to test the qualifica- candidates for election or transfer, and for the payment of he candidates.

ouncil is empowered to arrange for informal meetings and for the dissemination of electrical knowledge.

is taken for the Council to borrow moneys for the purposes stitution on the security of its property.

ouncil may appoint committees for special purposes, and to them any of its own powers.

port of the proceedings at any meeting may be taken or l without the consent of the Council.

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ordinary general meeting of members was held at the on House on Thursday last week, to consider the proposed cles of Association.

Z. de Ferranti, the President, was in the chair, and notice convening the meeting had been read, stated that ncil had received from many directions a number of and suggestions regarding the proposed new Articles. The believed that the amended Articles were in every way good point of view of the interests of the Institution, but they a mistake had been made through following the ordinary ractice by making the time too short to enable proper tion of the Articles to be given them by a number of ; he, therefore, proposed the adjournment of the meeting ive time for very full consideration of the Articles, to a earlier than November 30th. Mr. Hammond having the motion, the President said he would now put it to ng, when Mr. A. J. Makower suggested that if possible of the meeting should not be half-past four in the after- at 8 o'clock.

C. Raphael asked leave to move an amendment to the n, pointing out that if the meeting were adjourned and the the next meeting issued in the same terms as the notice eeting, the Articles would have to be discussed *en bloc*, and ments could be proposed, the members not having had 's' notice of them as required by the Companies' Act.

MMOND said he thought provision could be made so that nlty would not arise.

PHAEL remarked that the Provincial Members and Asso- nbers were desirous of having a great many amendments he Articles, and asked for an assurance that steps would so that these amendments should be in order, and might ed; in the absence of this assurance, he thought they t to permit the meeting to be adjourned without a much ussion than was presumably intended, from the President's marks.

Siemens pointed out that, after the adjournment of the eeting, those present could talk over the proposed Articles, would be plenty of time before the new meeting for to send in their amendments to the Council, which could o the notice of the new meeting, if necessary. The Council lged that the present notice had been too short for such ant resolution, and wished to prolong it in this way.

to Mr. Makower, the President explained that the anted the fullest discussion of the proposals at the meeting which would follow the adjournment of the formal

URICE Solomon said that if the motion of adjournment ed, anything decided at the informal meeting would not weight.

ESIDENT, to illustrate the impossibility of proceeding with sion, pointed out that one member alone had sent in 27 nts. If all the material were sent in, there would be plenty reduce the amendments to a workable form—otherwise e time of the members would be taken up with these alone.

RSE said that any amendment that could be put at that meeting could be put at the adjourned meeting. If there were amendments which, in the opinion of the Council and members, were desirable, what was necessary to make those amendments legal should be done. The object of the informal discussion was to come to a consensus of opinion on both sides of the table.

Mr. Makower again asked for an assurance that the time chosen for the meeting should be one at which the younger members could attend.

Mr. A. J. Cridge pointed out that, if they resolved themselves into an informal meeting, no report would be presented of the proceedings, and Mr. A. P. O'Brien said the afternoon meeting was inconvenient to the older as well as to the younger members.

Mr. A. H. Dykes supported the proposal to adjourn and hold an informal meeting, after which members who had points to put forward could send them in to the secretary, and the amendments could be sorted and discussed at the next meeting; the hon. solicitors could arrange that whatever was decided at that meeting could be confirmed at a later meeting.

Mr. Makower asked what advantage would be gained by adjourning first and discussing the proposals afterwards?

The President explained that the members generally suggested that they had not anything like enough information, and therefore they could not properly vote upon the Articles. There appeared to be no objection to holding the meeting at 8 o'clock. The remarks of the members present would be reported, and from that point of view it made no difference whether the discussion was formal or informal. They wanted to get the views also of those who were not present.

Mr. F. C. Raphael pointed out that the meeting was not open to the Press, and asked that the shorthand notes of the official reporter should be placed at the disposal of the Press.

The President, in reply, said that they wished to give the meeting the widest publicity possible, and would like to see the matter appear in the Press, so that it should reach all the members of the Institution. The shorthand report would, therefore, be at the disposal of the Press.

Mr. M. Solomon was pointing out that the offer to adjourn the meeting did not really meet the difficulties which they had come up expressly to try and deal with, when Mr. Hammond, rising to a point of order, said that at meetings of companies a person could only speak once on the motion or the amendment, and that if a member were at liberty to speak as many times as he liked, they would never get the meeting through.—The President agreed as to the rule, but Mr. A. Campbell, supported by Prof. Mather, said that that had not been the custom at the meetings; people had been able to speak more than once if the meeting wished to hear them.

Mr. Solomon asked if he were in order, but the President said that it would be impossible to conduct the business in that way. The Council, like the members, wished to do the best they could for the Institution, and the simplest thing to do, if they wished to give the Council the benefit of their advice, was to adjourn the meeting, and then to remain to hear those things which were most to the point in the interests of the Institution. He then put the question, and the resolution was carried by a majority.

The President said the two outstanding questions in these Articles were, first, the amount of the subscriptions; and, secondly, the re-arrangement of the membership. Small changes of wording or arrangement could not have very much effect on the prosperity and usefulness of the Institution. With regard to the subscriptions, he came there mainly to see what could be done to bring the Institution more into touch with the needs of the industry, to increase the prosperity of electrical work, and to extend the applications of electricity, and to do various things for the good of the members. The difficulty which he met at every turn was that there was no money to spare for any such purpose. They could not get results without paying for them. Regarding the alteration of membership, he was largely responsible for pressing the idea that the Institution wanted to be not only a scientific society, but a body which dealt generally with the whole wide interests of electrical work in this country. The only body that could really represent electrical interests was that Institution, which should, therefore, put itself into such a form that it could be really useful to the interests of all concerned in electrical work. Therefore, it was desirable not to limit the membership to purely technical people; they wanted to bring in many able men who were not purely electrical engineers, and to get them to help in conducting this business. The question of naming the various classes had been the most difficult thing he had ever come across in all his experience; after months of meetings it would be very hard to find anything that would meet the case more satisfactorily than what the Council had put forward. He called upon Mr. Hammond to speak first, as the chairman of the Articles Committee, which had discussed the Articles for 18 months.

Mr. Hammond made a lengthy statements as to the necessity for the revision of the Artioles and for the new proposals. Two years ago a Committee was appointed with instructions to re-arrange and revise the Articles; it consisted of 12 members, including the six chairmen of the Local Sections. After 18 months' work the new Articles were submitted to the Council, which had since then made a careful study of them. It was, therefore, not a hurried piece of work. The importance of raising the standard of qualifications of Members and Associate Members had been a guiding principle, and the Council had decided to adopt examinations for this purpose. The Licentiate class was introduced to provide for the admission of men who, while engaged in electrical engineering, could not pass the examination for Associate Membership; formerly these could enter the Associate class, but this class consisted largely of gentlemen of high standing in other professions, for whom it should be entirely reserved. Much

difficulty had been met with in finding a suitable title for the new class, and "Licentiate" was chosen for want of a better name. It was already used by the Royal Institute of Architects for a similar purpose. Those Associates who were qualified as Associate Members would be transferred to that class, the Associate class becoming an absolutely non-electrical class, not holding the rank of Corporate membership. The terms of admission to the class of Member had been modified, and the constitution of the Council revised, giving direct representation to the Associates, securing the introduction of new members, and providing for the better representation of the Local Sections. The mode of election of the Council had also been changed to facilitate outside nominations. Regarding the increase of subscriptions, the acquisition of that building had added to the dignity conferred by membership of the Institution, though it did not necessitate an increase of subscriptions *per se*. But they were working on a small margin, and if the upper part of the building were not let to new tenants in June next, a liability of about £3,000 per annum would be incurred. To provide against this a number of past and present Members of Council had formed a guarantee fund of over £7,500, which could be drawn upon, if necessary, by way of loans repayable when convenient to the Institution. However, they were not asking for increased subscriptions because they could not pay their way, but because, being in possession of the Institution Building, they could now carry out various new developments which hitherto had been impracticable. The building was used by some 13 kindred societies. It had been proposed to issue the *Journal* monthly, to inaugurate lectures by specialists, to hold summer meetings, to open an employment bureau, to supply technical and commercial information to individual members, and to start a lending library, but all these things required additional funds. The expenditure on the staff was extremely low, but additions to the staff were imperatively necessary. The proposed new rates were equal to, or less than, those of the other engineering bodies. It was estimated that the matters under consideration would necessitate an additional expenditure of almost £2,000 capital, and over £2,000 per annum, if carried out in full. Six months ago the Council embodied in the Annual Report everything that he had told them that day in respect of their desire to enlarge the scope of the Institution, and foreshadowed the increase in subscriptions and entrance fees.

Mr. Solomon expressed the thanks of the members to the President and Mr. Hammond for the exposition which had been put before them; he said it was one of their great regrets that some such exposition was not sent out with the notice of the meeting. The Articles raised very vital questions in the life and future of the Institution; the Committee had sat for three years on the subject, so they would conclude that there was another side of the case, and it was vital that both sides should be fully discussed before they came to a decision. He referred particularly to the Articles dealing with the qualifications of membership; there were to his mind—and he believed he voiced the opinion of a good many—two objections to them. The first was that they did not want a new class of members, because they did not want their Institution to be split into so many classes and divisions, each labelled with specified qualifications; the Institution should be more catholic and draw all distinctions between two or three classes and not more. Further, there were two ideals before them; they could endeavour to make themselves a purely professional Institution, or an Association of all interested or concerned in the electrical industry. But they could not do both. He thought the Council was endeavouring by these new qualifications to do both, and such a policy was destined to failure. As a professional Institution they wanted three classes of members—Members who were at the top of their profession; Associate Members, the great average of the people in the profession—both these classes being strictly professional men; and Associates, which should include all the non-technical men. The alternative was to broaden their scope, and in that case they wanted two classes—Members, including the most distinguished people, whether technical or non-technical, and Associate Members, which should include the remainder whether technical or non-technical. The Institution should make up its mind which of those ideals it wanted to follow, and then draw up its classification accordingly. He would not then argue whether one way or the other was the better. Regarding the question of fees, Mr. Hammond had made a statement of the reason for the increase in which not one figure had been put before them. If they were to be asked to raise their subscriptions they ought to be shown in £ s. d. what the additional income was to be used for. As a local member he voiced the feeling of country members that if any alteration of subscription were made, consideration should be shown for the fact that the country members could not enjoy the same advantages as town members, and some difference should be made in the subscriptions, to allow for the fact that that palatial Institution was of no practical use to the former. Turning to the election of the Council, provision had been made for increasing the representation of the Associates, who, however, had no vote in the affairs of the Institution. Why were they given a representation on the Council equal to that of the Associate Members? In future, it appeared, the new members of the Council would be nominated by the Council, and in practice, though not in theory, outsiders would get no chance of nominating new Councillors, seeing that they had to give notice three months beforehand, and that after the Council's list of nominees had been produced, outsiders could not propose fresh men, as they could under the old rules. That was a very valuable privilege and ought to be restored. The Local Sections and individual members were very anxious to propose amendments, and in Birmingham, on Tuesday, a meeting was hastily called and well attended, which sent in a resolution asking the Council to submit the Articles for discussion at the local centres; he hoped the Council would accede to that resolution, which he had with him, and which was signed by most of the leading members of the Birmingham Section. He understood similar resolutions had been sent in from many of the branches. He did not want the mistake to be repeated, of calling a meeting to discuss Articles without the amendments also before them.

Mr. W. Cramp asked whether it would be in order for the Local Sections to call their Committees or the whole section together to discuss the Articles, and to forward the necessary amendments by the date mentioned.

Mr. E. H. Rayner suggested that an explanatory letter should be circulated to the members, dealing with the effect of the alterations in the wording of the Articles, and giving a review of the present and future financial situation. It would be a great advantage to have a *résumé* of the treasurer's statement circulated to the members, especially to the local meetings which might be held. Referring to the composition for life membership, in the case of members had paid three guineas yearly, and the composition had been 40 guineas—13⅓ years' purchase—which he considered a very proper sum. Under the new regulations that sum would be raised to 80 guineas, or 20 years' purchase of the increased subscription, which seemed excessive.

Mr. A. Campbell said there was no doubt whatever that a change of subscription touched very directly, and sometimes very acutely, every member of every branch, and it seemed to him that far as he had talked to members, that every member would be desirous of expressing his opinion on the matter. No doubt a great deal could be done with a great deal more money, but he suggested that when it came to the final decision of this financial matter a referendum should be taken of the members of all classes. They were all very thankful to the past and present Councils and benefactors for that magnificent building and really delightful library that was a very great advance, and they must not go ahead too quickly after it. The Associate Members and the Associates formed the backbone—in numbers at least—of the Institution, and remembering that very probably the average income of the members of that class was between £150 and £200 a year, he thought it was not desirable to ask more than two guineas a year from them, especially as many of them had to belong to another society as well. As it was a matter which acutely concerned all who were asked to subscribe, it should not be decided by a vote of those who were into that room, which did not represent the whole of the membership, but by a direct referendum.

Mr. F. C. Raphael said he cordially agreed with the general principle of the alteration of the Articles—to enroll every good member of the Institution; if an increase of subscription were necessary, they must pay it. He would like to ask Mr. Hammond why the Associate Members had only one representative on Council, while there were 2,809 Associate Members to 1,331 Members, a majority of more than two to one. Mr. Hammond had said that in the report of the Council they had full notice of practically the whole of the provisions put forward in the proposed amendments to the Articles; was there any mention of the proposal to have an absolutely new class of members, to make a very serious alteration in the method of electing the Council, to give the Council power to delegate its own powers to non-members of the Council? All these things were included in the proposed new Articles. The Council also took powers to incorporate any other association whatever with their own, without seeking the permission of the members. These should not be things of which only a week's notice was given, and that notice should not be given in such a way that he concluded it was the first thought of the Council that the new Articles could be accepted *en bloc*, without opportunity for discussion. Speaking as an Associate Member, he said he was now proposed to increase the class of Associates by as many members who were not electrical engineers as possible, and to form a new class called "Licentiates," electrical engineers who were unqualified to be Associates, and certainly could not be licensed practice as the word "Licentiate" obviously implied. He suggested that the "Licentiates" should be called "Subscribers," a name which met the case very well; they subscribed to the Institution but had practically no qualifications, and as they did not want to have such an abbreviated title as the initials of "Licentiate of the Institution of Electrical Engineers," obviously they must write the word "Licentiate" in full. Again, if they were to have a large number of new Associates, obviously the position of the Associate Members would be prejudiced. To the general public there was very little difference between Associate and Associate Member. He proposed that Associates should be called "Affiliated Members." (The President pointed out that the word "affiliated" had painful associations.) Dealing with the representation on the Council, Mr. Raphael proposed that there should be not Associate Members and three Associates on the Council, but four of the former and two of the latter; he hoped this proposal, as it would be accepted. The election of the Council had already been referred to; the effect would be that the Council would not be its successors. That was not the position in any other Institution, and he felt it was due to an error in drafting.

Mr. W. R. Cooper said he hoped a statement would be made to the members showing why the increase of subscription was necessary, and referred to Mr. Mordey's statement, when it was decided to take over that building, that no increase of subscription would be necessary. Would it not be possible to raise the subscription merely of new members, and to make a distinction between country and town members, as was done by the Civil Engineers? Associate Members did not transfer to the class of members as they ought to, and if the subscription were put up, that feature would become still more marked. He agreed with the criticism directed against the Licentiate class; he was afraid the public would think Licentiates more highly than the full members, and once they

o that class they would stick in it for the rest of their lives. ought to be a migratory class, and after a certain number of yea's eir subscriptions should be made equal to that of the Associate mbers, so as to make the Licentiates transfer to the higher class. regarded students, the term "Graduate" would be more suit- e. as used by the Mechanical Engineers. The election of mbers at meetings of the Institution was an absolute absurdity; uld it not be better to do away with them altogether? He reed that the Associate Members should have a larger represen- ion on the Council, say, four to two, and felt that the proposed tem of outside nominations was too cumbersome and would fall o disuse. The use of the word "present" in Article 57 was st ambiguous, and the word ought to be deleted. He asked the uncil to give an indication of their policy with regard to the orts of meetings, and suggested that it would be better to have other informal meeting before the formal meeting on November h for further discussion.

Mr. A. P. O'Brien supported the remarks of Mr. Campbell and ers as regarded the subscription of Associate Members, and asked w the increased amounts were to be applied. The Licentiate class s not very necessary, in view of the wide provisions made for sociates.

Mr. T. H. Roberts-Wray said the most vexed question seemed be that of subscriptions. He thought that, legally, they could increase them without obtaining the consensus of opinion of erybody who would have to pay them.

Mr. A. J. Makower said that if they charged 80 guineas for com- anding for a 4-guinea subscription, it meant at 5 per cent. mpound interest that the expectation of membership was an inite number of years. The old rate was not 13 years, but 22 ars at 5 per cent. A more reasonable figure than the one ggested would be 50 guineas, or about 20 years' purchase.

Mr. A. A. C. Swinton supported Mr. Cooper's suggestion that other informal meeting should be held.

Mr. A. H. Preece thought that probably the new Articles uld eventually be accepted *in toto*, but it was an unfortunate stake on the part of the Council to hurry it too much. The cellent statement given to them on entering the room should ve been in their hands a week ago; it ought to be sent out to the members, and the amendments received should be sorted and sted up in the Library. An estimate of the future income and penditure should be issued to the members. He thought that the mbers did not want to be "bluffed," but that, when they got hold the facts, they would support the Council as they had always ne in the past.

Mr Hammond, repairing an omission from his previous remarks, d the Council took the view that, as the majority of the country embers resided within the area of one of the Local Sections, and a ney grant was made annually to each Local Section, which, th travelling and printing expenses, brought up the total expendi- re on Local Sections to more than *one-third* of the subscriptions of eir members, it would be fair to fix the subscription at the same ure all round. The subscriptions of the bulk of the existing embership, namely, Associate Members, Associates and Students, ll be the same as those of the Mechanical Engineers and of the untry members of the Civil Engineers.

The President said that another meeting would be held at o'clock in the evening of that day fortnight, and asked the members forward suggestions by that day week (Nov. 9th), to give time for em to be sifted. By then they would have an immense mass of formation. Before that meeting they proposed to send out the tement showing the principal alterations, and Mr. Hammond's planations of the Council's reasons for the different changes ade.

In reply to various questions, the President said that the port of the meeting would be furnished to the technical papers, d that the suggestions from the Local Sections and other sources ould be placed before the meeting to be held that day fortnight, t these would not be sent out to every member. All members ere requested to send in their suggestions in writing.

OUR LEGAL QUERY COLUMN.

Questions addressed to this column should be written on one side of the paper only.]

Inquirer" writes: "(1) Assuming an installation is carried out a good practical manner with the general quality of materials d fittings, and the same passes the tests of the Corporation Elec- icity Supply Department, has the Corporation any authority to ject the installation and refuse to connect the supply to same?

"(2) Has a Corporation any powers or authority to dictate to a ntractor the kind or quality of wires, cables, flexible cords, cut- ts, wall-plugs and fittings, generally, to be used on its supply private consumers' premises?

"The reason for asking these questions is because, at the present me, the contractors in this town are being dictated to as to what ey shall and shall not use, irrespective of any tests.

"The requests of the Corporation have, up till now, been very ell met in reference to flexible cords and cut-outs that only one rm make, &c., but the writer is inclined to think that when they egin to ask for conduit fittings of a certain make, wires and cables *Association quality*, wall-plugs of certain types, &c., they are exceeding the powers granted to them, and taking upon themselves authority which they have no right to.

"I am a believer in good work, but I, along with other contractors and also factors, do not like being dictated to too much as to whose make and what quality of goods I should sell and use."

*** Without an opportunity of perusing the local by-laws and the Act of Parliament under which the Corporation is acting, these questions cannot be answered with much certainty. As to (1) it would seem that there are certain by-laws in existence, and the Corporation is clearly entitled to enforce these. Speaking off-hand, however, it is apprehended that if the Corporation tests are satisfied the Corporation can make no further complaint.

As to (2) it may be that there is a by-law which enables the Corporation to insist upon certain types of wires, wall-plugs, &c., being used, but again, speaking off-hand, it is thought that such a by-law would probably be *ultra vires* and bad. In this connection, however, it is material to notice that by Sec. 18 of the Electric Lighting Act, 1882, "undertakers shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way to control or interfere with the manner in which electricity supplied by them under this Act, and any licence, order or special Act, is used." The fact that restriction may not be placed upon the use of particular lamps or burners gives colour to the suggestion that the use of specified fittings may be prescribed. The proper way to test the matter would be to install a set of premises independently of the Corporation and then allow that body to take such legal steps as it may be advised.

LEGAL.

The Hythe Telephone Dispute.

In the Chancery Division on Friday, November 3rd, Mr. Mecklein, K.C., stated to Mr. Justice Swinfen Eady that he had a motion in the action of the National Telephone Co. *v.* the Mayor, Aldermen and Corporation and Burgesses of the Borough of Hythe, to restrain the defendants from revoking, or purporting to revoke, wayleaves, or interfering with the company's poles. His Lordship would recollect that last week his learned friend, Mr Russell, K.C., had another motion in the action of Dickens *v.* the National Telephone Co. He (Mr. Mecklein) was informed that his learned friend appeared in both cases, and was filing evidence in regard to the first. Under these circumstances he asked that both motions should stand over for a week, the undertaking given last week to be continued.

Mr. Russell, K.C., said he had only just received the notice of motion in the case of the company *v.* the Borough of Hythe, and it was necessary that that should stand over. As regarded the motion of Dickens *v.* the company, he was ready to go on with that, but he agreed with Mr. Mecklein that it would be better if both motions stood over until next week, on the understanding that the undertaking should be continued.

His Lordship consented to that course being taken.

Alleged Breach of Warranty.

At the Newcastle-on-Tyne Assizes, on November 2nd, before Mr. Justice Horridge and a special jury, an action was commenced for damages for alleged breach of warranty alleged to have been given in connection with a second hand steam condenser. The plaintiffs were the Urban Electric Supply Company, of Hawick, N.B., and the defendants were the Lumsden Machine Co., of Gateshead-on-Tyne.

Mr. Waugh, K.C., and Mr. H. B. Grotrian were for the plaintiffs, and Mr. J. Scott Fox, K.C., and Mr. R. M. Stephenson were for the defence.

Mr. Grotrian explained that the defendants pleaded that no warranty was given, or, in the alternative, if it were given, that it was fulfilled, and further, that if any such warranty were given there had been undue delay in bringing the action.

Mr. Waugh explained that the plaintiffs had various works in England and Scotland for the distribution of electricity. Intending to increase their plant at Hawick, they entered into negotiations with the defendants for the purchase of a condenser, and on February 28th, 1910, the defendants wrote offering to sell the plaintiffs a condenser capable of dealing with 15,000 lb. of steam per hour. Defendants were purchasing the condenser from the Coatbridge and Airdrie Electric Supply Co., of London and Coatbridge, for £275, and they sold it to the plaintiffs for £350, so that defendants got a fair return for their services in the matter. Plaintiffs' manager saw the condenser in sections at the premises of the Coatbridge Co. Plaintiffs asked the defendants for the original specifications of the condenser, and these the defendants obtained from the Coatbridge Co. The defendants were then informed that the condenser was capable of dealing with not more than 8,000 lb. weight of steam, but with that knowledge in their possession they did not inform the plaintiffs of the fact. When the machine was erected on the plaintiffs' premises it was, in fact, found to be incapable of meeting the demands of the plaintiffs, and was really useless for their purpose. The plaintiffs now held that the condenser was not worth more than £200, and on that ground they claimed £150, and they claimed a further £135 for the time and

material used in erecting the machine on their premises, so that the claim of the plaintiffs was £285.

Mr. Rye, plaintiffs' late manager, said he could not ascertain the condensing capacity of the machine when he saw it at Coatbridge, because he saw the machine dismantled and in sections, and he had not facilities for measuring up the tube area.

In cross-examination, Witness said he asked no questions as to cooling area. He examined the condenser for condition and not for capacity.

Mr. Alexander Anderson, assistant engineer to the plaintiffs, gave evidence as to testing the condenser, and said the machine was not capable of dealing with the amount of steam required by the plaintiffs.

Mr. Henry Joseph, plaintiffs' resident engineer, also gave evidence as to the inadequacy of the condenser.

Mr. John Elliott, an expert witness, also spoke as to the capability of the condenser. He had had 15 years' experience, and had dealt with approximately 2,000 condensing plants. The plant in question had a condensing surface of 854 ft. and was only capable of dealing with 8,500 lb. of steam, maintaining a 25-in. vacuum with water at 80° F. per hour. If the condenser was worked under the best possible conditions, it was not capable of dealing with 15,000 lb. of steam. The best possible was 10,000 lb. of steam, with a vacuum of 26 in. and water at 36° F.; those he considered were the best possible conditions.

The Court then adjourned, and resumed on the 3rd inst.

Mr. Scott Fox opened for the defendants. He said the plaintiffs had given no real evidence that the condenser was incapable of doing the work required of it by them. The machine was sold in June, 1910, and delivered in February, 1911. Plaintiffs had made two trials, at which the defendants were not asked to be present, or to be represented, and upon the result of those trials they based their case. Before fitting up the condenser, the plaintiff had made structural alterations in the condenser, which, in the opinion of the counsel, were calculated to interfere with its vacuum. Even if they had bought the condenser with a warranty, counsel submitted that they had no right to alter the machine before putting it on trial, and he asked the jury, even if all else failed, to find against the plaintiffs on that ground alone. He further complained that the machine had not been used to the best advantage. It had never been tried with a full head of water or with the air-pump working at its full capacity, and it was admitted by the plaintiffs that the circulating tubes were not clean. It was for the jury to satisfy themselves, before finding in favour of the plaintiffs, that the machine, with proper adjustment, and perhaps a little coaxing and a little patience, and before it was altered structurally, could not perform the work required by the plaintiffs.

Mr. Thomas Lumsden, Gateshead, managing director of the defendant company, gave evidence as to the sale of the condenser to the plaintiffs, and said he was of opinion that the machine would meet the requirements of the plaintiffs. Witness was cross-examined as to why he did not furnish the plaintiffs with the more detailed specifications which he received from the Coatbridge and Airdrie Electric Supply Co., Ltd., the former owners of the condenser, and in reply, he said he received those specifications on the day following the inspection of the plant by the plaintiffs' manager, and he did not communicate them because that gentleman had seen the plant. In regard to some correspondence between the parties prior to the sale, witness admitted that standing alone those matters indicated a sale by description, though he did not realise it at the time.

Prof. R. L. Weighton, Professor of Engineering at Armstrong College, said that since 1903 he had made a special study of surface condensing plant. The specification of February 28th, in which it was stated that the condenser was capable of dealing with 15,000 lb. of steam per hour, was handed to witness, who pointed out that no mention was made of the vacuum required. The essential feature of any condensing plant was the degree of vacuum required. Giving his opinion of the tests carried out by the plaintiffs, Prof. Weighton thought better results might have been obtained had the full volume of water specified been put through the condenser and the air pump worked at the proper speed.

After a long hearing the jury found for the plaintiffs, awarding £116 13s. 4d. damages, and £100 for the cost of erecting and taking down the condenser.

His Lordship entered judgment for £216 13s. 4d. and costs, and granted a stay of execution for 14 days with a view to an appeal being entered.

British Westinghouse Electric and Manufacturing Company, Ltd., *v.* The Underground Electric Railways Co. of London, Ltd.

On Tuesday and Wednesday the Court of Appeal, composed of Lords Justices Vaughan Williams, Buckley and Kennedy, had this case before them on the appeal of the plaintiffs against the refusal of the Divisional Court (Mr. Justice Pickford and Mr. Justice Lush) to set aside an award of an arbitrator, whereby plaintiffs' claim for about £80,000 in respect of the balance of the price of certain machinery was dismissed, and the defendants' counterclaim for damages for alleged breach of contract was allowed to the extent of about £20,000.

The proceedings in the lower Court have already been reported.

Sir A. Cripps, K.C., Mr. Disturnal and Mr. Tangye appeared for the appellants; and Mr. J. P. Fitzgerald, K.C., Mr. Roskill, K.C., Mr. A. B. Shaw, and Mr. L. Macassey for the respondents.

In support of the appeal, Sir A. Cripps submitted that in a claim for breach of contract of this kind the true measure of damages was the cost of putting the persons who had suffered through the breach in the same financial position as near as pos as they would have been if the contract had been carried Inasmuch as the substitution of the Parsons machines put the way company in a substantially better position than they w have been under the contract for the Westinghouse machines, fact ought to be taken into account in ascertaining the cost. complaint was that the arbitrator in assessing the damages, failed to take that matter into consideration, and he conte therefore, that the award ought to be set aside.

Mr. Disturnal followed on the same side, and the hearing adjourned.

Coffin *v.* Gibbons and the P.M.G.

Mr. C. Hayden Coffin was the plaintiff in an action heard week by his Honour Judge Sir William Selfe at West Lon County Court. The defendant was Mr. John E. Gibbons, of N Side, Wandsworth Common, an engineer working for the Office. The Postmaster-General was a third party interested, Mr. Gutteridge appeared on his behalf. The claim (says *Standard*) was for damage to Mr. Coffin's wall at his resid Campden Hill Cottage, Kensington, caused by removing the foot in laying a Post Office telephone. Judgment was given for Coffin for £15 15s. and costs, together with an injunction.

NEW ELECTRICAL DEVICES, FITTING AND PLANT.

"Century" Hand Lamp.

Messrs. Ward & Goldstone, of Springfield Lane, Salford, d attention to the features of their "Century" hand lamp, which been introduced in order to overcome certain objections to port accumulator hand lamps. The latter are heavy, troublesom recharge, but dependent on its being regularly done for t efficiency, and the burning hours are much less than, for insta those of the "Century" lamp. In the latter a new type of battery is fitted which, on test, has given one to three ho burning daily, up to a total of between 60 and 85 hours.



"Century" Hand Lamp and Battery.

The dry battery is 6½ in. high and 3 in. square, and gives 25 to amperes at 4 volts on short circuit. The lamp is fitted with a 4-v metal lamp and a lens, and is of English manufacture throughou Messrs. Ward & Goldstone claim that no dry-battery hand lamp this size has ever approached its burning hours.

U.S.A. Federal Incandescent Lamp Suit.—In Marc last the Federal Government filed suit against incandescent lam companies for alleged violation of the Sherman anti-trust la Last month the proceedings ended in a decree ordering the dissolutio of the National Electric Lamp Co., of which the entire stock is no held by the General Electric Co., and of its 20 subsidiary companie the business of which must hereafter be conducted in the name the General Electric Co.; the defendants are enjoined from makin agreements with manufacturers of lamp-making machinery an glassware which will prohibit the latter from making similar agre ments with others; and all parties to the suit are enjoined fro entering into any combination or agreement fixing resale prices lamps or imposing conditions having any bearing on such resal So far as relates to central stations and other consumers of incan descent lamps, the decision in the case appears to be quite sharpl limited in effect to creating an open market for the ordinary carbo filament lamp, in which trade competition alone will regulat prices. As that type of lamp, however, is now less used than th modern high-efficiency lamp, and is rapidly becoming obsolete, th consumer will not be greatly benefited by its release from artificia price conditions.—*Electrical World.*

METALITE, LTD.

On Monday last, at the invitation of the directors, we paid a visit to the new works which have been equipped at Derby by Messrs. Metalite, Ltd., for the manufacture of their tungsten lamps. It will be remembered that the company was floated in July, 1910, when it purchased the works of the Bryant Trading Syndicate at Horsell Road, Highbury, N. These works were then employed in the manufacture of metallic-filament lamps under certain secret processes, and the syndicate claimed to have developed a large demand for its filaments. Being in need of increased manufacturing facilities, which could not be secured in Highbury, the new company at the time of its flotation was in search of suitable premises, and eventually obtained them in the shape of a works built a few years ago for the manufacture of incandescent gas mantles, which had been closed as the result of a financial deal. These freehold works have now been equipped by Metalite, Ltd., with machinery and apparatus for the manufacture of their lamps, for which they are admirably adapted, and the substitution of the electric for the gas lamp industry cannot but be regarded as a happy omen for the future.

The building is laid out on one floor, except along the frontage, where there is a second storey, and it is excellently lighted from the roof—an important matter in a tungsten lamp factory. Besides the space occupied by the present building, there is ample room on the site for extensions.

The equipment provides for the manufacture of the complete lamp from start to finish. The filaments used are at present of the squirted type, but it is hinted that a drawn-wire filament is being perfected. Lamps of all the usual sizes are made, and are put on the market under the title of "British Metalite," it being the boast of the company that it is British made throughout. The latest types of machinery are installed in the various departments, and the equipment is capable of a large output, though at present, as the company is engaged in training local labour, the output necessarily falls far short of what, no doubt, will ultimately be attained.

At a luncheon which followed the inspection of the works, the chairman, Mr. W. Stewart, said that shares could still be obtained at par. The Mayor of Derby, Sir Thos. Roe, in giving a hearty send-off to the new industry, welcomed it as affording an opening for female labour—other large industries in Derby employing male labour almost entirely. Mr. J. Metcalfe claimed that the equipment of the factory was equal to that of any other works in the country; he referred to the early struggles of the company and the adverse criticism met with at the commencement, but said it was pulling through. More capital had been spent than was actually subscribed, thanks to their existing works and stock, and he appealed for the purchase of the company's shares, which, he said, in view of developments in progress, would shortly be worth double.

The engineer to the company, Mr. F. Harrison, said that experiments were being carried on in the works laboratory, and he hoped in a few weeks to produce something of a very startling nature, but could not enter into details.

Our views as to the constitution of the company were fully detailed in our issues of July 22nd and 29th, and November 4th, 1910, and we need not here repeat them. The company now possesses works which should enable it in due course to share in the growing demand for tungsten lamps; it is evidently short of capital, but we believe the technical processes supervised by Mr. Harrison are in very capable hands, and, for the sake of the shareholders, we hope the company will succeed in establishing itself on a sound and permanent basis.

Elland Electricity Supply.—At the meeting of the D.C. last week a resolution was adopted to the effect that an inquiry should be instituted into the working and cost of the electricity works. Mr. T. E. Cragg, who moved that this should be done, contended that according to figures which he had in his possession, the cost was now £11 per week more than it was in 1908. Although about £150 more had been spent on coal this year than in 1908, the units generated were considerably less.

BUSINESS NOTES.

Catalogues and Lists.—The Armorduct Manufacturing Co., Ltd., Farringdon Avenue London, E.C.—Eight-page illustrated list of Armorduct luminous radiators, in which prices are boldly indicated.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—New catalogue of 64 pages containing a full and illustrated account of the Sturtevant heating and ventilating system, suitable apparatus and equipment being shown for various classes of buildings—factories and warehouses, schools and colleges, public halls and establishments, hospitals, &c., churches, theatres, &c., hotels and residences, electricity works, ships, tunnels, &c.

The Concordia Electric Wire Co., Ltd., The Wire Works, Crown Parade, Cricklewood Lane, London, N.W.—Pamphlet (Section 102) containing tabulated prices and technical data regarding their "Asbestin" high-conductivity copper wire, and asbestos braided wires for rheostats and radiator connections, and giving a brief account of the purposes and qualities of "Asbestin" insulation.

National Electric Lamp Association, Cleveland, U.S.A.—Bulletins 8c, dealing with miniature carbon lamps; and 12A, relating to the electric lighting of automobiles.

The Waltham Manufacturing Co., 2, Jackson Road, Holloway, London, N.—Illustrated leaflet giving prices and brief particulars of Waltham arc lamps (Proctor's patent), flame and enclosed, also small arcs for enlarging and projection work, and accessories.

We have received from the Transparent Printing Co., Ltd., of 155, Victoria Street, Westminster, S.W., some specimens of transparent printing by their new patented process. These specimens are specially adapted for shop window bill displaying. Being luminous with transparent letters on coloured ground they are effective and attractive. A price list has been issued.

Consular Notes.—Germany.—The British Consul at Stettin reports that electric central power stations are being erected in various parts of the province to supply towns, villages, estates and farms with electric light and power. Several of these stations are already working. They will be of great assistance to small farmers and artisans requiring power at a cheap rate, but there appears to be some doubt whether large landed proprietors will benefit to a similar extent. Up to the present steam engines have been used for agricultural purposes; it has, however, latterly been found that the cost of electric power is considerably higher. The current required for a threshing machine of average size is said to cost 2s. 1d. per hour; larger machines as now used would cost about £1 5s. to £1 10s. per 10 hours. Steam engines, on the other hand, consume about 7 cwt. of coal during 10 hours, and 1 to 2 cwt. more when driving the larger threshing machines. For heavy agricultural machinery the steam engine would, therefore, be the more economical. A wireless telegraph station is to be erected in the post office at Swinemünde. The tower is to have a height of 157 ft., and messages are to be received from a distance of 190 miles. The work will be carried out by a Stettin firm. Other similar stations are to be erected on the Baltic coast.

Sicily.—The British Vice-Consul at Catania reports that the Société Anonyme Tramways et Eclairage Electriques à Catane is about to undertake the construction of an electric tramway between Catania and Acireale (a rich agricultural district). The scheme was put forward by the Sociéta Elettrica della Sicilia Orientale which is also interested in the enterprise.

Mexico.—The British Vice-Consul at Guadalajara reports that electrical machinery is being largely installed in the mining sections of the district as electrical power is being sold by the Cia. Hidro Electrica e Irregadora de Chapala from £10 to £12 10s. per H.P. per annum, thus effecting a notable saving over steam power. The current generated by the above-mentioned company is three-phase, 50-cycle. In general it may be said that consumers will transform the voltage down to 440 or 220 volts. All machinery used is of the alternating-current type. There are many British firms which issue catalogues in Spanish. Often, however, catalogues in Spanish are sent to buyers whose names evidently show that they are British. As it is frequently the case that British engineers are employed by Mexican firms, it would always be well to send catalogues to each applicant in both English and Spanish. Using both catalogues, it is comparatively easy for the engineer to explain technical points in the proper words to a Mexican employer. Commenting further on the use of electricity in the mines, the Vice-Consul states that in anticipation of the advent of this cheap power, numerous large and costly reduction plants have been erected at various mines. The cost of wood fuel has been about 14s. per cord. On a basis of 3½ lb. of coal (price £2 8s. per metric ton) consumed per H.P.-hour and taking 2¾ cords of wood of average moisture as equal to 1 metric ton of coal, fuel costs formerly worked out at about £39 per H.P. per annum for coal and £27 per H.P. per annum for wood. The price at which electric power will be sold is £10 to £12 per H.P. per annum. Immense deposits of low grade ore hitherto untreatable on account of cost, will now be treated at a fair profit.

Bolivia.—The British Consul at Sucre reports that in the year 1908 a limited liability company was formed in Cochabamba, with a capital of 850,000 bolivianos (£68,000), subscribed chiefly by a German firm of electrical engineers, of Oruro, the same firm which founded the Electric Light and Power Co., of Sucre.

The principal aims of the Sociedad de Luz y Fuerza Electrica were to generate electrical energy from water-power on the River Chocaya and construct, first, a line of light railways or tramways

from the city of Cochabamba to its suburbs; second, an installation to provide electric power and public and private lighting; and third, to erect electrically driven flour mills and other industrial machinery.

By the end of the year 1909 the electric light and flour mills were so far successful that it was found convenient to raise the capital of the company to £100,000. In the year 1910, the capital was further increased by £300,000, in £4 shares, bearing an interest of 6 per cent. guaranteed by the State for 25 years.

By the terms of its agreement with the Government, which guarantees the interest on the stock, the company is investing the whole of the £300,000 in erecting larger generating stations and laying down a system of light electric railways of 30-in. gauge, extending over a distance of about 90 kiloms. (56 miles), connecting the city of Cochabamba with the rural towns of Arani, Quillacollo, Vinto, Punata, Tarata, Cliza and Calacala.

The towns given above represent centres of great agricultural activity, and there is no doubt that, by connecting them with Cochabamba, they will help to feed and increase the traffic on the railway line to Oruro.

Later in his report, the British Consul says that no accurate information is officially given showing the proportion that British imports bear to those of other countries in the separate districts of Bolivia, but it can be assumed that the proportion in the districts of Sucre and Potosi is more or less the same as for the whole country. Thus, deducting from the total amount of British imports in 1910, a very large part which arrived in gold, and making allowance for a considerable sum representing the value of railway material, which went specially to Potosi and Cochabamba, it appears that British manufacturers are still holding their own, and even gaining upon those of Germany and the United States. The Consul is convinced that British firms would find it very profitable to establish branches in the district to deal principally in articles of British manufacture.

Admitting that it would not pay to have branch houses in every town comparatively thinly populated as in Bolivia, with foreign employés who would naturally command high salaries, the plan of utilising the native element, properly organised on systematic lines and subject to control and strict supervision from one central office might be followed. In one case, the central office has been established in La Paz, where a very few experienced employés have increased their staff as the business grew by taking in promising young people from among the natives, and these, when they were seasoned and the unfit weeded out, were sent off to minor branches in the provinces. They took with them the business principles they had acquired, added to their own knowledge of the *clientèle*, local freights, means of transport, the credit, and even the particular idiosyncrasies of the people with whom they had to do business. Nay, more, it is found in practice that this system sets up a bond of sympathy between the population and a foreign firm which goes a very long way towards creating trade. In course of time, as the business developed, the most trusted men from the staff of the central office were successively sent forth to establish branches in all the capitals of departments, *i.e.*, Sucre, Oruro, Cochabamba, Potosi, Santa Cruz, Tarija and Beni, and each of these has thrown out minor branches into the provinces to the number of 32 altogether. One experienced man, doing the round of all these branches and minor dependencies occasionally, keeps them all working in proper order, at the same time that he looks into reports of possible new openings, of alterations in the routes of transport to economise time and freight, also for extending the business generally.

Exporters and packers should always bear in mind that the violent shocks, continuous movement, and the exceptionally rough treatment, suffered by goods coming into this country, can never be overestimated, but that they are very frequently underestimated. Cases should always be of the strongest, and the goods very securely packed, so that nothing inside can possibly become loosened. Experience has shown that when cases contain parts that may, under rough treatment, get loose, it is very advisable to cover such cases over with canvas or strong linen. Iron bands can hold a case together, but when it contains a machine, for example, nuts, screws and other small parts easily drop out if a single board of the case is broken, thus rendering the machine unserviceable for months, until new parts are obtained, whereas with a canvas cover all the contents are held inside. Boxes sent by parcel post are generally insecurely packed. In this respect it should be borne in mind that when such boxes become even partially broken *en route*, this affords the only possible pretext for unscrupulous persons wilfully to complete the damage and extract the contents with perfect impunity. Otherwise, parcels coming by post are only opened once—at their destination and in the presence of the owner.

Uruguay.—The British Minister at Monte Video reports that, in order to obtain orders, the personal visit of a traveller is much more effective than a catalogue sent by post. The following advice is, however, offered to those who cannot face the expense of sending out travellers and have to rely on the power of printed matter. First, a catalogue should have an attractive cover and handsome illustrations. Secondly, quotations in English measures of weight and length should be avoided, and the English language should not be used in the text of the catalogue. The majority of merchants in this country do not understand English sufficiently to read an English catalogue with certainty, nor do they care to puzzle their heads with English weights and measures. The ideal catalogue for Uruguay would be written in Spanish, with the prices quoted in Uruguayan gold ($4 70 c. to £1), and the measurements according to the metric system. The next best would be a catalogue written in Spanish, with the measurements according to the metric system and the prices quoted in pounds sterling and decimals of pounds, or in francs, which are easier than the former to convert into Uruguayan money.

With regard to travellers, it may be pointed out that if British firms desire to open up new business in this country, it is rarely sufficient for their representative to pay a passing call on one or two merchants on his way to Buenos Ayres. The merchants of this country are not disposed to enter into business relations with travellers whom they do not know personally. It is, therefore necessary that ample time be allowed for travellers to make themselves known to the merchants with whom they wish to do business. Once they have established personal relations of this kind, they will have to go far before they find such good faith, such courtesy, and such attention as they will meet with among the merchants of Uruguay.

Siam.—The British Consul at Chiengmai reports that, through the abandonment of the palace of Petchaburi, which was being built for the late King, the Government have now on their hands an expensive electric plant designed for that building. In order that it might be utilised, it was suggested that it be set up in Chiengmai, which is still without any scheme of lighting, however crude, though the second city in the kingdom. The chief difficulty in the way of this scheme, which would obviously confer great benefit on Chiengmai, is the lack of proper fuel. Paddy husk, used in Bangkok, is here unobtainable in sufficient quantities, and other fuel is out of the question, on account of expense. There remains only firewood, and it is doubtful if an adequate supply of this can be obtained. A plant driven by water-power seems the only one suitable. The Siamese Government have recently sent up an electrician to make inquiries and report upon a scheme for adapting this plant to Chiengmai.

Book Notices.—*A Course of Elementary Workshop Arithmetic.* By H A. Darling. 1911. London: Blackie & Son. Price 1s. 6d.—This is a very simple and practical course, beginning with a few revisionary exercises and working up to mensuration, duodecimals and graphs. Throughout the work care is taken to interest the student by drawing examples from the every-day problems met with in various trades and workshops, with excellent illustrations, and the data used are such as the student will recognise as being in agreement with those to which he is accustomed in his avocation. There is no electrical section, but the book is well adapted for the preliminary instruction of electrical trade students.

"Science Abstracts." Sections A and B. Vol. 14, Part 10. October 25th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"Atti della Associazione Elettrotecnica Italiana." September, 1911. Milan: Stucchi, Ceretti e C.

"*Announcements* 1 and 2 of the Eighth International Congress of Applied Chemistry, September, 1912." New York: The Secretary.

"Electrical Engineering Test Sheets." By F. C. Caldwell. 1911. London: Hill Publishing Co. Price 9s. 6d. net.

"The Telegraphists' Guide." By J. Bell and S. Wilson. London: S. Rentell & Co. 1911. Price 2s. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVII, No. 8. October, 1911. New York: The Society.

"Electric Mains and Distributing Systems." By J. R. Dick and F. Fernie. 1911. London: *Electrician* Printing and Publishing Co., Ltd. Price 10s. 6d. net.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXVIII, No. 4. October, 1911. Philadelphia: The Club.

"Boletin de la Sociedad de Fomento Fabril." September, 1911. Santiago de Chile: Casilla 44D.

We have received a "Circular of Information concerning Patents for Inventions and the Registration of Designs and Trade Marks," from Messrs. Wheatley & Mackenzie, consulting engineers and patent agents, of 40, Chancery Lane, W.C.

Trade Announcements.—Scholey & Co., Ltd.—A company of just a dozen, mainly Press-men, a *recherché* dinner in Pagani's best style, a new addition to the industrial firms of the electrical world, and Mr. Scholey's eloquent arguments in favour of the *raison d'être* of his company's birth, served to pass away a most delightful evening on Friday of last week. The only toast was that of "Success to the new firm of Scholey & Co., Ltd.," to which both Mr. Scholey and his partner, Mr. Hill, replied in feeling terms.

It has been a favourite idea of Mr. Scholey's for some time past that much could be done to improve the condition of the electrical industry by a judicious system of co-operation. He referred mainly to the possibilities of manufacturers being in closer touch with one another in regard to the merely manufacturing side of these undertakings. There are in this country several large concerns with magnificently equipped factories and highly trained technical staffs which in ability are second to none in the world, yet they would have gained considerably if they had been subjected to interchange of ideas, both in regard to manufacturing and designing of machinery. At some time or other they must be of necessity engaged on similar problems, each working them out in their own way, and he thought it seemed feasible that an enormous wastage would be saved if one manufacturer were to tell another of the manner in which he had overcome difficulties that had beset his path on some occasion or other. By a pooling of interests, under which each manufacturer had a share of a contract, it would be possible to keep in this country much of the work which at present finds its way to foreign countries. Moreover, a combination of this character would bring great influence to bear on those financial people who are ever ready to find money for electrical schemes abroad. It may be taken for granted that no manufacturer, no matter how well his works are organised, and no matter how clever and ambitious his staff may be, can economically cover the whole field of electrical engineering. Probably there are one or two special

xamples in manufacturing in which he stands without a rival; hen another manufacturer is equally efficient in some other direc- ion, and so you proceed until you have a group, each member of which can perform a particular function in electrical work with conspicuous success. Would it not be in the highest interests of all, if such manufacturers could confine themselves to that parti- ular work which they do best, instead of attempting to deal with so many different types of apparatus? Then on such occasions when it was necessary to devise large and comprehensive schemes, the manufacturers in co-operation would be able to deal effectively with them, and in that manner be in a strong position to meet the competition of the large foreign organisations. In Mr. Scholey's opinion there has been far too much attention paid to manufac- turing and not sufficient consideration given to the purely com- mercial side of the business. Then, again, there has been an unfortunate tendency whenever a manufacturer has been success- ful with a particular machine or apparatus, for other manufac- turers to immediately copy it, and consequently we have soon arrived at a state of over-production. It may be urged that this is arguing too much in the realms of conjecture; he would, therefore, come to a more immediate and perhaps a more practical phase of the subject. One is aware that there are scattered throughout the country numerous comparatively small manufac- turers, who in a somewhat modest way are carrying on a reasonable business with considerable advantage to themselves. He had in mind those manufacturers who specialise on a particular article and being able to reap the benefit of repetition work in their factories, and not being encumbered with heavy establish- ment charges, can produce a first-rate article at a comparatively moderate cost. It will be a matter of general interest to know that as a result of careful investigations, it may be emphatically stated, that in regard to both quality and price the products of these manufacturers are equal to anything that the world can produce. Moreover, it should never be overlooked that, collectively, the specialist manufacturer forms a backbone of the British elec- trical industry, and of the capital invested in manufacturing by far the largest proportion is invested in the small and scattered works of the country. The strength of the small manufacturer, however, is his weakness. So long as his trading is, comparatively speaking, local, he invariably succeeds, but directly he attempts to widen the area of his operations, he runs the risk of his prices going up by virtue of his increased selling expenses. The specialist manufacturer, however, deserves a wider market on account of the quality and comparative cheapness of his wares, and it had occurred to him that there was room for an organisation which could under- take the selling for a group of what he would call "the specialist manufacturer," and it is precisely that which his company is attempting to do. The company has entered into certain definite agreements with manufacturers, and in time it is expected to add others. The proposition of Scholey & Co. is, that they will devote themselves entirely to the development of suitable markets, and the manufacturer shall confine himself to making material, looking to the company to effect the sales. They expect to do consider- able trading at home, but mainly they desire to further trade abroad, for which purpose they will eventually establish agencies both in this country and in the most prominent towns in the British Colonies and South America. Notwithstanding that our foreign competitors have been and are sending a good deal of material abroad, there is a strong disposition in favour of doing business with people in this country, and the new concern proposes to take advantage of that feeling. In the course of discussion which ensued, it was further explained that the large manufacturers in this country are exceedingly friendly to the idea, and in three or four cases have made definite offers to help. It was also stated that the new company is not confining itself to electrical work, but will be actively engaged in selling various mechanical appliances and machinery.

Well as Mr. Scholey is known to everybody, we have the advantage of having been intimately associated with him for 22 years. For the first 10 of these he acted as assistant editor of the ELECTRICAL REVIEW, and it was during this period that our daily intercourse led us to form an opinion of his worth and ability which has become strengthened as years have gone by. He served the REVIEW right loyally and well, and during his tenure of office he had ample opportunities of making the friendship of many of the best men in the electrical profession, friendships which he has retained to this day, and which we hope and believe will be of the greatest assistance to him and his partner in the new sphere of operations in which they have chosen to embark.

When Mr. Scholey left journalism as a profession to engage in that phase of the engineering world in which he has made himself so popularly known throughout the length and breadth of the country, we lost the services of one in whom we placed our com- plete confidence, but our loss was his gain, and although we were deprived of his invaluable co-operation we have ever remained on the best of terms.

We need not refer to the two years he spent in the service of Messrs. Mather & Platt, beyond the fact that he there gained the experience which was to serve him to such good purpose when he joined the firm of Messrs. Dick, Kerr & Co., Ltd., whose employ he left only a fortnight since, although it has been an open secret since the beginning of the year that his intention was to commence business on his own account. No firm could have had a more devoted and loyal member of its staff than Mr. Scholey proved to that just mentioned. His personality was an asset to that firm of the highest value, and we know that more than one rival concern would gladly have engaged Mr. Scholey's services at considerably higher remuneration had he chosen to accept the overtures made to him.

Nobody knows better than ourselves the sterling worth of the senior partner of Scholey & Co., and we make bold to say that he commands the confidence of the whole electrical fraternity. Of Mr. Hill we can only say that if he had not the most implicit con- fidence in Mr. Scholey, and the most optimistic conception of what the newly-formed company will achieve, he would not have relinquished the post of engineer and manager to the Bournemouth tramways to throw in his lot with the company, and Mr. Scholey would certainly not have entertained the idea of a partnership with Mr. Hill unless he, too, was perfectly satisfied that he had in him, met his *alter ego*.

We wish, and we believe our readers will re-echo our wish, the new venture God-speed and every success, for although 'tis not in mortals to command success, they'll do more, they'll deserve it.

MESSRS. D. EDGAR GREENWOOD, A.M.I.C.E., & J. KILNER WELLS have opened a coal-testing laboratory at 25, York Place, Baker Street, London, W., where they will attend to inquiries from central station engineers and others who may, from time to time, wish to know the calorific value and other properties of the coal or oil fuel they use.

THE WARNER INTERNATIONAL AND OVERSEAS ENGINEERING CO., LTD., of Carteret Street, Westminster, S.W., announce that they keep, for the convenience of their clients, a list of rolling stock for which the owners have no further use.

MR. J. W. RECORD, late manager of the instrument works of the General Electric Co., Ltd., now the Salford Electrical Instruments, Ltd., and MR. T. J. BOORNE, under manager of the switchgear, instruments and electric light accessories department of the General Electric Co., Ltd., London, who both recently resigned their respective positions in order to commence business under the title of "The Record Electrical Co., Ltd.," have now opened their new works at Broadheath, near Manchester, where they intend to manufacture electrical instruments and other specialities. Mr. Record will control the works and conduct the Manchester business, whilst Mr. Boorne will look after the firm's interests in London from their office at Caxton House, Westminster.

THE REES ROTURBO MANUFACTURING CO., LTD., Wolverhampton, have altered their telephone number to 900 (two lines).

MESSRS. PRICE & CO., electrical engineers, of 16, High Street Newport (I.W.), have opened a branch business at Shooter's Hill West Cowes.

MESSRS. RICHARDSONS, LTD., Billiter Square Buildings, London, E.C., have just been appointed London representatives of Messrs. Tait & Co., Kobe, Japan, who are opening an engineering depart- ment. Firms desirous of doing business in Japan and the East are invited to send catalogues in duplicate to Messrs. Richardsons' Export Department.

Bankruptcy Proceedings.—W. H. HOWARD (Holborn Electrical Co.), electrical engineer, 5, Featherstone Buildings, Holborn, and Finsbury Park.—Receiving order made November 1st, on debtor's petition.

E. J. CROSIER (Crosier, Stephens & Co.), engineer and merchant, Newcastle-on-Tyne.—November 25th is the last day for receipt of proofs for dividend, by the trustee, Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

Voluntary Liquidations.— DAVIS ELECTRICAL CO., LTD., 17, Moor Street, Cambridge Circus, W.—The adjourned meet- ing of the creditors, convened by the liquidator under Sec. 188 of the Companies (Consolidation) Act, 1908, was held on Monday at Armfield's Hotel, South Place, Finsbury, E.C. Mr. George Corfield, the Liquidator and Receiver for the debenture-holders, presided. At the original meeting on October 23rd, a statement of affairs was submitted by the liquidator showing liabilities to unsecured creditors, £3,333, and assets £2,885. There were debentures issued to the amount of £3,313, leaving a deficiency as regards the debentures of £427, and no assets available for the creditors. Mr. Corfield reminded the meeting that the adjournment had taken place to allow a committee of the creditors to consult with Mr. Davis and the debenture-holders on the possibility of formulating a scheme of composition. The committee had met, and there was no formal proposal submitted to them, Mr. Davis stating that he was not yet able to submit any offer. Mr. Davis had, however, mentioned the figure of 2s. 6d. in the £, but he (Mr. Corfield) had stated that that was one which the creditors would probably not consider. The position, therefore, resolved itself into one where there was no offer before the meeting, and it was a question for the creditors to consider what resolu- tion they would propose. Mr. Lowe, representing Messrs. J. McDougal & Co., thought that Mr. Davis should be present in order to hear what the creditors had to say and to answer any questions that might be put to him. It was not so much a matter of his making an offer of composition as it was giving up some portion of the debentures, whose value had been enhanced by the use of the goods belonging to the creditors. Mr. Davis was then called in, and remained throughout the meeting. Mr. Rook, representing two of the principal creditors, a member of the committee appointed on the previous occasion, said that he had had an opportunity of going through the statement of affairs of the company as presented by Mr. Corfield, and he found that from September 1st last to October 16th the company had purchased £1,600 worth of goods. The statement of affairs showed total unsecured liabilities £3,333, and, therefore, the purchases between those dates were practically half of the total liabilities. The stock in trade at the date of the statement of affairs amounted to £1,735, which was very little more than the amount purchased in that period. For the purpose of the statement of affairs there was a discount of 25 per cent. taken off cost, amounting to £433, which was absurd, having regard to the fact that the goods were new and only just delivered. But whether the goods purchased

had gone into stock or into book debts he had not been able to ascertain. The fact remained that the unsecured creditors' claims amounted to £3,333, and the debenture claims amounted to within a few pounds of the same total. He thought that this was a case in which the debenture-holders might take 10s. in the £ and the creditors the other 10s. As it was, in the absence of any such proposal, the debenture-holders had it all, and the creditors would receive nothing. In these circumstances he thought the creditors would be well advised not to agree to confirm the appointment of Mr. Corfield as voluntary liquidator, but to take some action among themselves to have matters properly investigated. The large purchases of goods during the last days of the company's existence wanted some explanation, and more especially as he understood some goods were received by the company after the date when the resolution to wind-up was passed for the reason that the company was not able to carry on its business. Mr. Lowe, also a member of the Committee of Inspection, said he confirmed what Mr. Rook had stated. He maintained that it was impossible for Mr. Davis to say that he was unaware of the position of the company when he was ordering the goods referred to in September, and the creditors had to consider the question of his personal responsibility. Mr. Kennard, the solicitor of the company, explained the circumstances under which he was consulted. The meeting which passed the resolution for winding-up was not held until October 6th, and he thought it was not right to suggest that Mr. Davis was not entitled to order goods as he had done. A creditor contended that Mr. Davis knew the position of the company at the time, and as he had to go to his father-in-law and ask for money, he was not entitled to order fresh goods, and use them to swell the property which the debenture-holders could claim. Goods to the value of £1,600 were accumulated in the month prior to the winding-up, while the debenture-holders stood to get everything, and the creditors nothing. Another creditor said it was clear Mr. Davis had been ordering goods while he knew the company was insolvent. The proper course in the circumstances was compulsory liquidation where the machinery of the Court would allow matters to be fully inquired into, and make persons personally responsible if they were properly so. He pressed the creditors not to assent to the voluntary liquidation, so that a petition might in due course be presented to the Court for compulsory liquidation. Other creditors spoke in the same strain, and were followed by Mr. Davis, who stated that when he ordered the goods in September he did not know the company was insolvent. He invited any of the creditors to inspect the company's books and check the stock to see whence the goods had gone. A creditor remarked that if the £1,600 worth of goods had been sold, where was the cash for it? It was either stock or book debts, and there were only £1,600 worth of book debts now. After considerable discussion, in which the purchases and sales of the company were gone into, it was proposed that "The appointment of Mr. Corfield as voluntary liquidator be not confirmed, and a petition be presented for compulsory liquidation of the company, and that the committee already appointed continue to represent the creditors, and advise them as to the best course to pursue." A creditor inquired whether it was not a fact that some portion of the last debenture issued was in respect of arrears of salary to Mr. Davis, and Mr. Kennard replied that the last debenture issued was to secure money advanced by Mr. Davis, and £100 representing arrears of salary. There was considerable further discussion, and in the result the resolution not to confirm Mr. Corfield's appointment with a view to compulsory liquidation, was carried with one dissentient.

Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, London, E.C.—A largely attended meeting of the creditors of the above was held on Monday at Winchester House, Old Broad Street, E.C., the voluntary liquidator, Mr. Herbert J. Page, of Messrs. Annan, Dexter & Co., 21, Ironmonger Lane, E.C., being in the chair. It was reported by the chairman that on October 2nd last, the trustees for the first debenture-holders appointed his partner (Mr. Edward Dexter) to act as Receiver. The debenture-holders took that action because certain of the creditors were threatening to enforce their claims. The Receiver had been carrying on the business with a view to its sale as a going concern. It was thought that the best course to adopt was to offer the business for sale by tender. As the liquidator of the company he had not at present any assets to deal with. The Receiver would have to hand over to him the balance that remained after paying all costs, charges, and satisfying the claims of the debenture-holders. Those principally concerned were of the opinion that the best price would be obtained by the offering of the business for sale by tender, and he saw no reason to question that view. Under the circumstances he did not think it would be wise for him to place any values on the assets of the business. According to the balance-sheet of the company, prepared in March of the present year, the tools, patterns, drawings and patents were valued at £13,905, plant and machinery at £1,182, office furniture at £182, and the stock in trade at £4,892, or a total of £20,469. There were, however, book debts of the face value of £956, which were estimated to realise £557, and cash in hand £29 19s. 3d. The assets therefore totalled £21,047, but they were subject to charges aggregating £7,042, which left the net assets at £14,004. The charges consisted of preferential claims £194, first mortgage debentures and interest £5,975, and second mortgage debentures and interest £872. The claims of the unsecured creditors amounted to £4,937, and as regarded the creditors a surplus was shown of about £9,000. The claims of the unsecured creditors might be increased by a small amount, and the surplus shown was subject to the realisation of the assets. A scheme for the reconstruction of the company had been brought before the shareholders, but it involved their finding a sum of £7,000. The shareholders did not respond to the invitation to take up new preference shares in the company, and therefore the scheme fell through. Mr. Spiller, wh stated that he represented one of the principal creditors, asked there was a series of undisclosed mortgages on certain of the boo debts of the company. He added that such charges ought to hav been registered, but that had not been done. The liquidator repli that he believed some of the book debts had been sold, but he wa not in possession of the full details of the matter. Mr. Spille replied that book debts had really been mortgaged at so muc per cent. He declared that the business of the company ha not been carried on in the ordinary way. A reconstructio scheme was proposed last June, but it was not brought befo the shareholders till the end of September—two days befo the Receiver was appointed. In his opinion the business possesse by the company was a good one. The chairman said that th claim by Mr. Spiller's firm was not all admitted. As regards th debentures there was a first issue for £6,000 in March, 190 Second debentures for £2,000 were created on September 20th las but only £870 were issued. Mr. Scholey remarked that he had com to the meeting fully expecting that an offer of 20s. in the £ woul be made to the creditors. He had formed that opinion after rea ing a circular issued by the company in which creditors wer asked not to press. The principal assets were the patents, an apart from them there was not sufficient to pay the debenture holders, let alone the unsecured creditors. Replying to question the chairman stated that the company was formed in March, 190 with a capital of £30,000, divided into 28,000 ordinary shares o £1 each, and 2,000 deferred shares. In all 14,100 shares had bee issued for cash, and 4,000 ordinary and the 2,000 deferred shares wer issued for a consideration other than cash. Mr. A. M. Billington the late managing director of the company, said that after the fir 18 months' trading the company had lost most of its workin capital. Since then some difficulties had been experienced, bu they had managed to work the business up. One or two creditor had threatened to compulsorily wind up the company. He himsel was the principal creditor of the company, and also the large debenture-holder. Mr. Spiller said it was proposed to sell th business by tender, and he desired to see it offered for sale publicly After a short discussion, a resolution was proposed by M Scholey in favour of the appointment of his principal (Mr. G. H Corfield) to act as the joint liquidator of the company, wit Mr. Page. The resolution was seconded by Mr. Spiller and agree to, and a committee of three of the trade creditors was als elected.

Smoke Abatement.—In connection with the Manchester and Salford Smoke Abatement Exhibition, which opens to-day i the City Exhibition Hall, Manchester, and will continue unt November 25th, Messrs. E. Bennis & Co., Ltd., who are exhibitin at stands Nos. 20 and 23, have issued a new pamphlet. In this the show in detail some of their various manufactures and the installation in which they are employed, expressly intended for the abolition o smoke and the cheap generation of steam in leading boiler house in the United Kingdom. General descriptions appear of the different stokers and self-cleaning compressed-air furnaces, and large half-tone views are included of steel works, electricity works, tram way station, colliery and other boiler houses.

Liverpool International Exhibition, 1912.—We have received preliminary particulars of the above Exhibition which is to be held from May 1st to October 31st next year on th Edge Lane Hall Estate. The general aim of this Exhibition i somewhat similar to that of the Glasgow Exhibition of the presen year—namely, to emphasise the developments of mechanical and elec trical machinery, arts, crafts and textile work, and in view of th location of the Exhibition, it should be of exceeding importance to ou mechanical and electrical friends in the Midlands and in the North We understand that the advance applications for space and inquiries in connection with the Mechanical and Electrical Hall show tha the popularity of the Exhibition is not diminishing, and a further expansion of business in the electrical trade may reasonably be ex pected from this Exhibition. We shall give fuller details in a later issue.

Dissolutions and Liquidations.—Rugby School Electric Lighting Co, Ltd.—This company is winding up voluntarily, with Mr. A. E. Donkin as liquidator.

Imeson, Finch & Co., Ltd.—A meeting of creditors is called for November 15th at the office of the liquidator (T. R. G. Rowland), Victoria Buildings, Stockton-on-Tees.

Byrd's Electrical Co., 24, Dale Street, Liverpool.—Messrs. H. T. Byford and H. Speight have dissolved partnership as from December 31st, 1910.

Dynamic Thermometer Co., automatic temperature regulating experts and manufacturers, 11, The Terrace, Barnes, S.W.—Messrs. H. S. Benson and E. and T. J. Rorke, have dissolved partnership.

British Electric Time Co., manufacturers of electric clocks, Kingsway House, London, W.C., and C. E. Harrison & Co., Curtain Road.—Messrs. C. E. Harrison and L. J. Aron, have dissolved partnership. Mr. Aron continues the businesses.

With reference to a notice appearing under this heading in our issue of last week, The Economic Electric Co., of Twickenham, S.W., ask us to state that they are in no way connected with the Economic Electric Co., Ltd. (Liverpool) there mentioned. The Twickenham firm has been trading under the above name since 1896.

Smithson, Sharpe & Co., electrical and mechanical engineers, Sykes Street, Hulme, Manchester.—Messrs. Herbert Smithson and Edgar Ravenhill Sharpe have dissolved partnership. Mr. Smithson will attend to debts and continue the business as sole proprietor under the old title.

Sandy & Franks, electrical and mining engineers, Defiance Works, Massinger Street, Old Kent Road, S.E.—Messrs. W. J. L. Sandy and H. W. Franks have dissolved partnership. Mr. Sandy attends to debts.

Winchester Electric Light and Power Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidators (Messrs. F. E. Gripper and A. R. Dyer) by November 30th.

Electrical Works and Development Co., Ltd.—A meeting is called for December 8th at 52, Gracechurch Street, E.C., to hear an account of the winding up from the liquidator, Mr. R. Boughton.

LIGHTING and POWER NOTES.

Allerton Bywater.—The P.C. has had under consideration estimates of the cost of lighting the parish by gas and by electricity. After discussion, it was decided to obtain further information and to adjourn further consideration of the matter until the next meeting.

Bognor.—The U.D.C. has decided to consent to the application for a prov. order for electric supply, to be made by the chairman, Mr. W. Tate, J.P. The Council is to have the option of purchasing the undertaking at the expiration of 15 years, or at the end of every subsequent five years, and current is to be supplied at a maximum price of 6d. per unit for private lighting, and at 4d. for public lighting.

Canada.—The creation of a new portfolio, with the designation of Minister of Power, is announced from Ontario. The Hon. Adam Beck, chairman of the Hydro-Electric Commission, will be appointed.

Continental Notes.—Sweden.—The power station at Trollhättan is now undergoing considerable enlargement, two new turbines of 10,000-H.P. normal capacity being in course of installation. At present four similar sets are at work, these forming the equipment at the opening in March last. As, however, one set is held in reserve; it has become needful, in consequence of the rapid increase in the demand for current, to enlarge the station's capacity. The hitherto available turbine units have been so much drawn upon in late months, that a maximum yield of 25,000 H.P. has now been reached. As the normal yield of the three turbines is 30,000 H.P., and fresh demands for municipal and industrial uses are coming steadily in, the necessity for the enlargement has become apparent. The erection of the new turbines has so far advanced, that it is hoped to set them running early in the new year. They will raise the total capacity of the plant to 60,000 H.P.; the maximum capacity of the present station is reckoned at 80,000 H.P. The Waterfalls Administration have recently opened negotiations with Uddevalla respecting a supply of electric current from that station, and the contract is expected to be sealed within a few weeks' time. This contract is a preliminary to the erection of a new transmission line first to Uddevalla, then to Munkedal, and possibly also to Lysedal. It is further hoped, by means of this line, to secure customers for current among the numerous stone quarries on the West Coast, who will thus be provided with the opportunity of modernising their works. The Waterfalls Administration are prepared, so soon as the contract with Uddevalla is completed, to begin the erection of the West Coast transmission line, the completion of which is expected in the course of next year. There already exists a line to Gothenburg, and also one to Kungälf and Tofta, branching of from the Gotbenburg line near Nol. With regard to the projected supply of current to Copenhagen, it is now considered that no technical obstacles stand in the way. Attention is, therefore, being concentrated on the national-economic side of the question, and before the end of the year the Waterfalls Administration will lay the results of their investigations before the Government. The Water Department will itself conclude no contract with the Danish capital, nor will the Government on its own initiative, but the matter will be left to Parliament. On the Danish side the greatest interest in the matter is shown, and it is not improbable that an agreement to supply current to Denmark will be arranged. As to the Trollhättan works generally, it is considered that, notwithstanding the retarding agencies at its start, it has fully justified calculations, and that the gross receipts, which totalled 750,000 marks at the end of 1910, will attain to nearly a million marks this year.—*Elektro. und Masch.*

The Waterfalls Department have instructed Prof. G. Cassel to institute an inquiry into the advisability of exporting electric current from Trollhättan to Denmark for a period of 20 years, and at a price of about 100 kroner per KW.-year.

Spain.—The municipal authorities of Algemes (province of Valencia) have just invited tenders for the concession for the electric lighting of the town during the period of ten years.

Dartford.—The U.D.C., on November 3rd, decided to apply for a loan of £8,500 for electricity purposes, viz., Uniflow engine, balancer, switchboard, superheaters, piping, feed pump and buildings, £5,700; cables, &c., for three years, £1,000; boiler, £1,600; contingencies, £200.

Devonport.—The T.C. is negotiating with the Admiralty for the supply of current for lighting and power to the Royal William Victualling Yard, the Naval Ordnance Depôt and the King's Harbourmaster's jetty.

Epsom.—Mr. J. F. C. Snells has been selected to advise the U.D.C. as to the purchase of electrical power plant at a fee of 50 guineas. The Council is applying to the B. of T. for license to supply electricity to premises in Ewell.

Glastonbury.—At a meeting of the T.C., a committee of the whole Council reported the receipt of a letter from Messrs. Purves, referring to the notice they had given of their intention to apply for an E.L. order, and suggesting supplying the Corporation in bulk at a guaranteed minimum rent, and also the construction of a refuse destructor. The matter was fully considered, and the town clerk was instructed to reply to the effect that Messrs. Purves' proposals did not meet with approval, and declining negotiations. At another meeting of a committee of the whole Council, the question of electric light for the borough was further considered, and it was unanimously resolved that it was most desirable that the control of the lighting of the town should be in the hands of the Council, and as notice had been received of the intention of other parties to apply for an E.L. order, the Council was recommended to take the necessary steps to obtain an order itself. This the Council decided to do.

Great Harwood (near Blackburn).—The U.D.C. has decided to apply to the B. of T. for a provisional order authorising the Council to introduce electric lighting and power for all public and private purposes within the urban district.

Greenock.—An electrical exhibition, promoted by the electricity department of the T.C., has been held in the Town Hall —from October 31st to November 7th—the time having been extended three days. Like the previous exhibition, the recent one has proved in every way successful.

Herne Bay.—At a meeting of the U.D.C. on November 1st, it was reported that the clerk had communicated with about 100 electrical companies, inquiring whether they would be prepared to negotiate with the Council regarding the carrying out of the E.L. Order, and only six replies had been received. Two companies declined to negotiate, two stated that they could do nothing unless a local company was formed, and two expressed willingness to submit a scheme for carrying out the Order. The Council again deferred the matter for further information to be obtained.

Hove.—The Lighting Committee of the T.C. has decided to engage Messrs. Hancock & Dykes to make an inspection of the plant at the Holland Road electric generating station at the end of the current year.

Hoyland.—The U.D.C. has resolved that in view of the electric lighting scheme now under consideration, the question of the proposed lighting of Skiers Hill and Duke Street and the introduction of automatic lighting be deferred.

The Council has also decided to have another interview with the representative of the Yorkshire Electric Co. in reference to the suggested electricity scheme.

Lincoln.—The T.C. has applied to the B. of T. for consent to the use of overhead lines for the transmission of current at a pressure of 460 volts from Yarborough Road to the military barracks.

Llandudno.—An inquiry has been held on behalf of the L.G.B. into the application of the U.D.C. for sanction to borrow, among other amounts, £500 for electric lighting purposes.

London.—In discussing the financial relations of the local Borough Councils and the L.C.C., the Finance Committee of the latter body refers to the position created by the London Electric Supply Act of 1908, and deals with the formulation of a comprehensive policy for electricity supply in London. The Committee says:—

"It appears to us desirable that the Council should lay down some policy, and from one point of view the present time would seem not inappropriate for such action, inasmuch as there remain just 20 years between now and the earliest date by which the Council could purchase the companies' undertakings, and this period corresponds with the loan term allowed for generating plant. Hence any loans sanctioned for such plant after 1911 will be in respect of plant estimated to last until after the Council is empowered to purchase the companies' undertakings, and if the option to purchase is exercised, the Council will then be the authority for supplying electricity in London side by side with the Borough Councils. It would seem to be preferable, so far as the financial aspect of the question is concerned, for Borough Councils, where possible, as opportunity offered, to link up their undertakings for mutual support as well as for economy, instead of extending a number of comparatively small, and in some cases unprofitable, concerns which may, on economical grounds, some day have to be scrapped. It must, however, be borne in mind that no expression of opinion by the Council as to the policy which should be adopted would have any binding authority upon the Borough Councils who have established electricity undertakings, or upon the companies owning electricity undertakings. In any event, it is clear that while under existing conditions the Council might be able to give effect, to a limited extent, to any policy it might adopt as regards the undertakings of metropolitan Borough Councils, it would have no such power as regards the other undertakings. These considerations appear to us to point to the desirableness of an attempt being made to secure some agreement as to the future lines of development on the part of all electricity supply authorities in London, including companies as well as metropolitan Borough Councils."

A combined gas and electric lighting scheme for the City streets is understood to have been agreed on, and will be considered

by the Court of Common Council at an early date. Details of the scheme have not been published, but it is understood that centrally hung and bracket lamps will be generally adopted in preference to standard lamps, also that there will be an increase of nearly 50 per cent. in illumination with a considerable decrease in cost.

Islington.—The Lighting Committee reports to the effect that in August last it called the attention of the Council to the fact that the L.C.C. required the establishment of electricity testing stations within the borough. As a result of negotiations the L.C.C. agreed to the use of sub-stations, which will be constructed in connection with the extension of mains, as testing stations. The cost of connecting such sub-stations with the central station by means of pilot wires, and the provision of the necessary instruments is estimated at £2,400. The Committee has decided to make application to the L.C.C. for the borrowing of this sum.

Bermondsey.—The Electricity and Street Lighting Committee reports that, in connection with the Council's application to the L.C.C. for sanction to a loan of £18,563 for extensions to the electricity plant, the L.C.C. had asked to be furnished with information in as full detail as possible as to the terms which it is understood were offered to the B.C. for a supply of electricity in bulk by either or both of the two companies having powers of supply within the borough. While questioning the right of the L.C.C., the Committee had furnished the County Council with a copy of the report, showing that the offer of a supply in bulk had been exhaustively considered, and that no offer had been received which would in any way compare with the advantages and economy derived from plant extensions. The Finance Committee of the County Council was not satisfied with the details furnished, and stated that it had now decided to recommend the County Council to refuse to sanction the loan if the B.C. persisted in its refusal to supply the information asked for, but had postponed taking up this recommendation to the Council, in order to give the B.C. an opportunity to reconsider its decision. In the event of the County Council refusing to sanction the loan the Council has the right of appeal to the L.G.B. under Sec. 4 (1) of the London Government Act, 1899. It seemed to the Committee that the County Council misapprehended its true functions under the Metropolis Management Act, 1855, as a loan-sanctioning authority, and was endeavouring to control or dictate the policy of the Bermondsey Council in the administration of its municipal undertaking, and the Committee has decided to inform the County Council that it has been supplied with all the information necessary, and under these circumstances the Council does not see its way to furnish the additional details demanded.

Morley.—The T.C. has decided, by a majority of one vote, not to proceed further with the electric light scheme, which has been under consideration since last February.

Queensbury and Clayton.—These District Councils have been discussing the question of the advisability or otherwise of combined action with a view to obtaining a provisional order for the supply of electricity to their districts, and to transfer it to the Electrical Distribution of Yorkshire, Ltd., or otherwise. The two Councils have, however, decided to postpone consideration of the matter for 12 months, and in the meantime to make inquiries from Halifax and Bradford as to the terms upon which they would supply the districts concerned with electricity.

Rosyth (Fife).—The severe storm on Sunday did great damage to the electric installation at the works in connection with the new naval dockyard at Rosyth, Scotland. Practically every electric wire between the power station owned by the contractors and the various departments all over the works was brought to the ground by the hurricane. On the following day all the electrically-driven machinery was at a standstill—cranes, concrete crushers and mixers, and all the various workshop power installations.

St. Helens.—The electrical engineer to the Corporation has been requested to prepare a report on the question of the supply of energy for heating and cooking purposes.

Saltash.—The Devonport T.C. has been approached with reference to a supply of current for Saltash.

South Africa.—A recent issue of the *South African Mining Journal* describes the Kleinfontein central power station (Transvaal), built with the object of supplying energy to the New Kleinfontein Co., Benoni Cons. G.M., Ltd., Apex Mines, New Boksburg G.M., Ltd., and Rand Klip, Ltd. The plant generates three-phase current at 3,000 volts and 25 cycles, which is transformed up to 20,000 volts for overhead transmission to sub-stations at the various mines. The present plant consists of three 2,000-kw. Parsons turbo-alternators, but the lay-out provides for 20,000 kw. eventually. Six Babcock boilers of 30,000 lb. rated output, for 200 lb. pressure, with superheaters to give a steam temperature of 500° F., are installed in the boiler-house, with overhead bunkerage of 60 tons per boiler, supplied through a conveyor system from a 750-ton storage bunker. A 240-tube Green economiser with independent motor-driven scraper-gear is allotted to each boiler, while each set of two boilers is coupled to a steel chimney through a 30-in. motor-driven Sirocco fan. The output of this plant is controlled by Ferranti switchgear of the remote solenoid control type. Commenting on the above plant in a later issue, the same journal says that in a recent month, on a comparatively small output, the total costs, including interest, depreciation, &c., averaged 7·4d. per unit. When the Benoni supply is provided, it is expected that the figure will drop to 4·1d., and, of course, still further improvement will result as the plant is fully loaded. The chairman of the General Mining and Finance Co., Ltd., reported at the New Goch meeting that the saving effected by the change from steam power to purchased electrical power was equal to 7·28d. per ton milled.

The reduction plant of the Brakpan mines is electrically driven by means of energy purchased from the Victoria Falls Co. The electrical supply is taken from two sub-stations situated on their main power line, one being situated at each of the two main shafts, partly at 2,100 and partly at 500 volts pressure. Electric power is used throughout the plant for all purposes, the aggregate power of motors installed or pending installation being approximately 10,000 h.p., and the proportion in which power is used for different purposes is as follows:—For mine pumping, 1,500 h.p.; main hoisting engines, 4,500 h.p.; stamp battery and tube mills, 1,950 h.p.; reduction works pumping plant, 1,000 h.p.; the balance being installed for sundry surface and reduction works plant. The whole of the power supply is distributed through underground cables of the paper-insulated, lead-covered and armoured type, of which some 28,000 ft. have been laid. The cables are laid as far as possible on a ring system, whereby supply to any point can be maintained through an alternative part of the system in the event of the breakdown of any particular cable. The surface lighting is carried out by means of overhead lines, and a large amount of lighting has also been carried out underground. Of the three main hoisting engines, two are of the direct-current type using Ward-Leonard control supplied by A.C. to D.C. motor-generators, and the third is plain three-phase with rheostatic control. The capacity of each hoist is 100 tons per hour hoisted from a vertical depth of 3,800 ft. For measuring purposes the total supply is divided into six main sections, the supply to each of which is separately metered, corresponding to the broad purposes of pumping, hoisting, milling, &c. These are further subdivided into some 27 pairs of feeders for separate metering, thus giving a close check on the total and individual consumption.—*South African Mining Journal.*

The surface equipment of the Modder B mine is electrically operated by over 6,000 h.p. of motors, including eight 50-h.p. motors for the stamps, three 40-h.p. motors driving gyratory crushers, five 100-h.p. motors direct geared to tube mills and various pump motors from 80-h.p. downwards, conveyor motors, &c. One single drum Ward-Leonard controlled winder does all the hoisting of ore.

A scheme for the electric lighting of Wynberg is under consideration. It may include the supply of power to private consumers.

Potchefstroom is falling into line with the general municipal activity which at present is characteristic of South Africa, the local authorities having decided to raise a loan of £32,000 to cover the cost of an electric lighting scheme and various other works.—*British and South African Export Gazette.*

South Shields.—At a meeting of the T.C. on the 2nd inst., the Electricity Committee recommended that a borough electrical engineer be advertised for at a salary of £400 per annum (without the privilege of taking pupils), in succession to Mr. J. H. Cawthra, who is going to South Africa. In moving the adoption of the report, Alderman Rennoldson, chairman of the Electrical Committee, said that although the Committee was not unanimous, the majority of the members thought the Council should advertise for an engineer at a salary of £400: so far as he was concerned, he would not be sorry if the Council decided to offer a larger salary in order to secure the best possible man for the position.

Stafford.—The T.C. has decided, subject to the payment of £1,250 by Messrs. Edwin Bostock & Co., Ltd., boot and shoe manufacturers, to lay an additional main to the firm's factory, where a much larger supply of current is required, at a cost of £2,500. The firm's contribution will be repaid, without interest, by way of rebates on accounts for current—viz., 25 per cent. if the annual account is £500 and upwards and 20 per cent. if the account is over £200 and less than £300.

Swindon.—On November 2nd, a L.G.B. inquiry was held into the application of the T.C. for a loan of £3,510 for a battery, boosters, switchgear and buildings. There was no opposition.

Thurlstone.—The U.D.C. has approved a plan submitted by the Yorkshire Electric Power Co., of a proposed electric power sub-station at Nether Mill for the supply of electric energy to various parts of the district.

Turton.—The electricity undertaking carried out by the U.D.C. in conjunction with the Lancashire Electric Power Co., Ltd., was inaugurated on November 2nd, when the current was switched on by the chairman of the Council, Mr. R. Ashworth, and 65 street lamps, each of 50 c.p., were lighted. The Council is taking current in bulk from the Power Co., and a number of private houses are being wired.

Warrington.—On the recommendation of the Electricity and Tramways Committee, the T.C. has decided to hire out arc lamps for outside shop lighting on basis of 670 hours' lighting per lamp per annum. Repayment of the capital cost of lamps and wiring will be spread over five years. When the matter came up for confirmation by the Council, Mr. Pemberton objected to the Corporation entering into competition with tradesmen, and expressed a hope that no one would apply for the lamps. In reply, Mr. Hawthorn said that private traders had had 11 years in which to supply the demand, and the time to object was when the Corporation Bill was before the House of Commons.

Walsall.—It is proposed to lay an alternating current main from Park Street along Station Street to Bridgman Street to enable a supply to be given to the L. and N.W. Railway, subject to the company consuming 50,000 units a year, which represents a revenue of £200.

Romford.—The Guardians have decided to take no further action with regard to the question of lighting the workhouse with electricity.

TRAMWAY and RAILWAY NOTES.

Bingley.—The District Council has unanimously decided that application shall be made to the B. of T. for prov. orders for the running of tramways on the main road through Bingley from Shipley, and for the supply of electricity for lighting and power purposes.

Bournemouth.—At the meeting of the T.C., the general manager of the tramways presented a report for the half-year ended September 30th. The total receipts were £52,199, as compared with £53,191 in 1910, and the expenditure was £28,892, as against £29,967 in 1910, while the gross balance was £23,307, as compared with £23,224 in 1910. The only increase in expenses was £405, and the decreases were :—Traffic expenses, £802 ; repairs and maintenance, £221 ; power expenses, £455 ; motor-'bus, £179.

Brighton.—At yesterday's meeting of the T.C., the General Purposes Committee presented a report on the railless trolley system, and on Hove's decision not to promote a Bill authorising railless traction in co-operation with Brighton. The Committee is of opinion that it is desirable that the Brighton Corporation should extend the proposed railless traction scheme westward, through the borough of Hove and the neighbouring urban districts of Portslade and Southwick to Shoreham, and that provision should also be made in the Bill for serving the existing omnibus route from Western Road, Hove, to Hove Station. The Committee is also of opinion that power should be taken in the Bill for the Corporation to run motor-omnibuses in connection with the tramway and railless traction system, and that the opportunity afforded by the promotion of the Bill should be taken to apply to Parliament for powers to expend a sum not exceeding the proceeds of a halfpenny rate in any one year upon advertising the attractions of the borough. The Hove Council has decided to fight the first proposal in every way possible, and as a last resort to secure similar powers for itself.

Continental Notes.—Austria.—The appearance of the French group associated with the Omnium Lyonnais in connection with the projected conversion of the Vienna City Railway, is producing some interest both in financial and electrical circles in that city. The group has submitted a proposal that the City of Vienna should raise a loan of £4,166,000 for the enterprise, and the company, which would work the railway, would pay 4 per cent. of the gross receipts as interest on the loan. Apart from financing the undertaking, the group would not concern itself with the conversion of the railway and the construction of the proposed new underground line, which would be left to the Austrian electrical firms. The scheme is declared to be unacceptable because it would not permit of the payment of the whole of the interest on the loan to be raised by the city. It is calculated in electrical circles in Vienna that the traffic receipts of the new railways would range from £1,250,000 to £1,458,000 per annum, and 4 per cent. would yield £50,000 to £58,300 to the city, whereas the interest charge on the loan would amount to £166,000 per annum. The question is, however, far from being ripe for settlement. The Siemens-Schuckert Co. and the A.E.G.-Union Co. are about to prepare a joint scheme and get into communication with the Traffic Commission on the matter. It is considered that the labours in this direction will extend over the whole of next year, by which time something definite should be known in regard to the financing of the undertaking. In any case, the sum of £4,166,000 estimated by the French group is regarded as much too low for the purpose of the conversion and the building of the underground line.

Germany.—A public service of electric motor-vehicles taking current from overhead conductors is about to be established between Neuhausen and Sending, near Munich.

Italy.—A preliminary concession bas just been granted to the municipal authorities of Spalato in respect of a proposed electric railway between Spalato and Salona.

La Società per le Forze Idraulicbe de la Maira, of Piedmont, is increasing its capital from £240,000 to £440,000 with the object of establishing a large central electricity station to utilise the water power of the River Maira in the Province of Piedmont. The new station will supply the electrical energy required for the railways in the Ligurta and Piedmont Provinces which the Italian State Railway authorities propose to electrify at an early date.

The Town Council of Rome has signed a contract for the building and working of an electric railway from Rome to Ostia with the representatives of the Metropolitan Co. of Paris. The railway will consist of two sections, one above ground from the sea to the Porta S. Paolo, the other underground from the Porta S. Paolo to the Piazza Venezia.—*Zeitschrift des Oest. Ingen. und Architekten Vereines.*

Dudley.—As a result of the recent accident on the tramways, considerable correspondence has taken place between the T.C. and the Tramways Co. A letter from the company states that the management is giving the very closest attention to the rolling stock with a view to securing as far as possible immunity from a recurrence of accidents such as the one which recently took place on the Castle Hill. The accident, it considers, was in no way attributable to lack of brake power. To increase security in this respect instructions have been given that all cars about to descend the Castle Hill are to come to a dead stop at a marked pole near the top of the gradient. With regard to Bath Hill, drivers ascending the gradient have been given instructions not to stop between Farthings Lane and Queen's Cross. The whole question of compulsory safety stops on the district system is being gone into by the general manager.

Guiseley (Yorks.).—The trackless trolley system appears to be making headway in the West Riding of Yorkshire, where, following upon its adoption by the Leeds and Bradford Tramway Committees, a private syndicate is said to have brought forward the proposal that Guiseley should be linked up with Otley and Ilkley by trackless system. It is said that a Bill is to be promoted in Parliament, and the Leeds Corporation has agreed not to offer any opposition, providing the Bill contains a clause requiring the completion of the works within three years, and subject to a satisfactory arrangement being first made between the Corporation and the promoters with reference to through fares from Leeds.

Heston and Isleworth.—At a special meeting of the U.D.C. a motion to receive a report of the General Purposes Committee to the effect that the Council should apply in the next session of Parliament for an Act, conferring, among other things (1) further electricity powers, and (2) the construction of railless traction routes in the district and the adjoining districts of Twickenham and Southall-Norwood, was negatived by 11 votes to 9.

Japan.—It is proposed by the Tokio municipality to issue bonds for £9,175,000 to purchase existing tramways, construct new ones, and for electric supply purposes.

Leyton.—The tramways manager reports having received an offer from Siemens Bros. Dynamo Works, Ltd., with regard to lighting the Council's tramway-cars with tantalum lamps. The offer is to lamp the 60 cars and maintain an average of 40 running cars for £9 per month for a one year's contract, £8 per month for a two years' contract, and for a three years' contract, £7 per month. The tramways manager reporting on this offer states that if the lamps were installed, in addition to having a better lighted car, an approximate saving of £14 for a one year's contract, £26 for a two years' contract, and £38 for a three years' contract, would be effected. In view of this report the Tramways Committee has decided to accept the offer to light the cars for a period of three years.

Manchester.—A correspondent informs us that an underground railway of over four miles long is contemplated ; the scheme is being engineered by Mr. James Welsh, of Manchester.

Marple.—At the monthly meeting of the U.D.C. on Monday, reference was made to the intention of the Stockport Corporation to promote a Bill in Parliament for providing a service of railless cars between Stockport and Marple. A petition, signed by 260 Offerton people, has been forwarded to their Council, and the Hazel Grove Council has passed a resolution in favour of the scheme. It is rumoured that railless cars are to run along the Macclesfield road. Mr. W. B. Hodgkinson said the Council had approved of the scheme, but it bad a free hand as regards the details. Many residents of Marple did not favour the proposal. Those who work in Manchester and live in Marple say it will take away the picturesque rural appearance of the place and the tradesmen believe it will draw the trade to Stockport and cause a great decrease in the rateable value of Marple.

Matlock.—A conference has taken place between representatives of the Matlock and Matlock Bath Councils regarding another proposal to revive a scheme for a railless trolley service in the locality.

Rotherham.—The engineer has been instructed to prepare specifications, &c., for the purchase of nine new tramcars, and tenders are to be invited for the supply of same.

Ramsbottom (near Bury).—At a meeting of the U.D.C. to be held on the 16th inst., a resolution is to be moved that a Bill be promoted in Parliament for powers authorising the erection of overhead equipment, and all other works necessary or expedient for the installation and use of a system of railless electric traction.

St. Helens.—It has been decided to extend the tramway in Newton Road.

West Bromwich.—At the meeting of the T.C. on Friday last, the Mayor reported that at last a settlement had been arrived at with regard to the vexed tramway question, the agreement between the Corporation and the tramway company having been signed and sealed the previous day. The agreement, his Worship added, was fair for both parties. The Council had not taken any advantage, and bad taken care that the company did not. He hoped the agreement would be faithfully carried out by both parties in its entirety.

West Hartlepool.—At a meeting of the T.C. on October 31st, the resolution that the Council give notice to purchase the portion of the Hartlepool tramway that is within the borough was formally confirmed.

Wolverhampton.—The Corporation Tramways Committee in its annual report to the T.C. presented this week gives the following statement of traffic receipts, &c., for the first six months of the financial year ending September 30th last, as compared with

the same period last year :—1911, 580,883 miles ; 5,796,366 passengers ; £26,732 receipts ; 1910, 565,844 miles ; 5,369,916 passengers ; £24,916 receipts. It will be seen from the above figures, says the Committee, that the total revenue for the period referred to shows an increase of £1,815, or ·477d. per car-mile, whilst the car-mileage has increased by 15,039 miles. This satisfactory result is due to the exceptionally fine summer which we have enjoyed this year, and to the extra traffic on the occasion of the Coronation Festivities.

TELEGRAPH and TELEPHONE NOTES.

Correction.—In the "Empire Wireless" leaderette in our issue of 3rd inst. the last paragraph should read :—

"In the course of a Press Association interview, Mr. Charles Bright has called attention to the present position of affairs, and the *Daily Graphic* of October 30th stated that the prevention of monopoly was one of the legitimate functions of a Government."

The rest of the paragraph is our own comment on statements made by the *Daily Graphic* In the same article, by a printer's error, 180 million was reduced to 80 million words a year.

Pacific Cable Bill.—At the second reading of this Bill in the House of Lords on Tuesday last, the Earl of Liverpool said that its object was to enable the Pacific Cable Board to lay a cable between Australia and New Zealand, which would result in a saving of £6,000 a year by reduction of staff, besides facilitating communication.

Spain.—It is reported from Madrid that the Compania de Telegrafie sin hilos has been formed in that city to acquire the concession granted in 1908 to the Oerlikon Co. The capital amounts to £260,000, and comprises £100,000 in ordinary shares and £160,000 in preference shares. The directors are said to include Mr. Marconi, Mr. C. Isnes, a former Spanish Minister of Finance, and the manager of the Oerlikon Co. in Madrid.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

Victoria.—November 28th. Ebonite earpieces, calculagraphs, and insulators for the P.M.G. See "Official Notices" October 6th.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

Austria.—November 17th. The Austrian State Railway authorities at Cracow are inviting tenders for an installation of electric lighting at the railway station at Nowy-Sacz.

Blackpool.—November 18th. Taking up and re-laying a short length of double-line tramway. Mr. J. S. Brodie, borough engineer, Town Hall.

November 29th.—One 1,500-kw. steam turbo-alternator, one barometric jet condenser, and one 800-kw. mixed-pressure steam turbo-generator, for the Corporation. See "Official Notices" to-day.

Bootle.—November 20th. Slack for the electric light station, for the T.C., for six and twelve months from January 1st. Electrical Engineer, Pine Grove.

Canada.—Lethbridge.—November 24th. Municipality. Power station equipment, comprising boilers, economiser, steam turbo-generator, condenser and sub-station equipment ; 10 per cent. deposit with tender. Plans, &c., from A. Reid, superintendent engineer, Lethbridge.

Chatham.—November 14th. Incandescent electric lamps for a year, for the T.C. Chas. Day, Borough Surveyor, Town Hall.

Dublin.—November 21st. Electric lighting and fire-signalling apparatus for the new Fire Brigade station, Thomas Street, for the Waterworks Committee. Specification for lighting (7s. 6d., not refundable) from the City Electrical Engineer, and for the signalling apparatus (4s. 6d., not refundable) from the Chief's Office, Central Station, Tara Street, Dublin.

Edinburgh.—Tenders are invited for an electric light installation at Tynecastle Supplementary School. J. A. Carfrae, architect, 3, Queen Street.

India.—November 14th. The Secretary of State for India is inviting tenders for rails and fishplates and electric cranes, &c. Director-General of Stores, India Office, Whitehall, S.W.

London.—L.C.C.—November 14th. The Tramways Department is inviting tenders for sand drying and crushing plant. A. L. C. Fell, Chief Officer of Tramways, 62, Finsbury Pavement, London, E.C.

November 18th.—Various stores and materials for the Port of London Authority, including : Item 27, carbons for electric arc lamps ; Item 28, electric lamps (carbon filament). Stores Superintendent, 106, Fenchurch Street, E.C.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains, ; (2) power station, car-shed and repair-shop equirments ; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Norway.—January 31st, 1912. The Norwegian military authorities in Christiania are inviting tenders for the supply of 100 sets of field telephone apparatus.

Salford.—November 27th. Two 1,000-kw. direct-current turbo-generators, for the Corporation. See "Official Notices" November 3rd.

Sheffield.—November 13th. One 5,500-kw. steam turbine, condensing plant, pumps, pipework, &c., and alternator and exciter, for the Corporation. See "Official Notices" October 13th.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Stretford.—November 13th. Electric mains and accessories, for the U.D.C. Mr. R. Rowland, electrical engineer (returnable deposit of £2 2s.).

Swindon.—November 22nd. One 250-kw. Diesel oil engine generating set, accessories, switchgear, &c., for the Corporation. See "Official Notices" November 3rd.

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. For further particulars, see this column for October 27th.

Warrington.—November 17th. Telegraph materials and carbons, for a year, for the Cheshire Lines Committee (form No. 6). Stores Superintendent, Cheshire Lines, Warrington.

West Ham.—December 4th. Electric light installation at the Gainsborough Road Schools, for the Corporation. See "Official Notices" to-day.

CLOSED.

Amesbury (Wilts.).—The tender of Messrs. Grossmith and Co. has been accepted, at £998, for the electric light and power installation at the isolation hospital. The highest tender was £1,394 (Edmundson's Electricity Corporation, Ltd.).

Atherton (Lancs.).—The D.C. has accepted the tender of the Brush Electrical Engineering Co. to supply two single-phase, core type, oil-cooled transformers, each having a capacity of 30 k.v.a.

Cardiff.—The tender of Messrs. Stothert & Pitt, Ltd., has been accepted for one 3-ton and three 1-ton electric jib cranes, for the Great Western goods yard, at Newtown, Cardiff.

Dundee.—The T.C. Tramway Committee has approved of the acceptance of the offer of the Railless Electric Tramway Construction Co. for the supply of two 20-h.p. railless trolley cars for the Clepington Road district of the city. The estimated cost of the cars is £700 each. The overhead equipment and poles are to cost £1,258. The railless route will extend to 1¼ miles.

India.—The *Indian and Eastern Engineer* understands that the Tata Hydro-Electric Power Supply Co., Ltd., have placed the following orders in connection with their Bombay hydro-electric scheme, a 30,000-h.p. plant :—

Dynamos.—Messrs. Siemens.
Turbines.—Escher, Wyss & Co.
Switchgear and transformers.—General Electric Co., of New York.

It is also understood—but the report requires confirmation—that the pipe-line order will be placed with Messrs. Escher, Wyss & Co.

Largs.—Mr. J. A. Robertson, Corporation electrical engineer, Greenock, in a report to the T.C., recommends the refuse destructors offered by the Horsfall Co. (£2,587) and by Messrs. Heenan & Froude (£2,967). Mr. Robertson was asked to draw up a specification placing the two firms on a similar basis and to ask them to tender again. Of the seven offers submitted to Mr. Robertson, the lowest was £1,100 and the highest £2,967.

Leyton.—The U.D.C. has accepted the tender of Mr. R. R. Todd, at £249, for the supply of one mile of ·2 sq. in. distribution cable. Nine tenders were received, the prices ranging from that of the accepted to £405. Three of the tenders submitted were not in accordance with the specification.

St. Helens.—The Electricity Committee has ordered an additional feeder panel from Messrs. Ferranti, Ltd., and has accepted the tender of the Sutton Heath and Lea Green Collieries Co., Ltd., for 12 months' supply of fuel.

London.—L.C.C.—The Highways Committee received the following tenders for plant, &c., required for the new sub-station to be erected at Vauxhall :—

One 20-ton Overhead Travelling Hand-Crane.

John Smith (Keighley), Ltd.	(recommended)	£259
Herbert Morris & Bastert, Ltd.		260
Holt & Willetts		265
James Spencer & Co.		280
Carrick & Ritchie, Ltd.		305
London Hoist and Machinery Co.		318
S. H. Heywood & Co., Ltd.		369
Thos. Smith & Sons		555

High-Tension Electric Cables.

Siemens Bros. & Co., Ltd.	(recommended)	£9,762
W. T. Henley's Telegraph Works Co., Ltd.		9,898
Callender's Cable and Construction Co., Ltd.		10,062
British Insulated and Helsby Cables, Ltd.		10,070
Western Electric Co., Ltd.		10,188
Johnson & Phillips, Ltd.		10,504
W. T. Glover & Co., Ltd.		11,104
Foote & Milne, Ltd.		12,143

Low-Tension Electric Cables.

Western Electric Co., Ltd.	(recommended)	£15,162
Callender's Cable and Construction Co., Ltd.		15,401
W. T. Henley's Telegraph Works Co., Ltd.		15,500
Johnson & Phillips, Ltd.		15,522
Foote & Milne, Ltd.		15,611
British Insulated and Helsby Cables, Ltd.		15,801
Siemens Bros. & Co., Ltd.		16,203
W. T. Glover & Co., Ltd.		16,803

Rotary Converters.

Dick, Kerr & Co., Ltd.	(recommended)	£6,089
General Electric Co., Ltd.		6,149
British Westinghouse Electric and Manfg. Co., Ltd. ..		6,185
Ditto (alternative tender—not to specification)		6,002
British Thomson-Houston Co., Ltd.		8,240
Ditto (alternative tenders—not to specification)		5,848 6,161 6,260
Electric Construction Co., Ltd.		8,307
Bruce Peebles & Co., Ltd. .. (not to specification)		14,646

The estimates of the chief officer of tramways comparable with the tenders are £300, £9,800, £15,300 and £6,300 for the overhead crane, high-tension cables, low-tension cables and rotary converters respectively.

The Metropolitan Water Board has accepted the following tenders in connection with the new pumping station and engines at Walton :—

Siemens Bros. Dynamo Works, Ltd.—One 5-B.H.P. motor for opening valves, £89.

General Electric Co.—440 yards of twin circular vulcanite hard-core cable, ⅛ diameter, to connect electric pumps, £27 15s.

Gwynnes, Ltd.—One 4-in. Invincible pump and one special starting panel, for lifting out drainage water and natural-filtration water from the valve pit, £76.

The Board has further accepted the tender of the British Insulated and Helsby Cables, Ltd., at £75 17s., for the supply of two miles of V.I.R. cable with steel drawn-wire centre, required for repairs to the telephone at Hampton station.

Stafford.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for the provision and laying of 3,000 yd. of cable, at £2,010.

Swindon.—The T.C. has accepted the tender of Messrs. J. H. Holmes & Co. for a traction booster, at £327.

Torquay.—The T.C. has accepted the tender of Messrs. Whiteway & Ball for the supply of 3,000 tons of Featherstone pea slack coal and 800 tons of house coal screenings for the Electricity Department.

Uxbridge.—The Hospital Joint Board has placed the electric lighting and underground cable work of the fever and diphtheria blocks of the Isolation Hospital with Messrs. G. Weston and Sons, Ltd.

Walsall.—The Corporation Electricity Committee has accepted the tender of the British Westinghouse Co. for supplying two transformers, at £88, and switchgear, at £121, required in connection with the supply to Messrs. John Russell & Co.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued :—

Monday, November 13th.—"A" Company. Lecture by Major Le Rossignol on "Switchboard and Paralleling Dynamos." Company work, 7 to 9.30 p.m.

Tuesday, November 14th.—"B" Company. Same as "A," above.

Wednesday, November 15th.—Gymnastic classes, 7 to 10 p.m.

Thursday, November 16th.—"C" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.

Friday, November 17th.—"D" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.

Saturday, November 18th.—Social Club annual dinner, at 7.30 p.m., at the Café Monico.

There will be a week-end mobilisation camp at Dover for "A" and "B" Companies, leaving Victoria Station at 1.30 p.m. on Saturday, December 9th.

(Signed) P. H. Campbell, Capt. R.E., Adjt. L.E.E.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Birmingham Local Section).—Friday, November 10th. At 7 for 7.30 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society.—Friday, November 10th. At 5 p.m. At the Finsbury Technical College. Papers on "Physiological Effect of an Alternating Magnetic Field," and "Demonstrations of Acoustical Experiments, New and Old," by Prof. S. P. Thompson, and other papers.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, November 13th. At 6 p.m. At the I.E.E. Paper on "Departmental Contracts," by Mr. W. S. Mountain.

Institution of Civil Engineers.—Tuesday, November 14th. At 8 p.m. Papers on "Loch Leven Water-Power Works," by Mr. A. H. Roberts, and "The Hydro-Electric Plant in the British Aluminium Co.'s Factory at Kinlochleven," by Mr. F. B. Sonnenscheio.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, November 14th. At 8 p.m. At 207, Bath Street, Glasgow. First meeting of the session.

Institution of Electrical Engineers (Manchester Local Section).—Wednesday, November 15th. At Liverpool. Joint meeting with the Liverpool Engineering Society. Paper on "The Function of the Laboratory in the Training of an Engineer," by Prof. E. W. Marchant.

Royal Society of Arts.—Wednesday, November 15th. At 8 p.m. First meeting of the session. Opening address by Lord Sanderson.

Institution of Electrical Engineers (Students' Section).—Wednesday, November 15th. At 7.45 p.m. First meeting of the session. Opening address by Mr. C. P. Sparks.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, November 15th. At 7.30 p.m. At the Hotel Metropole. Inaugural address by Mr. T. Harding Churton, followed by a smoking concert.

Illuminating Engineering Society.—Friday, November 17th. At 8 p.m. At the Royal Society of Arts. Report on progress during the vacation, and paper on "Notes on the Design of Motor-Car Headlights," by Dr. H. R. B. Hickman.

Northampton Institute Engineering Society.—Friday, November 17th. At 5.45 p.m. Paper on "The Design of Electric Power Stations," by Mr. A. H. Perrett.

Junior Institution of Engineers.—Saturday, November 18th. At 3 p.m. Visit to the works of the Tottenham and Edmonton Gas Light and Coke Co.

NOTES.

Emergency Stand-by Plant.—Some 11 years ago a water-power plant was installed at the residence of Col. Hopton, of Canon-Ffrome Court, Herefordshire, the plant being an interesting one, as it is water-driven from the River Ffrome on a rather low fall. The turbine is one of Messrs. Gilbert Gilkes's manufacture, with a horizontal wheel and a vertical shaft, the drive being from the turbine fly-wheel, which is horizontal, to the dynamo pulley, which is vertical. The current is transmitted about ¼ mile to the battery room, which is situated close to the mansion. The output of the plant is about 12½ H.P., and during the 11 years the plant has been installed there has been no shortage of water until this year; but owing to the extreme drought of the past summer, the last month caused a good deal of anxiety, and the short supply of water necessitated some means of getting over the difficulty. At Col. Hopton's suggestion, a



Old Steam Car Driving Dynamo

White steam car which he had ceased to use for road work was brought into operation. With great difficulty this car was got into position outside the turbine house and blocked up on wood brackets; one of the back wheels was removed, and in place of this a belt pulley was put on, the other hind wheel being allowed to rest on the ground, so as to prevent it running through the differential. The White steamer was found to be able to carry the load continuously for 12 hours at a stretch; giving 40 to 50 amperes at 150 volts, and running on cheap petrol, the consumption was a gallon an hour. Owing to the fact that the car was a fixture, the condensing plant had to be disconnected, as there was not sufficient cool air to condense the steam, and the exhaust pipe was carried to the atmosphere. The water tank capacity without the condenser was capable of running the load for about an hour at a time. The engine was capable of driving the dynamo, which is, of course, shunt wound, on the lights direct without a variation of 2 per cent. in the voltage.

Electrical Contractors and Electrical Inspectors.—On November 2nd, 1911, at the Clerkenwell Police Court, before Mr. Bros, an application was made by Mr. R. Tweedy Smith (solicitor to the Electrical Contractors' Association, Incorporated), on behalf of Mr. A. Edward Evans, of 38, Fitzroy Street, Fitzroy Square, and also on behalf of Messrs. McDonald, Syer & Co., Ltd., of 295, Gray's Inn Road, W.C., for the appointment of an electrical inspector under the terms of the provisional order obtained by the St. Pancras Borough Council in the year 1883. Mr. Tweedy Smith explained to the Magistrate that the right of appointing an electrical inspector in London was vested in the County Council, with the exception of two areas, namely, St. Pancras and Chelsea. The right of the Magistrate to appoint an inspector in St. Pancras was given to him by Sec. 28 of the provisional order of 1883. The Magistrate, however, had no power under the order to insist upon the electrical inspector testing anything except the mains of the undertakers and the meter of the consumer. This defect he, however, contended had been remedied by the Board of Trade regulations which had been issued since the date of the order, and Regulation 31 provided that any consumer who was dissatisfied with the action of the undertakers in refusing to give or in discontinuing a supply of energy to his premises, had a right to apply for the installation to be tested by an electrical inspector. By Sec. 6 of the Electric Lighting Act, 1882, a Board of Trade Regulation has all the effect of an Act of Parliament in varying any provisional orders. It was explained to the magistrate that the two applications were somewhat different. In the case of Mr. Evans, he had some 60 lights in his house and factory. In the factory he had a 7½-H.P. motor, and four radiators in his house and two in the office. It appeared that a Tucker fuseboard had been provided for some of the radiators, and that the engineer, Mr. Baynes, had refused to connect this fuseboard on the ground that it did not comply with a notice he had issued. Such notice was on the back of the form signed by consumers for the supply of electricity, and was headed "Terms and conditions of supply." The particular provision referred to was that "all main fuses shall be of the enclosed cartridge type built up of porcelain. If other types are used, a clear break or not less than 4 in. must be provided for main fuses, and 3 in. for sub-fuses." Mr. Baynes had got the impression that he could insist upon a particular type of fuse, notwithstanding the fact that all other engineers in the Metropolitan area were accepting the same fuseboard he was rejecting. Mr. Tweedy Smith informed the magistrate that there had been several faults on the undertakers' mains resulting in the lamps of consumers being burnt out, and that really what the engineer was trying to do, was to protect the consumer's premises from the leakages from the undertakers' mains. The engineer, on the other hand, by his own Provisional Order, Sec. 59 *d* and *g*, was bound to observe the following regulations:—"The supply of electricity to any premises shall be capable of being turned off at some point outside such premises. All service lines and positive and negative poles of service lines upon the premises of any consumer shall be at a distance of not less than 3 in. from one another respectively." The Corporation of St. Pancras were not complying with such provisions, but were insisting upon a larger break in fuses, really to guard against the defects in their own mains. The Tucker fuseboard in question had been passed by the Board of Trade, and the application was now that the Magistrate should appoint an Inspector to examine the same fuseboard and installation at Mr. Evans's premises, and also to test the meter at the premises of Messrs. McDonald, Syer & Co., and the mains of the Corporation of St. Pancras.

Mr. Syer gave evidence to substantiate the statement of his solicitor. The Magistrate, who had heard Mr. Barrington Ward's contention on behalf of the Borough Council at the previous hearing, then stated that he was of opinion that he ought to appoint an electrical inspector. Mr. Ward, counsel for the Corporation, applied to the Magistrate to adjourn the case for him to consider the arguments advanced by Mr. Tweedy Smith. The Magistrate thereupon adjourned the application until November 22nd at 2 o'clock.

Electrical Trade Union Lectures.—We are asked to state that the West London branch of the Electrical Trades Union are running, as is usual during winter months, a series of lectures on social science and the practical application of electricity. The next lecture is to be delivered by Mr. Clarke, of the Anti-Socialist Union, on "Socialism and Trade Unions," on Tuesday, November 14th, at 9 o'clock p.m., at the Bush Hotel, Shepherd's Bush Green, W. We understand that interesting questions and discussions are assured, and all engaged in the trade are invited to attend. Anyone wishing to join the branch is asked to write to Mr. W. J. Webb, 98, Coomer Road, Fulham, S.W.

Tube Railway and Omnibus Co.'s Amalgamation.—On Monday, Mr. Martin asked the President of the Board of Trade whether he was aware that an amalgamation of the London General Omnibus Co., the Metropolitan District Railway Co., and the Underground Electric Railways Co. was being arranged, and whether he would introduce legislation similar to the Sherman Anti-Trust Law of the United States of America to protect the public against combinations intended to prevent competition in railway rates? Mr. Buxton replied that he had seen it stated in the Press that some such arrangement was under consideration. The recent Departmental Committee on Railway Amalgamation recommended, *inter alia*, that the Railway and Canal Traffic Act of 1894 with regard to increase of railway rates should be extended to cover passenger fares, and the Government hoped to introduce a Bill next session to deal with the matters covered by the recommendations of the Committee.

Post Office Engineering Department.—On Wednesd last week, Mr. Steel Maitland asked the Postmaster-Gener whether it was proposed to change the headquarters of the Eng neering Department of the Midland District of the Post Office fro Birmingham to Nottingham, and if so, what were the reasons for t change?—The Postmaster-General replied that the superintendi engineer's headquarters would be moved from Birmingham to No tingham, as part of a general arrangement for assimilating th districts of the superintending engineers to those of the surveyo Such an arrangement was highly expedient for the smooth a efficient working of the service, and was especially necessary view of the forthcoming transfer of the National Telephone Co undertaking to the Post Office. The change would be made at onc The telegraph and telephone interests of Birmingham would in n way suffer, and the growth of the stores staff at the Birmingha depôt would probably before long quite make up for the remov now contemplated.—Mr. Amery asked if it was proposed also divert the stores centre now at Birmingham, the great headquarte of the National Telephone Co., which were shortly to be taken ove and the main underground cables which were at Birmingham, the centre of the great industrial area, which they served at pr sent.—The Postmaster-General said there was no proposal to alt the cable route, and the stores department at Birmingham w more likely to expand than contract.

Post Office Stores Department.—Mr. Alden in th Parliamentary Papers asked the Postmaster-General whether th report of the Committee appointed early in 1910 to inquire into th working of the factories department of the Post Office would b published, and, if so, when; whether he was in a position to giv any information regarding the recommendations of that Committe whether he could say on what date these recommendations wou be brought into force; whether he was aware that, although th existing clerical staff of the factories department was declare redundant on March 4th, 1910, the official policy to be pursued i disposing of that staff had not yet been definitely declared; an whether he could now state how the redundant staff would be di posed of.—The Postmaster-General replied that the Committee ha reported, and the report was now under his consideration. He feare that he could not, at the present moment, make any statement wit regard to the recommendations of the Committee or with regard t the publication of the report.

Will.—The *Times* states that Mr. William Shuter, lat chairman of the Telegraph Construction and Maintenance Co., Ltd who died on October 3rd, aged 82, left estate of the gross value £43,720, with net personalty £41,604.

The Telegraph Construction Bill.—In the House o Lords on Monday this Bill, which enables the Postmaster-Gener to take over telegraphs constructed across railways and canals, wa read a second time. The *Times* report says that all the great trun railways had agreed to the measure with the exception of two Scottis companies.

Wages at South Kensington Generating Station.— In the Parliamentary Papers, Mr. Tyson Wilson asked the Firs Commissioner of Works if he had received a complaint that th engine drivers and their assistants employed at the South Ken sington generating station were being paid considerably les than the standard rate of wages; and, if so, what steps had h taken in the matter. Mr. Dudley Ward replied that while th First Commissioner was not prepared to admit that the engine driver and their assistants employed at the South Kensington generating station were being paid considerably less than the standard rate o wages, he was giving the matter his careful consideration, an hoped shortly to be in a position to arrive at a decision.

Copper.—The copper situation at the end of October as summarised in Messrs. Merton's statistical circular, shows n marked change in general features. Visible supplies have dropped 5,504 tons, 1,300 tons of which represents a decrease in the quantity afloat from Australia. This decrease is high, but in accordanc with the tendency to reduce European stocks. Supplies from th United States to English ports and Havre are low; to othe European ports just average. From Spain and Portugal supplie are distinctly low. Shipments from Chile are down, an Australia shows about 500 tons below the average. Deliveries, on the other hand, are up to the usual quantity, hence the large withdrawal from stocks.

American stocks increased 3,328 tons during September, and the world's visible supply for the end of that month, therefore, shows an increase of 3,754 tons over the quantity returned for the end of August. This figure was 130,239 tons higher than it has been since the end of June, 1911.

During October stocks in Rotterdam fell 350 tons, and those in Hamburg are estimated to have decreased 900 tons.

Imports and Exports in October.—Our foreign trade during last month showed substantial increases in all three sections —imports, exports and re-exports.

Imports advanced by £2,804,498 as compared with October, 1910, but electrical goods dropped by £24,351 to £131,249. Machinery advanced by £75,752 to £430,881.

Exports advanced by £5,855,071, of which yarns and textile fabrics account for about £3,000,000, the rest being spread over practically all departments, both manufactured and unmanufactured. Electrical goods are better by £49,837 at £296,016. Machinery advanced by £257,602 to £2,908,435.

Re-exports have increased by £678,546.

(*Continued on page 789.*)

THE COMMONWEALTH EDISON CO.'S NEW POWER STATION.

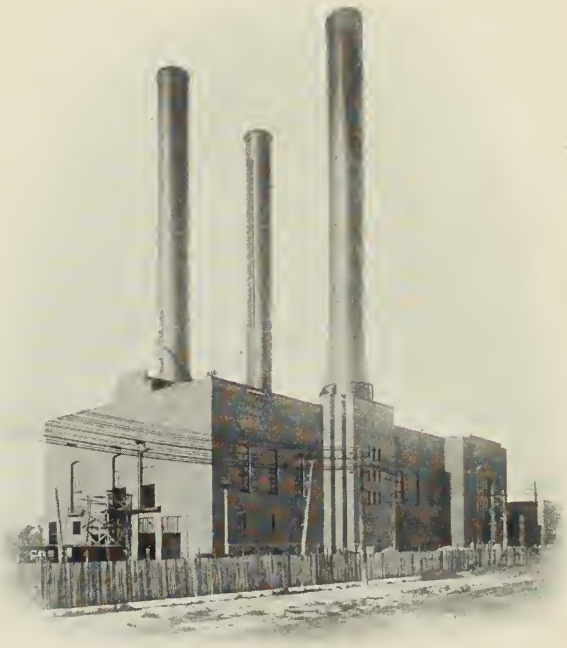
The electrical progress of the city of Chicago needs but little introduction to our readers; an immensely thriving business and manufacturing centre, with a population of over 2¼ millions, it is already well known for its Fisk Street and Quarry Street power plants of the Commonwealth Edison Co., with their large Curtis turbine units, as also for the Chicago drainage-canal power project. With the opening of a third large power station by the Edison Co.—the new North-West Station—Chicago may almost claim to lead the way in such matters, as the plant will be unique in the matter of the large units to be installed there. The new North-West Station will be linked with the Fisk Street and Quarry Street plants, and in all of them steam-turbine units are used exclusively.

The first 5,000-kw. Curtis vertical turbine ever built was the basis of the design of the well-known Fisk Street station, and was started-up in 1903.

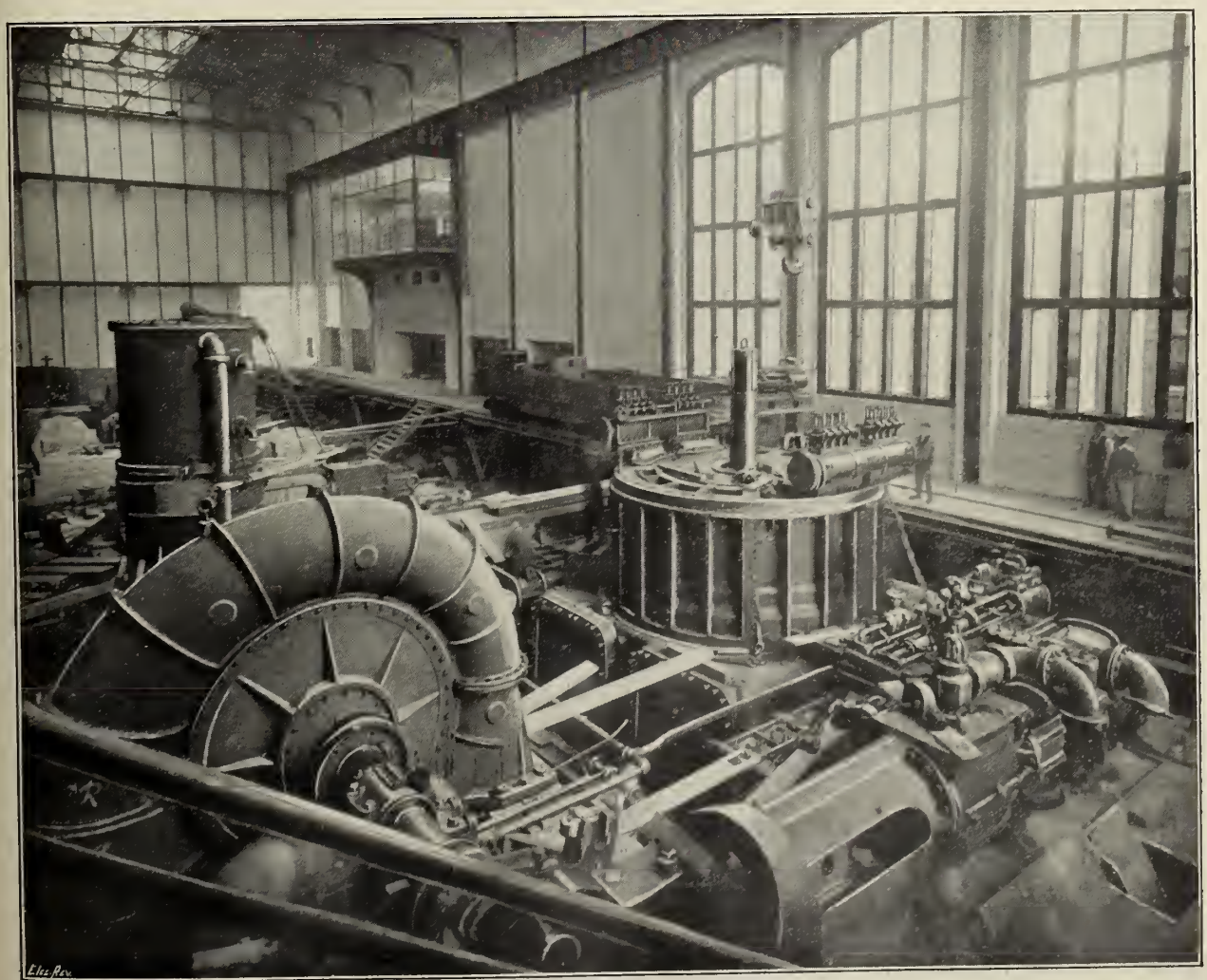
This unit was followed by three similar ones, and six Curtis units of 12,000 kw. each, continuous rating—the four early 5,000-kw. units being subsequently replaced by another four sets of 12,000 kw. each, making a total of 10 similar Curtis units aggregating 120,000 kw. Then followed the Quarry Street station with six 14,000-kw. Curtis turbine sets, and now comes the North-West plant with an initial equipment of two 20,000-kw. units, which are the largest turbo-generators ever built.

In a period of about eight years, therefore, the total steam-turbine capacity of the company has increased to 18 units of 244,000 kw.—a figure of which they may well be proud.

The new station will, moreover, contain ultimately six 20,000-kw. units, and the plans anticipate a duplicate station alongside, with a similar capacity, making a total of 240,000 kw. on the North-West site.

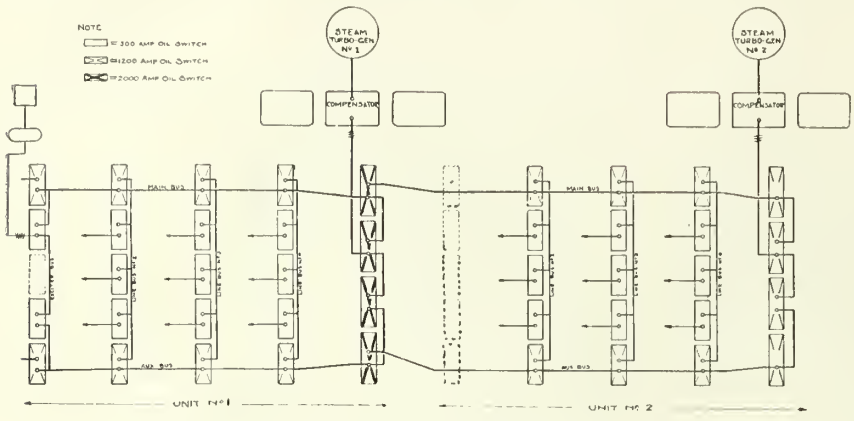


The New North-West Power Station, Chicago.



Interior of Engine Room; first 20,000 kw. Set during Erection.

The site comprises 110 acres, and is served by the Chicago & North-Western Railway and north branch of the Chicago River; it is situated some 7 miles from the centre of the city, and about 8 miles from the Quarry Street and Fisk Street stations.



Key Diagram, Generator and Switch Connections.

two outer tracks also run in this basement, under the ash bunkers, for dealing with the ashes.

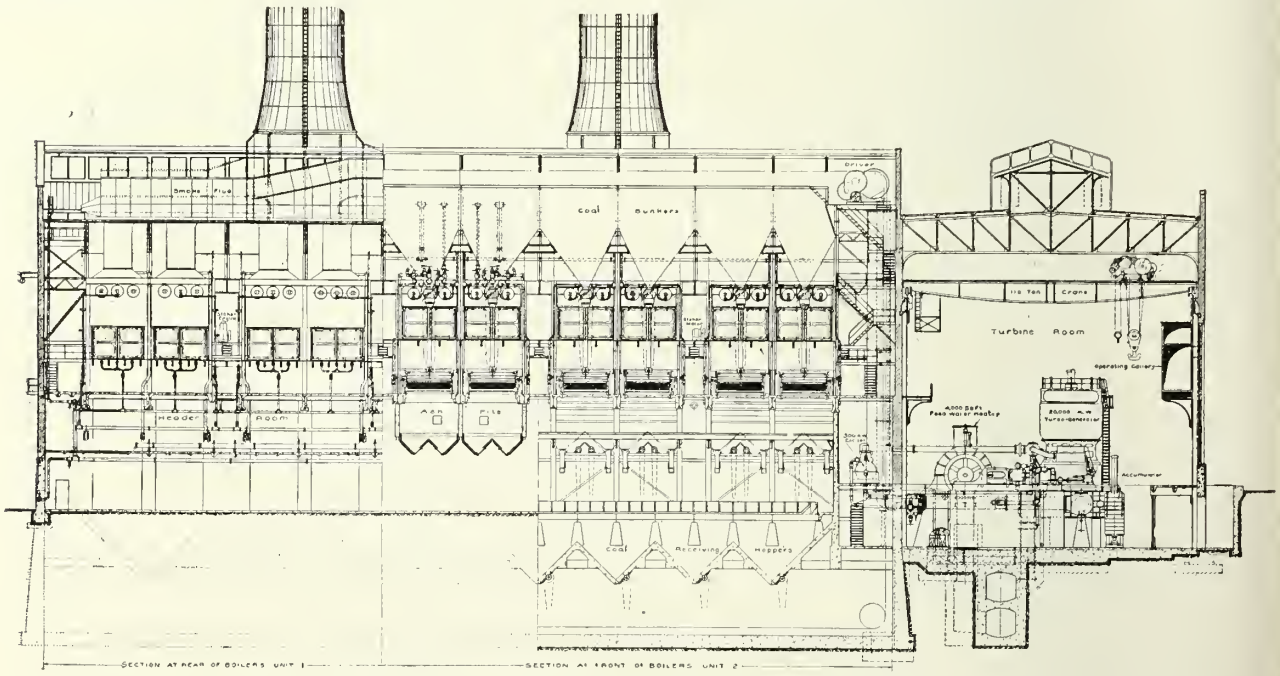
A travelling coal-handling crane with a grab bucket spans the coal tracks for emptying cars with non-hopper bottoms; cars with hopper bottoms discharge directly into coal receiving hoppers below, holding 75 tons for each boiler.

Below the hoppers is a second basement, with a travelling coal crusher spanning a 34 in. × 36 in. bucket conveyor, which encircles vertically the entire double boiler section and feeds overhead coal bunkers of a capacity of 63 tons per boiler.

The bunker capacity thus amounts to 1,400 tons for each unit of 10 boilers, but outside storage between the twin stations will give accommodation for 250,000 tons in addition.

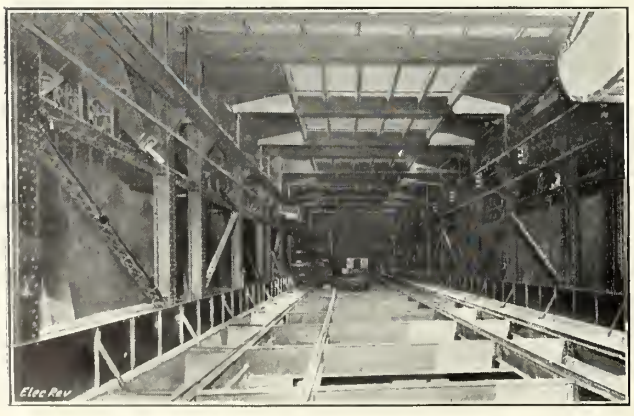
The boiler house floor is 21 ft. above that of the turbine room, permitting the boiler operator to have an unobstructed view of the latter.

Ten triple-drum Babcock boilers are provided for each



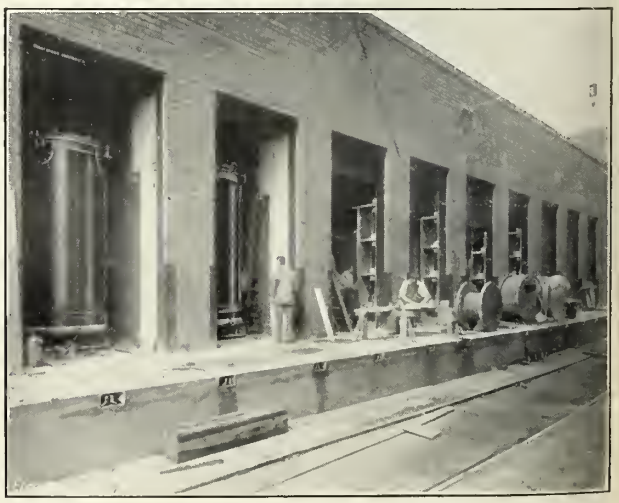
Sectional View, North-West Station, Chicago.

The new station is divided into three distinct buildings, viz, the boiler and turbine house, the switch house and the transformer house—all these are of steel frame construction, with brick walls, concrete foundations, coal receiving hoppers, tunnels, &c. Fuel entering from the railway will be dealt with by the Edison Co.'s third-rail 600-volt locomotives, and shunted into two inner tracks running under the boilers:



Coal Tracks and Hoppers under Boiler House.

20,000-kw. turbine unit, installed in two facing rows and subdivided into batteries of five boilers each. These boilers are cased in sheet steel to ensure against air leakage, and are equipped with chain grate stokers; each ten boilers



The Transformer House.

discharges into a 17-ft. dia. brick lined steel stack rising to 250 ft. above the boiler house floor.

The boiler pressure is 250 lb. with 150° superheat; a 6-in. steam pipe from each boiler connects to a 16-in. main header in the basement for each turbine, and the headers for Nos. 1 and 2 units are interconnected by a 10-in. loop which also supplies pumps and auxiliary plant; a duplicate system of boiler feed pumps, turbine driven, is provided for each unit, also service and fire pumps, in a pump room in the basement.

The turbine room runs across the end of the boiler houses as is usual nowadays where large units are installed.

The two 20,000-KW. units to be initially installed each consist of a 4,500-volt, 25-cycle, three-phase alternator mounted on a five-stage 750-R.P.M. Curtis turbine with a condenser in the base and under the turbine room floor; later on some 60-cycle generators will be installed.

A special ventilating system is provided for the alternators, which, by means of fan blades round the top of the rotors, suck cool air through metal ducts from the basement, discharging it downwards through the machine and thus neutralise heat radiation from the top of the turbine.

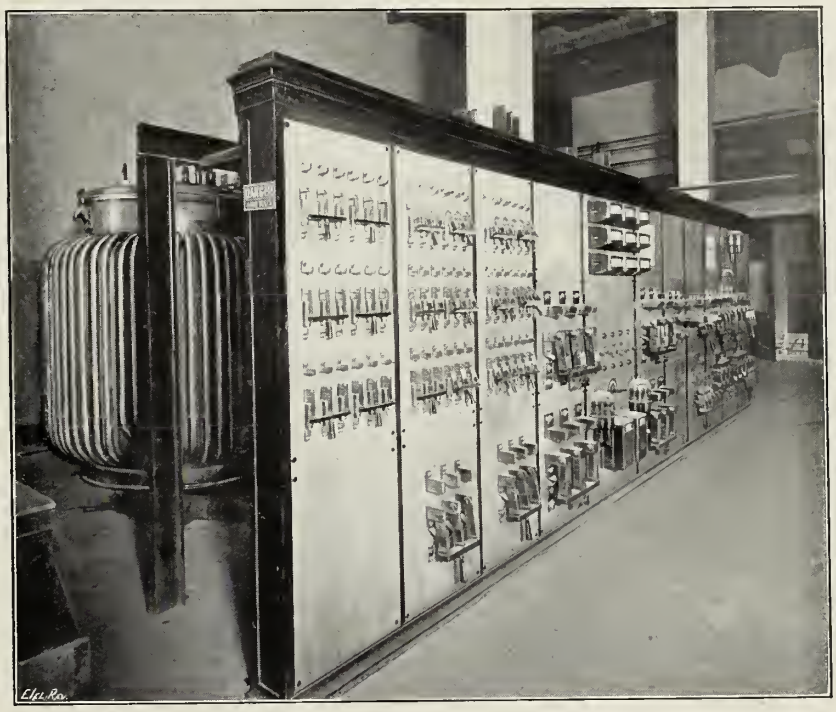
These turbine units stand 27 ft. above the floor, are 15½ ft. greatest diameter and are spaced on 44 ft. centres. A 300-KW. steam-driven, and a 200-KW. motor-driven exciter are provided for each unit; the former is a turbine set, while the latter is operated from the 9,000-volt system through an oil-cooled transformer stepping down to 220 volts.

A railway track extends along one wall of the turbine room and a 110-ton Morgan crane spans the latter.

The condenser circulating system is of interest; a crib with motor-driven revolving screens has been provided for the intake water which flows in a tunnel under the discharge tunnel to near the river, where the two tunnels diverge.

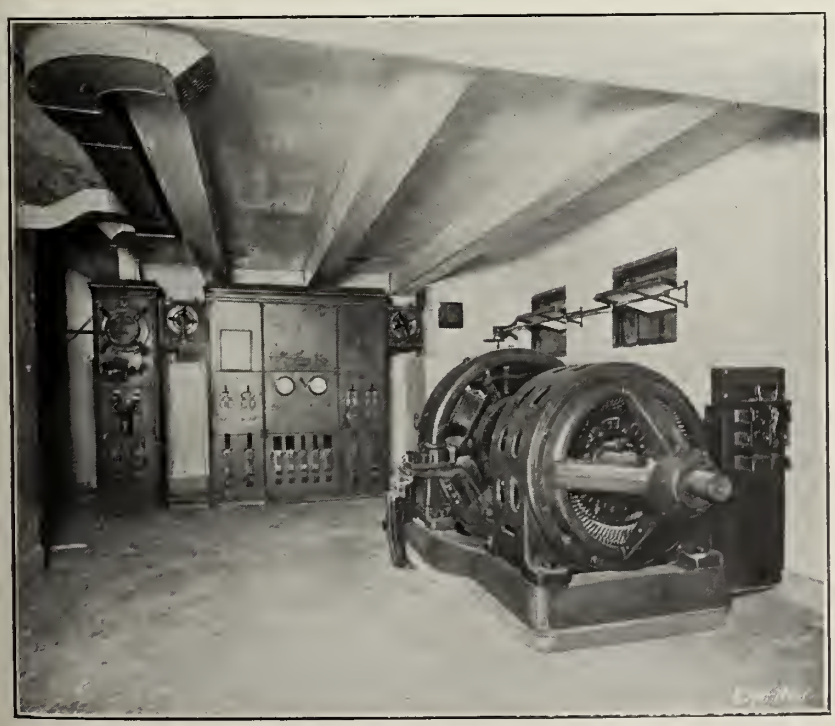
The circulating system deals with 210 gallons per unit per second. The turbine step bearings are supplied with oil under 1,200 lb. pressure by two pumps per unit with an accumulator plant; a second oil supply is also provided, from two pumps, circulating oil at 100 lb. per sq. in. to the upper bearings and turbine governors.

The lay out of the switchgear comprises an operating house of three floors overlooking the turbines, and connected by a passage leading over the transformer house, to the switch-house beyond, the last mentioned being a three-floor building.



Distributing Board in Sub-station.

The transformer and switch houses are parallel to the engine room. The generator leads—two per phase—and a neutral cable are led down the ventilating duct and run to auto-transformers in the transformer house. The field leads are similarly carried down the ventilating duct and led to the exciter board on the first floor of the operating house, being connected to 125-volt bus-bars. The generator field rheostats are motor-operated, the resistances being on the second floor of the operating bay and the contact heads on the top panel of the switchboard; the field leads are connected with double-pole solenoid-operated circuit-breakers. Two emergency excitation batteries are provided, each comprising 70 cells and two end-cell switches; also a third battery for operating the oil-switch controls.



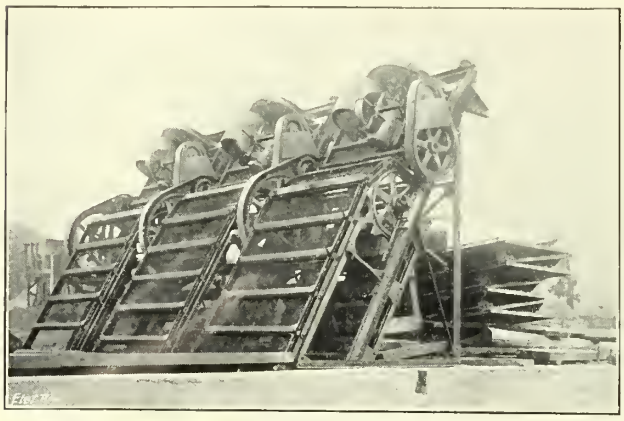
Exciter Set and Switchboard.

The third floor of the control bay contains bench-boards for controlling the generator switches, and vertical panel-boards for controlling the feeder switchgear.

The lead-covered cables from the generators connect to three 3,333-K.V.A. auto-transformers per unit for raising the generator pressure from 4,500 to 9,000 volts. The transformers are oil-insulated and water-cooled, with forced circulation; each occupies a separate fireproof compartment, and stands on a truck which can be run on to an unloading platform and transferred to the railway for repairs.

Special oil-filling, filtering and emptying arrangements are provided. The neutral cable of each generator and the neutrals of the auto-transformers connect to a bus-bar in the transformer house, which is coupled through an oil switch with another bus-bar, which latter is earthed through a resistance of about 2½ ohms.

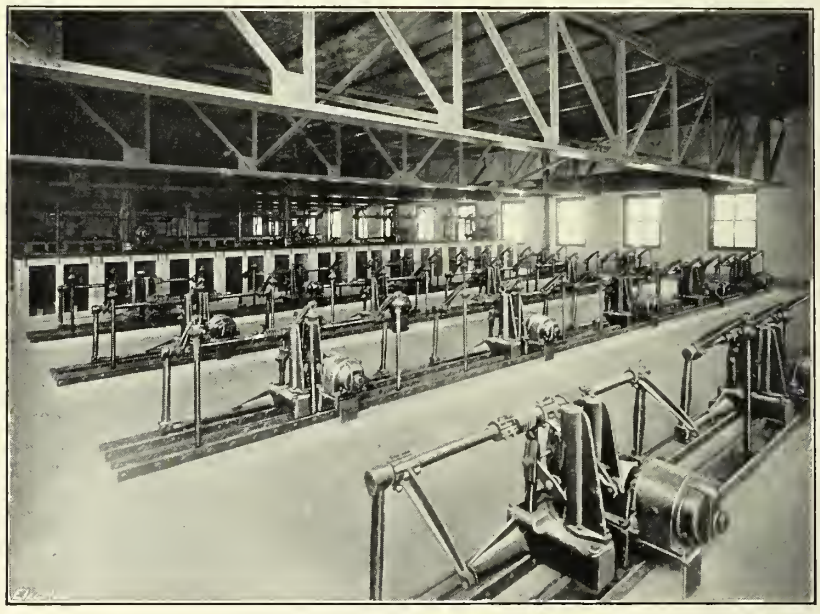
The 9,000-volt transformer leads entering the switch house are connected by 2,000-ampere oil switches to main and auxiliary bus-bars; interconnecting 2,000-amp. oil switches



Revolving Screens, Circulating Intake.

are provided for coupling the main and auxiliary bus-bars of each generator unit, and these bars are connected through 1,200-amp. oil switches to four line bus-bars running at right angles, each line bus feeding three 300-amp. feeder oil switches, and thus making a group of twelve 300-amp. feeder switches per generator unit.

The bus-bars, instrument transformers, &c., are located on the first floor of the switch house, mounted in concrete compartments; the second floor contains 19 oil switches for each unit, the oil pots being in single, instead of double, rows, as commonly arranged; the third floor contains all the operating mechanism of the switches, slightly raised above the floor, except for the generator and interconnecting switches. This arrangement safeguards the mechanism in case of a burn-out below.



Switch-house Floor, Containing Oil-switch Mechanism.

The control switchboards consist of black slate panels; miniature painted wood busses, mounted on the bench boards in connection with pilot lamps, indicate the connections and condition of the system to the switchman. At one end of the switch-house a sub-station is provided, containing light and power transformers; all the lamps—about 2,000 incandescent and 50 arc—and approximately 900 H.P. of station induction motors are supplied by 60-cycle, 115-230-volt circuits, from four 750-KW. three-phase oil-cooled transformers, which, in turn, are energised by a 12,000-volt 60-cycle line from Quarry Street station, and another from the Whipple Street sub-station. As a reserve, six 100-K.V.A. transformers, fed from a 4,000-volt service, are installed.

A feature of interest is a testing set for testing generators switches, lines, &c.

This consists of a motor-generator set, comprising a 500-K.V.A. generator direct-driven from a 220-volt, 200-KW motor with an exciter coupled to the shaft.

This supplies 300-volt current to a step-up transformer with series and shunt resistance connected in each phase for the purpose of obtaining a good sine wave. The transformer has an output of 500 K.V.A. at 20,000, 40,000 or 60,000 volts.

The high-voltage terminals of the transformers are connected with links and switches for obtaining the various pressures desired; the shunt resistances are fixed with a capacity of 100 amperes, while the series resistances are variable with a capacity of 1,000 amperes; a lead-covered three-conductor cable runs to the second floor of the switch house terminating in cabinets containing plugging equipment for extending the test leads to the oil switches.

The new station is to start with 15 outgoing lines, three of them connecting to the Fisk Street plant; the bulk of the station output, however, is intended for the north-west section of the city, where there is a rapidly increasing load.

The steam equipment was designed by Sargent & Lundy consulting engineers, while the Commonwealth Edison Co were responsible for the electrical arrangements.

In conclusion, we are indebted to our American contemporary the *Electrical Review and Western Electrician* for the above details of the plant, also for kindly placing at our disposal the various illustrations which are included.

The Electrical Contractors' Association and Sales Departments.—With a view of testing the legality of the establishment of an electrical sales department by the Sunderland Corporation, local electric traders and contractors have decided to apply to the High Court for an injunction to restrain the Corporation from continuing this competition. It is stated that the action is to be taken through the Electrical Contractors' Association.



Generator Control Board.

NOTES.

(*Continued from page* 784.)

The British Fire Prevention Committee.—The winter session of this Committee was commenced last week with a meeting to conduct a series of fire tests dealing with a small hand extinguisher intended to put out electrical and petrol fires. There was a large attendance at the Committee's Regent's Park testing station, the Earl of Londesborough, K.C.V.O., Mr. Alexander Siemens, M.Inst.C.E., and Mr. Edwin O. Sachs, F.R.S.Ed., members of Council, receiving the visitors, among whom were leading officials concerned in fire matters from the War Office, Board of Trade and other public departments, also Sir George Hastings, Sir Wm. Bell, LL.D., and others interested in the subject. The Committee's usual offic al report will be issued in due course. The testing arrangements were under the direction of Mr. Percy Collins, J.P., F.S.S., Mr. Ellis Marsland, Mr. Dyer, Mr. Wylson, F.R.I.B.A., and others, composing a sub-committee of ten. In December some fire-resisting doors and partitions from the United States will be under investigation.

A Peculiar Russian Lighting Concession.—One of the most extraordinary lighting concessions ever placed on record has recently been granted by the Municipal Council of Moscow to a Belgian company for a term of years expiring in 1945. The company, which bears the title of the Centrales Electriques, is actually seeking to raise from £1,000,000 to £1,200,000 to carry out an undertaking, the ownership and working of which would at any time be absolutely at the mercy of the city authorities. It is necessary to mention, in the first place, that the Electric Lighting Co. of 1886 of St. Petersburg already possesses a station in Moscow, in addition to other stations in the Russian capital and in Lodz, and the Moscow works had a turnover of 28,480,000 KW.-hours in 1910, the consumers' connections representing 43,466 KW. The company, which has no monopoly in Moscow, has felt unable or unwilling to meet all the wishes of the Municipal Council, which, consequently, decided to secure the establishment of a competitive undertaking. A competition was instituted, and resulted in applications being made by two Belgian companies, two French electrical companies and a Russian firm, but, with the exception of the Centrales Electriques—to which the concession was awarded—the other four rivals withdrew when they became acquainted with the draconic conditions which the Municipal Council sought to impose. It is, indeed, astonishing that anyone was found willing to agree to the terms which, it is stated on good authority, provide that on the establishment of the works, at the cost of the concessionaire, all the installations, including site, network of mains, &c., immediately pass into the possession of the city, so that the concessionaire only becomes the usufructuary. As a consequence, in those cases in which the concession can be declared forfeited on the basis of the penalty conditions, the holder would not only lose the right of working, but also the whole of the works apparently without the payment of compensation. The plans for the initial works and of subsequent extensions have to be submitted to the council for approval, but if the alterations required by the latter are not carried out, the city is empowered to dissolve the contract, when the deposit of £110,000 to be lodged up to the starting of supply, and all the works already completed would devolve upon the city without any indemnity being paid. It is also stipulated that the supply company must carry out extensions of mains to a distance of 400 yards from mains already laid, for any connection without any guarantee of a minimum consumption of current. It would therefore be possible to compel the company to constantly proceed with extensions where there would be absolutely no prospect of any return, and where even the city is unwilling to lay gas mains in consequence of inadequate sales.

The concession prohibits, under pain of forfeiture, the conclusion of any understanding with the Electric Lighting Co. of 1886, in regard to areas of supply, prices, &c., and in general, the non-fulfilment of any one of the material conditions would enable the city to set aside the contract and become the possessor of the undertaking. No guarantees are provided against an improper use being made of this right, and no appeal to arbitration or the ordinary Courts is foreseen. The conditions in respect of the charges to be made for lighting are also very peculiar. After the early or transition period, when the price will be somewhat higher, the maximum charge has been fixed at about 4d. per KW.-hour, with rebates, whilst the rate to be charged to the city may be lowered to one-half of that amount, and if the cost of production is largely decreased in another large city, the supply price is to be reduced in Moscow! The rate of the existing company is 7½d. per KW.-hour, although this is subject to rebates, whereas the lowest in Russia is declared to be in operation at Odessa, where 6½d. per KW.-hour is the rule. The new company is to pay from 7½ to 12 per cent. of the gross receipts to the city in return for the concession, an amount which, taken in conjunction with the maximum price—is thought to render the commercial prospects of the undertaking very unfavourable, especially as the cost of installation and working in Russia is said to be 80 per cent. more expensive than in the West of Europe, owing to the import duties and the various expenses, which are high. It should be added that on the expiration of the concession in 1945 the whole of the undertaking becomes the property of the city free of charge, although this would appear to be the case from the beginning, as previously mentioned. It is almost impossible to understand how any company could be found willing to agree to conditions which are of such a partial character, and which would deprive the holder of any freedom of action in the working of the concession, more especially when it is known that the Moscow City Council is simultaneously approaching the Duma for sanction to establish municipal electric supply works which are proposed to be worked in conjunction with the existing power station which supplies the tramways in the city. The promoters of the new scheme for Moscow do not appear to meet with much financial encouragement in Belgium, and it is considered that German financial institutions, which are also interested in Russian electrical enterprises, will likewise manifest reserve towards the project. If, however, it should be possible to raise the capital required for the undertaking, the fact will act as an incentive to other Russian cities to seek to impose similarly onerous conditions upon promoters, and at the same time hamper the development of central station work in Russia on a financially sound basis.

The Olympia Motor Show.—While a visit to the Motor-Car Exhibition at Olympia reveals the fact that, for the first time, not a single electrically-propelled vehicle is displayed, an inspection of the galleries shows that the ever-increasing popularity of the automobile is finding a large amount of work for the smaller branches of electrical engineering. In the production of magnetos for ignition purposes various manufacturers have shown great ingenuity, while the fact that electric lighting is rapidly displacing the older means of illumination by oil and acetylene lamps has led to the introduction of quite a number of interesting and specially-designed dynamos suitable for installation on motor-cars. In one case, the arrangement is being utilised for the starting of the engine.

The London Chamber of Commerce and the National Insurance Bill.—At a special meeting of the Engineering Section of this Chamber, held on Friday last, the terms of this Bill, especially Part 2 relating to Unemployment, were considered. Reports were presented showing the amendments which had been tabled on the suggestion of the Chamber, which the Section generally approved. The following resolution was unanimously adopted on the motion of Mr. E. W. Petter, seconded by Mr. W. A. Walber (chairman of the Metal Trades Section of the Chamber):—

"That in the opinion of this meeting the effects of the National Insurance Bill, if passed into law, will be to make competition at home and abroad with foreign production increasingly difficult or impossible for English producers, and by its effect on wages increase the cost of living and labour unrest; and, further, in the opinion of this meeting it is manifestly unfair to put a tax upon employers for the purpose of providing against unemployment, which tax, when added to the cost of production, must tend in itself to bring about that unemployment for which the Act is supposed to provide a remedy, and this meeting earnestly requests H.M. Government to allow further time for consideration of the effects of the Bill upon manufacturing trades, and particularly urges that Part 2 or Unemployment Section should, before being passed into law, form the subject of a Royal Commission before which evidence of employers as to the effect upon their respective trades may be taken.

"That copies of this resolution be forwarded to the President of the Board of Trade, the members of the Grand Committee, all members of the Section, and the general and trade Press."

In the course of the discussion it was pointed out that the condition of the engineering trades was such—owing to the relatively small profits earned by many of the firms and companies, especially the smaller concerns—that the cost of unemployment insurance, in addition to that for sickness, would materially reduce the margin of profit. A case was mentioned where an engineering undertaking employing 1,500 men, which had been struggling for the last five years to pay its way and was approaching a remunerative stage, would be seriously handicapped by the new charges under the Bill as a whole. Reference was also made to the difficulties which would arise in regard to contracts entered into prior to the introduction of the Bill, against which contingency no provision had been made. Another criticism was that no allowance is made for the fact that in certain parts of the country there is invariably a week's holiday each year, so that continuous employment of 52 weeks would not occur, and the employers would therefore apparently be debarred from the reduction for continuous employment allowed under the Bill. The meeting also considered that it was contrary to public policy to give power to the Insurance Commissioners and the Board of Trade, with the approval of the Treasury, to bring other classes of trades than those scheduled within the benefits of this part of the Bill, without direct authority from Parliament, and those present were of opinion that any such extension of the schedule should not be made except under the direct sanction of Parliament or by a provisional order.

Proposed London Industrial Employers' Federation.—We are informed that, as a result of a circular letter issued in September by some London manufacturers, being members of the Council of the London Waterside Manufacturers' Association, a number of manufacturers of London and district have expressed themselves in favour of a federation of London industrial employers, the objects of which would be mutual defence in instances of strike trouble, to prevent unfair picketing, and generally for co-operation with regard to labour difficulties; also the formation of a Parliamentary Committee. The Council of the London Waterside Manufacturers' Association met on Tuesday, October 24th, and unanimously resolved that preliminary steps should be taken to promote a federation, and a special committee was appointed, consisting of Mr. Alexander Siemens, Mr. L. A. Martin, Mr. F. C. Hill, Mr. Alfred

Brooks and Mr. J. Carr, with power to convene a meeting of those London manufacturers who have expressed approval of the idea. The Committee have now called a general meeting for Tuesday, November 21st, at 2.30 p.m., at the Abercorn Rooms, Liverpool Street Hotel, E.C., to consider a number of draft resolutions constituting the federation. Our readers who are interested in the matter can obtain further particulars from Mr. C. Taylor, London Waterside Manufacturers' Association, 1, Oxford Court, Cannon Street, E.C.

Institution and Lecture Notes. — Institution of Electrical Engineers.—At the opening meeting of the Session of the Institution of Civil Engineers last Tuesday evening, a deputation consisting of Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers, Mr. R. K. Gray, Past-President, Messrs. W. Duddell, F.R.S., W. H. Patchell, J. F. C. Snell, and Major W. A. J. O'Meara, C.M.G., Vice-Presidents, Mr. Robert Hammond, Hon. Treasurer, and Mr. P. F. Rowell, Secretary, presented to the Council and members of the Institution of Civil Engineers an illuminated address of thanks, as follows, on behalf of the Institution of Electrical Engineers:—"We, the President, Council and Members of the Institution of Electrical Engineers, desire hereby to express to the Institution of Civil Engineers our deep sense of gratitude for the privilege so generously granted to us from February, 1872, to April, 1910, of holding the ordinary meetings of this Institution, more than 500 in number, in the Hall of the Institution of Civil Engineers. The hospitality extended to us during this long period of 38 years has conferred a material and lasting benefit on the development of the electrical profession, and will always be held in our memories with sincere appreciation and thankfulness."

Royal Society of Arts.—This Society begins its session on Wednesday, November 15th, with an address from Lord Sanderson, G.C.B., the chairman of the Council. At the meetings to be held before Christmas, papers will be read on "The Industrial Progress of America," by Prof. James Douglas, LL.D.; on "London Transport," by Mr. W. Yorath Lewis; and other subjects. Four Cantor lectures on "The Carbonisation of Coal" will be delivered by Prof. Vivian Lewes, and two Juvenile lectures on "Soap Bubbles" will be given in January by Mr. C. V. Boys, F.R.S. A long list of papers for the meetings to be held after Christmas is also published. It includes the following:—

H. A. Roberts, M.A., "The Relations of Science to Commerce and Industry."
E. K. Scott, "The Manufacture of Nitrates from the Atmosphere."
Charles Bright, "The Administration of the Imperial Telegraphs."
Prof. G. W. Osborn Howe, "Recent Progress in Radio-Telegraphy."
Dr. Leonard Hill and Martin Flack, "The Influence of Ozone in Ventilation."

Royal Institution.—The Christmas course of juvenile lectures this year will be delivered by Dr. P. Chalmers Mitchell, F.R.S., on "The Childhood of Animals."

Junior Institution of Engineers.—At the recent annual general meeting, Mr. W. T. Dunn was elected chairman, and Messrs. S. Bylander and P. L. Young vice-chairmen.

On the 15th inst., at 6 p.m., a lecture on weights and measures and the metric system will be given to the members of the London Association of Accountants. Admission is by ticket, for which no charge is made.

The Delhi Durbar Illuminations.—The *Times*, in referring to the preparations for displays of fireworks and illuminations in the various cities which the King and Queen will visit in India, says that Messrs. James Pain and Sons have been commissioned by the Indian Government and municipal authorities to provide fireworks both day and night at the Delhi Durbar and to illuminate the city at a cost of £3,000. Calcutta will be illuminated with 10,000 prismatic lamps and electric glow lamps. The Government buildings will be decorated with draperies and floral designs, and the city with flowers, flags and triumphal arches. A firework display will be given on the Maidan at a cost of £2,500, and the illuminations and decorations will cost £10,000. At Rangoon Messrs. Pain will illuminate the islands with 200,000 prismatic lamps and 15,000 Oriental lanterns. Bombay will be lighted by nearly 50,000 lamps. Altogether Messrs. Pain's contracts amount to nearly £30,000.

Municipal Co-operation with Private Enterprise.—A scheme is being promoted in Bavaria for the establishment of a large power station for supply in bulk and to large industrial consumers. It is proposed to form a company with a total capital of £400,000, of which 51 per cent. would be subscribed by the municipal authorities of Nuremberg, 24 per cent. by the municipal Council of Fürth, and 25 per cent. by the Schuckert Electricity Co. and its Bavarian banking institutions. The undertaking would deliver a supply in bulk to the existing stations in the two towns in question, the Nuremberg tramways, the Franconia overland central station in Ansbach, the Siemens-Schuckert works in Nuremberg, and other large works in that town. It is intended to proceed with the enterprise independently of the projected utilisation of the water-power of the Walchen lake, although, if tho latter is carried out, the former would be held as a reserve station.

Appointments Vacant.—Electrical engineer for the South Shields Corporation electricity undertaking (£400); clerk for the Maidstone Corporation tramways department; shift engineer for the Colchester electricity department (£2). See our advertisement pages to-day.

Educational Notes.—On October 25th an important extension of the Bradford Technical College was opened, consisting of a large block devoted to experimental textile work. The new section includes a power station equipped with a suction gas engine of 125 H.P., a compound steam engine of 200 H.P., a high-speed vertical engine of 75 H.P. and a turbine of 75 H.P. The turbine is coupled to a three-phase alternator, and each of the other engines to a dynamo. The boiler house contains a 30 × 8 ft. boiler, superheater and economiser. The plant supplies light and power to two other buildings besides the new section.

Physical Society's Annual Exhibition.—This Exhibition will be held on Tuesday, December 19th, and will be open both in the afternoon and evening.

Fire.—On Tuesday night a serious fire occurred at Mazda House, 77, Upper Thames Street, E.C., the new building of the British Thomson-Houston Co., Ltd. The premises had lately been fitted up for the purposes of the company's business, and an additional floor had been put up on top. From the reports in the Press we gather that three floors were destroyed, only the lower portion of the building being saved, and business is being carried on there with the least possible delay.

Osram Week.—The war of electric lighting against gas will be carried right into the enemy's camp next week—*Osram Week*. The G.E.C. are conducting a big advertising campaign making use of great dailies throughout the kingdom to create the personal interest of electricity consumers in Osrams and Osram lighting. The scheme also includes the principal wholesale houses and local traders. The latter will be making a special shop-window display of Osrams.

B. of T. Report on Lewisham Accident.—Lt.-Col. von Donop has now reported on the overturning of an L.C.C. car near Lewisham High Road on September 2nd. The car was descending a gradient on a curve, at moderate speed, when it jumped the track, and after travelling a short distance, fell on its side. The Inspector attributes the derailment to the sudden locking of the wheels by the hand-brakes, and momentary stoppage caused by the application of the magnetic brake, in conjunction with the movement of the live load to the outside of the curve under centrifugal action, which would cause the car to tilt, lifting the "near" side wheels off their rails. The "off" side wheels then left the track, and the car, gradually heeling over, ran on until obstructed by another tramway track, which caused it to fall completely on its side.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. G. F. Gregory, of Darlington, has been appointed second engineer-in-charge at the Ilford electricity works.

Mr. J. Pilling, borough electrical engineer at King's Lynn, has, it is understood, accepted the position of managing director of a local company formed to take over and re-open the St. Nicholas Ironworks, at Lynn.

The Southampton T.C. has decided to increase the salary of Mr. H. L. Mills, assistant electrical engineer, from £250 to £260 per annum, rising by £10 a year to £300.

Tramway Officials.—The salary of Mr. A. B. Slater, manager of the Burton-on-Trent Corporation Tramways, is to be increased from £150 to £175 per annum.

General.—The *Australian Mining Standard* states that Mr. A. G. H. May, M.I.E.E., who is the electrical engineer and manager of the Wonthaggi (V.) electric lighting scheme, has been appointed to the position of resident engineer for Victoria of the Inverell Light and Power Co.

The same exchange says that Mr. A. H. Wood has resigned the position of electrical engineer and director to the Toora (V.) Electric Light and Power Supply Co.

The *Indian and Eastern Engineer* states that Mr. Beames, the new chief electrical engineer for Mysore, arrived from America and took over charge from Mr. Gibbs, now of the Tata Hydro-Electric Power Co., of Bombay, at the end of September.

Mr. E. Dormann, A.M.I.E.E., chief engineer of Aron Electricity Meter, Ltd., is leaving his present position next week in order to take up an important appointment in Sweden.

Obituary.—Mr. J. Dixon.—The death occurred very suddenly, on October 30th, of Mr. Isaac Dixon, who was for a long period in the engineering department of Messrs. Siemens Bros., Ltd., of Charlton, S.E. The deceased gentleman, who was in his 71st year, served on the Greenwich Borough Council for six years.

Mr. John Brown, F.R.S.—We regret to record that Mr. J. Brown, F.R.S., died in Belfast on November 1st. The deceased gentleman was the inventor of the viagraph for recording road surface inequalities. He was an A.M.I.E.E., and a Fellow of the Physical Society, and in 1902 he acted as local secretary in connection with the Belfast visit of the British Association.

Mr. J. Eagleston.—The death occurred on October 30th of Mr. Joseph Eagleston, B.A., who for many years up to 1909 had managed the business of Messrs. Eagleston & Son, electricians, St. Clement's, Oxford. He was 75 years of age.

NEW COMPANIES REGISTERED.

Switchgear & Cowans (1911), Ltd. (118,136).—This company was registered on October 19th, with a capital of £8,200 in £1 shares (3,000 preference), to carry on the businesses formerly carried on by the Switchgear Co., Ltd., and Cowans, Ltd., and those of electrical engineers, electricians, manufacturers of and dealers in electric apparatus and fittings, &c., and to adopt an agreement with J. E. Waller. The subscribers (with one share each) are:—J. E. Waller, St. Stephen's House, Westminster, S.W., consulting engineer; J. G. Statter, Springfield Lane, Salford, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. E. Waller (permanent director and chairman) and J. G. Statter; remuneration of J. E. Waller, £75 per annum; of other directors, £50 each per annum. Registered office, Springfield Lane, Salford, Manchester.

Cebu Syndicate, Ltd. (118,079).—This company was registered on October 16th, with a capital of £1,000 in £1 shares, to acquire or construct, work and turn to account any tramways, railways, telegraphs, telephone lines and electric, hydraulic and other works in the East Indies or elsewhere. The subscribers (with one share each) are:—J. W. Pollard, 7, Upper Mall, Hammersmith, W., clerk; W. Farrier, 524, High Road, Leytou, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors, who require none) £10. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Allen & Grosse, Ltd. (3,736).—This company was registered in Dublin on October 16th, with a capital of £1,000 in £1 shares, to carry on the business of an electric light company in all its branches. The subscribers (with one share each) are:—G. Allen, Dundela Park, Belfast, electrical engineer; H. P. Grosse, 83, Fitzroy Avenue, Belfast, electrical engineer. Private company. The first directors are G. Allen and H. P. Grosse; qualification, 25 shares. Registered office, 35, Queen Street, Belfast.

Water, Gas and Power Undertakings, Ltd. (118,223).—This company was registered on October 25th, with a capital of £4,000 in £1 shares (3,000 preference), to construct, maintain, develop, work and control any waterworks, gasworks, reservoirs, roads, tramways, electric power, heat and light supply works, &c. The subscribers (with one share each) are:—A. F. Bell, 323, Brixton Road, S.W., gentleman; W. H. Herod, 17, Frinton Road, N., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Canwarden & Co., 37-39, Essex Street, Strand, W.C.

Dimming Switches, Ltd. (118,381).—This company was registered on November 3rd, with a capital of £20,000 in £1 shares, to carry on the business of mechanical and electrical engineers, electricians, &c., to acquire from the Midland Electric Manufacturing Co., Ltd., a licence to use and exercise an invention for improvements in current graduating devices or resistances applicable for electric lighting or heating. The subscribers (with one share each) are:—G. T. Thornhill, Craigmore Park Road, Moseley, manufacturer; H. Laidlow Downes, 1-3, Stanley Street, Liverpool, merchant. Private company. The number of directors is not to be more than five; the first are G. T. Thornbull, W. L. Barber and H. Laidlow-Downes; qualification, 500 shares. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Power Accessories, Ltd. (97,862).—A memorandum of satisfaction in full on October 7th, 1911, of debenture dated March 16th, 1910, securing £150, has been filed.

Nottinghamshire and Derbyshire Tramways Development Co., Ltd. (75,397).—Issue on October 2nd, 1911, of £4,050 debentures, part of a series of which particulars have already been filed.

Corona Lamp Works, Ltd. (116,527).—Issue on October 10th, 1911, of £500 debentures, part of a series of which particulars have already been filed.

Footscray Electricity Supply Co., Ltd. (86,863).—Issue on October 6th, 1911, of £600 debentures, part of a series of which particulars have already been filed. (Previously issued of same series, £2,500.)

Anglo-American Electric Co., Ltd. (87,403).—Return dated August 24th, filed August 26th, 1911. Capital, £360,000 in £1 shares; all shares taken up; £7 paid; £299,993 considered as paid. Mortgages and charges: £90,000.

British Electric Traction Co., Ltd. (49,855).—Return dated June 29th, filed September 15th, 1911. Capital, £4,000,000 in 200,000 ordinary and 200,000 preference shares of £10 each; 133,501 ordinary and 161,437 preference shares taken up; £10 per share called up on 117,926 ordinary and 142,500 preference; £2 604,260 paid; £343,120 considered as paid on 15,375 ordinary and 6,937 preference. Mortgages and charges: £1,903,841.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

Mr. Henry Wolfenden presided on November 2nd, at Winchester House, E.C., over the twenty-eighth ordinary general meeting of the shareholders of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 709), said it was with somewhat conflicting feelings that he addressed the shareholders. On the one hand, the result of the year's trading had been fairly satisfactory, and they might congratulate themselves upon the improvement shown over the two previous lean years, the gross profit this year being equal to that of the previous two years added together. On the other hand, they regretted that they did not feel justified in recommending the payment of a dividend, although they had earned one. The reason was that they wished to conserve their resources for improving the business. The improved profit was due mainly to two causes, one being the increased volume of turnover and the other economy in production. Their endeavour was to cultivate a large and increasing business by producing economically and selling at a moderate rate of profit. That they had done a larger trade was shown by one figure in the year's balance-sheet—viz., under the heading of debtors, which were £67,103 against £55,900 in the previous year, an increase of £11,403, which was equal to about 20 per cent. Their desire was to continue this policy, and to carry it further. They proposed to extend their selling organisation gradually to countries abroad where they were not now adequately represented, and they hoped thereby to extend the demand for their manufactures. To meet this increased demand they must also be prepared to extend their manufacturing facilities if required. All this would be dealt with after due deliberation, and with care and watchfulness, but it implied the possible employment of more funds in stocks, working capital, and, perhaps, plant, and it was only to their internal resources, viz., their savings from profits, that they could look to provide these funds. Hence the large appropriation this year to the reserve fund, and the absence of a dividend on the present occasion. But they trusted this disappointment might be only temporary. He fully recognised the just claims of the shareholders to consideration, and he was not an opponent to paying dividends when earned. Next to the pleasure of receiving them was the pleasure of paying them, and when they met again a year hence, if they had, as they hoped, as good a report, or a better one, the question of dividend must, and would, receive proper consideration. Another reason for circumspection, although he did not lay undue emphasis on it, was the present position of the lamp industry. This was an important part of their business, and had for some years been passing through a period of transition, and even yet the state of transition, or evolution, might not have reached finality. Whatever the result, it would, no doubt, be for the ultimate good of the industry and consumers alike. But, in the meantime, they were gradually building up a reserve against a contingency which they hope may never arise, viz., any possible depreciation in the value of stock arising from changes in the type or methods of manufacture; and to the stock reserve this year they also made a liberal appropriation. Bearing on this question of stocks, they would observe that the figure under the head of stock and plant, showed an increase of £13,135. This increase was divided as follows:—Plant, £1,361; work in progress, £4,708; and the difference was due to lamps. The stock of carbon lamps continued to decrease. On the other side of the balance-sheet they would note that the amount of the second debenture stock outstanding as security for loans had been reduced from £100,000 to £70,000. This, of course, meant that they had repaid part of the loan, and he hoped that next year this line in the balance-sheet would have disappeared. Naturally, one would expect that on account of the reduction of loans, the amount owing to creditors would have diminished also, but the trade creditors had increased, for the same reasons that their debtors had increased, viz., a larger business, and consequently the total figure under the head of creditors remained practically unchanged. To sum up the year's situation, the whole of the profit made after payment of the debenture interest had been profitably employed in strengthening and extending the business. Since the close of the financial year they had maintained and perhaps improved their trading results when compared with the corresponding period of last year, and without venturing to prophesy as to what might happen in this world of change, he thought he might say their prospects were favourable for the current year. They had a good lamp to offer to their customers, and one which, in their opinion, was not excelled by any other on the market. They did not ask a higher price than their competitors. There was no part of their lamp which they did not make in England. It was essentially British made throughout, and under those circumstances he confidently appealed to the support of all British consumers, and he asked them when buying to demand the Ediswan lamp and see that they got it. By so doing they would be helping the company, and also would be acting up to their principles, whether Free Traders or Protectionists. As Free Traders they would be buying in the cheapest market, and as Protectionists they would foster British manufacture, and without desiring or intending to introduce controversial matter on that occasion, he said that both consummations were devoutly to be wished.

Mr. E. B. Ellice Clark seconded the motion, and the report was adopted without discussion.

The Chairman was re-elected a director, and the proceedings terminated.

Cape Electric Tramways, Ltd.

Mr. Ludwig Breitmeyer presided on Wednesday last week, at the offices, London Wall Buildings, E.C., over the fifteenth ordinary meeting of the shareholders of the above company.

In moving the adoption of the report, the Chairman said they would remember that at the meeting last year he expressed a strong belief that they had seen the worst of the dull times, and that in future they would be spared that acute depression for which their undertaking had suffered in the last five or six years. He was happy to say those anticipations had been realised. Their returns showed a marked improvement both for the Cape Town and Port Elizabeth systems. The passengers carried exceeded those of the previous year by almost four millions, with an increase

in the receipts of about £15,000, whilst the figures of the last few months since the close of their financial year on June 30th had shown still further advances. This satisfactory result enabled them to recommend the payment of a dividend of 2½ per cent. free of income-tax on the ordinary shares, besides placing £8.000 to reserve, and carrying forward the handsome profit balance of £8,574 to next year's account. After a lapse, therefore, of six years they had arrived at a dividend-paying stage. The beginning he must confess was modest, but for shareholders who might be impotent he had the consolation of saying that, in his opinion, they would improve upon the modest start, and be able to pay more in the coming years, because the prospects for the future were very encouraging. Every measure that could be devised to increase the revenue of the company had the careful attention of the directors. On the advice of the management they had decided to install a motor-'bus service in Cape Town, and a few 'buses were now being built, and were expected to be at work by the end of the year. They would be run in several localities where no tramlines existed, and would act as feeders to their general system. If the experiment was a success—and he did not see why it should not be—this feature would be considerably enlarged. Some important changes had taken place in the general management. Their general manager, Mr. Giles, who had managed the Cape Town system, had accepted an appointment in a kindred company. They were much indebted to Mr. Giles for his careful and economical management during a long and trying period of extreme depression. The board were pleased to be able to offer the Cape Town post to Mr. Barkley, the general manager in Port Elizabeth, who had successfully managed that system during the same period of depression, and they were fortunate in being able to select from the staff in Cape Town a capable tramway man in Mr. Freemantle for promotion to the general managership at Port Elizabeth. Both these gentlemen had given proof of their fitness for the posts to which they had been appointed. Last month a circular was forwarded to the shareholders stating that Port Elizabeth had again suffered from a flood, owing to a cloud burst in the valley of the Baakens River. It occurred on September 29th, and was precisely similar in its effect, although in a less degree, to the flood in the same river in December of 1908. Luckily the damage done was much less than that of the previous occasion. So far they had had a rough preliminary estimate, and the total amount of loss would probably not be more than about £1,750, the greater portion of which was covered by insurance. The traffic was only suspended for a few hours, and owing to the energy of the manager and staff the loss of traffic was trifling.

Mr. J. B. Taylor seconded the motion.

Mr. Theophilous asked where the company got its coal from, and also suggested that the board might consider the extension of the tramways from the entrance to the Agricultural Society's premises in Cape Town, down to the main road, a distance of 800 or 1,000 yards. He pointed out that there were a number of houses on the main road, and it also led to the large native location about two miles away. He considered such an extension might lead to a greater use of the tramways by the natives. Having recently visited Port Elizabeth he endorsed the views of the directors concerning the brighter prospects of the company.

The Chairman said the suggestion would be considered, but, of course, it would not pay them to lay down a tramway for the Agricultural Show which was only held once a year. They were using Natal coal, but each year tenders were invited, and they accepted the lowest.

Mr. W. B. Rommel (managing director) said the board had considered the suggestion, but they could not see that it would be a paying proposition. He hoped, however, to make a visit to South Africa next year, and would look into the matter.

Replying to Mr. Joseph, the Chairman said the flood at Port Elizabeth would not cost the company more than about £250.

Mr. Joseph said that with regard to Mr. Theophilous's suggestion, he thought they ought to conserve their money. They did not want to spend money specially for Kaffirs, for a distance of 800 or 1,000 yards was nothing for a Kaffir to walk.

Mr. Theophilous said that if Mr. Joseph was in business in Port Elizabeth he would be glad of the Kaffirs' money.

The report was then adopted, and £800 was voted to the directors for their remuneration.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Amalgamated Dry Batteries, Ltd.
Durolite, Ltd.
Edison Gower-Bell Telephone Co., of Europe, Ltd.
Elmore's American and Canadian Patent Copper Depositing Co., Ltd.
Elmore's Foreign and Colonial Patent Copper Depositing Co., Ltd.
Elmore's Patent Copper Depositing Co., Ltd.
Elmore's Wire Manufacturing Co., Ltd.
Premier Boiler Tubes, Ltd.
Rossendale Belting Co., Ltd. (this is the company registered in August, 1902, not that now trading under the same name).
South-Western Electrical Co., Ltd.

Prospectuses.—*The Mexican Light and Power Co., Ltd.*—£1,000,000 of 5 per cent. second mortgage 50-year bonds of this company were offered last week at the price of £87 per cent. The list was closed on Monday.

Toronto Power Co.—The *Times* reports that the issue of 4½ per cent. debenture stock in this company was a great success, applicants only getting 60 per cent. of the amount applied for.

Amazon Telegraph Co., Ltd.—The directors' repo for the year ended June 30th, 1911, to be presented at the meeti on November 14th, says that the gross revenue amounts £118,525, and the working expenses to £54,945. After providi £15,000 for debenture interest and £15,000 for reserve account a deducting the debit balance of £18,493 brought forward from t previous year, the directors now recommend the payment of dividend of 4 per cent., less income-tax, on the share capital, lea ing £5,669 to be carried forward. The duplication of the ma cables was fully completed in March last, and since then the co munication between Manaos and Para has been satisfactorily mai tained. Mr. Eustace C. Quilter, who joined the board in Novemb last year, offers himself for re-election.

Eastern Telegraph Co., Ltd.—The directors' repo for the six months ended June 30th, 1911, states that the reven for the period amounted to £672,397, from which are deduct £232,756 for the ordinary expenses, and £58,603 for expenditu relating to maintenance of cables, sundry differences in exchan and income-tax payable abroad, leaving a balance of £381,038. which is added £23,762 brought from the preceding accou making a total available balance of £404,800. After providing income-tax payable in England, interest on mortgage debentu stock, and for two quarterly dividends on the preference sto which in all absorb £81,260, there remains a balance of £323.5 out of which the directors have distributed a bonus to the staff celebration of the Coronation of King George V, costing £24,4 and have placed £150,000 to the general reserve fund, and ha allocated £100,000 to meet the two interim dividends of 1½ p cent. each on the ordinary stock, the balance of £49,048 bei carried forward. With the view of strengthening telegraph communication in the Mediterranean, it has been decided to lay additional cable between Gibraltar and Egypt, touching at Malta.

West India and Panama Telegraph Co., Ltd.—The directors report that for the six months ended June 30th, 19 the amount to credit of revenue is £47,318, against £43,523 the corresponding half-year of 1910, and the expenses have be £25,329, against £24,636. The result is, therefore, a balance £21,989, to which is added £1,584 interest on investments a £1,146 brought forward from last account, making an availa total of £24,719. The directors propose that this amount be de with as follows:—First preference shares: Dividend, six mont to June 30th, 6s. per share, £10,369 ; second preference shar dividend, six months to June 30th, 6s. per share, £1,401 ; ordin shares: 1s. 6d. per share, free of income-tax, £6,624 ; re-ei account, £3,500 ; balance to current half-year's account, £2,8 The traffic receipts for the six months show an increase of £3,7 compared with those for the corresponding period.

Western Telegraph Co., Ltd.—The directors' repo for the half-year ended June 30th, 1911, states that the revenue the period amounted to £405,011, and the working expenses £164,809. After providing £16,373 for debenture stock inter and £7,930 for income-tax, there remains a balance of £215,8 to this is added the sum of £30,276 brought forward fr December 31st last, making a total of £246,175, out of which s a bonus to the staff to commemorate the coronation of Ki George V, amounting to £8,613, has been paid. A quarte interim dividend, amounting to £31,189 has been paid, £140.0 transferred to the general reserve fund, and £10,000 to the la and buildings depreciation fund. The directors now recomme the declaration of a final dividend of 3s. per share, making with t interim dividends a total dividend of 6 per cent. for the year, a the payment of a bonus of 2s. per share, both free of income-t which together will amount to £51,982, leaving a balance £4,390 to be carried forward. The dividend and bonus will be pa able on November 16th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors report for the half-year end June 30th, 1911, that the gross receipts amounted to £329,7 against £344,960 for the corresponding half-year of 1910. T working expenses, including £18,973 for maintenance of cabl absorb £151,618, against £152,407 for the corresponding period 1910, leaving a balance of £178,091. From this is deducted £2,9 for income-tax payable in England, £15,048 for interest on debentu stock, and £11,020 for Coronation bonus to staff and other extr ordinary expenses, leaving £149,080 as the net profit for the ha year. After adding £27,617 brought forward from the previo half-year, there is an available balance of £176,698. Two quarter interim dividends of 1½ per cent. each, amounting to £75,000, ha been paid for the half-year, leaving a balance of £101,698, of whi £50,000 has been transferred to the general reserve fund, and t balance of £51,698 is carried forward.

Stock Exchange Notices.—The Committee h appointed a special settling day as under :—

Wednesday, November 15th.—Water Softeners (France), Ltd.—55,000 sha of £1 each, fully paid (Nos. 1 to 55,000).

And ordered the undermentioned securities to be quoted in t Official List :—

Para Electric Railways and Lighting Co., Ltd.—Further issue of 5,000 6 p cent. cumulative preference shares of £5 each, fully paid (Nos. 129,001 134,000).

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordina shares of £5 each, £3 paid (Nos. 190,001 to 230,000).

West African Telegraph Co., Ltd.—The directo have declared an interim dividend at the rate of 4 per cent. p annum.

British Electric Traction Co., Ltd.

The adjourned extraordinary general meeting of the shareholders was held at the Cannon Street Hotel, E.C., on Friday, under the chairmanship of Mr. E. Garcke. The object of the meeting was to further consider the directors' scheme for the re-arrangement of the capital of the company. It will be remembered that the first meeting held on October 17th was adjourned to allow a committee representing the ordinary and preference shareholders to confer with the board.

The Chairman explained that the meeting was unanimously adjourned till that date, and the shareholders had in the meantime received a copy of the modified scheme of arrangement. In submitting the amended scheme for the re-arrangement of the capital, he was glad to be able to say that it was unanimously recommended by the directors and by the representative committee of shareholders which the directors invited to confer with them. The amended scheme had also, apparently, met with acceptance by the shareholders generally. It was true some criticisms had been offered by a few shareholders, but these criticisms were of a mutually destructive character. The few preference shareholders who disliked the amended scheme were balanced by the few ordinary shareholders who considered the scheme was not good enough for their class. There was, however, one complaint which had been urged to which he must reply. It had been said that as they gave over two months for the consideration of the directors' scheme, they ought to give longer time than was proposed for the consideration of the amended scheme, but shareholders were under a misapprehension who thought there was any intention to rush the amended scheme through that day. All they could do that day was to lay the scheme on the table and ask them to approve it in principle, and to pass a preliminary resolution to alter the articles of association so as to facilitate the formalities of carrying out the scheme. They would then propose that all the meetings be again adjourned, and even after that there would be a further interval of about three weeks before the confirmatory meetings would be held. The shareholders would, therefore, have ample time for the consideration of the scheme. Moreover, it would be recognised that after all the discussions which had taken place on this question, less time was now required by the general body of shareholders for the understanding of the amended scheme than would be the case if it were put forward as an initial proposal. Then, furthermore, the amended scheme was simpler than the directors' scheme, inasmuch as it did not attempt to accomplish as much as was proposed by the original scheme. At the last meeting he pointed out that the problem which had to be solved was a complicated one, and that the directors' scheme could be simplified only by ignoring some of the factors of the situation The amended scheme did not deal with the capital rights of the two classes of shares in any way, but confined itself to dealing with the question of distributable profits; in that way, the scheme was made simpler. The reason why, at the conference between the directors and the Committee, they came to the conclusion that it was better to refrain from altering the capital rights was this: the ordinary shareholders argued that unless the board could satisfy them by a valuation of the assets that the proposed alteration in the capital rights was fair, the ordinary shareholders were practically taking a leap in the dark in agreeing to give priority of capital to the preference shareholders. Now, the directors had the full conviction that the re-arrangement of the capital, which they had proposed, was fair to both classes: but they had to admit that, inasmuch as they were unable to make a valuation, and, moreover, argued against the advisability of making a valuation, they were unable to offer sufficient evidence to enable others to share their conviction that the assets were of sufficient value to enable the ordinary shareholders to give the proposed priority of capital to the preference shareholders without practically extinguishing their own capital interest in the company. As it was impossible to come to an agreement on this point, it was deemed best to leave the capital position unaltered, and to deal only with the position of the two classes of shareholders in regard to the future distributable profits, and in this respect the amended scheme was easily explained. The preference shareholders received, in exchange for each present £10 share, first, £2 10s. in cumulative preference stock, entitled to 5 per cent. per annum. This represented one-fourth of their existing £10 share with exactly the same rights as at present. Then, secondly, they received £5 in non-cumulative preference stock entitled to 7 per cent. Now here they had two variations from the present position—the £5 stock was non-cumulative instead of cumulative; on the other hand, the new stock was entitled to 7 per cent. instead of 6 per cent. Then, thirdly, the preference shares received £2 10s. in preferred ordinary non-cumulative stock entitled to 6 per cent. per annum, thus making up their present £10, but this last £2 10s. stock ranked *pari passu* with £5 of stock to be given to the ordinary shareholders. The preference shareholders would also receive income certificates in respect of the present arrears of preference dividend amounting to £266,371, or £1 13s. for each £10 preference share. The income certificates were to be redeemed out of profits available for distribution after the payment of the 6 per cent. dividend on the first stock of £2 10s., and of 7 per cent. on the second stock of £5, by the appropriation of an amount equal to the dividend paid in any year on the third or preferred ordinary stock, or, in other words, after the payment of the dividend on the first and second preference stock, the remaining profits were to be divided into two parts, one part of which was to be used to redeem the income certificates, the other part going to the preferred ordinary shareholders up to 6 per cent., and thereafter to the deferred ordinary shareholders. The present £10 ordinary share would in future be represented by £5 in preferred ordinary stock ranking *pari passu* with the £2 10s. preferred ordinary stock issued to the preference shareholders, and the second £5 would be in deferred ordinary stock entitled to all the profits of the company in each year available for dividend after paying the dividends and redemption of income certificates, as already stated. As regarded capital, all shares would rank alike, as at present. It would be seen that the preference shareholders were giving up future cumulative rights in respect of £7 10s., and they were allowing £5 of ordinary share capital to rank equally for dividend with the last £2 10s. of the preference capital, and the dividend on this preferred ordinary stock would come out of profits which at present belonged to the preference shareholders. Expressing the matter in simplest figures, the preference shareholders were at present entitled, out of the profits, when earned, in respect of each £10 share, to a dividend of 12s. per annum cumulatively, and to £1 13s. in respect of arrears of dividend. Under the amended scheme they received 3s. on their £2 10s. first cumulative preference stock and 7s. on their £5 second preference stock, or 10s. per £10 share, before the ordinary shareholders came in for anything, and any surplus profits would, until the arrears were paid off, be distributed in the ratio of about two-thirds to the preference shareholders and one-third to the ordinary shareholders, so that the sacrifice which the preference shareholders made to the ordinary shareholders was not an immediate sacrifice, and was not a serious sacrifice. Now what consideration were the preference shareholders receiving for allowing the ordinary shareholders to receive one-third of the distributable profits after the preference shareholders had had an amount equal to 10s., or 5 per cent. on their present £10 shares? The preference shareholders were receiving a double benefit, the one expressed in figures and the other expressed in the quiet enjoyment of their future dividends. The first benefit was that they got 7 per cent., instead of 6 per cent., on their £5 second stock. It might be said that this was a remote benefit, because it ought not to count until after the preference shareholders had had all the dividends to which they were now entitled, but if that argument was used, then it was a fair retort that the concession which the preference shareholders made to the ordinary shareholders was also remote, though admittedly not to the same extent. The second benefit, which the preference shareholders received had to be stated a little more fully. The ordinary shareholders had made it perfectly clear that, having regard to the existing equal capital rights, it would be to their advantage to have a reduction of capital, so that the amount of preference dividend would be reduced, and if no re-arrangement was made, the ordinary shareholders would, no doubt, take some steps to prevent larger dividends, or, perhaps, any dividends, being paid to the preference shareholders. He was not unmindful of having already stated that the directors were advised that a loss on capital account was not necessarily a loss which had to be made good out of revenue, and that the directors were justified in paying dividends in the face of admitted depreciation of assets, but if they attempted to act strictly on that view, and declined to make any rearrangement so that further arrears of the preference dividend would go on accumulating in front of the ordinary shareholders, it meant that the ordinary shareholders had practically no hope of receiving a dividend, and the preference shareholders must, in that event, be prepared for the ordinary shareholders making some desperate efforts to improve their position in one way or another. Every sensible man of business recognised that a compromise before litigation was generally preferable to a settlement after a prolonged and expensive fight. In thus baldly stating the position to both classes of shareholders, the directors were not taking sides. They had no reason whatever to favour one class of shareholders against the other, but the directors were in a position which enabled them to appreciate the enormous value to the company of a peaceful settlement of the present conflicting conditions. The amended scheme must be considered not by comparison with the first scheme submitted by the directors, but it must be compared with the present position. The first scheme of the directors would have accomplished more if it could have been carried, but it was evident that they could not have carried it except in the teeth of opposition offered by a strong minority. In matters of this kind they could not always have what they would like. There must be some compromise. The directors had recognised this by making necessary amendments in their scheme, and they could only hope that both the preference shareholders and the ordinary shareholders would recognise the wisdom of this principle, and accept the scheme which was recommended to them, not only by the directors with a full sense of their responsibility, but also by a Committee representative of all classes of shareholders, who had by hard negotiation secured for their respective constituents the best terms obtainable. The chairman concluded by moving that the scheme for the rearrangement of the capital of the company be approved in its amended form, and that the board be requested to take steps to alter the articles of association so as to carry the scheme into effect.

Mr. A. Shepherd said that he had been asked to second the motion as one of the representatives of the ordinary shareholders who had been in negotiation with the board. The principal objection they had to the scheme, as propounded by the directors, was that it interfered with the capital rights of the preference and ordinary shareholders, without giving any information as to the position of the company so as to enable them to judge whether the proposed alterations were fair under the circumstances. They did their best to get that information, but the chairman told them, as he told the shareholders at the last meeting, that it was impracticable as well as inadvisable that such a question could be settled by giving them a definite idea of what depreciation had taken place in the assets of the company. Then their position became clear, and they said definitely that unless the directors could give that

information they must oppose to the bitter end any alteration in the capital rights. As the chairman had told them, the board were convinced of the reasonableness of this proposition, and they accordingly receded from the position that the scheme should in any way alter the rights as to capital which the preference and ordinary shareholders had held since the incorporation of the company. Having got so far, it was their duty as reasonable business men to endeavour to frame a scheme which both classes of shareholders could agree to, and that scheme was now before them. Any additional advantages which the ordinary shareholders had given to the preference shareholders was compensated for by the elimination from the scheme of the alteration of capital rights, and he had every confidence in recommending the ordinary shareholders to accept the scheme. The scheme was not exactly what they would have liked, for had it been possible they would have liked the position of the company gone fully into and a reduction in capital made, so that a dividend could have been paid on all the stock. That, however, they had had to forego in deference to the strong views held by the board, but he hoped all the shareholders would join in doing the very best they could and loyally support the board in their endeavour to make the scheme a success. It was no benefit to those who were in the company that there should be dissension and grumbling going on from time to time, and if the scheme were accepted they ought to make up their minds to give it a fair and free chance of success.

Mr. Leopold Solomons, one of the representatives of the dissentient preference shareholders, supported the resolution. He said perhaps in some things they might have done better, but it would have been at the risk of causing dissension in the company. As they knew, a house divided against itself never prospered, and he conceived it better for them to give way a little on the terms he originally proposed as an alternative scheme to that of the board. Having referred to the courtesy with which the board had met them, the speaker said that with regard to giving up the preference on capital, he did not think the company would ever be wound up. It was true that their tramways scattered all over the country were temporarily depreciated, but he believed the day was not far distant when they would all come round again. He was not an expert, but he would give his views as to the value of the securities which they were to get in exchange for their preference shares. The 6 per cent. cumulative preference shares would be worth par. Then they came to the 7 per cent. non-cumulative preference shares, which he believed would come in for some dividend that year, and ultimately he expected they would get the full dividend. He put them down as worth 60 per cent. of their face value. Then there were the preferred ordinary shares which he thought were worth 30 per cent. of their face value, and lastly, there were the arrears of dividend for which they were to get certificates, and those they could not take as being worth less than 10s. Putting these values together they would see that their preference shares were worth to-day nearly £7. If they stuck to them they would one day get par value on all the securities save the arrears of dividend, which would bring them in £11 13s. per share.

Mr. J. B. Braithwaite said that they had heard that the scheme was not ideal, but it was a practical one, and one which had the great advantage of reconciling all the conflicting interests amongst the shareholders, which was of far more value to the company as a whole than any small pecuniary advantage which might be gained by one class of shareholder over another. But, after all, these matters did not affect the earnings, and what they wanted was a new coin of the value of one-tenth of 1s. Last year the company carried 313 million passengers, and the average fare was about 1d. If they had a coin worth 1·2d., or nearly 1¼d., it would make a difference of £271,000 in the company's earnings, the whole of which would be profit.

Capt. Summers proposed an amendment to the effect that the 6 per cent. preference shares should be substituted for 7 per cent. He urged the ordinary shareholders not to vote for a scheme which would place an extra £10,000 a year for all time on the company before the ordinary shareholders got a chance of getting anything.

The amendment was not seconded.

Sir R. Hampson pointed out that there were 7,000 shareholders in the company, and many lived in districts where the company's subsidiary undertakings were in existence. He urged every shareholder to try and forward the interests of the company by taking electric current where possible and by purchasing the productions of the Brush Co.

Mr. Simpson remarked that the preference shareholders were asked to agree to this readjustment, because if they did not the ordinary shareholders would try and get a reduction of capital. But supposing things went wrong, what guarantee had they that in a few years' time the ordinary shareholders would not try and do this? He would like to know how the board had made any safeguard against that.

Mr. Chandler contended that all the gain was on the side of the ordinary shareholders, and it seemed a proper kind of "Lloyd George scheme."

Mr. W. Parker said that obviously no scheme was going to increase the distributable profits of the company a single penny. It simply meant that where there were conflicting interests each side must give and take, and it was all a question whether what was exchanged was fair and reasonable. The company suffered at present from having a fixed charge, which was accumulating against them, and this damaged the credit of the company and its securities. Any scheme which enabled the company to meet these fixed charges must be of benefit to the company as a whole, and therefore the question was whether what the preference shareholders were giving up was balanced by what they were receiving, and the same thing applied also to the ordinary shares. So far as the arrears certificates were concerned, the holde had only to stick to them long enough to get the whole of th cash.

The Chairman said he wished to intervene in the discussion a matter of order. Engineer-Capt. Pamphlett had written, stati that it was his intention to move a resolution in condemnation the conduct of the directors. They had explained to him that t being an adjourned extraordinary general meeting, it was not practi to introduce any business other than that left unfinished at the l meeting. But in view of the fact that it was a motion proposi to condemn the directors, the board wished him to say they w most anxious to afford Engineer-Capt. Pamphlett every opportun to say what he had to say, and if the meeting approved they wou stretch a point and allow him to put his motion as an amendm to the resolution. If he was not prepared to do that he would ha to rule the motion out of order, because they were bound to ca on the proceedings in strict accordance with the statutes, and would be entirely out of order to introduce a new matter in l motion.

After a brief discussion on this point, the discussion on t business before the meeting was resumed.

Mr. A. H. Chalmers, who represented the preference sha holders at the meeting with the board, expressed his approval the scheme.

Mr. Hart asked if the chairman would explain what t ordinary shareholders were giving up. It seemed to him th were getting something and giving nothing up.

Mr. J. H. Alden said he brought his preference shares £12 10s. as an investment, and he had come there at considera trouble to protest against the reorganisation. He called it juggli with capital. If there would be a penny more to distribute dividends, he could understand the use of a scheme, but here t preference shareholders were asked to give up something and t ordinary shareholders nothing.

Mr. Freeman asked what would be the proper occasion on whi to ask a few questions as to the way in which the business was co ducted by the board.

The Rev. Mr. Atkinson said he did not think the prefere shareholders were so much in favour of the scheme as the direct thonght they were.

Mr. Cathcart thought it must be admitted that the scheme h been altered in favour of the ordinary shareholders, but, at the sa time, the preference shareholders would have the chance of usi their proxies against it.

The Chairman said that practically all the questions that h been raised had been answered by different speakers. With rega to Mr. Simpson's question, the scheme was formulated to preve any such movement as he feared. Mr. Freeman's question was o personal kind, and he would ask them to allow him to make t position of the directors perfectly plain. Mr. Freeman started saying that Engineer-Capt. Pamphlett had not had the opportun of moving his amendment, and therefore what opportunity wou he have for asking questions. He wanted to make it perfec clear that Capt. Pamphlett did have the opportunity of moving amendment, and it was only after the shareholders had expres their feeling that they proceeded with the previous question. far as the directors were concerned they welcomed the discussi and were sorry Capt. Pamphlett had not been able to tell the sha holders what was on his mind. They had been in correspondenc with Capt. Pamphlett for the last seven years, during which had on several occasions asked the directors to purchase his sha at the price he paid for them.

Capt. Pamphlett: Only on one occasion, please, and it was counsel's advice.

The Chairman said they had finally to tell him they would d continue the correspondence, but that if he would cease from i puting bad motives and confining himself to specific questions wi regard to the points he wanted information on, the directors wou give him that information, and since the beginning of the year l correspondence had been of a much more temperate character. had asked for a lot of information, and all the questions he had ask had been answered unreservedly. He would tell Mr. Freeman that any shareholder wanted any information he had only to come to t secretary or ask for an appointment with the directors, and would get all the information he wanted. All the informati had been given to Capt. Pamphlett before, but if he did not wa information, but wanted to do something else, he must choose l own opportunity.

Mr. Freeman said he was sorry the chairman took that vie and showed feeling about it. It was not an unreasonable reques

The motion was then put, and carried by 66 votes to 13.

Electrolytic Alkali Co.—The directors' report for t past year shows a profit of only £3,138. The unsatisfactory a unforeseen result is due to several causes, the principal being t serious reduction of output during the summer through the wat supply temporarily failing, and reduced prices. But for t abnormal conditions the company would have benefited from t enlargement and improvement of the original processes. The co pany's capital account has been over-expended to the extent £32,000; 2½ years dividend is due on the preference shares. T directors cannot recommend payment, and propose issuing £50,0 new preference shares.

Calcutta Electric Supply Corporation, Ltd.—T number of units delivered to consumers during the five weeks end September 29th, 1911, were 1,292,300, compared with 1,105,0 units in the corresponding five weeks of 1910.

Allgemeine Electrizitäts Gesellschaft.

The report of the directors for 1910-11 first refers to the increase of £1,500,000 in the share capital, and the financial transaction, which was recorded in this journal at the time, with the Felten and Guilleaume Carlswerk Co., whereby the company acquired the latter's dynamo works at Frankfort and also £800,000 in shares of that company. According to programme, the A.E.G.-Lahmeyer Co., of Frankfort, the whole of whose capital is held by the A.E.G., took over the stocks and orders of the dynamo works, which would presumably be cleared off at a profit in the current financial year. The question whether the Frankfort workshops, which were only partly used for manufacturing, should be devoted to other departments, for which otherwise new works would have to be erected in Berlin, was under consideration. As, in any case, an increase and extension of the Berlin shops was urgently required, owing to the larger sales and the extent of existing and prospective orders, six sites had been acquired adjoining the machinery works in Hussiten Strasse and Brunnen Strasse. During the year the prices realised by no means corresponded with the demand, judged from the augmentation in the turnover and amount of orders. In particular the turbine business proceeded without any rule, and over-production would probably occur in the glow-lamp market. The accounts show the following results for 1910-11, the figures for the previous year being added for comparison :—

	1910-11.	1909-10.
Share capital	£6,500,000	£5,000,000
Gross profits	1,257,000	1,055,000
General expenses... ...	38,100	23,900
Taxes	101,000	101,000
Depreciation	34,000	28,000
Net profits	1,085,000	902,000
Reserve fund	156,000	100,000
Bonuses	42,500	37,500
Pension fund	42,500	37,500
Dividend	805,000	700,000
,, per cent. ...	14	14
Carried forward	32,000	21,000

The dividend is at the rate of 14 per cent. on the old capital of £5,000,000 and 7 per cent. on the new capital of £1,500,000. As to the comparatively small amount provided for depreciation, it is stated that the machinery, tools and patterns at all the works have been completely written off, while patents appear at the nominal value of 1s. The gross profits shown have been solely realised from manufacturing and sales, thus indicating that depreciation is largely provided for out of the profits obtained from financial transactions and sales of securities.

The report proceeds to state that the machiney works were so well supplied with orders for all departments that it was not always possible to meet the demands placed upon them. The sizes and weights of electrical machinery were beginning to extend so enormously that the equipment was no longer able to deal with them, and the erection of a machine shop of equivalent extent had to be taken in hand, where heavy main line locomotives would also be built until the completion of the locomotive works. The number of machines and transformers made was 92,186, of 2,385,869 H.P., as compared with 72,460 of 1,476,623 H.P. in 1909-10, the number of small motors having increased by an average of about 30 per cent. in recent years. The new locomotive motors had admirably answered the purpose, and a large number of rack rail electric locomotives had been built for the Japanese State Railway. Apparatus and transformers for pressures up to 110,000 volts and for outputs of over 20,000 H.P. were constructed in the high-pressure factory. In the second half of the year the dynamo works in Frankfort were required to assist the machinery works, and were now carrying out orders for machines and transformers of the F.G.L. type. The shops in the turbine works were well employed, but prices were exceedingly depressed. Steam turbines to the number of 284 of 441,467 H.P. were delivered, as contrasted with 174 of 363,189 H.P. in the previous year.

As the orders for electricity meters and installation material necessitated a rapid extension of the shops, several departments of the apparatus factory were removed to premises rented for the purpose. The employment of the arc lamp shops remained about on the level which obtained in 1909-10 ; flame carbon lamps of long lighting duration and quartz lamps were successfully introduced. The Oberspree cable factory had a turnover of £700,000 in excess of the previous year, and the consumption of copper rose from 23,000 tons in 1909-10 to 27,000 tons last year. Orders for high-pressure cable again experienced an increase. The insulated wire factory remained fully employed, although at prices which further declined. In the lamp factory the sales of carbon filament types receded by 15 per cent., but those of the miniature lamp rose by 500,000 lamps. The deliveries of metallic-filament lamps increased by 60 per cent. After referring to the company's interests in motor-car companies, the report mentions that business with iron and steel works increased. The advantages of uniform electrification were fully manifested in the new iron works in Lorraine, and the older works would only be able permanently to withstand the competition if they followed the example of the undertakings which had at disposal power stations of 30,000 to 50,000 KW., and supplied motor installations of hundreds of thousands of horse-power. In addition to the central station plant the company furnished one of these works with three driving plants, each of 16,500 H.P., for reversing rolling mills. Two similar driving plants were constructed for Rhenish-Westphalian works, and two others for French iron and steel works.

The electricity works completed represented a capacity of 263,500 H.P., as compared with 226,600 H.P. in 1909-10, whilst the new stations and extensions in progress comprised 492,000 H.P., as against 324,000 H.P. in the preceding year. In the power stations of the Victoria Falls Co. steam turbines of 140,000 H.P. were already in operation, and the first units of the 40,000-H.P. compressed-air plant were running, the remainder to be erected within the next few months. The construction of the Vereeniging Works with an initial output of 36,000 H.P., and having a transmission line 49 miles long, was proceeding. After dealing with the work carried out in connection with overland or cross-country stations, it is stated that numerous orders were received for motor-car equipments for tramways. The most noteworthy event of the year in the electric railway branch was the opening of the trial working on the Dessau-Bitterfeld line on the alternating-current system. The result of the tests had been such that the Prussian State Railway authorities had decided to convert entirely to electic traction two long main lines, namely, between Magdeburg, Leipsig and Halle, a distance of 105 miles, and between Lauban and Konigszelt, a length of 148 miles. It is added that the construction of the Hamburg Elevated and Underground Railway, for which the A.E.G. formed a special operating company in conjunction with friends, had so far proceeded that working on the circle line would presumably be commenced at the end of 1911. The number of employés in the company's service amounts to 60,818, as compared with 41,663 a year ago, and 5,454 of the former are engaged at the works in Vienna, Riga and Milan.

Berlin Electricity Works.

The report of the Berliner Elektrizitatswerke, which have a moncpoly in the German capital, states that the improvement in trade and industry in general contributed materially towards the better results realised during 1910-11. The delivery of high-pressure current to large consumers continued to extend, and about 10,000,000 KW.-hours were supplied at the special tariff established for the purpose, the average use of the installations for more than 3,500 hours having confirmed the presumptions upon which the tariff was based. A larger share in the total consumption was expected to be taken by the high-pressure current in the present year. The reduction in the charges for supply for illuminated advertisements, which was rapidly increasing, had also favourably affected the consumption. The interpretation of parts of the contract for the supply of power to the Grand Berlin Tramways Co., referring to the conditions under which reductions in prices were to be granted, had led to differences of opinion between the parties, but a compromise had been arranged whereby the supply company had extended the scale of rebate, whilst the tramway company had undertaken to continue to obtain power from the Berlin Works until 1939, in lieu of 1919, as hitherto provided for under the old agreement. The accounts show the following figures for the two years :—

	1910-11.	1909-10.
Ordinary share capital	£2,205,000	£2,205,000
Preference (4½ per cent.) shares	1,000,000	1,000,000
Obligations	2,873,500	2,398,500
Gross profits	877,000	808,000
Renewal fund	26,900	24,300
Depreciation	222,000	219,000
Municipal share in profits ...	174,000	155,000
Net profits	529,000	486,000
Dividend on ordinary shares ...	264,000	242,000
Dividend on ordinary shares, per cent.	12	11

The dividend of 12 per cent. compares with 11 per cent. in each of the four preceding years, and 10 per cent. in 1905-6. It appears that the number of consumers increased from 28,639 in 1909-10, to 33,165 last year, and the connections reckoned in kilowatts advanced by 23,504 KW. to 206,726 KW., of which 81,260 were for lighting, 112,451 KW. for power, and 13,015 KW. for high-pressure supply. Including consumption at own works, the useful supplies were 51,119,859 KW.-hours for lighting, 72,688,722 for power, 64,405,442 for tramways, and 9,817,720 KW.-hours for high-pressure, being a total of 198,031,743 KW.-hours as contrasted with 174,430,000 KW.-hours in 1909-10. The sale price realised in Berlin, after deducting the tax payable to the city, averaged 15·36 pfennigs per KW.-hour, as against 15·57 pfennigs in the previous year, the decline being attributed to the reductions in prices previously mentioned.

Among the technical alterations in progress the report mentions the substitution in the Schiffbauerdamm station of two direct-current turbo-dynamos for the old reciprocating engines, and a similar change is being made in the station in Mauer Strasse, whilst a steam turbine of 20,000 KW. has been ordered for extensions in connection with the Obersprce station. The extension of the company's scope to Teltow in the South, and Niederbarnim in the North, had been carried out, and high-pressure cables for a working pressure of 30,000 volts had been laid for the purpose. The report also refers to the company's acquisition of one-half of the shares in the Berlin Suburban Electricity Works Co., and the total investments in this and other undertakings are recorded at £1,278,000. It is added that a further increase in the consumption has taken place since the conclusion of the financial year in June.

Cape Electric Tramways, Ltd.—The directors announce a dividend of 2½ per cent.

MARKET QUOTATIONS.

Wednesday, November 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£11 10	£1 inc.
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4⅜d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 10 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	9½d.	..
c „ „ (solid drawn)	„	7½d.	..
c „ Wire, basis	„	6⅞d.	..
c Copper Tubes (brazed)	„	9½d.	½d. inc.
c „ „ (solid drawn)	„	8⅞d.	½d. inc.
g „ Bars (best selected)	per ton	£72	..
g „ Sheet	„	£72	..
g „ Rod	„	£72	..
e „ (Electrolytic) Bars	„	£58 10	..
e „ „ Sheets	„	£74 10	..
e „ „ Rods	„	£62	..
e „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	5/- to 7/-	..
h India-rubber, Para fine	„	5/4	1/0½ inc.
l Iron Pig (Cleveland warrants)	per ton	46/6½	3½d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, Englisb Pig	„	£16 5 to £16 7 6	7/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½.	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£194 to £195	£2 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/2	½d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£30 12 6	£1 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
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r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

DURING the last week a more hesitating mood has overtaken the Stock Exchange, the uncertainty with regard to the labour outlook, accentuated by the inflammatory speeches now being made all over the country, having caused uneasiness in other markets besides that for Home Railways. At the same time, the public still exhibits a disposition to pick up shares in any sound concern offering fair scope for improvement in capital value.

Home Railway stocks have, of course, suffered most from the fear of a general strike, although the falls, big as they are, would have been of much greater extent had not there been a large number of people who refused to be frightened out of their holdings, their argument being that the men are not likely to risk losing the big concessions voluntarily made by the companies. As we pointed out last week, a good deal of the recent buying was on behalf of weak speculators, who immediately rush in to sell on any signs of a reaction, and to these, very largely, the present fall is due.

This depression, however, the Electric Railways have withstood with considerable firmness, and the losses are insignificant in comparison with those registered by most other stocks in the market. Central London Ordinary, in fact, have risen on the week 3 points to 69, while the Deferred at 52 are 1 to the good. Great Northern and City Preferred are also rather better. Metropolitan Consolidated fell 1¾ to 42, and Districts ¾ to 30. Throughout the week support has been forthcoming for these issues (though in the two latter instances of not sufficient size to meet the realisations), owing to the belief that the companies will be enabled to make a profitable bargain with the London General Omnibus Company.

'Bus stock, which at one time went to over 150, reverted to below 140 on revived rumours of the impending formation of a rival company. There is little doubt that some such scheme has been, at least, under consideration; but although it is unlikely that it will come to fruition, it is obvious how useful a lever it places in the hands of the railway companies during the present negotiations.

Underground Electric issues have also met with support. The shares have fully maintained their big rise of last week, while the Income bonds at 66 have put on a further point on top of their jump of £5; the 4½ per cent. bonds at 101 are also 1 better. London United Tramways continue, too, on the up grade, rising another ⅛ to 3⅜.

Although the modified scheme put forward by the directors of the British Electric Traction Co. has met with the support of the shareholders, the rise in the Preference shares has not been maintained, the price going back ¼ to 4¼. This may be partially due to a natural reaction, but the possibility of a coming reduction of capital has led to selling, although such a scheme would probably be to the ultimate benefit of holders. Dissatisfaction with the terms affected the Ordinary shares, which also fell.

Very little business has been done in English Electricity Supply shares; the continued inquiry for County of London issues has been the one redeeming feature. No quotable change has taken place, but it must be remembered that rises such as these shares have recently enjoyed are invariably the signal for selling by those who got in at lower levels. Rises of ⅛ in Bournemouth and Pool Second Preference and County of London Ordinary to 10⅝ and 12 respectively, and a fall to 10s. in Urban Ordinary, comprise the only changes in this market.

The chief interest of the week has centred on the Canadian-owned concerns, in which there has been great activity. The good progress being made by some of these companies is attracting increased attention. The yields, on the basis of last year's dividends, are, of course, in several cases comparatively small, but the bright prospects are considered by many people fully to warrant the present prices. Montreal Light, Heat and Power was one of the best features with a further rise of 3½ to 183. Sao Paulo Tramways rose three points to 186½, and Shawinigan Water at 122 have put on an equal amount, while the 4½ per cent. Debenture is also better. Mexico Tramways at 124½ have gained 2½ on top of their rise of 3¼ last week. Electric Development of Ontario, in which dealings have been particularly brisk, have been in good demand, and at 92½ have risen 1½. Rio Trams reacted ½ to 118½ after their recent rise.

The issue of Mexican Light and Power 5 per cent. Second Mortgage bonds at 87 was well subscribed, and the price is called nominally par at the moment. The common and the cumulative preference have given way, the former as much as three points, owing to sales by those wishing to exchange into the new bonds, apparently with the idea that these are cheaper. The First Mortgage bonds, however, have risen ½ to 96.

Among the other supply issues, Melbourne First Debenture rose ½ to 97½, and Kalgoorlie Preference were 1/16 better at 1 1/16. In the railway and tramway list, British Columbia Electric stocks have been well supported, and a general advance is shown, ranging from ½ in the Vancouver Debenture to 2 in the Preferred Ordinary, making the price of the latter 125. The Deferred at 145 gained 1. Brisbane Tramways Investment Ordinary at 7⅜ has scored another advance, and Bombay Second Debenture at 99½ is ½ higher.

In the Telegraph market there have been a good many interesting features, though the tendency is rather irregular. American Telephones have been largely bought, and have moved somewhat in sympathy with American Rails. New York has lately been taking a much more optimistic view of the situation; trade is said to be improving, and the idea is gaining ground in Wall Street that the Government prosecutions of trusts will be likely to abate in vigour now that the vitality of the Sherman Act has been demonstrated. American Telephone capital is 3 higher at 141, and the Collateral Trust rose ½ to 94½. Anglo-American Deferred were rather better at one time, but, on balance, have fallen ⅛ to 26⅛, though the Preferred at 111 have gained ¼. Small improvements have been scored by Commercial Cable Debenture, Oriental Telephone Debenture and Western Telegraphs, but Reuters gave way ⅛ to 9⅛, and Eastern Telegraph ½ to 101½. National Telephone Deferred at 119 have regained the 10s. lost last week. West India and Panama at 2¾ have lost 1/16, but the other issues improved, the Second Preference at 10¼ showing a rise of 5s.

The Miscellaneous division has been idle, with few changes of importance. Babcock & Wilcox march steadily upward, and have risen ⅛ further to 5⅞. The company is understood to be well supplied with orders, and it is now thought that any economies that will be found possible to make in Naval administration will not affect it. A little liquidation caused a fall of a point to 58½ in British Westinghouse Debenture, and India-Rubber, Gutta-Percha shares gave way an equal amount to 13½. Henley's Debenture rose ½ to 108, while some investment buying of Edison & Swan 4 per cent. Debenture had the effect of raising the price £2 to 69

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅝	+ ⅛	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅜ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅜ — 7⅝	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	8 18 5
Charing Cross, West End & City	5	5	5†	8½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12½ — 12¾	+ ⅛	5 9 10
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12¾	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅛ — 8¾	..	5 14 3
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do 4½ % Second Deb.	Stock	4½	4½	99 —102 xd	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2¼	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	.	1⅜ — 2	..	8 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅞	..	6 8 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	8½ — 4	..	6 5
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	..	4 14
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	.	4 5
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	8	6†	..	..	..
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6⅜ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2⅝ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	½ — ¾	— ¼	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2¼	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅜ — 7⅝	..	6 7 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	..	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	107 —110	..	6 7 3
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	2⅜ — 2⅞	..	3 11 1
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	+1½	5 9 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	5/8 — 3/4	+ 1/16	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	96½ — 98½	+ ½	5 1 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	88½ — 90½	—3	4 8 5
Do. 7 % Cum. Pref.	$100	7	7	106⅛ — 108⅛	— ½	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	+ ½	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8	181 —185 xd	+3½	3 15 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	34 — 36	..	13 17 10
River Plate, Ord.	Stock	10	..	223 —233	+5	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½ — 103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	121 —123	+3	3 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	+ ½	4 4 11
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11⅞d.	3/32 — 7/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ — 108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	..	7¼ — 8¼	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	140 —142	+3	5 12 8
Do. Collat. Trust	$1000	4	4	93½ — 95½	+ ½	4 3 9
Anglo-American Telegraph	Stock	3¾	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110½ — 111½	+ ¼	5 7 7
Do. Def.	Do.	30/-	..	25/8 — 26/8	— 1/8	5 13 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6⅞ — 7⅛	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87 — 89	+ ½	4 9 11
Cuba Telegraph	10	6	6†	10 — 10⅜ xd	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18 xd	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅝	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	7⅜ — 8½	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	83 — 85	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½ xd	— ½	3 18 1
Eastern Extension	10	7	5†	13⅜ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ — 102½	..	8 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ — 100½ xd	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6	10½ — 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12⅞ — 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	3 ¼ — 33/4	+ ⅛	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58 xd	..	5 12 1
Mackay Companies Common	$100	5	5†	87 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	78 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	5	..	2 7/16 — 2 9/16	..	..
Monte Video Telephone, Ord.	1	6	6	1⅜ — 1 1/16 xd	..	5 12 11
Do. 5 % Pref.	1	5	5	1⅜ — 1 1/16 xd	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ — 105½	..	5 13 9
Do. Def.	Do.	6	6†	118 —120	+ ½	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9⅜ — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 10½	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 5/16 — 5 7/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	8 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101 xd	— ½	4 9 1
Oriental Telep. and Elec.	1	8	..	1 3/16 — 1 5/16	..	4 16 7
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	+ ½	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ — 101½	..	3 18 10
Reuter's	8	5	5†	8⅞ — 9⅜	— ⅛	4 5 3
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼ — 7½	+ 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 1/16 — 1 3/16	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98½ — 100½	..	8 19 7
West India and Panama Teleg.	10	1½	..	2 1/16 — 2 1/8	— 1/16	4 5 1
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10½	+ ⅛	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅛	+ ¼	5 14 3
Do. 5 % Debs.	100	5	5	102 —104	+1	4 16 2
Western Telegraph, Ltd.	10	7	6†	13½ — 14	+ ⅛	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	105½ — 108½	..	3 13 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99 —102	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 1/2	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1¼	— 1/16	Nil
Do. 6 % Pref.	10	1½	1½	4 — 4¼	— 1/4	3 6 8
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83 xd	+3	5 8 5
Central London Railway, Ord.	100	8	8†	68 — 70	+3	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	.	51 — 53	+ 1	3 15 6
Do. 4 % Deb.	100	4	4	102 —104	..	8 16 11
City & South London, Ord.	100	1½	1⅝†	31 — 32	..	4 13 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	[illegible]	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102 xd	..	8 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1¼	+ 1/8	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/8 — 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	3⅛ — 3⅜	+ 1/8	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1⅜	2†	41¾ — 42¼	—1/4	3 5 1
Do. Surplus Lands	100	2⅜	3†	65 — 67	..	4 2 1
Do. 3½ % Deb.	100	3½	3½	88 — 90	..	3 17 9
Do. 3¾ % Pref.	100	3¾	3¾	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	29¾ — 30¼	— 1/4	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101 xd	..	3 19 8
Do. 4½ % First Pref.	100	3½	4½†	86 — 88	+1	3 13 10
Do. 3¾ % Gtd.	100	3½	3¾	78 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5½	5†	27/32 — 31/32	..	5 12 4
Do. Def.	1	Nil	..	3/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1 1/16	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100½—102½	..	4 7 10
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Potteries, Ord.	1	2	..	1/16 — 3/32	+ 1/32	..
Do. 5 % Pref.	1	5	5	1/2 — 9/16	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1⅞ — 2⅛	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	+1	4 8 3
Do. 6 % Income	100	1	1½†	65 — 67	+1	1 9 10
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 13/16 — 5 3/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4½ — 4⅝	..	5 2 7
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½—100½	+ ½	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	7 1/16 — 7 5/16 xd	+ 1/8	5 4 11
Do. 5 % Pref.	5	5	5	4 7/16 — 5 1/4 xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	143 —147	+1	5 8 10
Do. Pref. Ord.	100	6	6	123 —127	+2	4 14 6
Do. 5 % Pref.	100	5	5	109 —112	+ ½	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	+1	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	+ ½	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	+ 1/4	4 6 7
Calcutta Trams, Ord.	5	6	..	5⅜ — 6⅛	..	4 16 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	— 1/8	4 17 7
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	..	1/16 — 3/32	..	Nil
City Buenos Aires Trams (1904)	5	5	2½†	5⅜ — 5⅝	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98 xd	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6

La Plata Elec. Trms, Prf,	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼ xd	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	123½—125½	+2½	5 11 7
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19 6
Do. 6 % Bonds	100	6	6	101 —103	+ ½	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 — 7⅛	..	6 15 7
Do. 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅜ — 1½	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	118 —119	— ½	3 15 8
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	..	4 17 7
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	184 —189	+3	5 5 10
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102 xd	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	..	4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	1/16 — 1 1/16	..	Nil
Do. 6 % Pref.	1	9	6	2 3/32 — 2 3/32	+ 1/32	7 2 2
Babcock & Wilcox	1	26	24†	5⅞ — 6	+ ⅛	4 6 8
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/32 — 7 1/32	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	57 — 60	—1	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	..	1/8 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9⅜ xd	..	7 13 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3 7/16 — 3 9/16	..	4 18 3
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10

Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	3/4 — 1	..	Nil
Do. fully paid	5	Nil	..	1¾ — 2¼	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	+2	5 9 7
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/4 — 3/8	..	6 13 4
Do. Pref.	2	7	7	11 3/8 — 11 5/8	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	86 — 91	..	4 7 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 5/8	..	5 18 10
Do. Pref.	5	4½	4½	4 3/8 — 5 3/8	..	4 5 11
Do. Deb.	100	4½	4½	107 —109	+ ½	4 2 7
India-Rubber, G. & T.	10	10	..	12⅜ — 14⅜	— 1	6 17 11
Do. Pref.	10	5	5	9 1/4 — 10 3/8	..	4 16 5
Telegraph Construction	12	20	10†	36½ — 38½	+ ½	6 2 1
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	..	1/32 — 3/32	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 8 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields a e in all oases oalculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

THE ELECTRIC VEHICLE IN AMERICA AS A PROFITABLE OFF-PEAK LOAD.

[FROM AN AMERICAN CORRESPONDENT.]

THE primary function of the commercial head of a central station company is to connect new load to the company's mains. At one time this was considered to be his only function, irrespective of whether such load were itself profitable, or whether it were likely to lead to the absorption of further profitable load. Probably all load is worth having; but at the present stage of the development of the central station idea, a great deal of well-directed energy is required in order that a sufficiency of profitable load may be obtained. By profitable load I mean, of course, "off-peak" load, *i.e.*, a load which can be carried during the valley of the load curve at practically negligible cost, and with naturally a beneficial effect on the daily load factor of the system. This is another way of saying that the secondary function of the commercial man, and not of far inferior importance to his primary function, is to do all he can to improve his station's load factor.

Battery-charging as a Profitable Off-peak Load.—Five years ago the possibility that the electric vehicle might furnish a profitable central-station load was not seriously considered. In the first place, the vehicle had not sufficiently proved its worth as a commercial success to warrant the supposition that the next few years would see any considerable advance in its popularity; but even if it had, there were few men who would have predicted its further introduction on such a scale that battery-charging might really run to many kilowatt-hours per day, and that great possibilities were therefore open in the way of obtaining a profitable off-peak load.

Now I am a little out of touch with English affairs, and I do not know exactly to what extent the central station companies in English cities have realised these possibilities. But there is no doubt that in the United States the power station people have fully awakened to a realisation of the opportunity, and it may be interesting to record some of the signs of this awakening.

In introducing my topic in this manner, I trust I have made it evident that I am not endeavouring to hold up the American central station man before the British, to the lauding of the former and the disparagement of the latter. The limiting conditions under which each must conduct his business have many points of difference. Any comparisons which could be made could not be based upon grounds of any similarity in each case, and no comparisons are therefore attempted. A knowledge of what the American supply man is doing to get this off-peak load, however, may be of service to the Britisher by way of suggestion, since, while some of the commercial moves of the former will obviously not be applicable to English conditions, others may, with but slight modification, be made to serve their turn among the more conservative and less susceptible English commercial folk.

In this country there is a healthy spirit of competition between many of the large cities, and again between many of the smaller cities in the same State, with regard to electrical development, evidencing itself in the street lighting systems, in the urban traction systems, industrial power applications, and so forth. The electric vehicle question is no exception, and the city of all others which has decided to get right ahead with the fostering of the electric vehicle business is the city of Boston. Other cities, and especially those in the New England States, have made novel departures in various directions to popularise the electric vehicle, but for good collective all-round work, Boston can show the worthiest record, and it is inevitable that I mention the name of this city frequently in writing these notes.

Ignorance and Prejudice are the Principal Obstacles.—Let us for the present leave on one side all consideration of the pleasure car, and confine our attention to the commercial vehicle, the light car for a grocery or dry-goods store, the freight handling truck for a railway company, the ice delivery or coal delivery wagon. The parties interested in the sale and operation of such wagons are the makers of the vehicle, the makers of the electrical equipment including motors and battery, the electric supply company, and the proprietors of the garage who are going to house and charge the vehicle. The last class may not be in existence, but they have got to exist before the proposition can be a practical one in any given city. All the parties will benefit through the introduction of the electric vehicle in the city. What is the principal objection which is standing in the way of their realising these benefits?

The principal obstacle, in many cases the only obstacle which they have to overcome, is simply ignorance on the part of the business men of the possibilities of the electric vehicle. If the electric vehicle were inherently still an unsatisfactory machine, it would be idle for the central station people to expect that they could do any good with it. But it suffers to a certain extent from its earlier disadvantages, which succeeded in many cases in getting it a fairly bad name; and the prejudice against it, or the total ignorance of what it can now accomplish, must be overcome. Listen to this. A big brewery company in New York, dissatisfied with the performance of an electric truck which they had purchased years ago, vowed that they would stick to horses and gasolene. After a long canvass, they yielded to argument, and accepted a new electric on trial, promising that if it gave satisfaction they would purchase a further consignment in a few months. At the end of the specified time, the order for the new (5 ton) trucks duly came in, with a further promise that if this second batch came up to the first one in quality and performance, they would bring their total up to 12. In quite a little time all the 12 were in service, the reason simply being that the brewery company (whose actual annual turnover I do not know) figured that they were saving $20,000 a year in transportation. There is an abundance of facts and figures which I could submit to prove the worth of the electric, but that is not within the scope of this article.

With individual disjointed effort, this prejudice and ignorance will be overcome in a few years, but with concerted effort and a sufficiency of enterprise, it can be overcome in six months or a year. I am only considering now the effect on the central station. How, and to what extent, does the central station benefit from the battery-charging load as regards the load factor of its system?

Actual Energy Consumption of Commercial Vehicles.—Roughly, 90 per cent. of all battery charging may be arranged to take place on off-peak hours. Under these conditions, we may assume that the central station is willing to allow 2d. for a KW.-hour. Now, the following table gives the total annual consumption in KW.-hours of energy for battery charging, based upon a demand 20 per cent. less than the maximum capacity of the battery. These figures I have seen in various papers and articles on the subject, but I believe that acknowledgment for their use is justly due to the General Vehicle Co., of America.

Type of vehicle.	Estimated KW.-hours. Average annual demand.	Income at 2d. per KW.-hr.
5-ton truck	11,000	£91 13 0
3½-ton truck	9,360	78 0 0
2 „ „	7,440	62 0 0
2,000-lb. wagon	5,520	46 0 0
1,000-lb. „	4,560	38 0 0
Domestic vehicle	2,400	20 0 0

The above figures give some idea of the income which these vehicles will yield. Taking a concrete case, suppose that in a city of 100,000 population, the supply company, through well-directed effort, were to succeed in persuading 100 merchants of the town to use one electric vehicle each for their delivery service, and that each of these vehicles consumed, say, 6,000 KW.-hours per annum, then the annual income from battery charging would be in the neighbourhood of £5,000. Actually the income would not stop at this figure, as if the 100 vehicle mark were reached, there would be a steady increase in the number of vehicles ordered; no man would be content with one electric if this still left him with some horse traction on his hands, and repeat orders would come in rapidly. The figures are based on 2d. per KW.-hour, which is surely reasonable.

The value of the battery-charging load can perhaps best

be appreciated by comparing the KW.-hours with the equivalent energy consumption of arc lamps, glow lamps, domestic appliances, &c. The vehicle is in service all the year round, summer and winter, week in and week out. If it is in service all day, then it has got to be charged at night, and this, therefore, nearly always takes place after 8 o'clock in the evening. The establishment expenses for billing, accounting, metering and other charges are all very low relatively, for a customer using even one vehicle only, while, as a matter of fact, very few customers use only one, and the advantages in this direction are, therefore, pronounced.

According to some figures published in the *Electrical World* (May 4th, 1911) there were in 1907 some 18 electric automobiles in the city of St. Louis. At the present time, as the result of the efforts of the supply company in advertising, and in the establishment of garage facilities, there are upwards of 500 electric vehicles in that city, "the average income from which is $8.50 per month in the case of cars stabled in public garages"—which extract plainly shows what is possible in the development of this business. Or, again, in the case of Springfield, Mass., little over a year ago there were fewer than half-a-dozen electric vehicles in the town. A campaign was set on foot to alter this state of affairs, undertaken purely by the electric supply people, and to-day there are upwards of 50 electric cars or electric trucks in that city, with a population of a little over 50,000.

How American Supply Companies proceed to Secure this Off-peak Business.—Now we will consider how these results can be achieved: how they have been achieved. The first thing is to get the vehicle known. When, in the early part of this year, Boston decided to get down to the problem, it was realised that the Edison Co.—the power supply company—would gain by working hand-in-hand with the makers of the vehicle. An extensive newspaper advertising campaign was inaugurated; a capable staff of salesmen was organised to make a thorough canvass of the merchant houses of the city; special attention was paid to the erection and equipment of a number of garages, with special charging facilities and charging rates; and a "sign advertising" campaign on a large scale was taken in hand. This last expedient may not be applicable to English cities, but it is an interesting example of American advertising methods. The supply company undertook to supply electricity free of charge to dealers in electric vehicles for the purpose of sign illumination for advertising the vehicle; and, furthermore, undertook to provide also free illumination of a large sign in a conspicuous part of the city which should make a display advertisement of all the local electric vehicle dealers and agencies. The point is that they realised that every effort on their part which could help the vehicle people to sell their product in their city could only react to their own advantage; so they decided to leave no stone unturned in order to further the vehicle sales by any advertising means in their power.

The electric vehicle people, for their part, were not slow to respond, and entered thoroughly into the mutual advertising spirit. One enterprising firm even offered to sell 100 vehicles at factory cost to any electric supply concern in the New England field, in order to assist in the development of the electric vehicle business in that area. The Electric Vehicle Club, of Boston, is the official body watching over the interests of the vehicle business in that city, and at the weekly meetings of the club a thorough discussion is made of the various ways and means whereby the interests of the business may be advanced. The value of such a body is obvious. Some of the difficulties which are encountered in the development of the business can best be met by some such parent body, such as difficulties with the city authorities. Local bye-laws may prevent a vehicle waiting idle at the kerb for more than a certain time, but it has not been difficult to arrange advantageous terms with regard to parking facilities, and a modification of the bye-laws has been agreed to where this has seemed necessary.

Boston was not the only place where the supply companies "got busy" over the newspaper advertising. Springfield relied chiefly upon this form of publicity in bringing its total of electrics from six to over 50 in the course of 12 months. The electric supply companies took page and half-page spaces in the daily and weekly papers of the town, and devoted the space simply to setting forth the advantages of the electric vehicle, specifying no particular makes, but dealing only with the vehicle in general. This is a good example of educational advertising, and its results, as we have seen, fully justified the expenditure. It was a gamble, in a sense, but it succeeded.

The Public Garage System.—Undoubtedly the question of suitable garage accommodation is a serious one, and, indeed, may almost be said to be the key to the situation. When once a merchant has been induced to invest in a single vehicle, it is essential that it should prove a success in all respects, since the investor will inevitably regard it somewhat in the light of an experiment and will be on the lookout for faults. The battery is the vulnerable part of an electric vehicle—that is to say, it is the vulnerable part, if the machine is not treated with due respect. In many cities, the public garage system has not been carried very far, this remark applying more to those places in which most of the electric vehicle business is taken by pleasure cars. The owners of these vehicles will usually take sufficient care of them to preserve the efficiency and life of the battery; but where the commercial vehicle is in question, the unskilled attendance which it receives nearly always results in deterioration of the battery, and the public garage system is almost imperative. There are many cities, too numerous to mention, but of which St. Louis, Boston, Cleveland and Minneapolis are good examples, where excellent garages have been erected and equipped, for the accommodation, maintenance and charging of a number of cars varying from 20 up to a hundred and more, the larger the better. The cost per vehicle of the "sub-station" equipment, rectifier outfits, &c., is, of course, reduced in proportion as the number of cars cared for is increased, although it is, of course, necessary to avoid the tendency to make the garages too few and far apart as not to be within easy reach of any point within the business area. At these institutions, in cities such as those I have named, it is usual to charge a flat rate of $25 or $35 a month for storage, maintenance, delivery, charging and small repairs. The advantages of the system are obvious. Only skilled men are employed, who have been carefully instructed in their business, and the repair item is reduced to a minimum on the "stitch-in-time" principle. Any progressive fault in a battery can be quickly noted and remedied, whereas if a similar case occurred in a private garage installation, no notice would be taken of it until it had reached such a point as possibly to cause delay on the road, whence complaints would inevitably arise. One of the large garages of the Boston Edison Co. has been placed under the direct supervision of the Electric Vehicle Association of America, and the tendency towards skilled supervision and inspection will, therefore, in this case be further emphasised.

In certain cases it may be found advisable to adopt the private garage system, and if in endeavouring to close a contract the central station canvasser imagines that the prospective customer would not be averse to making a trial of the electric vehicle under his own supervision, the canvasser should be ready to meet him. Boston, again, has a move ready to meet this emergency. The Edison Co. there have made arrangements to supply and install a rectifier charging outfit free—or, rather, at a nominal charge of $5 a month—to anyone desiring to try the electric vehicle, confident that the result can only go one way. If anyone prefers the private charging system, it may be usually taken to mean that due steps will be taken on his part to see that the vehicle and all the auxiliary equipment will receive careful handling and attention.

The Use of the Electric Vehicle by the Supply Companies.—The New York Edison Co. have also gone well ahead in the electric vehicle campaign, and themselves now own close on 100 commercial trucks and wagons of one kind or another. It is obvious that the electric supply company can do very useful advertising work in this manner, simply by using the vehicles themselves in their own transportation work, apart altogether from the actual advantages they obtain in quick and reliable transit. These 100 wagons are used for a variety of purposes—for dispatching crews on breakdown jobs, transferring tools, apparatus and material, and carrying meters—this being made ideally satisfactory by the design of a special body to the truck, fitted with receptacles around the walls for the bestowal of meters, in a manner similar to

the baker's cart for carrying loaves of bread, the meters being guarded against knocks and jolting in transit.

The New York Edison Co. have also several heavy trucks fitted with a winch for pulling cables through underground conduit in the streets. In some cities a special electric car is built with an upright pole and rigging affixed to the back of the body, which may be used as a derrick for swinging street poles, lamp-posts, &c., into position. Boston has several trucks provided with a rotary pump for draining manholes; and, in fact, there is hardly an end to the list of uses to which the electric car can be put, entirely outside the field of delivery and freight transportation.

In the summer of 1909 there were only some 10 electric supply companies using the vehicle for their own work; but by September, 1910, the figure had reached 36, and at the present time this total again has probably been well exceeded.

When the supply company is undertaking this work of advertising the truck by using it itself, great pains are taken to see that the advertisement *is* actually a good one. This applies particularly in the case of the first electric truck put on the streets of the city. No faults must show here; the wagon must be smartly turned out, and a breakdown must be a thing undreamed of.

The Necessity for a Staff of Special Canvassers.—Another matter to which I have already alluded in recounting the various steps in the Boston programme, is concerned with the salesmen staff of the supply company. All the usual attributes of the engineer salesman are required, and a good deal more besides. The canvasser must be ready to make definite recommendation as to the size of truck which the customer requires, and must be well posted as to the geography of the place, knowing well the condition of the streets, the number of steep gradients and other local street lore.

It were easy to multiply instances showing what has been done by the electric supply corporations in various American cities to popularise the electric vehicle, but the foregoing will probably suffice. In nearly all cases the campaign has required considerable courage on the part of the supply men, since it is in the nature of a gamble, to determine whether the merchants will respond; but in no single case where the publicity programme has been conducted by clear-sighted men, in touch with local affairs and requirements, has the result been in any doubt. Maybe some of these methods would be applicable to English conditions. There is no doubt about the value of the charging load if only the vehicles can be got on the road.

REVIEWS.

The Testing of Engines, Boilers and Auxiliary Machinery. By W. W. F. Pullen. Manchester: The Scientific Publishing Co. Price 12s. 6d.

This is the second edition of a book which was first named "Experimental Engineering." Apparently the volume has been greatly enlarged and almost rewritten. It is about ten years since it first appeared, and during the past decade there has been much progress in scientific engineering work. Moreover, it has now become most fully recognised in our educational institutions that experimental work is a very useful method of teaching. It is, we imagine, almost entirely for the student, and not so much for the engineer in practice, that the book has been written; doubtless many people outside of colleges, besides the lucky manufacturers whose apparatus is described, will find that the contents contain something of interest to them. Although there are 721 pages and 733 illustrations, the book is portable. The publishers seem to have done their part in a satisfactory manner. If, at moments, we are disappointed with what the author has produced, it is largely because we expected great things from a man with such experience in teaching, writing and the experimental side of engineering. To be outspoken, there are portions of this volume quite unworthy of him. While we can at once say that a number of students, and engineers, will find the book worth the money, yet we certainly think it could be greatly improved. For example, in the year 1911 we might reasonably expect more mention of the steam turbine, and although the words appear in the text we have certainly failed to discover them in the index. There are, it is true, some 10 pages on torsion meters (fig. 211 in this section has a title with the word "tension," a misprint for torsion), and it is equally true that a good deal of the general arrangements for steam engine testing are said to be applicable to steam turbines, but we think more might have been added with advantage. There is also so much that could with advantage be left out, that the book might well be reduced in price.

There is a four-page introduction on testing, containing sound common sense. Then comes the first chapter, which consists of tables and other data. We note that Regnault's steam tables are given, despite the more recent work, especially that of Callendar. Reference is made to this research in the text, a few equations from Callendar's paper being included. There is a misstatement, as n R/T is not = specific heat at constant volume at *freezing point*, but at *no pressure*. Then we have the following advice: "The easiest way of dealing with the above equation is to obtain the required results in metric units and then transform to English units." Surely it would have been more convenient to the reader if the author had modified the constants so as to make the equations applicable to English units. It should be stated that Regnault's tables have been corrected for the most recent values of the absolute zero of temperature (− 459·6° F), and the mechanical equivalent of heat (778 ft.-lb.); also curves show the results of more recent research work by some experimenters on the properties of steam. A short chapter on averages leads us on to the measurement of pressure. Here the illustrations are very much of the catalogue variety. A line diagram in place of figs. 29 or 30 would have been much better. In the next chapter (on the measurement of temperature) we find some of the latest work and apparatus described. The measurement of speed has a chapter descriptive of revolution counters, tachometers, &c. The measurement of power output is then discussed, all sorts of brakes being shown. Among the simplest is the Morris & Lister eddy-current brake. Dynamometers used in traction work are shown, although a separate chapter is devoted to the subject of measurement of power input with the dynamometer.

It is, however, from page 252 up to page 413 that the author really thoroughly enjoys himself. These pages are all about indicators and their diagrams. Although Mr. Pullen has written a separate book on the subject, he cannot deny himself the delight of elaborating, in great detail, the difficulties of obtaining accurate diagrams and of interpreting what they mean. When you are a specialist upon one particular subject, you cannot view the matter in its correct perspective when you are writing a general text-book. Here too much space, in proportion to the subject, is taken up with indicators and semi-catalogue pictures. Thus, fig. 225 shows the Thompson indicator, one-half natural size. Fig. 226 shows it *in* the box, and fig. 227 shows it attached *to* the box. There is a section about the Thompson indicator in general, then one on the large Thompson, another on the 1900 pattern Thompson, yet another one on the small Thompson, with a further one on the outside spring Thompson; one gets tired of the Thompson family and their portraits, five in number. Then we have every variety of the Crosby indicator. Since all the steam engine indicators are on the same principle and vary only in detail—chiefly the pencil mechanism—why all the many photographs are included is difficult to understand. When we come to the chapters on indicator diagrams, we find that a good deal of the descriptive matter could well be concentrated. (It is only fair to say that the collection of diagrams showing the various faults, &c., is very complete.) Probably the best type of illustration is that on gas engine diagrams (figs. 504, 505), where 10 diagrams are made to cover about three-fourths of a page. This arrangement should be contrasted with fig. 470, where much space is wasted.

There are useful hints on testing engines and the calorific value of fuels. The chapters on flue gas analysis and boiler testing are not so good. As an example, take the section devoted to the Orsat apparatus. The picture on page 577

is freely lettered. A great many references to these letters are made on the next two pages, which means that one has to be continually turning back to the figure. The description could be made in a much less laboured manner. As for the Sarco automatic CO_2 recorder, the picture in that case has different portions numbered, and when the reader sees that there are *100* such numbers, he begins to wonder if it isn't a memory lesson. Take this as a sample sentence: "Thence it passes into vessels 77, 66, 67 and 68 and into tubes 51, 52, 48 and 49." That is just the sort of fashion in which some makers are foolish enough to compile their catalogues. Can one wonder that the always overworked engineer gives the thing up in despair? In the chapter on boiler trials we have not only the recommendations of the Institution of Civil Engineers, but eight pages on which are reprinted the recommendations of the American Society of Mechanical Engineers. The chapter on testing auxiliary machinery is excellent, and so is the last one, on testing internal combustion engines. In one of the Appendices (p. 713) there is a clear diagram of the θ ϕ chart.

Although we have pointed out what we consider are the blemishes in the book, it contains a great deal of excellent matter. It is a monument to the author's industry. What is really required now is that some hard-hearted individual should take hold of it and unmercifully cut out all that is superfluous. The publishers should send it to some capable experimenter, who also knows how to write a book for the student, with instructions to reduce it to one-half the size. In a word, the editor's blue pencil is needed. Even as it is, the book can be recommended to men with money to spare. If all power-plant engineers studied it carefully, some of them would save on their coal bills. We cannot enthusiastically advise the student to purchase it, though it is essentially a supplementary book for the student.

Building in London: A Treatise on the Law and Practice Affecting the Erection and Maintenance of Buildings in the Metropolis. By Horace Cubitt, A.R.I.B.A., P.A.S.I.; with special chapters dealing with "The Cost of Building Work in and Around London," by H. J. Leaning, F.S.I., and "The Valuation, Development, and Rating of London Property," by Sydney A. Smith, F.S.I. London: Constable & Co. Price 31s. 6d. net.

It sometimes falls to the lot of a reviewer (who need not, of necessity, be an Irishman) to criticise those portions of a book which are conspicuous by their absence. Laying down a standard for himself, he can run on in such a vein to his heart's content, carefully avoiding the laborious process of checking and verifying the statements to which the author has actually committed himself.

It is difficult to imagine how any reviewer could so treat the work now before us. It is practically encyclopædic in character. Not only does it cater for the needs of the builder, who is called upon to steer his way through the mass of legislation which goes to make up the building laws of the metropolis, but the lawyer will find a vast amount of information of the severely practical type which is not often to be found in the volumes on his bookshelf.

In dealing with his subject the method adopted by the author is that of taking the various practical questions of street formation, drainage, air space, construction, &c., and treating of each of these in a separate chapter, where an attempt is made to include and explain the whole of the requirements of the law. In order to satisfy the scruples of those who do not care to trust to a mere quotation, all the provisions of the Acts, by-laws, and regulations which have reference to building work in London are printed in the second part of the volume. As the author admits in his preface: "Sometimes all that can be said is that the law is in an uncertain state, and that the obtaining of legal opinion is advised if interests of importance are involved."

Unless the present writer were the happy possessor of an encyclopædic mind, it would be impossible for him to give a complete and trustworthy review of this volume. A work which deals with everything from the erection of steel frame buildings and aeroplane sheds (giving the estimated cost of the latter) to the development of building sites from the financial point of view, would require to be dealt with by a jury of experts. Other technical journals will probably deal with those parts of the work which concern them. A few words may here be said upon those portions of the author's work which more especially concern the electrical world.

In dealing with the London Building Act in its relation to electricity buildings, the author draws attention to the fact that while such buildings are exempt from the general operation of the Act, they are subject to special treatment, the plans having to be submitted to the County Council for approval. He points out that if this provision was intended to allow greater freedom of construction, it has not operated satisfactorily, and then says: "It seems practically certain that if the routine in the case of such buildings were similar to that in the case of public buildings—the approval of the construction by the district surveyor, subject to there being a right of appeal to the tribunal—a great deal of unnecessary trouble and delay would be avoided."

Amongst other electrical matters which are dealt with are to be found the regulations as to the erection of generating plant, batteries, transformers, motors, &c., in places of public resort.

An elaborate system of cross references, and an exhaustive index, in which a table of cases is interspersed, tends to render this work most useful to the many classes of the professional community for which it is intended.

A Hand-Book on the Gas Engine. By H. Haeder. (Translated from the German and Edited by W. M. Huskisson.) London: Crosby Lockwood & Son. 18s. net.

After the title of this book we read, "Comprising a practical treatise on internal-combustion engines for the use of engine-builders, engineers, mechanical draughtsmen, engineering students, users of internal-combustion engines, and others." (The last word is delightfully vague.) However, it is only fair to say that the "Hand-Book" is really for the designer and student. It is, from their point of view, good, for it is an aid to the design of internal-combustion engines. It is a book for the drawing office, and not the works or the "others." There is no other book that can compare with it for the purpose mentioned. It will soon be really indispensable to the designer (student or draughtsman), and the information in all of the chapters and in the appendices is good. We are sorry that Mr. Huskisson "spoilt the ship for a ha'porth of tar" by reprinting Mr. Humphrey's paper (excellent as it is) on his own pump. It means a great deal of work to put a description of a new invention in concise terms, but, after all, Mr. Humphrey has issued a considerable quantity of literature about his pump, and one might reasonably expect something better than a reprint in a book of this character. The translator should have reduced the description of the Humphrey pump to about a page, and omitted all of the superfluous tables.

The book is typically German; it represents prodigious industry and little originality. The theory is the usual text-book theory, and the practice is all quite standard. There are many comparisons of sizes and other figures. Everything seems to have been done most carefully. The illustrations have been thought out well, the enormous number of calculations seem to be accurate (it is obviously impossible to check them all, but several that have been worked out by the reviewer are correct), and there are many pages of tabular matter. Of course, the data must be reliable in such a book, or there will be trouble. The last appendix seems superfluous, as every student and draughtsman has—or ought to have—an engineer's pocket-book. If the last 70 pages of tabular matter had not been set, we might have had most excellent value at less cost. However, we must not grumble, because our admiration for the book is considerable. It has been said, quoted and repeatedly re-quoted that "of the making of books there is no end," but there are many whose authors have merely ploughed the sands and worried the publishers. This is one of the books which were wanted. We suspect that there will be few designers

of internal-combustion engines without it at the end of a year. The author had previously written a most useful book on the steam engine. We are sorry that he did not more rigidly follow the same general style of that volume. This book is certainly a useful production, and we commend it to the advanced student of technology.

TEMPERATURE EXPERIMENT WITH A CUT-OUT FITTED WITH TIME LIMIT DEVICE.

By DANIEL H. OGLEY, B.Eng., Royal Technical Institute, Salford.

In this particular time-limit device a small piston, which is attached to the plunger of the cut-out, moves in a cylinder containing about $\frac{1}{8}$ in. of pure glycerine. The plunger is

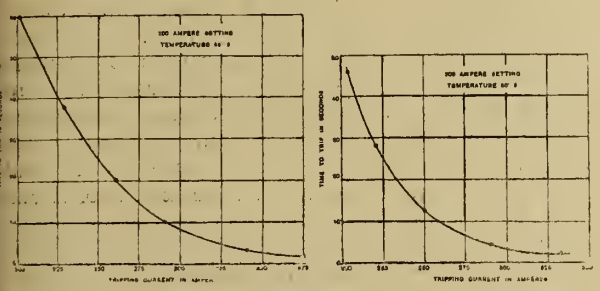


Fig. 1.

prevented from rising immediately the current reaches the value indicated on the particular setting, by reason of the viscosity of the glycerine.

It is obvious that the time taken to release the piston will depend to a great extent upon the thickness of the glycerine, and this latter upon the temperature.

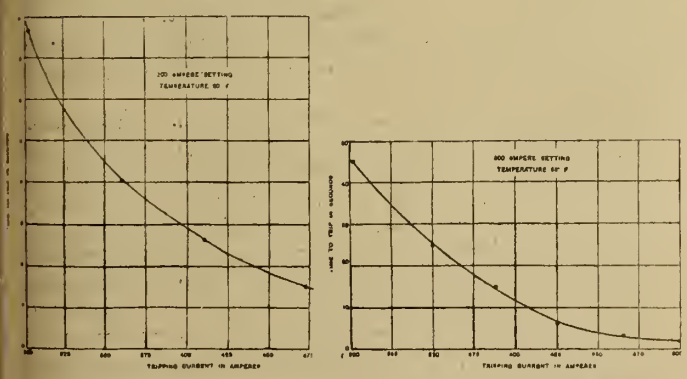


Fig. 2.

To ascertain the effect of temperature on the time of release of a cut-out fitted with such a device, the following experiments were made :—

The surface of the piston and the cylinder cover were first carefully cleaned to avoid any possibility of sticking, and the

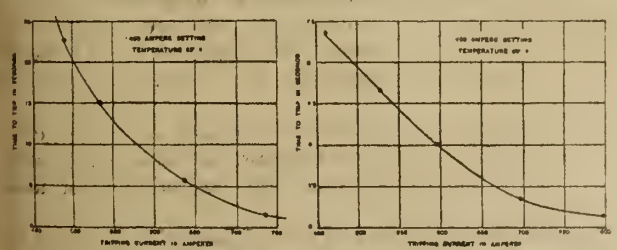


Fig. 3.

cut-out was then set to trip at 75, 100 and 150 per cent. of normal current—300 amperes in this case.

A first series of readings was taken at the laboratory temperature of 53° F. connecting current with time taken to trip. The time-limit device was then surrounded with a water heater and a second series of readings taken at a likely switchboard temperature of 80° F.

The results shown in the accompanying figures prove conclusively that it is useless to attempt to calibrate a cut-out fitted with such a time-limit device, except at the temperature at which it will have to operate.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Four weeks ago mention was made in these notes of the British Canadian Shipbuilding and Dry Dock Co. Since then an Order in Council has been passed by the Governor-General of Canada approving of the plans and specifications of the company for the erection of a dock and ship repair plant at Sydney, Cape Breton. The cost is estimated at nearly £1,000,000.

The town of Prince Rupert, B.C., is apparently destined to become great in the next few years. The Grand Trunk Pacific Railway Co. have made it their western terminus, and tenders have already been asked for excavation work for a new station site, dry dock and shipbuilding yard. In the summer a big syndicate was formed under the name of the Prince Rupert Hydro-Electric Power Co., Ltd. Control of various water powers within about 50 miles of the town has been obtained, and it is expected that from 25,000 to 30,000 H.P. will be available. In the larger towns here, at any rate, the reign of the overhead wire seems to be coming to an end, and conduit and underground cables are replacing it. It is wonderful in how many instances the old country, though so slow and behind the times (?) seems, after all, to be somehow (dare we say it ?) a little in advance of the New World.

Montreal recently created a special Commission to deal with the question of putting all cables and wires underground ; Toronto has already done a good deal in this direction, and now Hamilton is talking about it. The matter is not one of æsthetics only, though that side is not by any means overlooked, but of utility and cost and safety. A mass of tangled wires, hanging helplessly in the streets, is no uncommon sight after a storm, this state of things being neither good for the supply and other companies nor for the public, the latter being often in considerable danger of electrocution. Some of the British conduit and cable makers ought to reap advantage from these changes.

Static Electricity and Explosives.—A curious accident at the works of the Cotton Powder Co., Ltd., near Faversham, in June last, which unfortunately resulted in the death of a workman, is the subject of a report by Major A. Cooper-Key which was issued last week. It appears that the man was engaged in spreading a mixture of fulminate composition on a rubber cloth for the purpose of drying it; the weather had been exceptionally dry and warm, and the man wore rubber shoes. The mixture—consisting of fulminate of mercury, chlorate of potash and gun-cotton dust—was probably drier than was supposed, and the friction between the fingers of the deceased workman and the rubber cloth, it is believed, gave rise to a static charge, and eventually to a spark from the man's fingers which ignited the mixture and caused it to explode, destroying the building and practically blowing the workman to pieces.

The formation of static charges and resulting sparks is a phenomenon not infrequently met with in gun-cotton drying houses and similar places, and in the course of the inquiry which followed this accident it was found that such sparks could readily be produced under the stated conditions, and that gun-cotton and fulminate mixtures could be exploded by short sparks. No similar instance, however, appears to be on record, and the explosion was regarded as purely accidental. Acetone vapour was ignited by a spark from a man's finger in 1901, at Ardeer, and the operators were afterwards protected by means of copper rivets in the soles of their overshoes. The trays in gun-cotton stoves are also frequently fitted with strips of copper for the same purpose. The occurrence is certainly of exceptional interest.

BRAZIL: ITS PRESENT CONDITIONS AND THE POSSIBILITIES FOR FUTURE COMMERCIAL RELATIONS WITH GREAT BRITAIN.

By C. E. BEST and H. L. PARROTT.

Note.—In presenting this series of articles to the readers of the Electrical Review the writers have one great aim in view, which is to bring Britishers into closer relation and more intimate understanding with the new epoch of progress and development upon which Brazil has lately entered, and at the same time point out to both enterprising firms and to serious capitalists a means of employing their energy in many undertakings which now present themselves, and only await the advent of enterprise and capital.

Having resided many years and travelled much in Brazil, and having been personally connected with finance, commerce and engineering works in the country, they are anxious to convey to others the optimism and ambition which its wonderful wealth, enormous natural resources, and unique position have engendered in them.

They feel justified in prophesying that Brazil will, within the next 20 years, prove herself to be as rich as South Africa in gold, minerals and diamonds, and richer than any other country in agriculture and timber.

They trust that their good intentions will fully condone all faults and omissions which may be encountered in these articles. They will be glad of an interchange of opinions, and are willing to give all information possible upon the subject to those who are desirous of same.

To many people the name of Brazil still only conveys a vague notion of a country covered with huge expanses of tropical forests, the major part of which are still unexplored, but which are infested by every species of wild animals, snakes, &c., and for the rest of it, overrun by many tribes of wild Indians; also that the country generally is a hot-bed of deadly fevers, such as yellow jack, malaria, &c., and all suffering under a tropical climate which only a negro can endure.

Now a reputation for some of these features was without doubt somewhat justified in the past, though for the most part the terror of the fevers is now only history, while the climate is not nearly so bad as people at home imagine.

Brazil is vast beyond the idea of most people, its area being almost equal to that of Europe. Its tropical forests are probably unsurpassed in extent by those of any other country, while the wonderful variety of timber found therein, makes the richest collection the world can produce. In realising these facts, one is astonished that more foreign enterprise has not been manifested in endeavours to develop the timber industry.

As a proof that the Brazilians recognise the latent riches around them, we would state that a local company has just been formed with a capital of some £350,000 to develop the industry in part of the State of São Paulo alone. We (the writers) confess with regret that had we been 12 months ahead in our endeavours to float a company in England, this business might have been ours. However, we take heart, as we wish our readers to, for there is still much which may be accomplished in Brazil, with enterprise and capital.

Indians.—Unless the traveller intends exploring the interior of Brazil, he need have no fear whatever of Indians. The indigenous tribes have always receded further inland in response to the white man's intrusion—though at times their protest has ended in mortal combat to both sides, as in some cases of long railway extensions.

The Indian is seldom seen in the interior towns even, but when he does appear, it is a proof that he is already somewhat "domesticated," and ready to submit to the white man's power and *régime* of living.

Wild Animals.—From our experience it would appear that most wild animals, including the jaguar, are far more frightened of a man than we need be of them. On one occasion a large jaguar had followed for some distance one of us who was on foot in a forest. Only when retracing his steps did he realise the danger, but at his approach the beast had also turned, and disappeared.

Snakes are generally the cause of fear to some travellers, and not without reason, as there are many species of venomous cobra in Brazil, as well as the deadly rattlesnake. But most of them are timid, and make away as one approaches. The great danger is when one or one's horse happens to tread on a sleeping snake. But death may easily be avoided, even when bitten by a venomous snake, if the traveller will furnish himself with the anti-poison serum which is prepared in a special institute in S. Paulo. There are two special serums, prepared from the actual venom of the snake, which is a sure antidote if injected into the person bitten within a limited time—several hours it may be in some cases—and there is another kind of serum which may be effectively used when one is not certain of the kind of snake which may have bitten a victim.

Fevers.—Upon this matter also there is much erroneous opinion existing in the minds of people "at home." Unfortunately, 20 years ago Brazil did deserve the bad reputation then current as to the danger of catching fever by those who went to the country.

Now, to fully understand how little there is for the white man to fear from fevers, it is well to state that all credit is due to the Federal Government for their great efforts and marvellous achievements in removing one of the greatest barriers to progress in the country, *i.e.*, yellow fever. It was in the year 1850 that the first case was reported, but it soon gained such a hold on the place, that in the years 1850-8 it claimed 35,500 victims in Rio de Janeiro alone.

Along the coast are still to be seen several hulks of vessels which were abandoned and wrecked on account of the crew becoming stricken wholesale with the yellow fever and men becoming victims within a few hours of the attack. There are three wrecks lying south of Santos, in one of which it is reported, only one man was alive when the boat foundered. But the Government attacked the matter boldly, and by rigid measures and drastic improvements which necessitated the wholesale demolition of many old houses and even streets, the hygiene and sanitation of the large cities became so much improved, that to-day they are regarded as being more healthy than many European cities. The death rate of Rio is 20·7 per 1,000; S. Paulo, 20·8; Curityba (Brazil), 14·9; Paris, 17·6; Rome, 24·0; Madrid 28·0. The cause of infection was traced to the mosquito against which was organised a campaign to exterminate it and this has proved entirely successful in preventing further epidemics.

The improved sanitation and drainage of the town of Santos, together with the excellent docks along the river side have won for it the reputation of a health resort.

It is but rarely that a case of fever breaks out nowadays and when this does occur, it is invariably susceptible to medical treatment.

Probably no country in the world ever undertook such a stupendous task as that of remodelling a city like that which Brazil accomplished in Rio within the short space of two-three years, 1904-6. True it is that many millions were spent on the work, but it was money well spent, for once and for always it placed Rio de Janeiro beyond reproach as a city of incomparable beauty, with the most magnificent harbour in the world. As soon as the present port works are completed, the movement of imports and exports will be greatly facilitated, and the city's commerce is bound to make rapid progress.

To-day, therefore, Brazil has some model cities, with most of the modern advantages of sanitation and general comforts, railways, &c., which compare favourably with our own provincial towns. In Rio de Janeiro and São Paulo there are established electric tramway systems as excellent as any in Europe. But for these Brazil has to thank a Canadian enterprise.

Then, in Santos, the old style of mule-drawn, narrow-gauge tram service is quickly being superseded by the new system of overhead electric. For this improvement, we are glad to say, Brazil is indebted to an enterprising British firm.

The number of automobiles being used in the big cities, both for pleasure and for business, is rapidly increasing. The roads outside the towns are not suitable for motor traction.

Topography and Water Courses.—Brazil is a rather undulating country, with large plateaux extending into the interior. The natural consequence is that there is a plentiful supply of running water in all parts. It is rather a strange, though significant fact, that the great River Paraguay, which

empties into the River La Plata, by Monte Video, rises on one side of a small range of hills, while the River Tapajoz, which flows into the River Amazon, rises on the other side of the hills, a short distance away. Hence there is almost a complete watercourse intersecting the whole of South America, an approximate distance of some 4,000 miles.

As might be expected in an undulating country like Brazil, there are many rapids and waterfalls in the rivers, and a great number of them might easily be harnessed to generate electric or hydraulic power.

It is not generally known that there are two waterfalls in Brazil with an estimated volume of fall greater than that of Niagara. These are the Paulo Affonso, in the River San Francisco, and the Iguassu, in the River Parana. But there is ample water-power in all parts at present running to waste, which may, with the greatest advantage, be adapted to the service of many industries.

In the capital of Sao Paulo, the Sao Paulo Tramway, Light and Power Co.—a Canadian company of very creditable enterprise—obtained a concession to generate electric power from the River Tieté. They constructed a dam across the river, some 20 miles distant from the town, where, within a stretch of ½ mile, there is a difference of 33 ft. in the level of the river.

Some large reservoirs, fed by three iron conduits 14 ft. in diameter and ½ mile long, work several turbines, which run the generators. Sufficient electric power is generated and conducted to S. Paulo to run an excellent tramway service and furnish power to drive many large factories as well as supply light for public and private use.

The majority of industrial houses in S. Paulo depend absolutely upon this electric light and power, in spite of the fact that there is an excellent supply of gas, furnished by an English company.

Since the arrival of the Light and Power Co., there has been keen competition between them and the Gas Co. for supplying public and private lighting, but the Gas Co. is well established, and by good management has not suffered from the contest.

It is only some 12 years ago that the S. Paulo L. & P. Co. went to S. Paulo. At this time there was a poor service of mule-drawn trams, owned by two or three companies. The new company had to overcome tremendous opposition, and many difficult obstacles, before they could install themselves satisfactorily, and it was some years before they were real masters of the situation.

The old companies sent out gangs of men at night to pull up and destroy the work of laying the tramlines which the new company had done during the day. Naturally conflicts often ensued between the parties of the opposing companies. Added to this there was much opposition encountered from influential men and politicians in obtaining further concessions and protection of their labours.

It was only by indomitable courage, tremendous enterprise and patience, with the expenditure of very large sums of money—much of which undoubtedly was never anticipated before the scheme was entered upon—that they won their position beyond all dispute.

We venture to emphasise these facts, in order that British firms may appreciate what others have endured to accomplish their aims. In this case their efforts have been well rewarded, as well as in Rio de Janeiro, but of that scheme, more anon.

We would appeal to those persons or companies who wish to secure business interests of any kind whatever in Brazil. They must convince themselves of one salient fact, viz., that the Brazilian to-day is very wide awake to the possibilities and latent resources of his country, and though he, the Brazilian, is not able to undertake all the labours necessary to improve and develop the country on account of the want of national capital and men, he has decided to secure the best possible work and greatest advantage from the foreigner. It is therefore the best men who will win in the race for the biggest prizes.

British firms must be ready to *sink* their capital (some of it definitely), but the greater part for a year or two only, after which they may hope to reap handsome profits. They must treat all their own men, and all those with whom they have relations in Brazil, in an open-handed and generous manner.

To study petty economy will bring a crop of disappointments and difficulties, while the return on the capital expended will be far less in proportion than on the more liberal outlay. Capital is an "Open Sesame" in Brazil, so long as it is backed by keen diplomacy, thorough ability, and perfect organisation. Our competitors have shown us an example, but for that very reason they are now leading the way in many directions where the Britisher should be foremost.

Though with no wish to depreciate the many excellent achievements of Englishmen abroad, we say that in our experience it seems necessary for an Englishman to go abroad for some time in order to realise the sundry deficiencies of his countrymen in business, as well as to recognise the good qualities of our foreign competitors. Our desire is to stimulate our compatriots to regain and hold their well-merited position as the premier nation of the world in all commercial respects.

(*To be continued.*)

PROPOSED HYDRO-ELECTRIC DEVELOPMENT ON THE RIVER MAIPO, NEAR SANTIAGO-DE-CHILE.

[FROM A SPECIAL CORRESPONDENT IN CHILE.]

The rapid change that has taken place in the development of Chile during the last 10 years is astonishing. Nowhere, however, is this change so marked as in the capital, Santiago.

From a badly built, badly paved town it has suddenly become a modern city of 400,000 inhabitants with fine buildings and well-paved streets.

The increase in the commercial activity has caused an enormons suburban development, and the centre of the city has taken on a more commercial aspect.

The increased value of property has compelled owners to divide off their buildings into offices to accommodate the increasing commercial world, and the smaller rent payers have been pushed out to the cheaper property of the suburbs.

This shifting in the population has created a demand for further travelling facilities across and through the city.

In the suburbs small industries of every kind have cropped up, thus creating a demand for motive power.

There is also a constant demand for light as the city extends, and in the whole of the agricultural districts around Santiago there is a demand for power.

The present electric supply is in the hands of the Chilian Electric Tramway and Light Co., which has been working under great difficulties, and cannot by force of circumstances cope with the demand for energy.

In the first place, this company made an unfortunate contract with the municipality, in which it undertook to limit its tariff for passenger carrying, and in the second place, in the development of the water scheme it undertook to pay a very large sum for the use of the water which passes along the Canal de Maipo for irrigation purposes.

These two circumstances restrict the earning power of the business, and consequently there is not the desire that should exist to push the traction system further than the present contract compels. Under the arrangements with regard to lighting the company may charge an unlimited price per unit, modified only by the competition with the gas interests, whose charges are extremely high. It, therefore, makes this a paying part of the business, but as its contract is limited to the city of Santiago, it has no desire to push its mains into the suburbs, where it would not be a paying business to carry the traction service also.

This situation with regard to electric supply makes it absolutely necessary to look to other sources to satisfy the growing demands of the new districts, and it is not surprising that another undertaking is contemplated which shall be capable of meeting the demands which actually exist, the neglect to provide for which threatens to restrict the natural development of Santiago and its suburbs.

With a basis of the electrification of the railway between Santiago and Puente Alto a concession has been granted to Senor Julio Subercaseaux to use the waters of the river Maipo to develop power at San Juan de Pirque (October, 1911).

The water will be taken from the river near El Volcan and a canal built on the south bank of the river about 18 miles long; the fall at San Juan will be over 400 m. (1,320 ft.) and the minimum quantity of water will develop nearly 60,000 H.P.

The hydro-electric station will be placed at San Juan, under 20 miles from Santiago, and high-tension mains will be carried to Puente Alto and Santiago.

After the electrification of the railway between Puente Alto and Santiago, the surplus power available will be enormous, but no greater than the necessities require.

Apart from the public lighting of the various suburbs around Santiago, there is a field for lighting in the city itself, as competition with the present company will be useful to the public.

Then there is an absolute necessity for better travelling facilities in the suburbs, where the concessions of the present company do not extend, and where it has no desire to go on account of the low fare that must be charged.

The State Railways require power for the electrification of the very bad section to Valparaiso over the Tabon, and this new source of electric supply will facilitate this important improvement to the great benefit of the State Railway service.

Within the past few years the use of acetylene gas has extended so much that actually the importation of carbide of calcium is so great that a company contemplates setting up an installation for its manufacture. This is another direction in which the power of the River Maipo can be profitably used.

In every direction in and around Santiago there is a demand for energy in the form of power or light or heat, so that there is no question that the development of the water power embraced in the concession of Senor Subercaseaux will find a ready market, and will assist in an important way in the development of Santiago and district.

In the electric concessions which have also been conceded to Senor Subercaseaux there is no limitation to the prices that may be charged, and as there are no burdens to be borne, such as payment for the use of water, &c., similar to those which handicap the present electric supply company, it is evident that this will be a great and important business, which must become a source of profit to the capitalists into whose hands the concessions finally fall.

The definite studies are now being made, and we understand that suggestions as to the application of this new source of power will be received and welcomed by the owners of the existing railway from Santiago to Puente Alto, or the concessionaire, Senor Julio Subercaseaux, Calle Compania 1,213, Santiago-de-Chile.

SOME REMARKS UPON LONDON ELECTRIC TRAMWAY SYSTEMS.

By A. H. M.

Recent returns showing the enormous number of passengers dealt with by the London electric tramway systems, bring vividly to the mind the immense importance of this system of transit to Londoners. The writer is a frequent passenger on the cars of the different authorities, and has been strongly impressed by the possibility of improvement in various directions.

Both the L.C.C. and other systems of cars appear to suffer from a serious defect in the direction of badly-designed staircases.

A man approaching 6 ft. in height must ascend with the utmost care, or he will surely have his hat crushed by some ledge or other projection. Another defect (and one quite easily remedied) is that it is often impossible to obtain a continuous hold on the handrail on account of the fact that various obstructions meet the hand during the progress upward, or because the handrail is not a continuous and convenient one following a suitable curve at a proper level for a person of average height to grasp. It appears to be quite beyond dispute that designers have failed to supply what is required in this direction. Another source of danger is the fixing of boards outside the rail, but so close to it that the fingers become jammed between the two.

In these days of hurry, when cars are started whilst passengers are still climbing up, these defects constitute a source of danger, and should be remedied.

Those using the L.C.C. cars fitted with top covers can scarcely have failed to feel the draught which is encountered when the windows are lowered for ventilation. This is a particularly unfortunate defect, and one which mars the benefit which the public undoubtedly derive from the top covers in cold or wet weather. The question arises whether this draught can be avoided. The writer has given careful consideration to the matter, and is of opinion that the difficulty can be overcome by the employment of a proper system of ventilation. For instance, a small fan (suitably protected against the weather) could be fitted into the roof in such a manner as to draw away the foul air, whilst fresh air could be admitted by ducts placed high up at the sides. A fan taking ·2 of an ampere at 500 volts would probably do all that is required. If necessary, of course, other methods could be employed, but the writer feels satisfied that the difficulty is one which can be completely overcome.

Cars running on systems where top covers are not provided, place the public at a considerable disadvantage during wet or cold weather, and a natural result is the overcrowding of the interior. It, at the same time, appears to be beyond dispute that the tramway authorities lose considerable revenue in the course of a year, as many people prefer the train or other method of conveyance under such circumstances.

Assuming that there are valid and sufficient reasons why top covers of the ordinary type cannot be fitted, there is still the possibility of devising some sort of shield which would protect outside passengers from the worst of the wind and weather.

After making due allowance for the necessity of economising time, the writer considers that the starting acceleration and the stopping retardation of the L.C.C. cars are excessive. Although this appears to be general on the L.C.C. cars, it is not apparent on the cars of other systems. This fact would render it evident that the cause is to be found in the design of the controller and brake equipment. Of course, the danger here is that passengers may be thrown down if not actually occupying seats when the car starts or stops.

The writer fully recognises the splendid service which electric car systems have given to the workers of London, and sincerely trusts that their utility may be still further increased by the elimination of the defects which have been indicated.

Water-power in Germany.—Two further instances of proposed municipal co-operation with private enterprise are reported from Munich and Nuremberg respectively. In the former case a syndicate, which intends to utilise the water-power of the Leitzach with the aid of the Seeham Lake as a storage dam, has offered to supply the Munich city authorities with electric power, and the latter have agreed to the principle of the scheme. The syndicate will form a company for the purpose of carrying out the undertaking, and the Munich authorities will subscribe for 51 per cent. of the share capital, and become customers for 20,000,000 KW.-hours per annum. It will also be necessary for the Council to expend £60,000 for the erection of a transmission line 18·6 miles long between the Leitzach works and Munich. The second instance relates to the proposed formation of a company to establish supply works by the utilisation of the water-power of the Walchen Lake, and the delivery of power to Nuremberg, Furth, and to the projected station for Central Franconia. The town of Nuremberg would participate in the company to the extent of 51 per cent. of the share capital, whilst the balance would be equally divided between the town of Furth and the Schuckert Electricity Co.

An Edison Automobile.—A car equipped with an Edison storage battery of 50 cells, and capable of travelling 80 to 120 miles at 20 miles per hour, is described in a recent issue of the *Electrical World*. The car is carried on exceptionally well-designed spring suspension, and is intended for business service on country roads, which are notoriously bad in the U.S.A.

NOTES FROM INDIA.

[BY OUR SPECIAL CORRESPONDENT.]

MADRAS.—A very important street lighting contract is about to be settled by the Madras Council. It is reported that the issue lies between Messrs. Siemens and Messrs. Henley's Telegraph Works Co., whose prices are close to one another.

Recently tenders were invited for the electric lighting installation to be installed at a Madras Hospital. A specification was issued and signed by an engineer to the Corporation, and the few following excerpts may be of interest as showing what contractors are up against at times :—

1. "The whole of the work to be done in accordance with the most recent rules of the Institution of Electrical Engineers."

2. "*Distribution Boards.* . . . . One double-pole main switches to control the whole of the lights. All switches to be on one pole."

3. "*Casing.*—Tenderers should specify (in detail) and carry out work in accordance with the recent rules of the Institution. Tenderers to specify clearly how they propose to do work in the kitchens."

4. "*Incandescent Lamps.*—Tungsten to be of best brass collar type of the best make. Any lamp failing within two months of current being switched on to be replaced, unless glass is broken."

5. "Switches should be generously distributed throughout the installation, each lamp must be able to be turned off if its light is no longer required."

6. "*Fuses.* . . . The installation should be so designed as to be capable of taking 10 per cent. of the total candle-power specified in the schedule, and 30 per cent. of the fans specified in the same schedule."

7. "*Wood Casings.* . . . width of centre fillet of casings should be for main cables 2 in. ; for branch cables, 1 in. ; for single conductors, not less than 2 in. Tenderers to clearly specify how they propose to execute work in the kitchens."

8. "Fans to be similar to Crompton fan type. . . . Tenderers to submit complete specifications, including the following points—finish, motor, blades, blade-holders, speed, armature brush-holders, commutation, supporting tube, current consumption, regulator. Contractor to make *any* test ordered by the engineer."

9. "*Time.*—For installation of lights and fans within seven weeks from communication of acceptance. For lift within 10 weeks from date, &c."

10. "*Fines.*—Rupees 15 a day for every day's delay in completion. The engineer may impose a fine not exceeding 50 rupees for every occasion on which he notices unsatisfactory work. . . ."

Comment is scarcely necessary. A tenderer who could satisfy the above conditions, who could import and erect a lift within 10 weeks, who could design the installation so as to make it capable of dealing with 10 per cent. of its total candle-power, who could "specify clearly how he proposed to execute work in the kitchens," who could calmly submit to a fine of Rs. 50 each time his lordship the "engineer" was pleased to find fault—such a tenderer should forthwith be canonised. It is not at the moment widely known who got the contract, and it would be interesting to find out later how things developed.

The result of the railway and shipping strike in England is now being keenly felt in India, and particularly by those firms who have to work to a definite date, such as at the Delhi Durbar, some of whose consignments are now overdue. The congestion at the ports is intense, and at the goods stations of the railway companies it is simply confusion ; at the new goods station of the Durbar it is confusion worse confounded. To add to the seriousness of the matter, there is a rumour of a threatened strike among the railway hands generally. These men (natives, of course) are keenly alive to their own interests, and feel their position is considerably strengthened by the fact that the success of the Durbar is very largely dependent on the smooth and efficient working of the Indian railways during the next couple of months.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIA.—The Australian Customs authorities have issued the following decisions regarding the duties to be levied on certain imported goods.

Master clock and 31 dials electrically operated therefrom	20 %
Cut-out and hanger for arc lamp	10 %
Condensers : Steam engine	20 %
Other	25 %
"Fepco" sheeting, a composition of asbestos and rubber used chiefly as a packing for pumps	20 %

The Customs authorities have also decided that "wholly manufactured" for certificate of origin declaration purposes means that all the manufacturing processes shall have been performed in the United Kingdom from unmanufactured raw material of foreign origin irrespective of the proportion of British labour in the factory or works cost of the manufactured articles. Such goods will be entitled to preference.

TURKEY.—The Customs authorities have decided that machinery and tools imported into Turkey for the first installation of factories, or their enlargement, as also Decauville (portable) railways, aerial wire transporters, and spare parts, necessary for facilitating the transport of raw material and products of such factories, shall be admitted free of Customs duty.

In this connection, the Customs authorities have decided that, in order to prevent abuse, importers of the foregoing articles must present to the Customs Department a declaration from the Ministry of Public Works certifying that the material to be imported is entitled to benefit by the exemption accorded by the law.

The duties collected on machinery and tools for the first installation of factories since the date on which the Imperial Iradé sanctioning such exemption expired, are to be returned to the importers.

A Motor-of-all-Work on a Farm.—Mr. C. D. Bellows has a 640-acre farm 4½ miles from Maryville, Mo., and not only lights his house, barns and grounds by electricity delivered over his own transmission line from the Maryville central station, but performs his farm work with a 20-H.P. induction motor, mounted on skids, which can be moved about his place and attached at any of the numerous connections in his barns and silos.

The three-phase, 60-cycle, 2,300-volt transmission line was built by the local electric light company, of which Mr. C. C. Hellmers is manager, at the expense of Mr. Bellows, and is of best construction, with painted poles, creosoted butts, &c., costing the owner about $425. In the case of another line serving a farm installation 4 miles north-east of Maryville, the farmer attempted to economise by building his own line, and this work has given much trouble.

Mr. Bellows' meter is mounted in a pole box at his farm, and he pays the same rate as the regular Maryville town customers.

The lines on the farm premises are tapped at nine points for motor connections. At each of the three barns and four silos the taps are brought to knife switches, from which hang the wires for attaching under the binding posts of the motor unit terminals. The motor which is used for general work about the Bellows farm is a 20-H.P. machine of the three-phase, squirrel-cage induction type mounted on 8-in. × 8-in. skids, with its starting compensator. The motor unit can be rolled up to any machine to be driven, the wires being slipped into the terminal blocks and the switch closed. The cut-out switches are, of course, ordinarily left open when not in use, to prevent contact between the jumper wires.

This motor has been handled in the characteristic rough manner given farm machinery, and is frequently left out in the rain and wet weather without perceptible damage. It has now been in service nearly two years. Mr. Bellows also pumps his water supply by electricity, having a special 5-H.P. motor for this purpose.

During the last season 45 acres of corn on this farm were cut up into ensilage, the work being done by the 20-H.P. motor in 1½ days, or less than half the time formerly required with a gasoline engine. The Bellows installation is a thoroughly practical one, which has been given two years of the hardest service, and the owner declares that he would on no account return to the gasoline engine he formerly used.—*Electrical World.*

Personal Representation in the Argentine.—The importance of personal representation in foreign markets is once more driven home to the minds of British manufacturers in Mr. H. M. Mallet's Consular report on the trade and commerce of the district of Rosario, Argentine Republic, for the year 1910. As has been said so often before, he remarks again, that time and money are simply wasted by posting circulars to merchants. "Competition to secure orders has become so keen that some of the large firms trading with this country have agents residing here, whose business is simply to watch trade interests and visit all the larger towns, with a view of studying requirements and obtaining orders. By this method merchants and travelling agents have become acquainted, and large orders are not infrequently arranged on terms to suit the parties concerned."

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,314. "Holders for telephone receivers." J. Trenner. October 23rd.

23,334. "Electric insulators." G. Fuller and G. J. A. Fuller. October 23rd.

23,359. "Automatic electrically-governed engine-controlling apparatus." H. D. Hinckley and W. D. Hallinay. October 23rd. (Complete.)

23,393. "Telephone coin-collector." W. Fairweather. (Baird Electric Co., United States.) October 23rd.

23,407. "Means for actuating automatic electric and other alarms." A. J. Cuming. October 24th.

23,414. "Dynamo-electric machines." L. J. Hunt and Sandycroft Foundry Co., Ltd. October 24th.

23,418. "Electromagnets." D. E. Barnes and A. A. G. Jensen. October 24th.

23,439. "Process for charging or regenerating the plates of accumulators." Trautmann & Mayer. (Convention date, October 24th, 1910, Germany.) October 24th. (Complete.)

23,441. "Combined switch and plug connectors for electric wiring." D. S. Munro. October 24th.

23,495. "Apparatus for actuating conduit covers and collector ploughs of electric railways." D. D. Samaia. October 24th. (Complete.)

23,500. "Means of and apparatus for recording calls made by telephone." E. H. Bridge. October 24th. (Complete.)

23,508. "Semi-automatic telephone exchange systems." F. R. McBerty. (Convention date, October 24th, 1910, United States.) October 24th. (Complete.)

23,542. "Magnetic motor." W. H. Briggs. October 25th.

23,546. "Apparatus for electric light advertising and illuminations." A. B. Barker and J. H. Barker. October 25th.

23,548. "Windings of electric generators and other electrical machines." P. R. Jackson & Co., Ltd. October 25th.

23,549. "Field coils of series wound electric motors." P. R. Jackson & Co., Ltd. October 25th.

23,565. "Supports for electrical conductors." Callender's Cable and Construction Co., Ltd., and C. W. Kay. October 25th.

23,566. "Means for suspending electric conductors." Callender's Cable and Construction Co., Ltd., and C. W. Kay. October 25th.

23,614. "Transmission gear for the electric lighting of railway vehicles and other vehicles." J. Stone & Co., Ltd., and A. H. Darker. October 25th.

23,622. "Plug receptacles for electrical apparatus." Soc. Snon. Fabriek van Instrumenten en Elektrische Apparaten "Inventa." (Convention date, November 4th, 1910, Belgium.) October 25th. (Complete.)

23,639. "Electric planer drives." B. Wiesengrund. October 26th.

23,663. "Electric insulators." J. H. Ellis and British Insulated and Helsby Cables, Ltd. October 26th.

23,725. "Incandescence electric lamps." C. Carangelo. Con-(vention date, October 27th, 1910, France. Addition to 21,740/10.) October 26th. (Complete.)

23,731. "Electric telegraphy." J. A. L. Dearlove. October 26th.

23,732. "Regulators for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 26th.

23,734. "Circuit-controlling devices." E. M. Hewlett. (Convention date, October 29th, 1910, United States.) October 26th. (Complete.)

23,781. "Protecting devices for electric lamps." W. E. Perry and S. Davies. October 27th. (Complete.)

23,783. "Electric lamps." K. R. Smith. October 27th.

23,789. "Apparatus for automatically operating gas or electric lamps." C. R. Oliver. October 27th.

23,823. "Common battery telephone systems." Aktiebolaget L. M. Ericsson & Co. (Addition to 21,924/11. Convention date, November 9th, 1910, Sweden.) October 27th. (Complete.)

23,824. "Common battery telephone systems." Aktiebolaget L. M. Ericsson & Co. (Convention date, November 9th, 1910, Sweden.) October 27th. (Complete.)

23,830. "Electrical water heaters." L. Katz. October 27th. (Complete.)

23,846. "Automatic electrical signalling systems for railways and the like." W. C. Hawkes and E. J. Cleburne. October 27th.

23,882. "Circuit-breakers for rotatable controllers for electric circuits." J. A. Hirst and P. S. Brook. October 28th.

23,910. "Three-contact plugs for telephone switchboards or the like." Siemens Bros. & Co., Ltd., and W. H. Grinsted. (Siemens & Halske Akt.-Ges., Germany.) October 28th. (Complete.)

23,918. "Common battery telephone systems." Aktiebolaget L. M. Ericsson & Co. (Addition to 23,824/11. Convention date, February 7th, 1911, Sweden.) October 28th. (Complete.)

23,920. "Electromagnetically operated clutch mechanism." H. A. Cutler. October 28th.

23,931. "Photographic apparatus for indicating and measuring changes in electrical pressure." J. S. Dow. October 28th.

23,937. "New or improved machine or device for use in connection with telephones." H. S. Bryant and Third Hand Patents, Ltd. October 28th. (Complete.)

23,943. "Process for the closing of the longitudinal seams of tubes by electrical resistance welding." Gesellschaft fur Elektrotechnische m.b.H. (Convention date October 29th, Germany.) October 28th. (Complete.)

23,945. "Protection of electric circuits." G. North. October 28th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Automatic Switching In-and-Out Devices for Dynamo-Electric Machines Working in Conjunction with Accumulators. H. F. Foster. 23,577. October 10th.

Electric Switches. A. Eckstein and A. C. Heap. 23,525. October 11th.

Spring Contacts for Electric Switches, Fuses and the like. A. Eckstein and A. C. H 23,526. October 11th.

Electric Switch G. L. Welford. 23,622. October 12th.

Electric Weldi . E. B. Koopman and Pontelec Welding Patents, Ltd. 23,735. October 13th.

Electric Switchboards. A. Eckstein and A. C. Heap. 23,894. October 15t

Electric Driving Apparatus for Machines for Picking Metal Plates Sheets. F. C. Anderson. 23,957. October 17th.

Apparatus for the Production, Strengthening and Reception of Electric Vibrations. J. Schiessler. 24,696. October 24th.

Portable Devices for Transforming Continuous Electric Curren L. B. Miller. 25,065. October 28th.

Electric Process for Drying Timber. Alcock & Co. Proprietary, Ltd. 25,1 October 2 th. (November 5th, 1909.)

Galvanic Batteries. W. Morrison. 25,315. October 31st. (November 22 1909.)

Contrivance for Facilitating the Fastening of Electric Conductors Walls or other Supports. T. James and C. Jones. 25,846. November 7

Universal Angle Grip for Flexible Electrical Cords. A. C. Chapm and H. E. Mason. 26,909.

Combined Bell-Push and Temperature Alarm. C. Heath. 27,508. Nove ber 2oth,

Electrical Switches of the Two-Way Tumbler Type. T. H Tuck 27,903. December 1st.

1911.

Method and Means for Connecting Electrical Conductors to Brush for Dynamo-Electric Machines. British Thomson-Houston Co. (Gene Electric Co.) 76. January 2nd.

Spark-Gaps of Ignition Plugs. F. Lux. 325. January 5th. (May 4th, 191

Electric Letter-Box Signalling Devices. R. J. Warin. 365. January 6 (May 1st, 1911.)

Brush-Holders for Dynamo-Electric Machines. M. Walker. 1,338. Janu 18th.

Combination Locks for Electric Switches and other Serving Devic T. D. Robinson. 2,722. February 2nd.

Electric Signs. H. Bey. 3,7-9. February 15th.

Apparatus for the Rectification of Alternating Electric Discharg U. Magini. 3,865. February 15th.

Electric Fans. W. J. Railing and A. J. D. Krause. 3,918. February 16th.

Hub-Motors for Electrically Propelled Automobile Vehicles. V. H horn. 5,870. March 8th. (March 12th, 1910.)

Production of Electrical Oscillations by Direct Current. W. P. Thon son. (Ges. für Drahtlose Telegraphie.) 6,682. March 17th.

X-Ray Tubes. Touset. 7,076.

Safety Interrupter for Electric Tramways with Overhead Li G. Pratginestos de Bonaparte. 7,645. March 27th.

Indicating Devices for Electrical Measuring Instruments. M. Strel 8,033. March 30th.

Electric Alarm Signal. E. E. Rogers. 8,044. March 30th.

Telegraph Transmitters. J. W. Mackenzie. (American Transmitter a Manufacturing Co.) 10,043. April 25th.

Telephone Transmitters, Receivers or like Devices. W. M. Crowe a British L. M. Ericsson Manfg. Co. 11,132. May 8th.

Prepayment Mechanism for Electric, Gas and like Meters. W. S. Spra and Chamberlain & Hookham, Ltd. 11,929. May 17th.

Air-Propeller Driven by Electric Motor. A. Schaeffer. 13,623. June 7 (July 2nd, 1910.)

Electric Circuit Controlling Devices. P. Dunnind. 13,830. June 9 (June 0th, 1910.)

Electric Pocket-Lamps. E. Neudoerffer. 14,604. June 20th.

Electric Water-Heating Devices. H. Lofquist. 15,302. June 30th.

The Fixation of Nitrogen.—The nitrogen fixation pr cesses of Birkeland & Eyde and the Badische Anilin und So Fabrik have now reached a stage when their products may be co sidered ordinary articles of commerce; in fact, the works Notodden are now beginning to put on the market quantities nitrogenous material large enough to affect the price. Notwit standing this, however, the price of nitrogen in the various f tilising compounds still rises; sulphate of ammonia, for instan recently crept up to £14 5s. per ton. The success of the t processes mentioned, the present high price of nitrogen co pounds, the marked attention given in these days to scientific s culture, and the production of pure nitrogen as a by-product of t present-day manufacture of oxygen by the Linde process, a giving a great stimulus to the study of nitrogen fixation. Ea week sees a new process for carrying out this object. Many these processes are extremely ingenious.

One such process has been brought out by Messrs. Nobels, t simplicity of which seems remarkable. The apparatus, in whi the nitrogen and oxygen of the atmosphere are combined, consis of a hollow truncated cone, at the lower and smaller end of whi revolves a set of fanner blades. Inside the cone and on the pla at which the fanner blades revolve are fixed a number of met electrodes in a slanting position. In plan these electrodes appe as curved strips, one end of which is nearer the centre or axis the cone than the other; the near end almost touches the tips the fanner blades as they revolve. The truncated cone and t revolving shaft are connected to a source of high-tension curren so that a spark bridges the air gap between the tip of the fann blades and the near end of the electrode strip. As the blad move round the gap is widened out to the maximum at t other end of the electrode strip, so that the spark is gradual pulled out in the same way that the strong magnetic field of t Birkeland & Eyde apparatus pulls out the electric arc into broad flame. The flame of course forms an extremely thin she making a high temperature zone. The formation of this zone of hig temperature is one function of the fanner blades, the other is draw in the atmospheric air and project it through this flame wi the formation of nitrogen oxides, which are afterwards absorb in milk of lime in the usual manner. The consumption of energ is much less than in the ordinary process, as none is required energise the magnets. The amount of nitrogen oxides in the a which has passed through the flame varies from 1½ to 2 per cent.

THE

ELECTRICAL REVIEW.

VOL. LXIX. NOVEMBER 17, 1911. No. 1,773.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

CORRUPTION.

A MEETING of the Secret Commission and Bribery Prevention League was held at the Mansion House on October 24th.

In reference to the recent Act, it was admitted that the results were extremely meagre, and that the evil sought to be cured was still rampant and increasing.

We can hardly resist the temptation of saying : "We told you so." Before the Act was passed we pointed out that it would serve as a very convenient cloak. In Russia, where corruption has grown to a luxuriance unsurpassed even in the States, the law against the giving and receiving of bribes is more drastic than in any other country—and the cloak is more effective. Nay, the cloak is now thrown off, and corruption stands naked and unashamed ; the acknowledged master of the destinies of that great Empire.

We pointed out that the great difficulty was not the punishment of the culprit, but his discovery.

The old law was strong enough as regards municipal life, at least ; and yet it was well known that the evil was worse in municipal than in private affairs. We predicted that the Act would lead to the punishment of respectable persons for the most trivial and innocent "tips," while it would fail to expose the blackmailers of commerce. If it were not for the fiat of the Attorney-General, and the common sense of a certain number of people, the Act would jail an archbishop for tipping a guard to delay the train for two seconds to allow his Grace to get in. As a matter of fact, the convictions up to date have been almost all of a most trivial character. On two occasions men have been punished for giving some pence to draymen for carrying messages or parcels to their next place of call. The kind of bribery that was aimed at nas altogether escaped. The Mansion House meeting was convinced that the evil was unchecked and growing. The decision arrived at was to press for an amendment of the law, removing the fiat of the Attorney-General, so that anybody can prosecute anybody else without his sanction.

We deprecate most strongly any such movement. It would be certain to tend to the multiplication of trivial cases against persons who meant no wrong, for ordinary "tips" causing no injury to anybody. We do not believe any genuine actions against bribery have been stayed by the Attorney-General. His fiat is necessary to stop trivial or spiteful prosecutions.

The real trouble is, as we have all along contended, that there are only two parties to the crime and no witnesses ; and the law holds both equally culpable. Therefore, neither the giver nor the receiver will ever tell on the other. Every care is exercised. The bribe passes in coin. The books of both parties appear quite innocent, though, doubtless, the

auditors of many large concerns could a tale unfold. Such items go down to "Trade expenses," or Travellers' salaries," or "Commission account."

Should the unfortunate traveller who had to pay over the bribe be detected, he would be repudiated with honest scorn by his principal.

Many blackmailers are so sensitive that they must not be directly bribed. For such persons a game of chance or skill with high stakes has to be arranged. Others, again, are so scrupulous that they will not accept anything for themselves. But the blackmailed one is allowed to discover that some female relation has a taste for jewellery. It would be difficult to bring such gifts within the law, but they are pure blackmail none the less.

So many are the tricks and dodges of the blackmailer that we venture to say, as we said before the Act was passed, that so long as both parties to the crime are compelled by the fear of the law to keep silence, so long will discovery or checking of the evil prove impossible.

Isolated cases there will be, no doubt, of a blackmailer who is also a fool; but such cases only serve to make the cloak for the clever ones the more effective.

There is only one way to make this game too dangerous, and that is to let one of the two criminals go scot free. Which is it to be?

The blackmailer is the one who betrays a fiduciary position. He is buying for a client who trusts him to use an unbiased judgment. He accepts a bribe. In nine cases out of ten he asks for it, either directly or indirectly; and he makes it sufficiently clear that by that means only can the seller hope to obtain the order on which, in the long run, his living depends.

We hear a lot about honest buyers being tempted by wicked sellers anxious to part with quantities of gold. Such nonsense may be dismissed. Honest men are not tempted by bribes. They promptly kick the offender downstairs. They have their fixed scale of salary or commission from their employer, no matter whose goods they buy. They are in a strong position, and not at all at the mercy of temptation. But the seller, if he is confronted with a blackmailer, must bribe or starve.

His duty to his employer is to sell. He betrays no trust. An honest seller finds it difficult to exist; and, by the inexorable laws of cause and effect, he will soon become extinct unless a remedy be found. There is only one effective change that can be made in the law, and that is to relieve the seller from all responsibility, and fix the terrors of the law—tooth and nail—upon the dishonest buyer, or the agent who betrays his trust. If that be done, the blackmailer (who is a coward at heart) will go in terror of his life. He will be absolutely at the mercy of the other party, who is sure to use his power to an extreme, and finally to produce an exposure. A quarrel is pretty sure to take place some time, and when that happens the blackmailer will be given away by the blackmailed without compunction.

Other methods should not be neglected; above all the cultivation of a strong and healthy public opinion. The subject should be properly handled as part of the universal educational curriculum, so that the next generation may at least know right from wrong. A leading question should appear in all examination papers; the Institution of Civil Engineers might well lead the way in this. The evil must be torn up by the roots as speedily as possible.

An Exhibition Report.

Was the Olympia Electrical Exhibition a success? What were its merits? What were its failings? What lessons may we learn from the latter? These questions have been widely discussed during the last month, and some of our readers, already aweary of the subject, may wonder why we revert to the matter now, seeing that we have been silent for so many weeks. Our reason is that while all the furies were let loose by other penmen during the excitement of a busy period, and unworthy suggestions were made concerning ourselves, it was in the interests of the Exhibition and the industry that we should bide our time until the storm had spent itself, or, to change the figure, until the birds had beaten themselves to exhaustion against the bars of their cage. Now, calmly and dispassionately, we can review the event and its lessons. Lord Rosebery, in his Chesterfield speech, used the expression in a political connection of certain restive spirits, "Let them blow their trumpets—till they crack their cheeks." Has the remark no aptness in respect of those who strove to rally disaffected forces at Olympia? It is the easiest thing in the world to find fault with something that you have not done yourself. Most people think a thing ought to have been done differently—after the event. It is better to *advise* in good time than be late in the day to *criticise*. Writing editorially about this exhibition as long ago as February 17th, 1911, we said, in reference to the necessity for making the event popular with the public, compelling them to "come and see":—"Probably many of our readers will be able to advance useful suggestions of a dozen or two other ways in which the public shall be attracted, the general electrical trader's interest won, the engineer and architect, the councillor and shareholder, the mansion owner and the cottage dweller, all be made to feel it imperative to see the latest advances in electrical applications. *No doubt any original ideas will be welcomed if submitted in good time.*" We do not know whether our comments in that article were even considered by the committee or by the management, but we do know that their critics were not in evidence with original ideas when they were invited. Another remark in the same article was:—"A grand success, with record attendances, booming electricity for all we are worth—that is of more importance than the Exhibition Committee being able to show a big profit on the turnover." We might quote many more such remarks as these, made eight months before the event, for the edification of those who said the same things with the air of originality while the show was in full swing or when it was actually ended.

We should not have alluded to the matter now were it not for the fact that a report by the management, submitted to the Executive Committee, has been brought before us as a journal. The criticisms of the Press and of individual exhibitors led them to prepare this report, not merely with a view to showing the impracticability of various suggestions that had been made, and dispelling misunderstandings, but also in order that useful deductions might be drawn from recent experience concerning "certain modifications which might reasonably be adopted when another electrical exhibition takes place." Their report bears date November 6th—that is, several days earlier than one of our most esteemed contemporaries had managed to tabulate collected suggestions and draw conclusions from them.

It was not the fault of the management that there were not more working exhibits of electric driving of the machinery used in various trades. The effort was made to secure the co-operation of engineering firms to this end, but this was refused, as they "would not be recompensed for any outlay to which they were put," their exhibits being suitable for particular trade exhibitions. This is not an unreasonable attitude. It was motors and power we wanted to secure business for at Olympia. The motor makers might have made arrangements with the machinery makers, or better than that, and more fittingly, the supply companies who paraded their good intentions and the fact that they were spending much money, should have completed their scheme and had their large space better occupied by showing the uses of electricity for driving different classes of tools and machinery and domestic apparatus. Was this among the good resolutions that they failed to carry into effect? It is not likely to be forgotten that wherever there were working exhibits there the general public gathered. We have no words strong enough wherewith to condemn the apathy and the misguided policy, the want of business-like co-operation on the part of this co-operative party of supply authorities. They would have done more good had they shown working exhibits than they could hope to do by the display of pretty posters—however artistic. We were all there for business.

not play, not art! But we will leave the supply authorities for the present—the memory of their failure will be keen long enough for us to return profitably to the matter later on. It was in their interests, above all others, that *publicity* should be given to the event, and that the plentiful and early circulation of tickets should be made.

The management state why it was that their efforts to secure a model hospital ward, and a full display of electro-medical apparatus, were not successful, and they also show that free space was not regarded as a sufficient inducement by firms who might have displayed exhibits of electrical horticulture, Röntgen ray apparatus and electro-photographic transmission apparatus. It was not the fault of the management that the attendance was poor during the first week, for in July last all exhibitors and supply authorities within a radius of 80 miles were offered supplies of tickets at reduced rates. Furthermore, the fine weather during that first week was alone a considerable handicap to any indoor event, while in addition there were the open-air attractions of the White City and the Crystal Palace, all of which led London visitors to defer their visits to Olympia to the later weeks.

It may be that the official exhibition advertisements were inadequate to stimulate the public interest, and perhaps they were not attractively designed, but it is also the fact that exhibitors were little inclined to give the Press that advertisement support which, unfortunately, seems to be necessary in order to ensure for an event proper editorial recognition.

The management detail the measures taken by themselves for the ample display of posters everywhere, and they complain of the failure of exhibitors to give them reasonable assistance in this respect. The amount officially spent in advertising the exhibition of 1911 was greatly in excess of that spent on the 1905 show, it being approximately 10 per cent. of the revenue. We agree with the management that, at an exhibition of this kind, where every exhibitor is present primarily for the purpose of his own business, there are real objections to the grouping of competitive exhibits of a like class; furthermore, such an arrangement would involve the goods of larger firms being scattered in a number of places in the Hall. As a matter of fact, the cooking apparatus firms unanimously decided that it would be against their interests to have a collective exhibit. No business man needs to be told the reason for this attitude.

The organising managers contend that almost every practical suggestion that has been advanced by way of criticism had already been anticipated before it was tendered, and, as we have shown above, their conclusions were issued before some of their critics had completed their inquiry. So far as the managers are concerned, the conclusions arrived at as the result of the month's run and the discussions arising out of it, are as follows:—

They hold that, for future electrical exhibitions, the policy recently adopted at Olympia should be modified, first, by the abolition of the half-crown days. We are in the completest agreement possible here, as we have held that view tenaciously from the first. Secondly, they recommend that exhibitors be supplied with tickets in unlimited quantities, "with the liability that all such tickets as reach the management through the turnstiles of the exhibition shall be paid for at the rate of 6d. each. This probably, however, would tend to a reduction of revenue on ticket account." Thirdly, they hold that the duration of the exhibition should be restricted to three, or conceivably two, weeks only. This is specially recommended in view of the small amount of heavy machinery that is exhibited, but it may not meet with general approval. Lastly, they consider that before another Electrical Exhibition is decided upon, definite arrangements should be made with the supply authorities to ascertain exactly the amount of support that they are willing to accord by way of purchase of tickets, it being recommended that for a large Exhibition this purchase of tickets should be not less than £50,000 to 200,000. It is further recommended that the arrangements with the supply authorities should be for the sale to them of tickets outright at 3d. each. "Were arrangements made with the supply authorities that they would be liable to pay for all tickets used at the rate of 6d. each, it is most probable that such a method would considerably curtail the large distribution of tickets, and this for obvious reasons."

We have no desire whatever to silence criticism in respect of exhibitions of this character, but we cannot help feeling that no good end will now be served by a continuance of it in the destructive spirit by the indiscreet champions of a few apparently dissatisfied exhibitors. A good deal of water will have flowed under the bridges before the next Exhibition, and doubtless when the time comes for proceeding with the organising of another display, those responsible will profit by all the good, bad and indifferent advice which has been so plentiful of late.

The I.E.E. Articles.

The intensity of interest aroused among all classes of members of the Institution is well illustrated by the letters appearing in our "Correspondence" columns to-day. It should not be deduced, however, from the criticisms levelled at the proposals of the Council that the latter are necessarily at fault; some of the comments put forward, in fact, can easily be shown to be erroneous.

The parallel-column comparison issued by the Council is not an exhaustive analysis of the changes embodied in the new Articles; for instance, the maximum age limit for Students is specified as 26 years in Article 17, which does not appear in the tabular statement.

The question of representation of each class, too, which was put prominently forward in the discussion, and figures in one of our letters to-day, is attacked upon totally wrong premises. It is assumed quite gratuitously that the three Associates, for example, are to watch over the interests of the Associate class. But theoretically, at least, it is the duty of every member of the Council without exception to act in the interests of every class of member and not of any one class alone. For this reason separate representation of the Student class is unnecessary. A more plausible reason for the introduction of three Associates as members of the Council may be found in the fact that the Associate class in future will be composed of men of wide experience and great ability, and it is obvious that the Council will be greatly strengthened by the inclusion of men selected from this class, for the sake of their advice and assistance.

Perhaps the most difficult question to solve is the designation of the new class, for which the term "Licentiate" was suggested. After long consideration of the matter, we are driven to the conclusion that this title is absolutely inadmissible; the objections to it are insuperable. Despite the use of it by one or two other professional bodies in a similar application, by common usage it connotes the possession of full authority to act as a qualified member of the profession concerned. We know of over a dozen instances in which this is the case. The title is altogether too pretentious for the qualifications it would represent as applied to the new class of members.

The title adopted ought to give some *prima facie* indication of the professional standing of the member; it ought to be of such a nature that he will be impelled to transfer to a higher class of greater dignity at the earliest possible opportunity; and it ought to be such that it does not lend itself readily to misuse. Not one of these qualities attaches to the term "Licentiate."

It is useless to find fault without suggesting a remedy, and having spent some hours in the search for a more appropriate title, we can cordially sympathise with the President's comment on the extreme difficulty of the problem. The only title that we can recommend is that of "Junior Member"; this appears perfectly to fulfil the three desiderata that we have mentioned above, and it is a term already in use for the purpose—for example, the American Society of Civil Engineers employs the term "Junior" for a closely similar class of member, next in order to that of "Associate Member." We see no serious objection to the title, while its advantages are obvious.

The mode of election of the Council, we think, might with advantage be modified by a provision that the list of nominees should always exceed by, say, two names the number of vacancies, so as to render it certain that a ballot shall always be necessary. We believe this would remove most of the objections which have been raised to the system proposed.

D

CARBON LAMPS AS HEATERS.

By DONALD SMEATON MUNRO.

The low candle-power metal-filament lamp for high voltages has arrived at last, and it would seem that the carbon lamp will soon be entirely superseded. Manufacturers, contractors and consumers have among them many thousands of carbon-filament lamps which even now are unprofitable to use for lighting.

The writer suggests that these displaced lamps might be used extensively for electrical heating. The ordinary sizes up to 50 c.p. make very cheap, effective and easily replaced heating elements, and they may be used safely with standard holders.

It will be found, as a rule, more convenient to use obscured lamps, preferably run somewhat under their voltage.

The effective heating surface of five 50-watt pear-shaped lamps is considerably greater than the surface area of the standard 250-watt radiator lamp as ordinarily used.

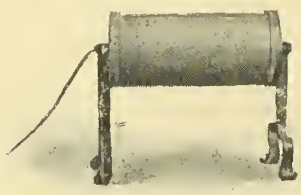


Fig. 1.

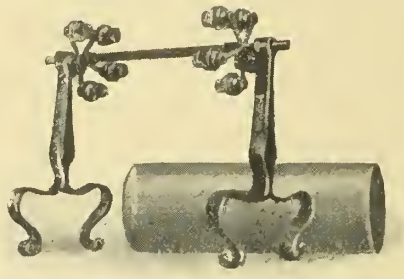


Fig. 2.

As heating energy is generally supplied at low rates, it is necessary to enclose the lamps in such a way as to prevent them giving more than a limited amount of light. This may be done by enclosing groups of lamps in cylinders of coloured glass or in box convectors, the sides or fronts of which may be of special glass or mica.

Carbon lamp convectors may be made of sheet copper so arranged that light does not percolate through the draught ingress and egress. Carbon lamp radio-convectors may be made of finely perforated copper sheeting.

Fig. 1 shows one convenient and cheap form of such a radio-convector which the writer has had made up. Fig. 2 is an inside view, and shows that the central axis is a length of iron tube carrying two brass lampholder spiders. The ends of the tube are screwed so that they may be fixed to stands or brackets by lock nuts.

The lamps are surrounded by a pin-hole perforated copper cylinder about 7 in. diameter × 16 in. long, and two brass end caps hold the cylinder rigidly in position.

As the flexible enters through the central tube, the cylinder is free to revolve; and as a third of the circumference of the cylinder is unperforated, this portion forms a shield or reflector which may be placed at any desired position.

The glow from the perforations has a pleasant sparkling effect which is further improved if a few red lamps are introduced.

When the heater is in use, the inner space becomes at once filled with hot air which pours through the upper pin-holes, and is constantly replaced by air from below.

The lamps are protected from mechanical injury so the apparatus may be applied at the most effective heating positions. Thus the radio-convector may be fitted over a floor ventilator; it may be placed on a window sill, or even screwed to the lower part of a door. The design is suitable for putting under a desk or table, and when large areas are to be warmed, they may be fixed at intervals around the walls or in suitable recesses. A switch or switches may be fitted on one of the brass end caps, but it is more in accord with modern practice to have the switch on the wall beside the socket connector.

When the ordinary carbon lamps become recognised as heating agents, there are many places where they may be utilised with effect.

Long corridors, for instance, which are now ineffectively dealt with by radiators at considerable intervals may be fitted with suitably adapted "Coronation Strip" run along the baseboards and covered in with sheet metal tube. Numerous other applications will suggest themselves.

There are, possibly, some disadvantages in using the carbon lamp for heating—it is not the purpose for which it was designed. But defects are also common to other heating elements. High resistance wire bobbin elements are impossible to repair, they smell in dusty atmospheres, and are sometimes expensive and awkward to replace. Mica slip elements are liable to puncture and short-circuit when the contacts become dirty and loose, and it is sometimes difficult to reach and detach the offending slip. Quartz elements are somewhat fragile.

The public has been more readily attracted by the low lamp radiators than by those of the non-luminous type. The cheerful appearance, and the fact that radiant heat is immediately perceptible by the hand and eye, are factors in the marked popularity of this type of radiator.

The filaments are long and delicate, however, and when placed vertically—as they usually are—they are in the worst position for heating an ascending column of air. Then the current they take is unduly heavy for the standard lampholder.

Some might consider that the use of ordinary pear-shaped lamps would tempt to dishonesty when there is a considerable difference between heating and lighting rates. But one never comes on cases where lighting lamps have been substituted for heating lamps on the existing patterns of open type radiators, and there the substitution could be more readily effected than in the types of closed radio-convectors indicated.

The writer has no wish to belittle the many excellent heaters on the market, but by drawing attention to some of their disadvantages he would perhaps, show that there is a field for the carbon lamp as a graded heat unit, and it is a flexible, clean and cheap unit which may be applied to many new heating purposes.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electrical Enterprise.

On moving to a new house, I recently sent an application for a service to the electrical supply company for my district. They inform me that as my house is 160 yards from the nearest main, they will require a three years' guarantee of a minimum current consumption. I find, from their own figures, that the total payments would come to very nearly the entire cost of laying the extension cable. The new cable would pass a score of good-class houses, some of which would doubtless take current within a year or two of the main being laid, yet I am expected to pay in three years more than half the cost of a cable which will earn profit for the company for the next 20 years or more.

I refused this noble offer, but eventually signed a guarantee for half the proposed amount, thereby pledging myself to spend on electricity nearly twice as much as I should otherwise spend on coal and gas, and to buy enough current to do all the household lighting, heating and cooking. The supply company state that this will not justify the capital expenditure, so I drop into the arms of the gas people, who sell at 2s. 2d. per thousand (against 5½d. per unit for electricity), and who have sufficient faith in the business to lay mains at their own expense.

A. L. Rawlings.

London, S.W.

Thermit Welding.

We notice that in your remarks on the Municipal Tramways Conference, appearing in your issue dated October 7th, you give the percentage of breakages on Thermit welded joints in Manchester, as *3 per cent.* We would point out that, although this figure appeared in the original proof of Mr. Mattinson's paper, it was corrected at the meeting, and should read "*0·3 per cent.*" *over 7,000 joints.*

As regards the apparent discrepancy between the results obtained at Glasgow and those at Manchester and Leeds, we think the following remarks will explain this.

The welding at Glasgow was carried out by the Corporation's own men, and was done prior to 1908, since when no Thermit welding has been carried out there. As was pointed out by both Mr. Mattinson and Mr. Holt, very decided improvements have since been made in the process, and we now always send our own trained men to do the welding, as it was found that the ordinary platelayer did not do the work with sufficient care.

During the discussion on the paper, Mr. McElroy, the general manager of the Manchester Corporation tramways, attributed the results obtained by them to a great extent to the fact that they now employ our welders.

We could mention a number of systems where we have carried out welding within the last three or four years, where there have been no breakages at all, and we do not think a proper comparison can be made between the results at Glasgow and those at places like Manchester and Leeds, where the process is being carried out on up-to-date lines.

For **Thermit, Ltd.**

R. Stutz,
Managing Director.

London, E.C.,
October 30th, 1911.

The Institution of Electrical Engineers.

Perhaps I may be allowed, as one of those most nearly affected by the proposed creation of the Licentiate class of the Institution, to express my hope that the proposal will be carried through.

Having belonged to the Institution for nine years, I am now nearing the age limit for senior students, and, as I have not yet attained that "position of superior responsibility" which is necessary for an Associate Member, it seemed inevitable that there should be a break in my membership. A man who has had a college training and served an apprenticeship in the shops is hardly out of his time at 24, and it is surely too much to expect in these days of overcrowding that he should at once obtain a position good enough to warrant his election as Associate Member after holding it for two years.

It does not matter whether the new class are called Licentiates or Subscribers, but it does seem desirable that something should be done to prevent those who have belonged for some years to the Institution, and are anxious to continue in it, being turned out owing to their not having attained, at the age of 24, the necessary position for Associate Membership.

F. Fawcett Smith.

Southampton,
November 11th, 1911.

The report of the meeting of the I.E.E. on November 2nd, the letters on the subject of the Articles of the Institution in your columns, and your own comments, indicate how sincerely those who have the welfare of the Institution at heart are striving to find the best method of improving its status and scope. But while the claims of Members, Associate Members, and of those gentlemen to be included in the proposed classes of Associates and Licentiates are being considered, permit me to point out that nowhere in print or speech is any reference made to the position of the Students under these altered Articles.

The Student class, I make bold to say, is the most truly representative of the Institution, for all its members are electrical engineers *in esse* or *in posse*. They are the rising generation of the I.E.E., and as such will be more nearly affected by the proposed alterations than the other classes. Yet no notice of proposed alterations has been posted to the Students, no one has voiced their claims and grievances, and it is to be presumed that the majority of the 1,800 Students are quite unacquainted with the details of the alterations. I trust, Sir, that you will kindly give publicity to this letter in your columns, to indicate to Students certain points in the new articles, and to appeal for immediate concerted action to obtain necessary amendments. Practical assistance can be given by the calling of special Students' Section (local) meetings, written support to local secretaries, and by letters to the Council and to the electrical Press.

Turning to the proposed alterations, the first important point is the qualification of a Student. The old Article 16 established a maximum age limit. This has been omitted from the new Article 16, but the old one should be reinserted.

Altered Article 16 Sec. *(b)* states that as an alternative qualification the candidate must be "pupil, apprentice or assistant under agreement under a corporate member." To this should be added "or pupil or apprentice to any approved firm of electrical engineers, approved supply company or municipal undertaking," and the words "under agreement" should be deleted. Reasons: First, there are many eminent firms who do not make such agreements with pupils, and, further, one such firm has at the present moment only one corporate member (who takes no active part in the business) but 20 Students on the staff. Of these 20, approximately 12 are apprentices; are then these Students to be disqualified? Their case is not covered as the Article stands without my proposed amendment.

With the examination for transfer we all agree, but as grounds for exemption should be inserted the obtaining of a Student Premium or the acceptance of a paper or original communication for publication in the *Journal*.

We must next consider the question of subscription. It is proposed to increase this to 1½ guineas for Students over 19 years of age. Why this distinction? What greater advantage is he to gain than his younger colleague? The Student of 21 is usually just beginning to be self-supporting on a meagre income, and is much less able to pay than the younger one supported by his parents.

Students can only agree without protest to an increased subscription all round if they can obtain the concessions for which they have long pleaded, and of which they stand in urgent need, viz., the publication of Student papers; increased allowances for printing and clerical expenses; refreshments after meetings; subsidies for long-distance visits; a free lending library; and payment of Student delegates' expenses. When it is remembered that an increase of half-a-guinea all round raises £900 extra, these claims can easily be met.

We must, however, protest strongly against the increased transfer fee, as this, with the examination fee, imposes a double increase of contribution. As this entrance fee increase cannot bring in more than £150 per annum in a total of £4,500 proposed increase of income, is it commensurate with the extra individual burden on the most poorly paid of the profession?

By Article 27 Associate Members on the register as such prior to December 31st, 1911, pay 2½ guineas, those on the register after that date paying 3 guineas. I suggest the addition of the words, "Associate Members on the register of that class prior to December 31st, 1912, and who were on the register as Students on January 1st, 1912, to pay annually 2½ guineas." (Or, if the maximum subscriptions be reduced from 3 to 2½ guineas, then this class to pay 2 guineas.)

My reason is that there are many like myself just about to apply for transfer to the A.M.I.E.E. class; if we can be transferred this year, our perpetual subscription as A.M. is one half-guinea less than if we transfer later. But it gives us no time to obtain the necessary signatures and for our

application to take the prescribed course before the end of this year.

Finally (and these points all support my statement), the Council are out of touch with the Students, and I therefore propose that if it is not possible to be incorporated in Articles 44 or 49, it be entered as a minute of the Council "that three Student delegates (non-voting) be appointed, to be called in conference with the Council when any matter affecting the Students is to be discussed, and that these delegates may request the Council to put such matter on the Agenda."

I appeal to all Students to unite heartily in the present endeavour to improve the status, the utility and the benefits of the "Students' Section," and thereby assist the Council in their desire to promote the welfare of the Institution.

Adolf R. Stelling, *Student I.E.E.*

Manchester, *November 11th*, 1911.

[The maximum age limit is still included, having been placed in a separate Article.—Eds. E.R.]

The proposed new rules have provoked considerable criticism from every class of membership except the one which they most nearly affect, namely, the Students. This is accounted for by the fact that in accordance with precedent—that word which has always been the curse of the I.E.E.—the Council omitted to circularise the Student members, who, like children, are supposed to be seen (and pay) but not heard. As no effective machinery exists within the constitution of the I.E.E. by which Students can in person impress their point of view, it is only possible to air grievances by breaking out occasionally in print. Knowing the Council's dislike of newspaper criticism, this, one would think, should stir them to action, but no—instead, they continue on their way, marking their elevation, in Emerson's words, chiefly by the innocent serenity, which, with babe-like Jupiters, they sit in their clouds and from age to age prattle to each other and to no contemporary, heeding not the petitions and complaints of those they represent or more truly do not represent, and consequently the position of I.E.E. Students is not improved.

The patience even of Students is limited, and the action of the Council in bringing forward the new rules in their present form is calculated rather to lead to wholesale resignations than to transfers.

Consider the position of the Student member. To ever get into the I.E.E. as a Student, it is necessary that the candidate should have electrical knowledge, and be in effect engaged in studying electrical engineering as a profession. Under the existing rules Studentship is the only rank for which definite qualifications as opposed to mere eminence are required. The very fact of a man joining as a Student means that he is making electrical engineering his life's work, and will ultimately pass into the higher grades. Therefore, whatever tends to alter the conditions of membership of these higher grades, or entrance into them, or the general status of membership of the I.E.E., affects him more acutely than it does any other class, and consequently calls for his most careful consideration. Therefore, in my opinion, although we Students are even under the present rules outside the constitution, we owe no apology to anyone for entering this discussion on terms of absolute equality with the members of those other grades which we shall in time enter.

Their interests are our interests, and our interests should be theirs; we will help them—let them help us.

To go through every point in the proposed rules which affects the Student would necessitate a special number of this paper. Briefly, the more important principles (apart from the question of rewording and extending most of the clauses) are the following:—

1. The division of membership into grades, and the designations of these various grades.
2. The qualifications for each grade.
3. Transfer from lower grades to higher grades.
4. Entrance fees and subscriptions.
5. Constitution of the Council, and the method of its election.
6. Voting powers of all grades.

I hope every Student will obtain a copy of the new ru and, after carefully considering their present and futu effect on Student members, will make known his views writing to his representative members on the local Stude Committees at London, Manchester and Glasgow; to Committee of his local senior Section; and also by letters the Press and to the Council.

There is no time to be lost; the matter must rece immediate consideration, and amendments to the vari clauses must be sent in without delay. Collective effort is bei made in one centre at least, but members must not wait this; their individual action will strengthen, not weaken, efforts of their committees.

Among the points which call for mention is the quest of minimum age limit. This condition, when tacked on the qualifications, becomes absurd, and has given rise difficulties before now. If the qualifications are satisfi what has age to do with it?

The admission of non-electrical people, however emine to the highest class of membership will not add to the sta of membership, nor does it help to make it clearer that ev Member is warranted to be an electrical engineer, as M Hammond seems to think it does. These eminent perso should be given a class by themselves, on the same plane regards rights and subscriptions as full electrical Memb but distinguished from them by name. For this class, name of "Honorary Associates" seems quite suitable.

The name of Licentiate is particularly unfortunate, as, spite of dictionary definitions, it is associated in the pub mind with permission to practise a profession, which, I ta it, a "Licentiate I.E.E." is distinctly unqualified to do.

One cannot congratulate the Articles Committee or Council on the new rules. If this is the result of months' hatching, something must be very addled.

Mr. Hammond seems to think that the dignity membership in the I.E.E. is conferred by the possession a certain building; this is perhaps so, the I.E.E. has nev done very much good for its members. The line of argume which he adopts, however, is ridiculous, and is rea equivalent to saying that if Mr. Hammond owned a sta he would be a horse.

If the members had been given reasonable time to refle they possibly would never have committed themselves to scheme which is beyond the resources of the Institutio The increased expenditure in the way of using more of t building, seems to be a sort of attempt by the I.E.E. become its own tenant.

The Council are granting the use of the Institut building to 13 other bodies; it is to be hoped that rent being paid for this. It is all very well to be hospitable wh the resources allow it, but not otherwise, and there is no s of obligation on the part of the I.E.E. to act as fairy g mother to the electrical industry.

Mr. Hammond gives a comparison showing h economically the I.E.E. manage compared with oth institutions, but no mention is made of rent or upkeep buildings. This item would show where the trouble li and would expose the penny-wise and pound-foolish policy our Institution. Even if the increased subscriptions through, the extra benefits will not be of much use country members. Why should these men pay three tim as much for their Local Section meetings, simply because being in the I.E.E.? Membership is not worth it no and certainly will not be under the new rules.

What I.E.E. members want for their money is not expe sive buildings, but personal and professional advantages.

In conclusion, let me once more ask all Students to tal effective means at once to secure the complete revision of t proposed rules.

H. Ambrose Carney.

Nutsford Vale Works, Manchester,
November 11th, 1911.

[The Institution cannot demand rent from societies which its rooms are lent, as in that case it would becon liable to very heavy taxation. We believe, however, that a expenses for lighting and heating, &c., are defrayed by the societies.—Eds. E.R.]

Quartz in Electrical Heaters.

Referring to Mr. C. O. Bastian's letter on this subject in our current issue, we beg to assure this gentleman that his remarks concerning his electrical heaters do not interest or appeal to us in any way. A correspondent put forward a claim for Mr. Bastian to be considered as the first to use quartz for electrical heating purposes, and we pointed out that this claim could not be sustained in view of the fact that this material had been used for the purpose for a number of years. We have quoted a few of the better-known firms using the material, and there is no question of their non-existence or non-use of the material, notwithstanding anything to the contrary that Mr. Bastian may say. We are sorry to learn that Mr. Bastian has not met anyone who has seen quartz used except for laboratory purposes; but this is his misfortune, which can, no doubt, be easily remedied if he chooses, probably with advantage to himself. It is probable that quartz apparatus, as manufactured by other firms, differs from that designed by Mr. Bastian, but we mentioned these points of difference in our letter contained in your issue of October 6th. The oldest application of quartz to electrical heating purposes, and that employing the largest units, that we are acquainted with, is the construction of electrical furnaces intended for the purpose of hardening steel tools, drills and dies, &c., in which a quartz muffle or tube is used, working at a temperature of 2,500° F., and consuming from 600 watts to 5 KW. We are not aware that these are used in laboratories; they find their largest application in engineering works, &c.; we have also supplied them for the manufacture of artificial teeth. This, of course, constitutes merely a single instance; there are also numerous others applicable to domestic and ordinary commercial purposes.

Paterson & Co.

Newcastle-on-Tyne, *November 13th*, 1911.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers.

The year's opening meeting of the session was somewhat exceptional, in that the presidential address was omitted, Mr. Ferranti continuing in the office the duties of which he so ably performed during the last session.

As usual, the early part of the evening was given up to the distribution of the premiums, exhibitions, &c., awarded in connection with the last session's papers, a list of which appeared in our issue of June 2nd.

The attendance was rather smaller than on similar occasions, and the absentees among those who should have been present to receive the awards were numerous.

At the close of the distribution, the first paper of the session was read by Mr. J. F. C. Snell, in the absence of the author, Mr. Wm. Taylor. We shall publish an abstract of the paper in our next issue.

The Present Position of the Electrometallurgy of Iron and Steel.

The last two meetings of the Faraday Society, held on October 2nd and 17th, were devoted to the consideration of three papers dealing with different aspects of the electric smelting of iron and steel. On both occasions Mr. F. W. Harbord, one of the Vice-Presidents, presided over what proved to be most instructive meetings.

The paper by Mr. Donald F. Campbell surveyed the subject from quite a general standpoint, although, as was to be expected from an engineer so closely associated with M. Héroult, he laid special stress on the achievements of the Héroult furnace, which, indeed, is now making remarkable strides, both in Europe and America. One of the principal factors on which depends the success of electric smelting is, of course, the cost of power, but it is a great mistake to suppose, as so many do, that it is the only factor of importance. The substitution of electric smelting of the ore for the blast furnace method of direct recovery of iron or steel is, for example, a proposition that would have not the slightest chance of success in countries like England or Germany, no matter how cheaply power could be generated. In Sweden, however, and on the Pacific Coast of America, where water power is plentiful, coking coal scarce or absent, and timber for charcoal abundant, the electric furnace enables iron smelting to be carried out with complete success, and the next few years will doubtless witness a development of the iron industries in the afore-mentioned countries that will prove to be of the greatest interest and importance. In Sweden such smelting operations are being carried on at Trollhättan, where a 50,000-H.P. plant has been installed, and at Dömnarvet, while in California there are the 2,000-KW. furnaces at Héroult. In both countries large deposits of very pure iron ore are available, and so long as electrical energy can be obtained for less than 33s. per KW.-year in Sweden, and 50s. per KW.-year in California, iron can be smelted electrically with an adequate margin of profit.

The refining of steel electrically is altogether a different problem from the smelting of iron. Here the cost of power is not the governing factor, and countries like England and Germany, where the manufacture of iron and steel by present methods is an established industry, have nevertheless much to gain by the adoption of the electric furnace, as at least an adjunct to existing plant. It may be noted that the world's output of electrically refined steel has risen from 30,000 tons in 1908 to 120,000 tons in 1910. The assured future of the electric steel furnace depends on its remarkable refining properties, brought about by the great heat easily attained. On this account, pure steel of excellent quality can be obtained from quite inferior ores, even under normal conditions in England, where power may cost anything from 0·4d. to 0·65d. per KW.-hour. The power consumption has been reduced during the past two or three years, by continuous improvements in details of furnace construction, from 750 units to 575 units per ton, equivalent to only some 24s. a ton with power at ½d. a unit, while the difficulties which once ruled as regards obtaining satisfactory electrodes have now according to Mr. Campbell, almost entirely disappeared.

For the manufacture of the best steels, the future will probably be entirely with the electric furnace, but will it, used in conjunction with the Bessemer converter, ever be able to compete generally with the open-hearth furnace for ordinary grades of constructional or rail steel? This problem is now receiving careful attention at the hands of American and German engineers, and several 20-ton furnaces are being erected to prove the economic possibility of the duplex process. The harvest for the electrical engineer in this direction may be a very great one, for in Germany alone 250,000 KW. would be absorbed by the steel maker.

Mr. John Harden's paper described the "Paragon" electric furnace, and dealt generally with the present position of the induction furnace. It will be remembered that the original Kjellin induction furnace was a melting furnace pure and simple, and was only of use for the purpose of obtaining pure steel from the purest scrap or Swedish charcoal iron. The small slag surface and comparatively low slag temperature precluded refining from taking place. The first step in advance was illustrated by the Roechling-Rodenhauser furnace, in which side electrodes were introduced, and the steel heated on the resistance principle, as well as inductively. For refining to take place most effectively, however, it is necessary to heat the slag to a very high temperature, and therefore in the "Paragon" furnace, the surface of the slag is heated by means of arcs. In this way the maximum heat can be applied exactly where desired during desulphurisation and dephosphorisation to the slag, and during the degasification of the steel through the body of the metal by means of the current entering the side electrodes or, if preferred, inductively. The furnace is thus a combined arc and resistance or arc and induction furnace. Why, then, not have arcs only, and do away with the resistance and induction principles entirely? Mr. Härdén contends that on the one hand smaller electrode consumption, and, on the other, a higher power factor, render the combination furnace an advance over either method used separately. The discussion brought forth a considerable amount of technical criticism which centred around the efficacy of the side-electrodes, but experience alone can be the ultimate judge as the value of a device of this kind, which has much to commend it on the surface.

Mr. Harden also described a small melting furnace known as the "Helberger," which is suitable for making special alloys on a small scale for laboratory work. It consists of an ordinary high grade plumbago crucible, lined with refractory material and heated electrically by induction. Temperatures up to 3,000° C. have been obtained in it quickly and at moderate cost, and it ought to find a wide sphere of usefulness in up-to-date works' laboratories.

Mr. E. Kilburn Scott gave a short description, and opened a somewhat lively discussion on the "Hering" pinch effect furnace. This ingenious furnace has already been described in the English periodicals, but its essential features may be briefly recapitulated. The "pinch effect" is the name given to the contraction—electromagnetic in character—of a liquid conductor through which a heavy current is passing. Mr. Hering uses this effect to bring about rapid circulation in the molten mass of an electric furnace. The current enters and leaves the bottom of the furnace through vertical metallic electrodes contained in resister tubes, made of magnetite or alundum, which are very small compared with the bulk of the furnace. The "pinch effect" operating in these tubes, a vigorous fountain-like circulation of the molten mass takes place above and around the resister tubes, on account of their lower ends being closed by the electrodes. So vigorous is the stirring that heat is thereby transferred from the resister tubes to the whole of the charge above.

The main advantage claimed for the furnace is its inherent simplicity. Any open-hearth furnace can be transformed into a Hering furnace by merely inserting resister tubes in its bottom, and the electrodes being made of metal, the difficulties of carbon electrodes do not arise. To obtain the high currents at low voltage necessary to operate the furnace, Mr. Scott recommended the use of the homopolar machine, a new form of which was to be seen at the recent Electrical Exhibition at Olympia.

From some further particulars communicated to the meeting by

Mr. Hering himself, it appears that a number of small experimental furnaces have been built for trying various metallurgical processes, and in these satisfactory results had been obtained. Steel had easily been melted, and no difficulties were anticipated when they came to work the furnaces of 1-5-ton capacities now under construction. The proper proportioning of the resister tubes had involved the determination of the electrical resistivities of iron, steel and ferro-alloys at high temperatures, and the necessary data had now been obtained.

The furnace, though admired for its ingenuity, was subjected to some severe handling, academic be it admitted, in the course of the discussion. The resister tubes at the bottom of the furnace in particular gave rise to expressions of grave misgiving, particularly as they, or rather the electrodes in them, had to be water-cooled. Further, the circulation of the metal through the tubes would wear them away, and once enlarged to any extent, the calculated current would not flow through the furnace. A serious difficulty would arise with direct currents, if the tubes became conductive at high temperatures. Mr. Scott replied that the danger of water-cooled electrodes had been greatly exaggerated, and most of the criticism passed applied equally to the tuyeres of a Bessemer converter. Experience on a small scale, at least, had not given rise to the troubles anticipated, and anyhow the construction of large furnaces was being proceeded with.

Higher Education: Some Views of a Teacher Employer.

By W. Cramp, M.I.E.E.

(*Abstract of Chairman's address delivered to the* Institution of Electrical Engineers, *at Manchester, October 27th*, 1911.)

Everyone of us must at some period have asked himself the question—"What sort of higher education is best?" It is largely because I know that both technical schools and Universities are now turning out men useless to employers, that I have ventured to deal with this urgent matter.

At the outset it is well to clear the ground by defining what we intend to consider. Spencer has given a well-known classification of the kinds of activity which constitute human life. Of his divisions, I take three as involved in the education to be given at a College or University, viz.:—

1. Those activities which, by securing the necessaries of life, indirectly minister to self-preservation.
2. Those activities which are involved in the maintenance of proper social and political relations.
3. Those miscellaneous activities which fill up the leisure part of life, devoted to the gratification of the tastes and feelings.

It seems to me that in a modern college the tendency is to forget the second and third divisions in laying stress on the first. Is it not exactly in this that the older Universities differ from the modern educational institutions?

If you agree, then, as to the necessity for attention to all three divisions of human activity, we are at once faced with an exceedingly awkward problem. It has been proved to the hilt that acquaintance with science (*i.e.*, with co-ordinated and rational knowledge) is of fundamental importance. Recognition of this fact has led to that extraordinary educational revolution which, by replacing one or two old subjects and adding a host of new ones, has rendered all courses from the elementary school to the University intolerably superficial and unsatisfactory. Yet this congestion is due to a consideration of the first division of our subject only. How, then, is it possible for us to add two more sections without producing more congestion and superficiality?

The true responsibility for the revolution is to be laid at the door of the old school, which was pioneered by Huxley and Spencer.

They were, without doubt, right in principle, but their doctrines have been carried too far, with the result which we lament to-day. Without denying the value of that sort of knowledge upon which the Huxley-Spencer school set such store, we must so limit it in quantity and order it in quality that it shall take its proper place in the first of the three sections, leaving appropriate time for all that is included in the other two.

This, I think, may be compassed by keeping in view two main objects. The first is the co-ordination and arrangement of the various paths leading from the infant school to the finishing school or university. The second is the proper planning of higher education, so that it is correlated with the succeeding paths in life.

In a letter to me from the late Prof. Ayrton, dated April 19th, 1902, he says:—"The great difficulty about the third-year men's training is our not knowing what branch of electrical engineering they are going to take up."

Precisely, and even if this were always known, it would not follow that it was the branch they were going to stick to. As an employer, the first fault that I have to find with my own students is the narrowness of their field of vision—the inflexibility and too great specialisation of their knowledge. Employers do not want men who can only do one thing properly. I am asking that every man who leaves a technical college shall possess, first, a wider scientific knowledge; and, secondly, wider general culture. Thus only can they obtain, with ripened experience, that greatest asset to the community—sound judgment in all things. And now, if I go back from my position as employer for a moment, and consider myself again in the position of teacher, I ask myself, first, what is lacking from higher education at the present day; and, secondly, how can that want be supplied? As an answer to the first question I submit:—

First, that higher education in practice, if not in theory, aims at producing a finished and specialised animal instead of a plastic, well-informed and broad-minded man. It aims at producing sort of industrial bee instead of a rational being. It is no mo possible to produce a useful specialist in turbines, wireless tel graphy, or any other branch of engineering at the age of 22, tha it is to produce a first-rate brain, ear or eye specialist. The ver idea of the latter would be regarded as ludicrous, but the former always expected. At the age mentioned we ought hardly to expe even such elementary differentiation as distinguishes betwee electrical and mechanical engineers.

All specialisation should, I think, be provided for later, either b higher University training or by experience in the ordinary wall of life. Think how such a change in the curricula would simplif the whole problem of education! It would relieve the tension i primary and secondary schools enormously. It would produce th type of men that we, as employers, really require, and it is the onl way, in my opinion, of providing time for all the training which to produce greater "width of field of consciousness."

Such a reform would fit in perfectly with the scheme of educa tion proposed by Dr. Pohl, for it would standardise a genera curriculum in all technical schools and colleges throughout th country for the first three years of training, while higher trainin than this could be given at scholarship-aided centres.

The scheme also fits in well with the dovetailing between manu facturers and training colleges, recently discussed at the meeting o the I.C.E. Let us suppose the varieties of training divided accord ing to the general professions to which they are intended to lea and during the ordinary three years of higher education let n specialisation by further sub-division be permitted.

There is, as far as each general course is concerned, no necessit whatever to distinguish between so-called "pure" and "technical" thus will one of the greatest modern bugbears be abolished. refer to the stupid rivalry between the so-called theoretical an practical men.

The general course corresponding to each profession should b arranged so as to cover Spencer's three divisions. There woul thus be in each case training in:—

1. The science appropriate to the profession.
2. Social and political and commercial relationships.
3. Language, literature and art.

Each division should have its appropriate manual training an practical work.

Section I.—This is the one section at present considered by da colleges. It should be generalised and broadened; I think that ca be done by fusion, simultaneous teaching and correlation of a the usual subjects.

All knowledge is correlative, that is to say, we know only an learn only by reference to impressions and sensations alread received and labelled. This immediately suggests analogy as on of the easiest ways of learning, one of the most interesting metho of teaching, and one that is likely to lead to the greatest width o consciousness if properly applied.

All the while the student, in whatever region of science he working, is always measuring, always interpreting one physic phenomenon in terms of another. For him knowledge is an ha monious whole. This is the very ideal of the teaching of science that there shall be no watertight compartments—no separa "subjects."

The aristocratic exclusiveness of the "professor" must go, th democratic communion of the philosopher must supervene.

Section II.—We turn now to the second section of my propos general course, which I have termed "training in social, politic and commercial relationships." I regard any well-regulate function at which student rubs shoulder with student unde conditions of control, voluntarily imposed and maintained by th students themselves, as practical work in this section. It is th section that produces manliness (so woefully lacking in man technical schools). It is this section which distinguishes the olde from the more modern Universities. But the older Universitie fail grievously in one direction, for while they develop manliness they also develop (towards outsiders) that collection of characte istics called "side."

While the common life at the University is to some exten restricted and narrow, in another sense it is very wide and free. It is a thousand pities that the consensus of opinion which forms th limit of the free path of the University atom in certain direction allows of and even encourages so much laxity. Anyone who ha talked intimately with Oxford or Cambridge men must have bee amazed at the toleration, and even approval, of loose morals an easy living countenanced at those Universities; countenanced, o course, so long as certain trivial social canons are not broken.

In another matter the width and freedom accorded to the undergraduates is extremely salutary, as, for instance, the divisio between work and play. The problem, then, is how to retain th advantages of a non-residential college while adding the beneficia effect of—

1. Freedom of action and individual responsibility (competition)
2. Corporate life and social responsibility (co-operation).

I suggest that in ordinary day colleges and technical schools th first of these must be encouraged by the provision of a principa and staff who are, in the best sense of the words, men an gentlemen.

Yet in the selection of a college staff, how little notice is taken o these things; still, either a University degree or original work is th chief reason for the selection of a teacher.

I believe it to be absolutely essential for the student to feel tha every member of the staff is utterly incapable of a mean or dishonou able action. Next in importance to choice of staff is confidence i the student, which must be shown by omission of unnecessar register signing, checking of hours, insistence on attendance an general shepherding.

To produce useful men for us employers, the fullest scope should be given to confidence in the individual, in order to foster the idea of individual responsibility.

Directly connected with the individual responsibility is that supple quality "initiative," than which none is more useful to employer and employed. It is a quality that cannot be really inculcated, but it may very easily be inhibited. What wonder is it that, within the cold confines of public school and University, with their "good form" and set expressions, this glorious quality sickens and soon dies?

What shall we do, then, to be saved? One thing only, it would seem, is of any avail. Remove from the University course every influence that can stunt the mind. Give width and play and freedom to every legitimate learning, and you shall see the initiative of the child blossom again in the man. Encourage suggestions, questions, modes of proof, independent reading and thought.

If some scheme involving effort on the part of the student to enable him to retain his opportunities could be devised for our colleges, we need never bewail the loss of initiative. I suggest, as a possible plan for engineers, that each year they should be required to have earned a stipulated part of their school fees by work in a recognised trade or shop. These fees might under a systematised arrangement with the employers be paid exactly as wages, but in metal checks, which would be honoured by the local technical school or University.

Corporate life and social responsibility is a less difficult matter to deal with. How it is gradually inculcated at the older Universities is very well known.

There is a well-graded community of interest in all manner of matters, allied but separate from the actual degree course. Undergraduates must willy nilly in a thousand ways be brought into contact with lines of thought distinct from their own special course. It is this which gives to the thoughtful man breadth and culture; it is this which we must in the newer universities replace and amplify. Those desirable results (directly due to residence) we must provide for in other ways, chief of which are in the University Union and the Athetic Union. This section is to be common to all the students, and therefore the artificial barrier now existing between men taking different courses would naturally be destroyed and a healthy interchange of opinions would result. In this section there remains still a most difficult side of social education to be dealt with. I mean the moral side. For employers it is essential, if business morality is not to fall to the low level of some of our Continental neighbours, that their empolyés shall be capable of acting even against strong temptation upon sound principles. Now in a non-residential college, "atmosphere" is almost out of the question, yet "tone" and a proper attribute of mind towards life in general must be somehow imparted. In this connection it is significant that in all the stages of Japanese education "morals" come first. In Western education they are hardly mentioned, except in a whisper. The first care must be as regards the choice and training of the teaching staff, through whose influence and example most of the effect will be most naturally produced. Here then again is an argument for the most rigid care in the selection of teachers, and for the most ample provision of opportunities for intercourse between students and staff.

Section III.—Of those activities which fill up, or should fill up, the leisure part of life, I have already mentioned some in Section II. Indeed, it is very hard to separate these two divisions. How can a love for, and an interest in Nature, literature and the fine arts be stimulated in the college student? The answer is very much as before—by the influence of great teachers acting upon a mass of colliding minds. I can see no other way. To an intelligent teacher opportunities occur almost daily of developing similar sensibilities. I do not see why even the colouring of a scientific diagram should be allowed to be crude, and there are many instances where artistic feeling has incidentally a very real commercial value. To electrical engineers the familiar instances of arc lamps, fittings, and even the shape of motors, will occur at once. In this section, perhaps more than in any other, the effect of breaking down the division between students preparing for different professions would be felt.

To sum up, then, I may give my answer to that question with which I began in a very short form.

The best higher education is that which prepares best for those three great kinds of activity which I have selected from Spencer's five.

The means for carrying this out are in my opinion these:—

1. The division of Technical Colleges and Universities into two sections, viz., the General and Specialised.

2. The arrangement of a course suitable for each of the five great professions at every "general" school.

3. The course for each profession is to embrace training in the three sections, which correspond to the three forms of activity.

4. In order to give time for all three sections and to inculcate general principles thoroughly, the first section (which now occupies all the time) should be taught as broadly as possible.

5. As but few of the colleges can be residential, the second and third sections, which embrace social and æsthetic activities, must be specially provided for.

6. This special provision would take the form of (*a*) a most carefully selected principal and staff; (*b*) avoidance of unnecessary restraint; (*c*) an arrangement by which the student should know that he was dependent upon his own efforts to remain at college; (*d*) proper opportunities for social intercourse, not only between student and student, but also between staff and student; (*e*) definite official encouragement of University unions, literary and debating societies, and æsthetic and athletic clubs.

I believe that even a day college organised on these lines would produce the man who is needed by the world and valued by employers. For it seems to me that for the provision of such general training there is nothing indeed lacking, but the will to organise, for the buildings and equipment exist, and the money is at hand.

The employer is crying out for men of bigger character and broader mind, and the parent is wondering why his son is an engineer but not a man.

We have, in fact, followed too far into a deep and narrow valley, the "Will o' the Wisp" of industrial Science "subjects." The descent was easy, to retrace our footsteps is impossible, but to climb again to the upper air where we may breathe again with more freedom *hic labor hoc opus est.*

Electricity in Iron and Steel Works.

By Walter Dixon, M.I.M.E., M.I.E.E.

(*Abstract of Presidential Address to the* West of Scotland Iron and Steel Institute, *October 20th*, 1911.)

The past 10 years have witnessed great developments in the power installations of iron and steel works, and great advances have been made since the time when economies in fuel consumption had to be first seriously thought about. Of late years attention to fuel consumption has ofttimes secured remarkable results.

One of the first and important incentives to steam saving in isolated engines occurred when it was found possible to transmit power electrically over large areas. Since that time electricity for motive purposes has become more or less universal in all auxiliary plant, the power for which has been generated in the steel works themselves, or, in some districts taken from a public supply.

So far as our own district is concerned, the electrification of works has hitherto been confined to what may be termed auxiliary plant, and, so far as rolling mills are concerned, has, up to now, only been applied in the case of the continuous running sheet and bar mills. Electricity, as applied to reversing rolling mills, with one or two exceptional cases, has not been adopted in this country, notwithstanding its extensive and largely extending adoption on the Continent. Such mills have been in use for four or five years, during which time, I believe, there has not been recorded any serious charge against them, and there are no adequate grounds for supposing that the maintenance and life of a properly designed electrical equipment will not compare favourably with steam driving.

In one sense the matter has been surrounded with difficulties, inasmuch as, while it is possible, owing to the easy and accurate methods by which electricity can be measured, to state exactly what power is required for any particular process or part of a process, no such record is possible with steam plant.

It was in our own district, in the year 1896, that blast-furnace gases were first utilised in a gas engine by the late Mr. James Riley in conjunction with the late Mr. B. H. Thwaite, with which installation and experiments I was concerned. The plant, though on a small scale, was entirely successful, but advance in this country was slow, for one, amongst other reasons, *i.e.*, that while, at that time, the possibilities were seen and appreciated, our leading gas-engine makers, notwithstanding all the inducements which were put before them, were not disposed to develop a large gas engine—a decision which some of them have lived to regret. Almost simultaneously with these experiments, the idea was being taken up by the Cockerill Co., of Seraing, with Mons. A. Greiner, who also saw the possibilities, and were prepared to, and did, themselves develop the necessary plant. It was owing, to a large extent, to this pioneer work being done by the Cockerill Co., that our British ironmasters were willing just to watch developments, though a further fact must be mentioned, viz., that many of the steel works had no blast furnaces, while many of the blast furnaces had no steel works connected with them, and this fact had a more general application to Scotland than to England.

It is now recognised that blast-furnace gases used in gas engines can develop not less than twice the power which can be developed in steam engines using gas-fired boilers.

Abroad, blast furnaces are generally associated with steel and other works requiring power, and the rapid increase in the number of gas engines now employed on blast-furnace gases shows to what extent the possibilities have been recognised and taken advantage of.

Statistics published in the *Iron and Coal Trades' Review* show the distribution amongst various countries of 1,033,509 B.H.P. of large gas engines, as follows:—

	B.H.P.	*Per cent.*
Germany	480,428	46·5
America	337,490	32·5
France	55,050	5·4
Belgium	46,714	4·6
Austria-Hungary	25,500	2·4
Great Britain	24,986	2·4
Other countries	63,341	6·2

This power has been used in the various industries, as follows:—

	B.H.P.	*Per cent.*
Iron and steel works ...	855,819	81
Collieries	68,200	6
Electricity works	34,950	3
Other works	74,540	7

The advent of the electrically-driven reversing rolling mill, bringing, as it did, the possibility of practically dispensing with steam, at once opened up the way for a large economy, by the practical elimination of the boiler range, and utilising the available gases to the full. This is, in my opinion, the reason of the advance in the adoption of the gas engine on the Continent and in America, and it remains for us to consider how far our own industry can be put on a similar basis.

A steel works cannot safely depend on a large and regular supply of power where only two or three blast furnaces are in use, the working of the furnaces not being sufficiently regular, nor the gas sufficiently constant, either in quality or quantity. These difficulties could, to a large extent, be got over by the introduction of a comparatively inexpensive gas-producer plant acting as a stand-by. Gas has replaced steam in a few works in this country, and the idea that such projects are economical has been confirmed.

Steel makers abroad have their power, practically speaking, for nothing, while, in many of our own works, almost every horse-power must be developed by the actual utilisation of coal in steam boilers. The time has surely gone by when a British steel maker should hesitate to get his power generated by gas engines. Too many works now successfully depend on such engines to warrant any hesitation, and it may now be taken as a fact that a properly equipped gas engine station, on modern lines, is as dependable as any other type of station, and the power can be obtained by this method for, let us say, one-half the coal that is being expended at the present time where boiler firing is resorted to.

Gas engines up to 5,000 H.P. can now be obtained to give out 1 H.P. for about 1¼ lb. of coal, which coal can be gasified in producers of simple and inexpensive type. Gas either used in gas engines direct coupled to mills, or used for electrical generation by means of gas engines, can be far more economically employed than the more or less arbitrary method of boiler firing, where large steam reserves must be kept for intermittent requirements. In this way, and by this method, economical development of power should demand careful consideration, even where blast-furnace gases are not available.

There is, however, another means by which this energy cost can be further considerably reduced, *i.e.*, by the introduction of gas producers coupled with ammonia recovery and by-products plant.

From each ton of fuel gasified, sulphate of ammonia of a gross value equal to, or exceeding, the original cost of the coal is being, and has been for some years past, continually obtained. Fuel treated in a similar way, and with plant adapted to the purpose, is used for gas making, the gas of which is successfully utilised for the heating processes in a steel works, including the melting of steel in open-hearth furnaces. This gas has the by-products extracted from it, which yield a price higher than the original cost of the fuel. Such processes have been working for years, and, within my own personal knowledge, coal has been so gasified to the extent of about 1,000 tons per day.

While the Board of Trade returns show that the country's trade is in a flourishing condition, we have before us facts which demonstrate that :—

1. Of our blast furnaces, many are blown out.
2. Of our steel works, some are closed and others partially closed.
3. Of our iron works, many are running on short time.
4. Many of our skilled and unskilled workers are, of necessity, out of employment, and
5. On the whole, no adequate or reasonable profit, or remuneration, is being earned.

It is taken as a truism in this district that when the Clyde is busy (*i.e.*, when the shipyards are fully employed) trade generally, and especially the iron and steel trade, is also busy. What is the recent experience? During a recent quarter there was a record tonnage of shipping built and launched, while simultaneously the iron and steel works were turning out only a small part of their possible capacity, and that at what has been characterised as rascally unremunerative prices.

A ton of steel can be produced here, and is produced, from the raw materials to the finished article at a cost per ton as low as that in any other part of the world.

For this reason, then, our iron and steel industry has earned its right to exist, and so long as iron and steel are required in our own country, our country should supply such materials, without the necessity of artificial bolstering and inducements. Yet we have numbers of our iron and steel works closed down—wholly or in part—and numerous others working at an output much below their capacity, and hundreds of idle workers watching millions of pounds' worth of what they might be producing being brought into our own country.

Still, assuming that a ton of steel can be, and is, manufactured in this country as cheaply as in any other, one is struck with the low dividends paid by our manufacturing companies compared with those of other countries.

Amongst other explanations of the present state of our industry, I would suggest the following :—

1. The importation into our country of material, resulting in our own works being run at a less than full capacity, necessitating a struggle for existence on the part of the various manufacturers.

2. The fact that imported material is delivered here at less than cost price—in fact, at prices lower than ought to be paid if trade is to be a legitimate exchange of commodities.

It is an error to assume that the evils due to the importing of iron and steel are measured by the quantity so imported. The worst evil is the demoralising effect on our home prices. Where a limited number of buyers exists, along with an unlimited number of sellers, the havoc which can be played with legitimate and honest trade by one "blackleg" seller is incalculable, and, to my mind, is infinitely worse than the question of how much he sells.

To these causes I largely ascribe our relatively poor profits, and they explain, at least in part, the present aversion to entering on large capital outlay.

There are, at the same time, other agencies at work rendering the task of the manufacturer still more difficult.

Recent legislation has tended, and still tends, to the increased costs of labour and raw material.

The legislation of every manufacturing country but our own is actively interested in, and helpful to, its industrial progress, while it is the policy of our State, as such, to take no such practical interest, other than to maintain and endorse a policy of fierce internal, and one-sided external competition, and to discourage, or make impossible, combinations for the protection and preservation of any industry.

There is, however, one kind of trust or combination which our Government upholds (and possibly rightly so) viz., that which goes under the title of Trade Unions, which unions, amongst their other functions, act in restraint of labour at unremunerative prices.

Our iron and steel manufacturing industry will be decimated if it is to be subject to conditions which allow our competitors to under-sell, and so to break a fair selling price, by putting material on our market which, irrespective of cost, can be purchased at less than the price at which we are able reasonably to manufacture; not forgetting, as there appears to be a tendency to do, that a fair remuneration on invested capital is a necessary part of the cost. When and where capital ceases to be remunerative, it will also cease to be available, and industry will cease.

If, as is sometimes alleged, certain of our industries can only be maintained by the purchase and use of foreign material, at a price less than cost, then we truly are in a perilous condition.

To my mind, the British iron and steel industry is not maintaining its relative position, and has not obtained a fair share of the large increase in the world's demands.

I think I shall voice the feeling of everyone here in calling for an inquiry, failing which our iron and steel industry is, in my opinion, destined to a retrograde and dark future.

LEGAL.

The Hythe Telephone Dispute.

In the Chancery Division, on Friday, November 10th, Mr. Justice Swinfen Eady had before him the two motions arising out of the dispute between the National Telephone Co. and Hythe Corporation over the local telephone service (see Elec. Rev. pp. 732 and 773).

Mr. Micklem, K.C., who appeared on behalf of the Telephone Co. in the first motion, The Company *v.* The Hythe Corporation, moved to restrain the Hythe Corporation from revoking or otherwise determining the licences or the right now enjoyed by the plaintiffs to keep poles along the bank of the Royal Military Canal between the Town Bridge and Twiss Road Bridge, and to restrain them until the trial of the action or further order from removing or otherwise interfering with the poles. Although his clients had not taken this view throughout the whole of the negotiations, they were now insisting upon their strict rights, and were claiming that the licences were irrevocable; or, alternatively, if that were not so, then they could only be determined upon proper notice. Having regard to the length of time the poles had been there, and the difficulty of putting in new poles, the company claimed that a reasonable notice would at least give them until next year.

His Lordship: In fact, you only want a notice sufficiently long to tide you over till January 1st next.

Mr. Micklem: Exactly; but, instead, the Corporation proposes to give us until December 27th, and then insist on an immediate removal. The Corporation had apparently entered into an arrangement with the Postmaster-General, under which the latter had agreed that if the former would put an end to their arrangement with the company on December 27th, he would, in the interval between that date and the taking over of the company's system, put down the underground system which they desired. In view of this position, the Corporation had taken a most extraordinary line by insisting on the removal of the poles, and then, when the company undertook to comply with that request, they threatened immediate proceedings. Under an agreement with the company, the Postmaster-General had to take over and pay for the plant in actual use on the day of the transfer, viz., December 31st next. The result would be that if the company's poles in question at Hythe were removed before that day, they must lose the value of that portion of their system, which amounted to about £300.

In answer to his Lordship, Mr. Russell said that the Corporation had never threatened to remove the poles, but they would give no undertaking not to do so. He appeared for the plaintiff in the second motion of Dickens *v.* The Telephone Co., and his friend's motion was really being moved as a counterblast.

Mr. Micklem said that the real question was not between Mr. Dickens and the company, but between the Corporation and the company. The Corporation gave the company notice of removal of the poles within 14 days, and the company simply notified Mr. Dickens that they intended to do it.

Mr. Russell, in opening his motion, said that Mr. Dickens on February 26th, 1908, entered into a contract with the company to have their service laid on. He had paid the rent in advance up to March 10th, 1912, and having done so, he not

unnaturally expected to get what he had paid for if the company could give it. On September 22nd, however, the district manager of the company wrote to Mr. Dickens to the effect that, in consequence of a recent notice received from the Hythe Corporation requiring the company to remove certain poles connecting his (Mr. Dickens's) service with the main trunk system, that system would be discontinued. Accordingly, on October 20th, plaintiff's solicitors issued the writ. The company had got the use of the wayleaves until December 27th, and Mr. Dickens's point was that they threatened to cut him off at once, two months before it was necessary. That being so, the notice of motion on Mr. Dickens's behalf was that the company should be restrained from altering, disconnecting or otherwise interfering with any wire or line used for the telephonic communication of the plaintiff.

Mr. Micklem asked his Lordship to grant an injunction against the Corporation restraining them from moving the poles.

His Lordship, in giving judgment, said that it would be impossible to grant Mr. Dickens an injunction to restrain the company from disconnecting his telephone service, and compelling them to maintain his connection unless, at the same time, the company were enabled to do so by maintaining their poles and wires. He then proceeded to outline the facts in regard to the motion of the company against the Corporation, and declared that the change in position which the Corporation from time to time took up was almost Gilbertian in humour. He had read the correspondence, and it appeared that at one time the Corporation would say the telephone poles must be removed at once. The company would agree to do so, and after a little "conversation" between the parties, the Corporation would postpone the operation of the order. Later, however, another notice would be sent to the company to remove the poles at once. Again the company replied they would do so, and gave instructions to their workmen. Thereupon the Hythe Corporation would turn round with remarkable agility, and threaten the company with an injunction if the poles were removed. It was asked what was behind it all? Well, it would seem that the Hythe Corporation desired to insist on the wires and poles remaining until December 27th, and then they must be at once quickly removed and cleared away before December 31st. But what, might be asked, was the object of doing this? It appeared that if they remained up until December 31st the Postmaster-General would take them over and the Government would have to pay the company for them, whereas if they could only procure their removal before that date, the Government would not have to pay for them. Then it might be asked, but what concern was that of the Corporation of Hythe? It appeared, however, that under an arrangement which had been described as exceedingly satisfactory, the Corporation had arranged with certain officials of the G.P.O. for an underground service to be installed forthwith to take the place of the Telephone Co.'s service if the latter's service were removed, if not by December 27th, at least by the 31st. It had been suggested that the matter might be allowed to drift on till December 27th, and then see what could be done, but he thought it would be melancholy if the Court were to adopt such a course, as the result would possibly be a free fight on the land in question when the day arrived. The Corporation, with a squad of men, might invade the land and take possession of the poles until a superior squad of men belonging to the company drove out the invading army. The justice of the case required that the defendant Corporation should be restrained from removing or otherwise interfering with any of the poles or wires of the company until judgment or further order; that the Telephone Co. remain in possession of the poles, and that Mr. Dickens should also have an injunction restraining the Telephone Co. from severing his connection.

His Lordship further ordered the costs in each case to be the costs in the action.

Workmen's Compensation Claim against the Charing Cross Electricity Supply Co., Ltd.

At the Bow County Court, on Monday, Judge Smyly, K.C., heard an application under the Workmen's Compensation Act made by George Charles Avent, a switchman, against the above company, of St. Martin's Lane, Charing Cross.

Mr. Clements, for the applicant, said that he had been in the employ of respondents since 1905 as a switchman, and it was part of his duty, on certain occasions, to clean the switches at the station in Marshgate Lane, Stratford. About 7 a.m. on April 13th last he was engaged in cleaning certain of the switches, when he received an electric shock of nearly 10,000 volts, which rendered him unconscious. He was removed to the hospital, suffering from injuries to his left arm and burns on his face and body. In the end his left arm had to be amputated. His wages were 36s. 2d. a week, and from the date of the accident until July 8th he was paid £1 a week as compensation. He admitted that, by Rule 8, they were forbidden to enter an extra-high-tension chamber, but he was engaged at the time of the accident on a gallery and not in a chamber. It was an interconnecting switch which caused the accident.

Applicant was closely cross-examined by Mr. Shakespeare, who appeared for the respondents, as to the technical part of his evidence and as to the nature of the switches with which he had to deal. He stated that they could only be reached by climbing over the steel bars or crawling under the switches.

Edwin O'Shea, a fellow workman with the applicant, said there was no guard to the interlocking switch, and a man cleaning it would be unprotected when it was alive. There was a guard there now, he believed.

Mr. Shakespeare objected that this was not evidence.

His Honour: I do not see how it is not.

Mr. Shakespeare: It has been held in the High Court that you cannot show that a man has been wise after the event.

His Honour: But they have not excluded the evidence.

Witness, continuing, said that after climbing over the bars applicant would be near the interconnecting switch, and was found about 4 ft. from it.

Mr. Shakespeare: What is there requiring you to get on top of the switch?—Witness: There are insulators which must be cleaned and contacts which the insulators surround.

The highest is 3 ft. 10 in. from the ground; do you ask his Honour to believe that you have to reach up to this?—Yes, to get at the other side.

Will you pledge your oath that either Mr. Yates or Mr. Golbourn, the engineers, have seen you on top of the switch?—I will.

Continuing, Witness said he had never been in the testing room unless both systems were dead. It appeared to him dangerous to do so. He did not know it was against the rules to go into the testing chamber at all.

Thomas Roberts, another switchman, said there were no high-tension chambers on the gallery in which the applicant was engaged. From one switch to another they had to squeeze past a buttress, but to reach the motor-generator switch he had not climbed the bars. There was a door, but he had never been through it. Cross-examined: The second gallery was not a switchboard, but a place where the switches were.

His Honour allowed the switchmen to leave as soon as they had given their evidence, remarking that it was not desirable that half the city should be plunged into darkness during their absence.

For the respondents Mr. Walter H. Kingston, the manager of the station, said it would be absolutely contrary to their regulations for anyone to pass through a certain door through the testing chamber, and past the interlocking switch, when the latter was half alive. There was ample room for men to pass without doing this. There was no reason to climb on the top of the generator switch to clean it.

Mr. Yates, a switchman, gave evidence as to the rules forbidding any man to go past the generating switch when it was half alive.

Mr. Shakespeare, for the respondents, said the applicant to succeed, must show that this was an accident arising out of and in the course of his employment, and that the risk was one which was contemplated by the employer at the time when the contract was entered into with the workman. When they looked at the evidence given there, it could not be said that the accident was one arising out of his employment, for applicant had sworn that he had been forbidden to clean any of the switches when they were alive. The contract of employment did not include switches when they were alive. He was doing something which he was never employed to do, and which, in fact, he was strictly forbidden to do.

After further argument judgment was reserved.

British Westinghouse Co., Ltd., *v.* The Underground Electric Railways Co. of London, Ltd.

At the conclusion of the arguments on the appeal in this arbitration, their Lordships reserved judgment.

Interesting Tramcar Case.

At Woolwich Court, before Mr. Hutton, according to the *Standard* report, an interesting point was raised when Harold Vincent Dimon was summoned for driving a tramcar on the Woolwich-Eltham system without two overhead conductors being in use. Mr. Barker, for the police, said an accident occurred, and Dimon was tried at the Sessions on a charge of causing bodily harm, but was acquitted. Mr. Jenkin, defending, argued that the Council, and not Dimon, were responsible, because the Regulation read, "any person using electrical power," and the Council answered to the "person" in this case. The Magistrate ruled against this view, but himself questioned whether the man at fault might not be the conductor, whose business it was to put up the second trolley pole. Mr. Barker submitted that the driver was in charge of the tramcar, and the conductor could not put up the pole unless the driver stopped the car. Mr. Hutton fined Dimon 5s., saying that he did so on the ground that the defendant drove the car without the second trolley pole or conductor being in use.

City of Birmingham Tramways Co., Ltd.

Mr. Justice Parker, in the Chancery Division, had before him on Tuesday a petition by the City of Birmingham Tramways Co., Ltd., seeking the sanction of the Court to a proposed scheme of arrangement with its debenture-holders, which would have the effect of releasing certain specifically charged assets.

Mr. H. E. Wright, in support of the petition, said that it was brought under the Companies' Consolidated Act of 1908, and the scheme was a very simple one. The company was a very prosperous one, and the debentures in question were all debentures to bearer. The company had sold most of its tramways, and it was contemplated that there would be almost immediately a further sale of the rest to the Birmingham Corporation for £150,000.

When that sale had been carried out the company would have no tramways left at all, but under the terms of the debentures, the debenture stock could not be paid off until 1917, and the company was, therefore, bound to keep matters as they were until that date. The company was incorporated in 1906 for the purpose of carrying on these tramways, and it had a capital of £1,000,000 divided into 200,000 shares of £5 each. The company had borrowed £300,000 on debentures to bearer, and although the whole £300,000 were issued, £97,500 worth had been redeemed and transferred into the names of trustees as part security for the sinking fund. Part of the proposed scheme was to cancel these debentures altogether, instead of keeping them in a state of suspended animation. There was a very large margin of security, and it was proposed to release a proportion of the specifically-charged assets.

Mr. Justice Parker asked what the debenture-holders were to receive in consideration for the release of their rights. It seemed to him, he said, a one-sided arrangement. What did the company propose to do when they got the scheme through ?

Mr. Wright said that the company desired to invest the assets over a wider field. As a matter of fact, they belonged to the British Electric Traction group, which intended to carry on a large tramway trust in the Midlands. If the scheme went through the debentures would still be secured over and over again, and the company would undertake always to keep the securities up to 10 per cent. over and above the amount of the debentures. They would, in fact, be quite willing to make it 20 per cent., and would undertake not to issue any debentures in priority to or ranking *pari passu* with those now outstanding.

His Lordship said that there were now assets to the amount of £400,000 to secure debentures to the value of £200,000, and at the meetings at which these proposals were suggested only £1,800 worth of debentures was represented. It was therefore as if he was being asked by a very small minority to sanction a scheme which was not in favour with the debenture-holders. He could not approve of a scheme which did not commend itself to him from a business point of view. In his opinion, the debenture-holders should receive some compensation by way of increased dividend, or something of that sort, in consideration of what they were giving up. He would not dismiss the petition, but would direct it to stand over for further consideration.

Mr. Wright said he would communicate his Lordship's views to his clients.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Radiator Lamp Substitutes.



Fig. 1.—"Economic" Radiator Lamp Substitute.

A device to replace the ordinary radiator lamps was first introduced by Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., in September of last year, but was made for voltages not exceeding 120 volts, it being necessary to run the substitutes in series above this voltage. We have now received particulars of substitutes to run singly on voltages up to 250 volts, D.C. and A.C. A single substitute can be made to consume 500 watts, making it possible to convert a two-lamp into an equivalent four-lamp radiator, thus saving the extra first cost of the larger radiator.

These substitutes are practically unbreakable, run at bright red heat, have a long life, and a new element can be inserted in a few minutes at a low cost, thus avoiding the purchase of a new radiator lamp, which is of course useless when burnt out. The slight additional cost of the substitutes over that of the radiator lamps is quickly saved. The appearance of the device, which is composed almost entirely of metal, is shown in fig. 1.

New Type of Police Lamp.

The adoption of the electric lamp for police work is of special interest to electrical engineers, and in this connection the Thomson lamp, introduced by Messrs. L. E. Wilson and Co., of 20, Cross Street, Manchester, appears to meet with considerable success. Police authorities do not all agree as to the type of electric lamp which would be suitable for their work; the size, the weight, the dimensions of reflector, and duration of light, all have been questioned in turn, and, in consequence, the variation in the requirements tends to make the work of standardisation a difficult proposition. The question is essentially one for the technical man, and therefore the tendency in the past to leave the police authorities to conduct their own tests is, in a measure, responsible for most of the variation of opinion encountered.

The Thomson accumulator in its present form is the result of these years of experience; the operation of re-charging is simple in character, and, beyond adding distilled water to the accumulator for the purpose of keeping it moist, little further work is involved.

The question of accumulator capacity is important from a police point of view, as the lamp should be capable of giving light for at least two normal duties, with sufficient reserve for contingencies. The light given by a glow lamp consuming ·3 ampere is far superior to that of the oil lamp, and from data collected, the average duration of light required for inspecting property is fairly well known; the light is not maintained permanently, but the flashing arrangement is used, and the constable is not rendered more conspicuous than necessary, which is another facility not afforded by the oil lamp: there being no smell, a still further advantage can be claimed, for the wrongdoer's sense of smell is almost as keen as his eyesight. The question whether a concentrated or diffused light is required by the police is also one which requires consideration.

In the Thomson Police Lamp the accumulator is firmly fixed in the case by spring clips, and access to all working parts is made easy by the adoption of a hinged door secured by a spring clip. The specially designed switch contains several important and interesting features, and is arranged for flashing or fixing the light as required. The glow lamp can readily be removed, and as there are only a few contacts in the lamp, there is very little apparatus to get out of order. Some lamps are equipped with wire handles, in addition to the strong belt attachment, and these are more especially required in places where an examination of stairways is an important part of the policeman's duty.

In some quarters belts are not worn by the police, and an electric lamp, known as the Military Lamp, is carried in a special pocket provided for the purpose.

Twin Lampholder.

Messrs. Galsworthy, Ltd., of 15, Newman Street, W., have introduced a patent twin lampholder (fig. 2) of compact design,

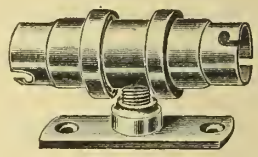


Fig. 2.—Twin Lampholder.

which is claimed to be the only twin holder on the market which can be wired either singly, series or in parallel.

The usual T-piece being omitted, some 2 in. is saved in length.

The holder is made in four sizes, in large and small Edison screw and bayonet-socket types, also as a single or end holder, and is useful for window, picture, sign and concealed lighting generally.

BUSINESS NOTES.

Pump Contracts.—The following are some contracts recently received by Messrs. Ernest Scott & Mountain, Ltd., for large centrifugal pumps:—

One pump to deliver 1,000 gallons per minute against 600 ft. head at 1,200 R.P.M. driven by a D.C. motor of 300 H.P. capacity, for Park Colliery Co., Ltd.

One pump to deliver 700 gallons per minute against 600 ft. head at 1,200 R.P.M. driven by a D.C. motor of 210 H.P., for Messrs. Edinburgh Collieries, Ltd., to the instructions of Messrs. D. Selby Bigge & Co.

One vertical centrifugal pump to deliver 1,500 gallons per minute against 135 ft. head at 1,000 R.P.M. driven by a D.C. motor of 95 B.H.P., for Coltness Iron Co.

One pump to deliver 250 gallons per minute against 500 ft. head at 1,440 R.P.M. driven by three-phase motor of 55 B.H.P., for Consett Iron Co.

One pump to deliver 125 gallons per minute against 440 ft. head at 2,880 R.P.M. driven by a three-phase motor of 30 B.H.P., for Consett Iron Co.

One pump to deliver 750 gallons per minute against 62 ft. head at 1,400 R.P.M. driven by a D.C. motor of 24 H.P., for Blyth Shipbuilding Co., Ltd.

The Indian Import Trade.—A review of the trade of East India in 1910-11 has recently been issued as a Blue Book. It shows that the imports of machinery experienced a decline of £220,000 as compared with the preceding year, this being the second year in succession for a reduction in the arrivals of machinery to take place. The share of Bengal was, however, £53,000 larger than in 1909-10, and the increase included £40,000 in electrical machinery, largely for the Tata Ironworks. In the imports of steam engines there was an improvement, the value being £546,000, but this total does not reach the level of two years ago. The imports of electrical and mining machinery, which amounted to £263,900 and £92,200 respectively, were the best on record. On the other hand, the Indian purchases of railway material decreased by £1,469,000, as contrasted with 1909-10, and in this case also the total of £4,124,000 for 1910-11 was likewise very considerably less than the total of £7,960,000 in 1908-9. The value of the imports of electrical and scientific instruments and apparatus in the past two years is returned as follows:—

	1909-10.	1910-11.
Electrical instruments and apparatus ...	£289,812	£343,382
Scientific instruments and apparatus ...	180,019	209,067

It will be seen that the electrical apparatus increased by 18·5 per cent. in 1910-11, and scientific apparatus by 16·1 per cent. The total quantity of machinery and mill work was valued at £3,154,000 in 1910-11, as against £3,374,000 and £4,411,000 in the two preceding years respectively.

Correction.—In our last issue, in "Official Returns," an error occurred in one of the titles. For Anglo-*American* Electric Co., Ltd., read Anglo-Mexican Electric Co., Ltd.

Patent Applications and Restorations.—Application has been made by Frank Michael Lewis for the restoration of a patent which expired in February, 1911, owing to the non-payment of renewal fee—namely, "Improvements in or connected with electric arc lamps," No. 4,557 of 1903.

The Comptroller-General has issued orders restoring the following patents :—

No. 7,320, of 1907. "Improvements in arc furnaces for the electrical treatment of gases." Granted to Salpetersaure Industrie-Gesellschaft G.m.b.H.

No. 849, of 1904. "Horizontal double-action lever pump." Granted to Frederick Thould

Catalogues and Lists.—The Underfeed Stoker Co., Ltd., Coventry House, South Place, London, E.C.—80-page catalogue containing full information regarding the "Underfeed" stoker, its theory and principle, with descriptions of different types of the stokers, their applications and the manner of their operation. Reports of tests showing economies, boiler efficiencies and smokelessness with underfeed stoking shown graphically in comparison with those with other systems of firing, and a great deal of other information of interest to boiler house and power station engineers, are given, together with points for coal-users on calorimetry, coal classification and analysis, the heating value of coals and their determination. Large and well executed half-tone photographic views showing the underfeed stoker, its parts, and many boiler houses where it is in service, run right through the book. The company have, as the above has indicated, endeavoured to introduce much matter making the catalogue of service to all engineers and others interested in the all-important question of efficient stoking.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot.—12-page illustrated pamphlet containing information accompanied by a number of diagrams, &c., regarding telegraph apparatus manufactured by them—the B.I. fast speed pole changer and new method of closed-circuit working.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, London, S.W.—New telephone apparatus catalogue, No. 535, of about 70 pages, containing many well-executed and well-arranged illustrations (art paper), with descriptions and prices of those articles among Messrs. Siemens's more numerous telephone apparatus manufactures which are in fairly general use. The contents include the following classes :—Competitive battery telephones, intercommunication sets, magneto telephones, C.B. instruments, portable, loud-speaking, high-tension and watertight instruments, switchboards, arresters, condensers, &c., and a telegraphic code and index. Attention may be directed to intercommunication sets with metallic circuits, metal-cased C.B. instruments, theatre-pattern loud-speaking telephones and mining telephones. Copies of the catalogue can be obtained by writing to the firm at Woolwich. Messrs. Siemens have also issued a leaflet supplementary to their "Stannos" catalogue, describing the "Twiston" connector for tapping "Stannos" sheathing, when used for concentric wiring, without the necessity for soldering ; also biscuit blocks prepared in various finishes.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Eight pages of their new catalogue, giving tabulated prices of knife switches and change-over switches, also illustrations, brief particulars and prices of fuseboards, "Soleed" porcelain handle replacement fuses, multiple-way switches, auto cut-outs for accumulators, shunt regulators, motor-starters and ship-lighting boards. Copies can be had on application.

Allgemeine Electricitats Gesellschaft, Berlin.—Pamphlets relating to automobile tower wagons, propelled by petrol and by electricity ; new overhead line material for tramways ; new tramway motors with commutating poles ; and an electrostatic indicator of the presence of high-pressure electricity on conductors, from 3,000 to 75,000 volts.

Messrs. W. Sisson & Co., Ltd., Gloucester.—30-page booklet giving neat half-tone illustrations of, and testimonials and reports concerning, the Sisson patent enclosed engine for electrical work, steam consumption curves being included.

The Reason Manufacturing Co., Ltd., Brighton.—Half-a-dozen introductory or advertisement leaflets, illustrating a few of their manufactures, including "Q.M.B." D.P. ironclad switches, "Bayley" hand lamps, electric clocks, outside lighting fittings (the "Bright'un"), electrolytic meters, &c.

Messrs. James Neil & Sons, Ltd., Grange Ironworks, Shettleston, Glasgow.—Pamphlet containing effective views in colour of their new incandescent rocking-bar furnace and patent double rocking firebars. A separate booklet contains a number of logical arguments on forced draught.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflet No. 119, relating to the uses of aluminium in the service of electric traction showing side panels for railway coaches, interior panelling, trolley heads and aluminium field coils.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—Twelve-page catalogue (Section W), tabulating sizes and prices of vulcanised wire and cables, twin lead-covered wires and cables, fuse wires, flexible cords, and electric bell wires, also illustrating and pricing a number of jointing accessories, including porcelain connectors and insulators.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.—Two new catalogues (28 pages each) one containing a very full and illustrated account of the "Ducter" patent potential ohmmeter, its method, constructional details, and uses, with a table of temperature factors for copper, and particulars of prices ; the other dealing equally exhaustively, and with many explanatory diagrams and views, with Evershed's testing sets for insulation and conductor resistance. We are asked to state that all previous catalogues for these specialities are now withdrawn, and copies of the above new lists can be obtained on application.

The Rees Roturbo Manufacturing Co., Ltd., Wolverhampton.—Collection of pamphlets, prepared in excellent style, with finely printed half-tone pictures on art paper. The whole are brought together in an expanding binding cover, and they contain the following information :—Specification of the Rees "Roturbo" self-regulating centrifugal pumps for mining and colliery service, with notes and diagrams explaining the principles and construction, table of duties, dimensions, weights, &c. ; description of the pump at Crumlin Navigation Colliery ; Rees "Roturbo" electrically-driven boiler feed pumps, containing specification and tabulated data ; pumps for fire service ; oil-engine-driven pumps ; and reprints of a number of articles appearing in the engineering Press on the pumps used for electric sewage and storm-water service, sea-water supply, &c.

Wiring Contracts.—Messrs. J. E. Cuthbertson and Co., of Falkirk, have received the following contracts :—

Lighting and power installation at Larbert Parish Church.
Addition to Larbert Co-operative Society premises.
Electric light installation at Stirling County Council new offices.

Theft of Telegraph Wire.—Before the Recorder last week, three young men were charged with stealing copper telegraph wire, the property of the Postmaster-General, from poles along the Regent's Canal. It was mentioned that the cutting of wires had been going on for years, and had cost the Post Office a great deal during the past 12 months. William Chown was sentenced to 12 months' hard labour, and Thomas Green to six months' imprisonment.

Reliable Rectifiers.—In reply to a letter in our "Correspondence" columns on this subject in our last issue, several firms claim to be able to supply rectifiers which can be depended upon—notably Messrs. Isenthal & Co. and Messrs. Muirhead and Co., Ltd. The Aluminium Rectifiers Co. and the Westinghouse-Cooper Hewitt Co., Ltd., also write to the same effect.

Trade Announcements. — Mr. W. R. Squire has opened an office at 288, Broad Street, Birmingham, where he is making a speciality of private telephone work for all purposes.

Messrs. Ship Carbons, Ltd., 67, Aldersgate Street, London, E.C., have been appointed sole agents in the United Kingdom for the "Watt" electric lamp works, of Vienna, Austria, makers of the "Monowatt" metallic-filament lamps and carbon lamps. They will carry stocks in London. We have received a leaflet stating prices.

Messrs. W. A. Laws & Co., of 7, Exchange Buildings, Whitley Bay, have taken over the electrical business (contracts and stock) of Messrs. Gray & Gray, of Newcastle-on-Tyne, and Mr. Wood, late electrical engineer to the firm, has joined Messrs. Laws. Mr. A. Gray has accepted a lucrative appointment in Rhodesia, and the firm of Gray & Gray is discontinued.

The business of the late Mr. G. W. Hull, electrical engineer, of Pangbourne, has been taken over by the Felgate Installation Co., Ltd.

Mr. W. J. Coles, M.I.E.E., of Messrs. Maxted, Knott & Coles, consulting engineers, Hull, has been appointed engineer-in-charge of the cement and crushing machinery department of Messrs. Edgar Allen & Co., Ltd., of Sheffield, who prepare designs, &c., for complete equipments of such plant, including the necessary power plant. Mr. Coles announces that his consulting practice will be continued, and he will advise on electrical and other matters as hitherto. His address, until December 1st, is 231-232, Birkbeck Bank Chambers, W.C., and after that care/of Messrs. Edgar Allen's London office, 52, Queen Victoria Street, E.C.

Osram Lamp Patents.—As will be observed from announcements appearing in our advertisement pages this week, the Edison and Swan United Electric Light Co., Ltd., have recognised the validity of letters patent No. 23,899 of 1904, and other letters patent owned by the Osram Lamp Works, Ltd., for the manufacture of Osram lamps. The Edison and Swan Co. have taken up a licence from the Osram Co. to use the above patents for the manufacture of their own metal-filament lamps, and they notify the trade and the public that on that account they run no liability or risk of patent litigation by purchasing Royal Ediswan lamps which they manufacture at their Ponders End and Newcastle-on-Tyne factories.

Lamp-Selling Campaigns.—Messrs. Siemens Bros. Dynamo Works Co., Ltd., of Tyssen Street, Dalston, are always very much alive, but as is usual at this period of the year, they are in the throes of a veritable trans-Atlantic hustle, with an advertising campaign pushing their lamps and other lighting material for the current lighting season. With their "Tantalum" showcard competition, and the result of it, our readers are already well acquainted, and at the present moment the provinces are being "taken by storm," practically every town of importance being enlivened, enlightened and beautified by these posters. "Little Bill" showcards in several colours have been circulated in thousands among trade customers, together with literature bearing the contractor's own name. Contractors who like to ask for them can have quantities of facsimile reproductions of the poster on postcards. Beyond the foregoing, there is a provincial newspaper campaign in progress, and electricity users are being circularised, to, we under-

stand, the tune of hundreds of thousands, hammering into their wooden heads that the tantalum is the lamp for them. Underground and other railways, carriers' vans and other media have likewise been selected for making the same appeal. A campaign which has been adopted on such a scale, and with the intention of co-operating with the trade generally, cannot fail to bring success to its originators, while it must assist in the general popularisation of electricity.

Book Notices.—*The Ten Republics.* By Robt. P. Porter. London: George Routledge & Sons, Ltd. Paper covers, 1s. net.—This is the first of a series of volumes on the Ten Republics of South America. The object of the series is to enlighten the British public concerning South American affairs and promote closer commercial and other relations between Great Britain and the 10 nations. The present is an introductory volume preparing the way for 10 others that are to follow dealing with the industrial and economic progress of each Republic separately. Mr. Porter, as most people know, has visited many of the Latin Republics, has had audiences granted by 20 South American Presidents, and has had placed at his disposal the bulletins and reports of the Pan-American Union; he is, therefore, in a position to write with authority on the progress that they are making and their importance as fields for British enterprise. In view of the articles which have appeared in our pages from time to time, it is unnecessary for us to indicate again here how large a share of the foreign capital invested in, and the foreign trade done by, the Republics, is British. In the first chapter the author deals with early history, very briefly outlining the course of events down to date, and the politics appertaining to the Republics: the economic and industrial progress of the latter are next reviewed, and there follow chapters containing much valuable information regarding each of the following:—Panamá, the Argentine Republic, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela. Twelve useful maps add considerably to the value of this introductory volume. We have no doubt whatever about the usefulness of Mr. Porter's books to those who desire to become better acquainted with South American trade and finance; probably when our readers have read the first of the series they will be anxious to secure the others.

"Bearings and their Lubrication." By L. P. Alford. Price 10s. 6d. net. "The Magnetic Circuit." By V. Karapetoff. Price 8s. 6d. net. "Electric Railway Engineering." By C. Francis Harding. Price 12s. 6d. net. 1911. London: Hill Publishing Co., Ltd.

"The Elements of Electrical Transmission." By Olin J. Ferguson. 1911. London: Macmillan & Co. Price 15s. net.

We have received from the Town Clerk of Falmouth a copy of an authorised and official illustrated booklet, giving particulars of the town, its climate and resources. The air renders the place particularly suitable for winter residence. Anyone interested can obtain a copy of the brochure by sending a card to the Town Clerk at the Municipal Offices.

The "Mechanical World" Pocket Diary and Year Book for 1912. Manchester: Emmott & Co., Ltd. Price 6d. net.—This well-known annual is the first of its kind to reach us this autumn; it contains various new sections, and several of the older ones have been revised or rewritten. It is wonderfully good value.

"The Technical Journal." Vol. IV, No. 4. October, 1911. Liverpool: The Northern Publishing Co. Price 1s.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, part 8. September, 1911. Johannesburg: The Institute. Price 2s.

"Die Selbstanschluss und Wählereinrichtungen im Fernsprechbetriebe." By A. Kruckow. 1911. Brunswick: Vieweg & Sohn. Price 10 M.

"*Engineering* Directory." October, 1911. London: *Engineering*, Ltd. Gratis.

"The Motor Manual." 1912. London: Temple Press, Ltd. Price 1s. 6d. net.

New Zealand.—The Customs authorities of New Zealand have recently given a decision to the effect that "electrical appliances, viz., brushes, carbon, wire gauze" are to be classified under No. 169 of the Tariff, the duty being at the rate of 15 per cent. *ad valorem* on foreign goods, and 10 per cent. on British manufactures.

Liquidation.—Howe Electrical Engineering Co., Ltd.—A meeting is called for December 14th at 7, Victoria Street, Liverpool, to hear an account of the winding-up from the liquidator, Mr. Arthur Thraves.

Bankruptcy Proceedings.—Wm. Henry Howard, electrical engineer, 17, Russell Road, Finsbury Park, and lately carrying on business at 5, Featherstone Buildings, Holborn, E.C., as the Holborn Electrical Co.—Under a receiving order made in the London Bankruptcy Court the first meeting of creditors was held on Monday before Mr. G. W. Chapman, Official Receiver. Having called over the proofs of debt, the chairman stated that the debtor appeared to have commenced business in 1900, by becoming a partner with Mrs. Emma Lea, who was then trading at 60, Red Lion Lane, E.C. No deed of partnership was prepared; the debtor had no capital, but he brought in his experience, and they traded as the Holborn Electrical Co. about three years, the profits being equally divided. On the dissolution Mrs. Lea retired from the firm, and the debtor continued the business alone. In 1907 he removed to 49, Lamb's Conduit Street, W.C., where he traded in the former style, and also as Howard & Co. Six months later he removed to more commodious premises at 1, New Oxford Street, and there traded for six months. The landlord, without his consent, entered upon the premises in order to repair the roof, and thereby damaged his business and stock. The debtor then removed to 5, Featherstone Buildings; two years afterwards he removed to 64, Red Lion Street; but finding the rent too heavy, he returned to Featherstone Buildings, and there traded until last April. Three years ago he commenced proceedings against the landlord of the New Oxford Street premises for trespass in connection with the above-mentioned repairs to the roof. Judgment, however, with costs, was given against him, to which fact, combined with want of capital, and general falling-away of business during the last three years owing to competition by electrical supply authorities, he attributed his insolvency. During the legal proceedings he was unable properly to devote his attention to the business, which fell off considerably; owing to lack of capital, he was unable to recover lost ground, and finding the position hopeless, he closed the business last April. He had since been pressed for the landlord's costs in the action, and eventually in order to avoid committal proceedings, he filed his petition on November 1st. He is now in employment. The statement of affairs showed liabilities £506, and assets, "doubtful and bad debts, £78." In the absence of any proposal, the case was left in the hands of the Official Receiver to be wound up in bankruptcy, the public examination of the debtor being fixed for December 21st. Appended is a list of the principal unsecured creditors, viz.:—

Buddacom, R. A.	£65	Griffiths & Son	£7
Bodien, Mrs.	19	Jackson & Co.	2
Cutting Bros.	17	Leverson, L.	4
International Time Recorder Co. ..	£24.		

William Francis Flint, electrical engineer, 53, Jameson Street, Kingston-upon-Hull.—The public examination of the above debtor took place on Monday, November 13th, at the Court House, Town Hall, Hull, before Mr. Registrar Farrell. The statement of affairs showed liabilities £1,743, and the debtor said that of this £792 was due to his father. He was indebted to the bank to the extent of £424, and the bank held a guarantee from his father up to £100. The assets were estimated to produce £637. Debtor said he had lost £400 on contracts. He obtained the contract for the lighting of the King's Hall, Hull, his being the lowest tender, and he expected to make a profit of £40. The amount of the contract was £530 and he was paid £400, and he had returned the contractees as being debtors for £126. The debtor admitted, however, that the work was gone over after he had considered he was finished with the contract. The Official Receiver: And so many imperfections were found that it practically had to be done over again?—Debtor: Yes. Continuing, he said he had made a loss of £350 through that contract, while bad debts were responsible for a loss of £138. He added that competition had been very keen, and it had been difficult to obtain a contract on which a profit could be made. He considered that his business had been a failure from the start. The examination was concluded.

W. R. Newbold Gard, electrician, West Ealing (lately at Orchard Electrical Works, Canterbury).—Receiving order made at Brentford on November 8th, on debtor's application.

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co., Ltd., has quoted £400 per annum as the price it would charge for the supply of electricity for pumping purposes at the sewage works, and ¾d. per unit for all units consumed. The quotation, it was explained, was made on the understanding that the supply would not be used, except in an emergency, during the hours of the maximum demand, and that the steam plant, if used at all, was only to be used on those occasions. The offer was rejected, it being arranged that the matter should be subjected to further consideration.

Ashburton.—The U.D.C. has decided not to accept the terms of Messrs. Purves, of Exeter, for an electric light installation for the town, viz., that the Council should guarantee a sum of £350 towards the cost, and a yearly sum of £30.

Bretby.—The Burton-on-Trent T.C. has applied to the Repton R.D.C. for consent to extend the E.L. supply to Bretby by means of a low-tension overhead line. The matter is being considered by a Committee

Briton Ferry.—The U.D.C. has applied to the B. of T. for permission to use overhead wires for the transmission of alternating current at a pressure of 230 volts, for the supply of electricity to private houses in the town.

Continental Notes.—Germany.—It is proposed to form a company for the purpose of electricity supply throughout the Palatinate. According to the scheme prepared by Mr. Miller, of Munich, in conjunction with the Rhenish Schuckert Co., the project is to be carried out in three stages, the first representing connections of 25,000 KW., the second 41,000 KW., and the third 80,000 KW. The supply would be obtained in the first place by the establishment of a new power station in Homburg, and, secondly, from the existing stations in Ludwigshaven, Pirmasen and Kaiserslautern, although these three would only be used at the time of heavy load, so that the cost of production could be kept as low as possible. The total capacity of the four works in the three stages would be 15,000 KW., 19,000 KW. and 36,000 KW. respectively. The Homburg station would be situated near coal mines and where

here is plenty of water, and thus be certain of economical working. It is proposed to step up the current to a pressure of 100,000 volts for transmission throughout the Palatinate, and to reduce it to from 100 to 400 volts for supply to consumers. The total expenditure on the works would be £1,200,000, of which a small portion would be provided by the local authorities and the contractors, whilst the remainder would be raised by the issue of debentures or by a loan guaranteed by the local authorities. The company would have the right to use State roads or property for the installation of cables for a period of 75 years, although the State would be authorised to purchase the undertaking after the lapse of 40 years. It is suggested that the works should be leased for a term of 17 years, so as to secure the guarantee of the payment of interest on the capital provided by the local authorities.

Spain.—The severity of competition in the supply of electricity in the Spanish capital is stated to have had an unfortunate effect upon the Madrid General Electricity Co., the situation of which has been examined by a Committee appointed by the French National Association of Foreign Bondholders. According to the report prepared by the Committee, the company was formed in 1889, and has at present a share capital of 6,000,000 pesetas and a loan debt of 10,730,000 pesetas and 8,940,000 pesetas; a large portion of the loan having been raised in France. During the first 10 years the company distributed dividends up to 26 per cent., but keen competition in the supply business has taken place since 1899. In 1897 the company purchased a large portion of the shares in the Electricity Supply Co. for Spain, Ltd., and in 1900 the northern central station built by the Schuckert group was acquired, whilst the working of the Electricity Supply Co.'s station was taken over in 1901, on the payment of a rental graduated according to the gross receipts. The payment of dividends ceased in 1903, but was resumed in 1907, 1908 and 1909. Since the last-mentioned year competition in Madrid has become very keen. As a consequence of the opening of a hydro-electric works belonging to the Electra Co., the price of electricity was reduced in August, 1910, from 1 peseta to 60 centimos per KW.-hour, and it has now been lowered by the Electra Co. to 40 centimos. Various efforts have been made to bring about an understanding, but without any practical result. The Madrid company in the circumstances finds itself compelled to provisionally postpone the payment of the January coupons. The company's accounts for 1910 showed net profits of only 933 pesetas, which sum was carried forward.

France.—To cover the expected deficit in the Budget of 70,000,000 fr., the French Finance Minister proposes to tax what is termed lighting *de luxe*. Coal and acetylene gas and electric lighting are alike affected. The threatened taxes on the last-named are to be, firstly, 0·005 fr. per KW.-hour, but public lighting supply and current used for heating furnaces and other industrial purposes, and for driving vehicles, are to be exempt; secondly, electric lamps, carbons, &c., are to pay on the following scale:—Up to 10 watts inclusive, 5 centimes for carbon and 10 for metal-filament; 11 to 30 watts, 5 and 15 centimes; 61 to 100 watts, 10 and 30; 101 to 200 watts, 15 and 50; 201 to 300 watts, 25 and 70; and 301 to 400 watts, 55 and 90. Mercury vapour lamps and neon tubes are to pay a uniform sum of 3 fr. per metre length; arc lamp carbons are to be taxed at 20 centimes per kg. The French Technical Press is much disturbed at these proposed taxes, which it regards as the prelude of possible futher exactions. The examples of Spain, Italy and Germany are cited in support of the tax, but it is retorted they are not fair parallels, as their general taxation is not so heavy as in France. For the Government it is claimed that the taxes will only level up to those already imposed on other illuminants—candles and petroleum.—*La Lumière Electrique.*

Crewe.—The Corporation is borrowing £3,600 for the purpose of extending the electricity undertaking.

Cuba.—Senor Antonio Ramos Valderas has obtained concessions for the establishment in Santo Domingo and in Esperanza, both in the Province of Santa Clara, of central electric generating stations for electric lighting purposes. These concessions are subject to the approval of the municipal councils in the above-mentioned towns.—*Board of Trade Journal.*

Dolgelly.—The U.D.C. has decided to carry out an E.L. scheme at an estimated cost of £3,000.

Doncaster.—Owing to the decision of the L.G.B. in declining to sanction the whole of the loan recently applied for, the T.C. has decided to meet a sum of £2,445 expended in recent improvements and extensions in connection with the electricity undertaking, out of revenue.

Farnham.—A proposal before the U.D.C. to do the sewage pumping by electricity, whereby a saving of £52 a year would be effected, has been referred back for expert advice.

Greenock.—The electrical exhibition promoted by the Corporation proved a huge success, over 10,000 persons attending during the nine days it lasted. Already the electricity department is experiencing the benefit of its enterprise, as quite a number of new firms and householders are becoming consumers. At the closing ceremony last week Provost W. B. McMillan thanked Mr. Robertson, the Corporation engineer, and his staff, on behalf of the town, for the great amount of energy they had expended in making the exhibition a success.

Grimsby.—The application of the Admiralty to duplicate the supply of electrical energy at the wireless telegraph station at Keethorpes by the provision by them of a self-contained plant at the station has been granted. In order to deal with the load for 1912-13, a motor-generator with an automatic booster, to work with one of the existing batteries on traction load, is to be installed at a cost of £900.

India.—Some details of the equipment of the new Kussara power station of the Bombay Tramways and Electric Supply Co. appeared in a recent issue of the *Indian Textile Journal*. The site has a frontage to the harbour and connects with the railway; it will allow of extensions up to 50,000-KW. plant capacity. The present boiler plant is provided with bunkers having a capacity of 2,500 tons, with a conveyor system connecting to a coal-crushing plant and receiving hoppers at ground level. The ashes are taken by a basement railway to elevators delivering to railway trucks. Sixteen Babcock boilers and four economisers are installed in connection with two 200-ft. steel chimneys. The generating plant consists of a 2,000-KW. turbo-generator and two 1,000-KW. engines and generators newly installed; also the following sets installed at Wari Bunder are being, or have been, transferred to the new building:—One 500-KW. and two 1,000-KW. turbo-generators, one 1,000-KW., one 300-KW. and two 500-KW. reciprocating engines and generators, giving an initial capacity of 8,800 KW. Provision has been made for the installation of three 700-KW. exhaust steam turbo-generators in connection with the 1,000-KW. reciprocating sets. The whole of this plant generates three-phase current at a pressure of 5,500 volts between phases. For condensing purposes the water of the Kussara Basin is drawn on, and the latter has been deepened so as to form a permanent reservoir of about 5,000,000 gallons. The larger units and groups of H.T. feeders are provided with remote-control switchgear, and the switches generally are installed on galleries along one side of the engine room. The engines and electrical equipment were supplied by the Brush Electrical Engineering Co.

Kedleston.—Subject to the sanction of the B. of T., the Derby T.C. has agreed to supply current to Lord Scarsdale at Kedleston Hall by means of overhead wires, at an outlay of £1,300, about half of which is guaranteed by Lord Scarsdale for his supply. In the application consent is sought to supply the parish of Quarndon, where current will be taken for over 20 large houses.

Largs.—The T.C. has received offers for a refuse destructor on a specification prepared by Mr. Robertson, the burgh electrical engineer for Greenock, the offers being by the Horsfall Co. (£2,490) and Messrs. Hennan & Froude (£2,897). Mr. Robertson is again to confer with the T.C. with regard to the tenders and to the provision of plant for working the stone-crushing machine, electric lighting, &c.

London.—Marylebone.—The Electric Supply Committee has recommended that as from the commencement of the next financial year (April 1st, 1912), a flat rate of 6d. per unit be adopted as part of the Council's tariff for electricity, and that all consumers adopting that rate may also have a special basement rate of 3d. per unit on the usual conditions. At present, reported the Committee, 1,930 consumers pay this flat rate, from them being obtained £32,970, or nearly 25 per cent. of the total revenue for private lighting. There are also 1,930 consumers who pay more than 6d. per unit, the value of income represented by payments in excess of 6d. being £1,850. The Committee did not think that a loss equal to £1,850 would be experienced. With regard to John Street dwellings the Committee recommended the following charges:—(*a*) 6d. per week per 25-C.P. Osram lamp in living rooms; (*b*) alternative to (*a*) 5d. per week per 16-C.P. Osram lamp; (*c*) 4d. per week per 25-C.P. Osram lamp in bedrooms; (*d*) alternative to (*c*) 3d. per week per 16-C.P. Osram lamp in bedrooms; (*e*) alternative to (*d*) 2d. per week per 8-C.P. Osram lamp in bedrooms. The Committee further reported that it had decided to approach the owners of tenements to see if they would agree to similar arrangements to that of the John Street dwellings, and £500 of the revenue balance had been set aside to cover the cost of such work, which would be given out to contractors. The recommendations were adopted.

L.C.C.—At Tuesday's meeting of the Council, the question of the supply of electricity at Bermondsey gave rise to a great deal of discussion. The Bermondsey Borough Council asked for sanction of a loan of £18,563 for its electricity undertaking, £17,684 being for plant, &c.

Sir George Goldie reported that negotiations had taken place between the Borough Council and the two companies having powers of supply of electricity within the borough, for a supply in bulk. The Council, he said, refused to supply the County Council with information as to the supply in bulk, and sent an extract from a report by the borough electrical engineer, stating that, in his opinion, "the Council had not received an offer for bulk supply which would in any way compare with the advantage and economy derived from extensions of the plant of the Borough Council's undertaking."

The Finance Committee recommended that the sanction of the loan be refused on the ground of lack of necessary information.

Mr. Ecroyd, in moving the reference back of the report, stated that the B.C. had a right to refuse the County Council the information it asked for. The recommendation was a deliberate attempt to strangle municipal enterprise in the interests of privately owned companies. Mr. H. H. Gordon, a champion of municipal enterprises, supported the Committee's recommendation. The loan was refused.

Sir George Goldie, in moving the report of the Finance Committee dealing with electricity supply in London, said it was a very valuable one. Mr. H. H. Gordon said that it would be little short of a calamity to London if the consideration of the question were allowed to end merely in the reception of the report. The time must come when they would have to seriously deal with the question and determine the future of the electricity supply of London. Great difficulty would be experienced in linking up the electricity supplies, owing to the fact that private companies as well as B.C.'s

were working under different systems ; he argued that the only means of obtaining a satisfactory solution of the problem was for the County Council to approach the companies and B.C.'s in the hope of getting a unification of the whole system for 1931. By way of inducement to the companies to come into agreement with the County Council after it had taken over the work of bulk generation, they might be allowed to work the distribution with the Borough Councils. He further contended that the County Council by appointing a Committee would be in a position to negotiate. Mr. Hayes Fisher, M.P., spoke on the great importance of the report, and agreed with Mr. Gordon with regard to the formation of a Committee to prepare some scheme which would be to the interest of the County Council and the ratepayers at large. The discussion was adjourned until the next meeting of the Council.

Merthyr Tydfil.—For the purposes of supply under the E.L. order, the Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for permission to use overhead lines for the transmission of current at a pressure of 11,000 volts. The lines will run from the generating station at Pennydarren to Treharris.

Mevagissey.—The P.C. has accepted the offer of the Electric Supply Co. to extend the overhead lines to Portmellin for public lighting purposes.

Monk Bretton.—The U.D.C. has acceded to an application from the Yorkshire Electric Power Co. for consent to the erection of overhead lines for the purpose of supply within the urban district. At the meeting, the chairman stated that the lighting question had been gone into thoroughly with the company, and it appeared that if the Council adopted electric lighting for the district, it would, on its present expenditure for gas, make a small saving.

Oldham.—The Electricity Committee has decided to install at Greenhill station a 1,200-KW. turbo-generator, to be driven by exhaust steam from the other engines at the works. The installation of the generator, which is expected to cost roughly £5,000, will enable the Committee to cope with the increasing demand.

Penmaenmawr.—The U.D.C. has had under consideration a report on the proposed electric lighting of the road from the entrance to the promenade up Paradise Road, as far as Clarendon Buildings in Pantyrafon, the estimated cost of the work being £160. After discussion, the matter was referred to the Roads and Improvement Committee.

Peru.—The Provincial Council of Huaraz is to arrange for the construction of a central electric generating station to supply the town of Huaraz and environs with electric light.

Radcliffe.—The U.D.C. has decided to extend the electricity works, and to this end an application will be made to the L.G.B. for sanction to borrow £17,000. A bulk supply is also proposed to be obtained from the Bury Corporation. In connection with this scheme, it is recalled that the Lancashire Electric Power Co., whose works are situated at Radcliffe, recently intimated that shortly it intended to ask for powers to supply electricity in the town.

Rugeley.—After discussing *in camera* a communication from the Ross Electric Lighting Co., the U.D.C. has decided to request Messrs. Drake & Gorham, of London, to report on the proposed electricity scheme for the town.

South Africa.—An electrical exhibition, promoted by the Electrical Committee of the Cape Town Corporation, was opened on October 23rd. The object of the Exhibition is to bring home to the public of the Cape Peninsula the advantages of the latest contrivances in electric lighting, heating, cooking and power. The exhibits have mostly been lent by the representatives of the electrical supply firms and by the local contractors. This is the first attempt at a local Electrical Exhibition, and it is hoped that it will lead to the increased use of electric energy for cooking and heating, as hitherto Cape Town has been somewhat backward in the adoption of electricity for anything outside lighting and motors.

The Municipality of Wynberg recently called for tenders for the electric street lighting and supply to consumers. These services have hitherto been rendered by the Cape Peninsula Lighting Co., Ltd., whose contract expires in September, 1912. The successful tenderer for the new contract is the Municipality of Kalk Bay and Muizenberg, the arrangement being to supply in bulk to the Wynberg Municipality by means of overhead H.T. three-phase cables. The distribution will be carried out by the Wynberg Municipality, the plant of the Cape Peninsula Co. being purchased at a valuation for that purpose.

The returns of theLadysmith (N.) Electricity Undertaking for the year ended July 31st, 1911, show a revenue of £3,277 and an expenditure of £1,704, leaving a gross profit of £1,573, which, after paying capital charges, leaves a balance of £15 to next year. The units generated were 139,578, an increase of 11 per cent. on last year. There are now 223 consumers served by 7 miles of overhead mains. The capital expenditure to date amounts to £15,729.

Speldhurst.—The Tunbridge Wells T.C. has been approached with reference to a supply of current to this parish, residents having applied for a supply of electricity.

Stockton Heath.—With reference to the electric lighting scheme, the P.C. has approved a draft circular, to be issued to the ratepayers, giving the charges for electricity for power and lighting purposes. If there is a sufficient demand, the Mersey Power Co., Ltd., which has Parliamentary powers for supplying current within the rural district of Runcorn, will be prepared to extend its mains to the district.

Stratford-on-Avon.—The Stratford-on-Avon Electricity Co., Ltd., is holding an electrical exhibition at the Skating Rink, Wood Street, from November 20th to 25th, from 2 to 10 p.m. each day.

Tunbridge Wells.—The T.C. has decided to apply to the L.G.B. for a loan of £6,000 for mains and sevices for three years.

Whitworth.—The U.D.C. has had an interview with Mr. George R. Peers in connection with the scheme prepared by him for supplying electricity in the district for lighting and power purposes. A sub-committee was appointed to meet the Rochdale Electricity Committee to discuss the terms offered by that Committee for supplying electricity in bulk.

Winscombe and Axbridge.—The Winscombe E.L. and Power Co., Ltd., announces that its mains will be laid at Winscombe and Axbridge for the supply of current for lighting and power by December. For light, the charge will be 6d. per unit, and for power and heating, 3d.

TRAMWAY and RAILWAY NOTES.

Accrington.—On Saturday night a runaway Bacup tramcar, descending a steep incline known as Manchester Road, Accrington, almost two miles long, collided with another car, with disastrous results. The cars were smashed and 16 people hurt. Both cars were thrown off the metals, and looked little better than scrap iron. The cries of the injured passengers in the darkness brought speedy aid, and they were extricated as quickly as possible from the wreckage. Charles Geo. Whittaker, of Crawshawbooth, the conductor of the runaway car, was taken to hospital suffering from serious injuries. Both cars were the property of the Rawtenstall Corporation, who have running powers over the Accrington Corporation's lines, and the two Corporations, along with Haslingden, jointly work a through service from Acerington to Bacup, thus linking up Accrington, Baxenden, Haslingden, Rawtenstall and Bacup, a distance of 10 miles. The driver, Thos. Cuffe, of Rawtenstall, did his utmost to check the speed of the car going downhill with the magnetic brakes, but without the slightest effect. The runaway car crashed into an electric standard at the side of the road, and the top of the car, which was a double-decker, was torn completely off. The driver stuck pluckily to his post. The driver states that "the metals were greasy after the frost. The speed of the car was terriffic, and he could not stop it. But for colliding with the other car, the consequences would have been even more disastrous."

Argentina.—In reference to the agreement concluded between the Mayor of Buenos Ayres and the Anglo-Argentine Tramway Co. for the construction of underground tramways in the city, H.M. Legation at Buenos Ayres reports the commencement of work on a line running from the terminus of the Western Railway to the neighbourhood of the Docks. The work has been entrusted to a German firm. It has been arranged to construct three other lines, two of which will be begun before the first is finished. One is to be a prolongation of the line being constructed from the terminus of the Western Railway to a suburb about two miles further on ; another is to run from the terminus of the Southern Railway to that of the Central Argentine, Pacific and Central Cordoba Railways ; and the other from the terminus near the docks of the line under construction to the public park at Palermo.—*Board of Trade Journal.*

The Compania de Tranvias Lacrosse has, according to the *Frankfurter Zeitung*, applied for a concession to build an underground electric railway from Buenos Ayres to the harbour.

Blackpool.—The General Purposes Committee recently received the ex-tramway employés, who allege that they were victimised through their connection with their Union. The case for the men was put before the Committee by Mr. F. Eccles, and each of the six men was heard separately. Mr. Furness presented a comparative statement as far back as 1907, showing that at present the average wage per employé was 33s., compared with 28s. 3d. last year, 25s. 10s. in 1909. 24s. 7d. in 1908, and 25s. 7d. in 1907. The allegation that men had been discharged because of their connection with the Union, was denied, and it was pointed that at the end of each season a large number of men had necessarily to be discharged. After hearing the statements, the Committee unanimously passed a resolution approving of the action of the general manager in discharging the men.

Brazil.—The Government has signed a contract with the banking house of L. Dreyfus & Co., of Paris, to build a narrow gauge electric railway from Retreito, province of Santa Catherina to Lages.—*Elektro. Zeitschrift.*

Burley.—The U.D.C., after receiving a proposal by a company to introduce railless cars into the district, has decided to give permission for the necessary notices to be filed, but has reserved its decision on the matter.

Cheshunt.—The U.D.C. has under consideration the question of adopting a railless-trolley system of vehicles.

Doncaster.—It has been decided that the intended application to the Light Railway Commissioners for an order to extend the Corporation tramways to Brodsworth and Warmsworth be not proceeded with until next spring in order that arrangements may be made with various authorities which will be affected thereby.

Brentford.—At the last meeting of the Council a report from the surveyor was read with regard to the inspection of the tramway track by Col. Yorke. He (Col. Yorke) said that he could not declare the track dangerous to traffic, but advised the company's officials to carry out repairs at once where necessary. In some places along the line where remedies had been tried, he found them to be as bad as the defect. The chairman of the Council said that he was present during the inspection, and that the manager of the Tramway Co. said that he had never had any complaint addressed to him, and the first he knew about the matter was that the inspector was coming down. In view of other remarks passed by Col. Yorke, the inspectors of the Tramway Co. agreed to repair any portion of the road which was necessary.

Continental Notes.—Italy.—La Società Italiana di Industrie Elettriche has secured the concession for the construction and working of a light electric railway from Spezia to Muggiano.

Spain.—La Société des Tramways de Barcelone has secured a concession for an electric tramway from Rambla de Cataluna to San Martin de Provensals.

Austria-Hungary.—A concession has been granted for the construction of an electric railway from Baden in the Helenental to Klausen-Leopoldsdorf. The line will be nearly 15 miles long, and the cost of construction is estimated at about £95,800.

Ealing.—At the last meeting of the T.C., the Highways Committee reported that, after receiving a deputation from the Chamber of Commerce advocating the establishment of a system of railless trolley cars fom Ealing Broadway to South Ealing, it was of opinion that it was impracticable to take any action that would enable the Council to obtain powers in connection with the matter in the next Parliamentary session, and that it should be instructed to consider the expediency of applying for powers the session following. Further, that the surveyor and the electrical engineer should be instructed to prepare a report relative to the comparative cost of railless trolley cars and motor-omnibuses (petrol and steam), both as regards the cost of installation, running and maintenance, together with alternative plans of the proposed routes. This was agreed to.

Fleetwood.—We are informed that a project is on foot for connecting up the Over Wyre district near Fleetwood, with Blackpool, by means of tramways to cross the River Wyre near Shard Bridge.

Haworth (near Keighley).—At a meeting of the D.C. a sub-committee was appointed to draw up a schedule of obligations under which the Council would be prepared to give its consent to the proposal of the Keighley Corporation to run railless trolley vehicles over certain roads in the Council's district. The conditions to be imposed are as follows :—(1) The Corporation to undertake to commence the service in the district within 12 months from the passing of the Act, failing which its powers would cease ; (2) the Council to have the option of purchasing the undertaking on terms at the expiration of either 7 or 14 years, providing notice of its intention to do so is given to the Corporation within 12 months of the expiration of 7 or 14 years ; (3) the service to be to the satisfaction of the Council as regards frequency, accommodation, fares, waiting rooms, and position of standards, while provision should be made for widening the highways where necessary. In case of difference on these points, the services of an arbitrator are to be requisitioned.

Glasgow.—As reported from time to time in the Review, the delay which has been caused in the presentation of the Tramways Committee's report on free tramway travelling facilities for the blind, has been the cause of some heated scenes at the Corporation meetings by the members of the Labour section of the Council. The first remit was made to the Committee more than a year ago, and a full report has just been published. In the report, which embraces a period of over nine years, it appears that proposals to provide free travelling for the blind over the system were first made as far back as 1902, but it was not until November of last year that the general manager was instructed to supply, free of charge, to institutions for the blind, special tokens to be used only by blind persons travelling on cars within the city. Of the total of 560 blind, or partially blind, persons 406 were at present receiving a monthly supply of tokens, while 132 who filled up the necessary applications did not apply for the "permits," and the principle followed by the Committee in the distribution of the tokens was to give the afflicted people a sufficient supply to take them to and from work and give a few extra for week-end journeys. Some of the recipients were at present receiving from 5s. to 7s. worth per month. In connection with other tramway systems on which the blind had the privilege of travelling free, notably those of London and Manchester, it was pointed out as somewhat strange that the London County Council had only issued 100 passes. These passes were, of course, only granted to the necessitous blind, and were intended to enable the blind to travel on a specified route or routes to and from business. On the Manchester system 250 passes had been issued to the necessitous blind, and in West Ham only 13. The privilege had been granted in other towns, but the conditions under which the passes have been granted vary very much. The Committee did not consider a blind beggar who stood every day at a street corner begging from passengers as a necessitous person from the tramway point of view, and it contended that the vast majority of the blind were perfectly content with what was being done for them. The total value of the tokens presently used was from £450 to £500 per annum. The parent Committee has sent the report back for a further report upon what passes could be granted to blind people for free travelling on the cars.

The Tramways Committee has had before it the remit from the T.C. asking for a report on the advisability of arranging for a period of three months, that two of the present ½d. stages be given for ½d. In Committee it was moved and seconded that the remit be sent to the Sub-Committee for consideration and report, before December 1st next, while the amendment (which was defeated on a vote) asked that the question simply be remitted back for further consideration.

Kingswinford.—At the monthly meeting of the R.D.C., on Monday, Mr. Higgs pointed out that children's ½d. fares had been instituted on the Brierley Hill and Stourbridge section of the tramway, and he considered reduced fares should be brought into operation on the Kingswinford and Pensnett section also. He therefore moved that the company be written to asking for the concession ; and at the same time that the agreement between the Council and the company as to running powers be brought before the next meeting of the Committee, in order to see whether the company was fulfilling its obligations.

Liverpool.—The public subscription fund for the loyal tramwaymen during the labour trouble is now closed, and it is proposed to distribute the amount equally among the employés, irrespective of rank.

There was a somewhat exciting scene at the meeting of the Tramways and Electric Light and Power Committee on November 10th. Councillor Max Muspratt took exception to the proposal to re-elect Alderman Fred. Smith as deputy-chairman, on the ground that the whole attitude of mind of Alderman Smith, where labour troubles were concerned, was a constant danger to the peace and goodwill of the city. On a vote Mr. Smith was re-elected, four voting against. When the sub-committees were chosen, an attempt by Councillor Gates to divide the electric supply and the tramways departments was unsuccessful

Middlesbrough.—A scheme is being prepared to link up Middlesbrough, North Ormesby, Cargo Fleet, South Bank, Grange Town, Normanby and Eston by a railless traction service. The project has been brought about largely by the fact that in its recent Parliamentary Bill the local tramway company failed to secure an extension of time for the completion of its long-projected scheme to extend the tramway service to South Bank and Grange Town. A syndicate has been formed, backed up by the owners of large works, and Messrs. Jackson & Jackson, of Middlesbrough, solicitors for the promoters, have addressed a letter to the North Ormesby U.D.C., intimating that Parliamentary powers are to be sought to carry out the scheme.

Mid-Lothian.—At a meeting of the Suburban District Committee of the County Council the question of tramways to Corstorphine and other places in the neighbourhood of Edinburgh was raised, and after discussion it was decided that the District Committee should give every reasonable facility for tramway extensions.

New Zealand.—The New Zealand Minister of Finance announced, in his financial statement, that plans were being prepared for the electrification of the railway through the Lyttelton Tunnel, with a view to the work being put in hand at an early date.

North London Railway.—The *Financial Times* states that the directors of this company have definitely decided to electrify their system. This step was agreed to at a board meeting on Wednesday, and it is anticipated that the work will be taken in hand immediately.

Nottingham.—In his report on the tramways department accounts of the Corporation for the year ending March 31st last, Mr. Walter Garth, one of the city auditors, stated that he was strongly of opinion that the tramways department should be supplied with current at the rate of 1d. per unit, as it provided a constant day load customer, added to which there was no difficulty or risk in collecting the account. This year ½d. per unit would make a difference of £5,918. This amount would be of considerable importance to the tramways department, and the reduction would not injure the electricity department, as that undertaking had now obtained the limit of its reserve fund. Its surplus interest amounted to £1,090, whilst its general surplus of assets for repayment of capital and for renewals were equal to 41·28 per cent. of its capital expenditure (the electricity department being in this respect the most favoured of any of the trading undertakings) whereas the tramways department had but 38·88 per cent. Although the amount added to the reserve fund was not up to the standard of the requirements of the fund, yet it was satisfactory to note that £3,817 had been carried to the credit, being an increase of £2,068 on the previous year.

Panama.—The U.S. Government is calling for bids for 40 electrically-driven locomotives required for towing ships through the locks at Gatun, Pedro Miguel and Miraflores, Panama Canal. The system of towing provides for the passing through the locks of a ship at the rate of 2 miles an hour, the vessel being held steady by four hawsers. A ship will come to rest in the forebay of the locks and four hawsers will be attached, two forward on either side and two aft. These hawsers will lead to the windlasses of four towing locomotives operating on the lock walls, two towing forward, and

the two aft being towed by their hawsers. The locomotives will run on a level, excepting where they pass from one lock to another, where they will climb or descend heavy grades. There will be two systems of tracks, one for towing, and the other for the return of the locomotives. After hauling a ship through the last gates, and into the forebay, the locomotives will coil their cables and return to await another ship, or will take hold of a vessel going in the opposite direction and tow her through.

South Africa.—Messrs. W. Spilhaus & Co., of Cape Town, have made application to the T.C. for a concession enabling the construction of an aerial railway up Table Mountain. They suggest a route from Oranjezicht or Rocklands, and propose electricity as the motive power, and have asked the Town Council to state at what rate it will supply current. The concession is asked for up to the end of 1912.

Tunbridge Wells.—The T.C. has informed the Parliamentary agents of a company that it does not view with favour a proposal to construct a railless traction route in the borough and between the town and Southborough.

West Hartlepool.—At a meeting of the T.C. on the 7th inst., the Mayor moved a report of a special meeting of the Tramways Committee which recommended the payment of the sum now due to the Tramways Company, and this was adopted. Another report of the same Committee was submitted, and Mr. Paterson, in moving its adoption, said it was proposed to apply for powers for constructing additional lines. These would be laid in Lynn Street, Musgrove Street, York Road, Elswick Road, Hart Road and Hart Lane. The Park section which the T.C. had acquired was in a bad condition, and it was recommended to advertise for tenders for its reconstruction. This work the borough engineer estimated would cost £4,000. The report was adopted.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government has decided to build a wireless station on New Year's Island, off the south coast of Tierra del Fuego, in order to assist the German South Polar Expedition, under Dr. Filcher, during the stay of the *Deutschland* in the Weddel Sea.

France.—In addition to the existing stations, wireless posts are being erected at Monrovia in Liberia, at Timbuctoo in New Guinea, at Fort Lamy and at Abecher, the last named to be connected with a station at Djibouti which is projected. Madagascar is to be connected with the island of Reunion and the Comorra Islands, which latter will thus be able to correspond with Djibouti. The French Indo-Chinese possessions are also to be linked up by wireless stations with French colonies in the Indian Ocean. In the West Indies, Cayenne is to be put in connection with Martinique and Guadeloupe, and communication will also be arranged for between New Caledonia and other French possessions in the Pacific. These various stations, linked together, will form a complete system united to Paris by means of the central station at the Eiffel Tower. —*Journal des Postes.*

Germany.—The Bremen firm of Lehnkering & Co. has decided to set up a novel telephonic arrangement for direct communication with its ships immediately on their arrival off the port of Bremen. A submarine cable is to be laid from the company's office to a point in the outer harbour. Here the ships' captains will be able to notify their arrival and receive orders as to loading and the like without leaving their ships.— *Elek. Nach.*

The wireless station which is shortly to be opened at Königsberg for the public service will make the seventh under the control of the Imperial Telegraph Department, the other stations being at Danzig, Swinemünde, Norddeich, Kuxhaven, Heligoland and Sylt. The public may make use of these stations through the Postal authorities.

Hythe Telephone Dispute.—In accordance with a promise to the T.C., the Post Office authorities have commenced installing an underground system of telephone cables, to dispense with the route running through the Mayor's Avenue and the Grove.

Russia.—The Russian Government is erecting a wireless station on the Island of Rano, 110 km. from the shore of the Riga Sea, for communication with ships and the mainland. A coast station is also to be set up on the Finnish coast near Reval.

State Telephones.—Among countries whose telephonic systems are wholly or partly worked by the State, Germany takes the leading place as regards the total of receipts. According to the latest statistics, those for 1909, the aggregate income from the three telephone administrations amounted to 161,500,000 fr. England, which occupied the second place, had a total of only 44,000,000 fr., and France had 43,000,000 fr. The income of no other country reached to as much as 20,000,000 fr.

U.S.A.—The Public Service Commission of New York State has decided a fight which has been going on before that Commission between the Postal Telegraph Co. and the Western Union Telegraph Co. for a year and a half past; the decision is in favour of the former. The Commission decides that the Western Union has been practising discrimination against the Postal, and has ordered that it be stopped. It appears that where the Postal Co. has a message destined to a point not reached by the Postal lines, the company has carried it as far as it could, and then turned it over to the Western Union for final transmission and delivery, and the Western Union has insisted that from three to five words be added to the message, and that the Postal Co. pay for the transmission of those additional words. The Public Service Commission now decides that this is an illegal charge, and orders the Western Union to discontinue it. The decree says: "Clearly a public service corporation must extend precisely the same facilities to a competitor as it does to the entire world; it can make no distinction between those offering it business. It must charge them alike, and serve them alike." This decision may have an important bearing on the demand of the independent telephone companies that the Bell companies shall furnish the former with the same facilities which are furnished to the public; it means a large saving of money to the Postal Co.

Wire Thefts.—The northern suburbs of Paris have been the scene for months past of extensive robberies of telegraph and telephone transmission lines, which have been cut over long distances and removed. The police have concluded that these thefts are the work of professional thieves. Domiciliary visits to the shops of second-hand dealers have resulted in the recovery of over 50,000 kg. of wire and the implication of some 54 dealers as receivers.—*Journal des Postes.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

Belgium.—December 5th. The Secrétariat Général de l'Administration des Hospices, of Brussels (Boulevard Botanique, Hopital St. Jean), is inviting tenders for the supply and installation of two electrically-operated lifts in the St. Pierre Hospital, Brussels.

November 27th.—The municipal authorities of Fleron-lez-Liége are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes.

Belgrade.—November 27th. The Directors of the Servian State Railways at Belgrade are inviting tenders for the supply of electrical material for the national mine at Szenje. Reference No. 38,238/11. Guarantee, 800 fr.

Blackpool.—November 29th. One 1,500-KW. steam turbo-alternator, one barometric jet condenser, and one 800-KW. mixed-pressure steam turbo-generator, for the Corporation. See "Official Notices" November 10th.

Darlington.—December 4th. 500-KW. D.C. dynamo coupled to a reciprocating steam engine, for the Corporation. See "Official Notices" to-day.

Dublin.—November 21st. Electric lighting and fire-signalling apparatus for the new Fire Brigade station. See this column in our last issue.

Kenfig Hill.—November 20th. Lighting of Kenfig Hill and district by electricity or gas, for the Penybout R.D.C. Particulars from T. Thomas, New Cottage, Pyle, near Bridgend.

London.—November 18th. Various stores and materials for the Port of London Authority, including: Item 27, carbons for electric arc lamps; Item 28, electric lamps (carbon filament). Stores Superintendent, 106, Fenchurch Street, E.C.

Hammersmith.—November 22nd. Low-tension service cable, for the B.C. See "Official Notices" to-day.

Fulham.—November 22nd. Transformers, for the B.C. See "Official Notices" to-day.

Neath.—November 25th. Small steam coal for a year, for the electricity generating station of the R.D.C. G. H. Thomson, electrical engineer, 12, Green Street, Neath.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

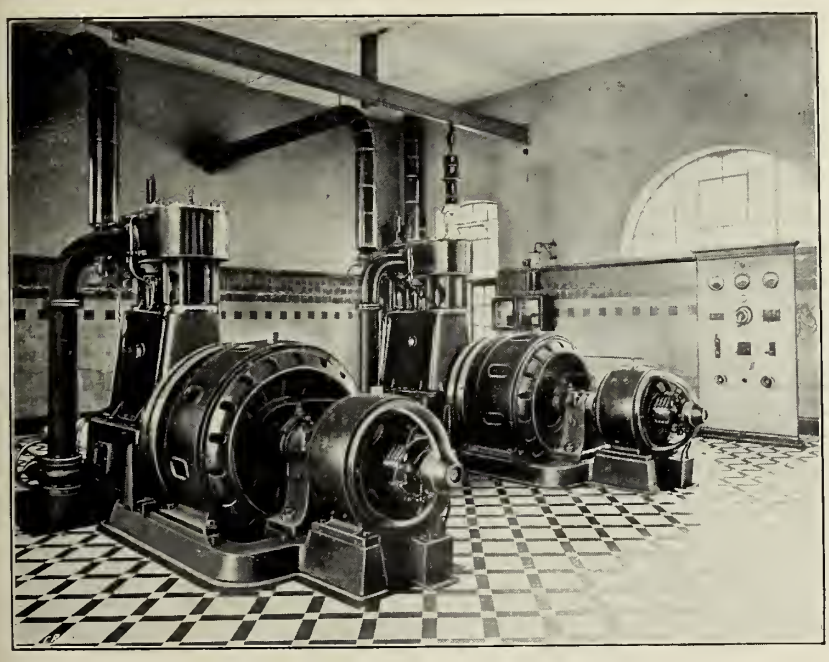
Norwich.—November 27th. Two water-tube boilers, for the Corporation Electricity Department. See "Official Notices" to-day.

(*Continued on page* 831.)

RECENT DEVELOPMENTS OF THE "SCHORCH" INDIVIDUAL DRIVE SYSTEM IN ENGLISH AND COLONIAL TEXTILE MILLS.

By W. R. ROTHENBERG, A.M.I.E.E., Member of the Textile Institute.

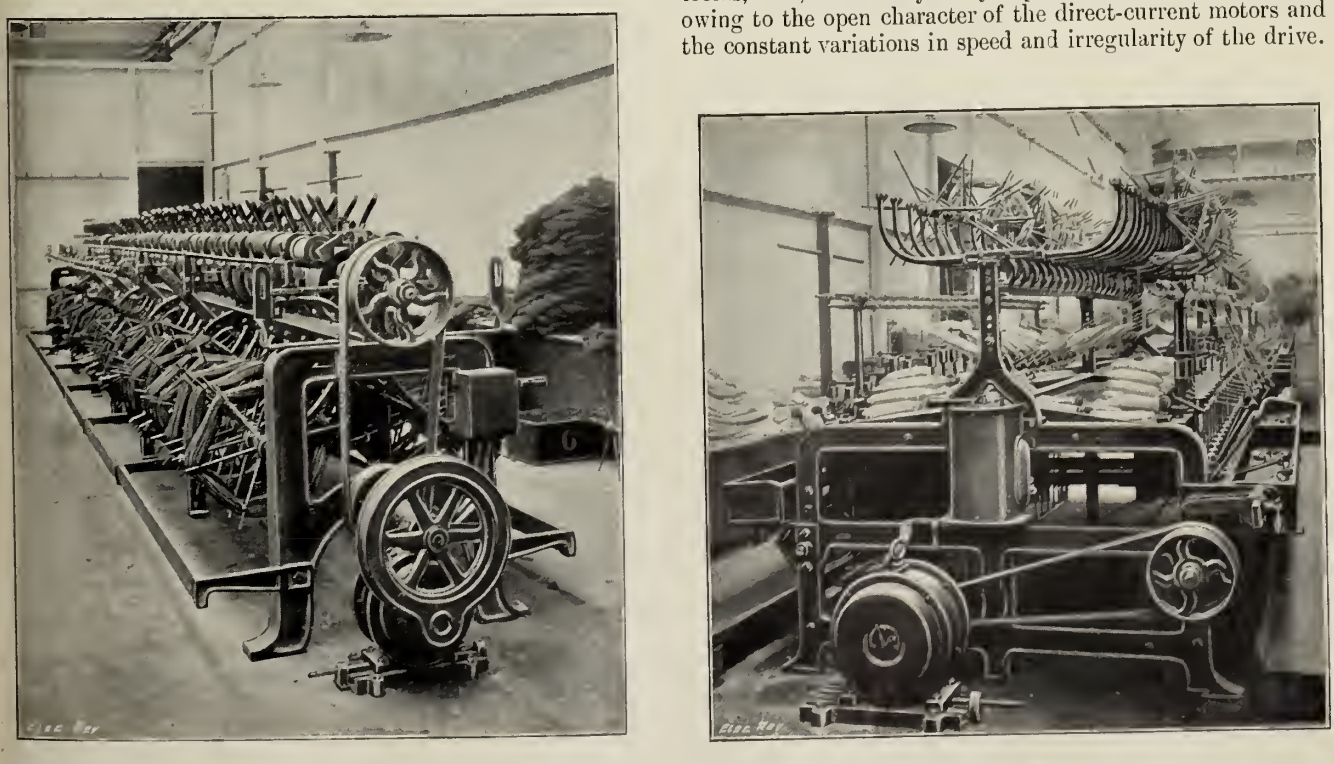
It is not very long ago that it was necessary to write lengthy articles and undertake prolonged and earnest missionary work to secure even a scant and tardy recognition of the benefits of electrical driving in textile mills. The claims of advantages which are made for electrical driving, viz., absolute steadiness of speed, increased output, saving in power, and all-round improved financial results have been discussed frequently, and as these are now daily proved in large English textile mills, it is not necessary to go fully into this matter. This article is only intended to show that electrical driving of textile machinery is by far the best method, and that it will in the future be adopted for all new mills, extensions, and in cases where the mechanical drive must be changed on account of alterations in the mills, &c.



Three-phase Power Plant for a Mill in N. Wales.

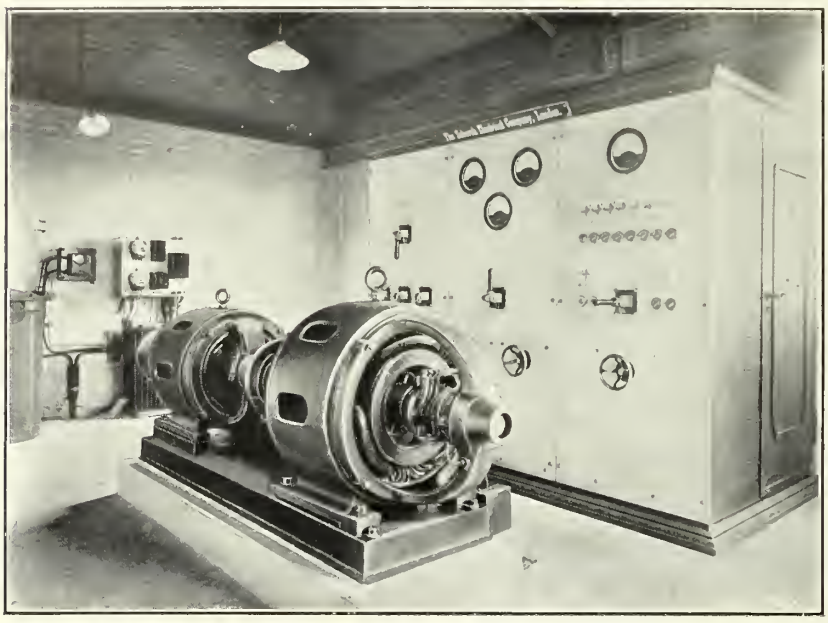
The chilly reception given to the pioneers of the so-called group drive system was perhaps easily to be explained by the many disadvantages in the system itself, but it was warmth itself compared to the attitude that was at first taken up in this country about three years ago towards the so-called single-drive system and its exponents. Earliest in this field was the Schorch Electrical Co., who, after having carried out within the last eight to ten years a great number of single-drive installations on the Continent and abroad, thought to introduce the same to the English textile manufacturers.

Progress at first was very difficult. Not only had the well-known conservatism to be broken through, but also an amount of prejudice which had been raised in many quarters by the failure of early experimenters in electrical single-driving. These were due to the electrical engineer's ignorance of weaving and spinning conditions, and the lack of suitable apparatus. In putting down electrical installations in textile mills in this country electrical engineers and contractors did not appreciate the very important point that for a textile mill only three-phase alternating-current is of use; it was thought to be quite good enough to install open direct-current motors to drive spinning frames, looms, &c., and many early experiments ended in disaster owing to the open character of the direct-current motors and the constant variations in speed and irregularity of the drive.



Examples of Winding Frames Driven by Schorch Motors, Through Back Gearing and Direct.

Furthermore, the fact was overlooked that the conditions under which electric motors have to work in spinning and weaving mills are not at all favourable to the use of direct-current motors fitted with commutators and brushes. Dirt and dust are soon deposited, causing sparking of the brushes, &c. As a rule, every available foot of floor space is taken up by machinery, and it is, therefore, necessary to fix motors in the most convenient positions, say, to the walls, ceilings, &c., and thus the motors cannot receive the regular and frequent attention required by direct-current machines. The three-phase alternating-current induction motor only requires attention every few months for the purpose of inspecting the bearings, and may, therefore, be quite properly fixed in such places.



Schorch Motor-Generator Set (Single-phase to Three-phase), with Exciter, for Lancashire Weaving Shed.

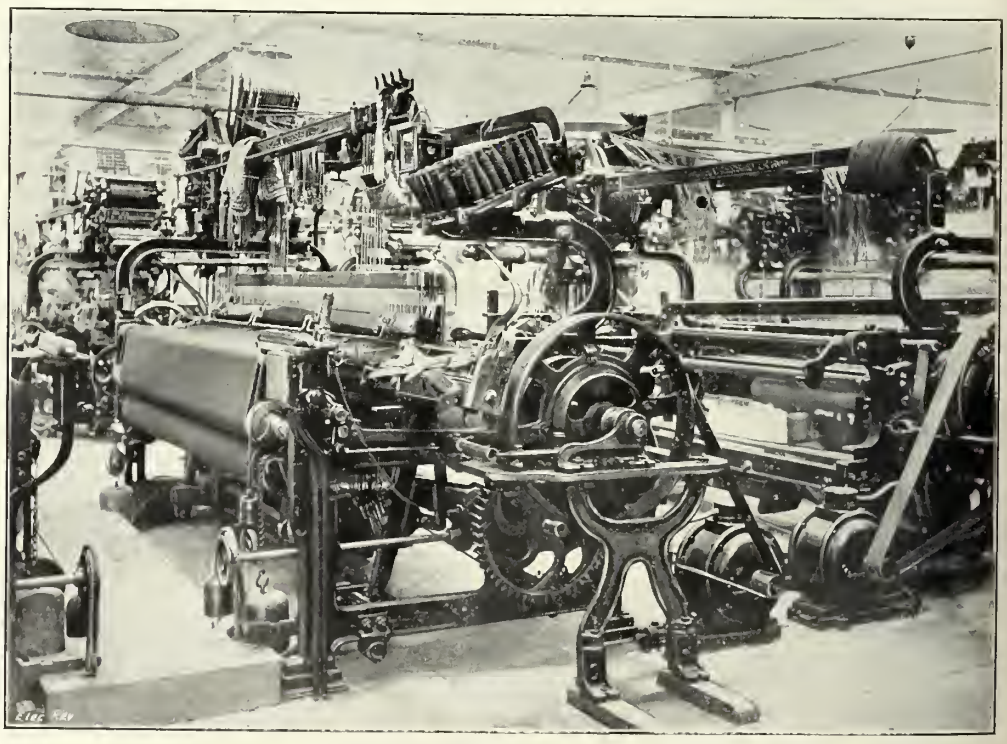
It is a recognised fact that all textile machinery must have constant and uniform speed, and in this very important point the direct-current motor has inherent defects. The alternating-current motor will run with absolutely constant speed; the direct-current motor will vary in speed even with an absolutely uniform load. In a case in the Bolton district where the writer carried out exhaustive experiments in a large mill to show the increased and improved production to be obtained when driving a number of looms by separate three-phase motors, there was no three-phase alternating-current available, and it was necessary to install a small three-phase generator which was run from a shaft driven by a 70-h.p. direct-current motor. The speed of the loom motors connected to the three-phase generator was found to be fairly satisfactory in the morning, but in the afternoon the speed was exceeded from 5 to 10 per cent.

This was easily explained by the fact that the field coils of the direct-current motor got heated up in the afternoon, and the speed of the motor was, therefore, considerably increased. The mill manager, therefore, did not believe the statements made as to the constant-speed drive. At that time a new independent large three-phase power station for this mill was completed, and when the tests were continued in connection with it, not only the constant speed of the loom motors was admitted, but also the increased and improved production, and finally the directors decided to install single-drive three-phase motors in their new weaving shed right through.

It might be mentioned here that this is one of the largest textile mills in this country—Messrs. Barlow & Jones, Ltd.—and that this single-drive installation has now been running for some time with entire satisfaction. With regard to the three-phase alternating-current system, it is of the greatest importance to employ for the individual drive only totally-enclosed motors fitted with ball bearings and of the highest efficiency.

The early failures due to the installation of direct-current motors and open three-phase motors in mills, undoubtedly raised an amount of prejudice in this country, which even yet has not been removed, but the Schorch Electrical Co. were prepared to conquer where others had failed. Owing to their works being situated in the heart of the German textile industry, they had been able to study the conditions intimately, and carry out a long and costly series of experiments in connection with the driving of all classes of textile machinery.

The result was two-fold. First, they evolved modern totally-enclosed spring-suspended highly efficient loom motors and other larger type totally-enclosed textile motors for the individual drive of mules, winding frames, &c., and,



Coating Looms, Individually Driven, in a Yorkshire Weaving Shed.

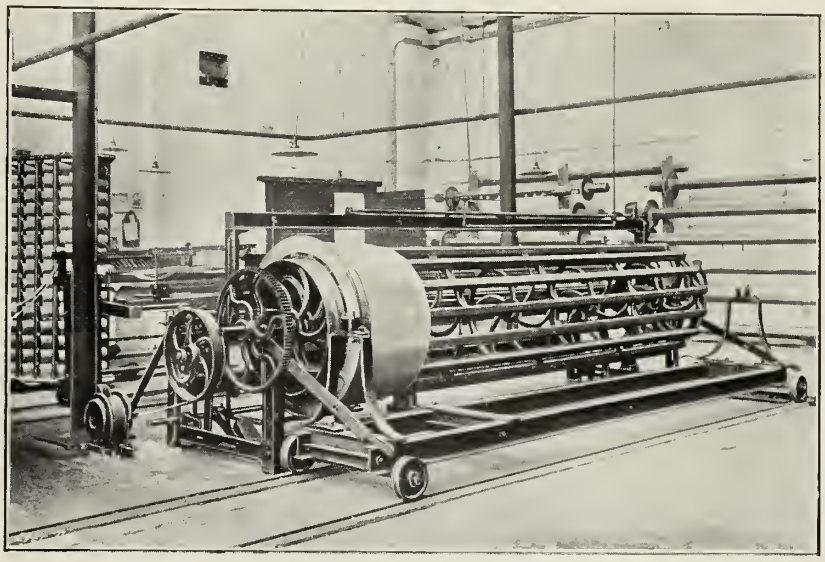
secondly, the electrical textile expert who, in addition to being an electrical engineer, possesses a full and intimate knowledge of the scientific side of textile machine driving. The latter is almost, if not quite, as important as the former, because in weaving, for instance, there are so many different sizes and classes of looms, that any one of a dozen different

ways of driving may be the correct method, and any of the other 11 would spell absolute failure, even with the same efficient driving machine. Even then the converts to the "Schorch" system were very shy of coming forward.

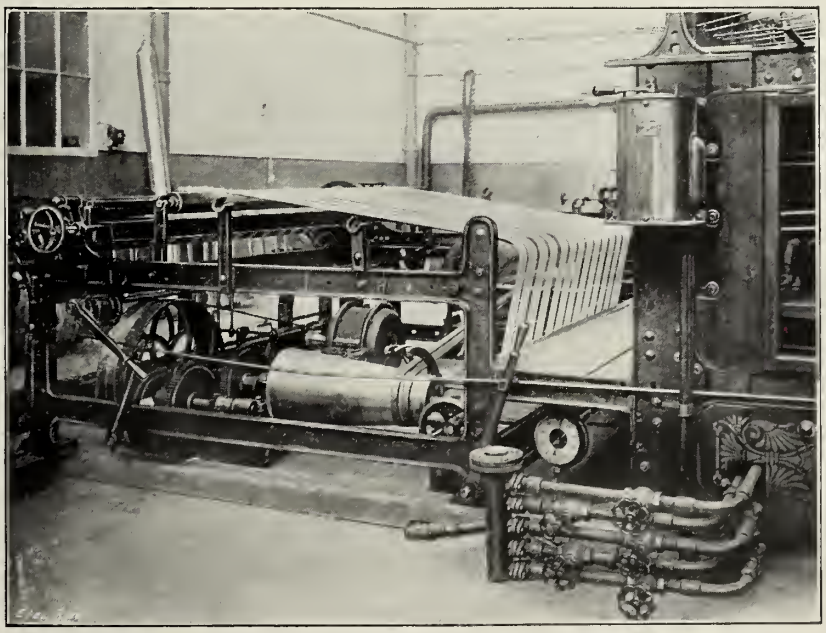
The first probably in the cotton manufacturing trade were Messrs. James Orr and Sons, Ltd., who considerably extended their single-drive installation. Another of the early firms to adopt the "Schorch" single-drive system were Messrs. J. H. Binns & Co., Ltd., Devonshire Mills, Keighley, who put down about 150 loom motors for the single driving of heavy coating looms, also totally enclosed three-phase motors for the individual driving of all their preparation machinery, such as sizing machines, dressing frames, &c. This installation has been working now for about 1½ years, and is giving perfect satisfaction.

It is especially noteworthy that the owners of the mill state that the upkeep of the plant is practically nil compared to their previous mechanical shafting drive. They freely admit having an increased production of 6 to 8 per cent., which is verified by the fact that all their weavers earn a few shillings more per week since they have changed from shafting drive to electrical individual drive.

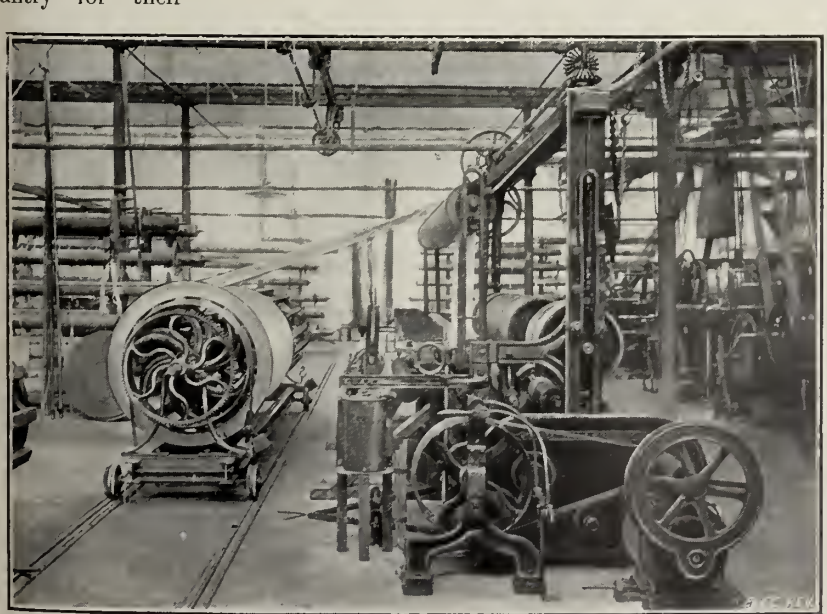
After the first few installations when the "Schorch" single-drive system could be seen working, the great benefits claimed were found to be actually obtained, the early hostility was to an extent reduced, and the Schorch Electrical Co. received a large number of orders in this country for their special electrical textile installations. With regard to the development of the electric single-drive system in cotton



The Individual Drive in a Lancashire Mill.



Sizing Machine with Schorch Totally-Enclosed Motor Drive.

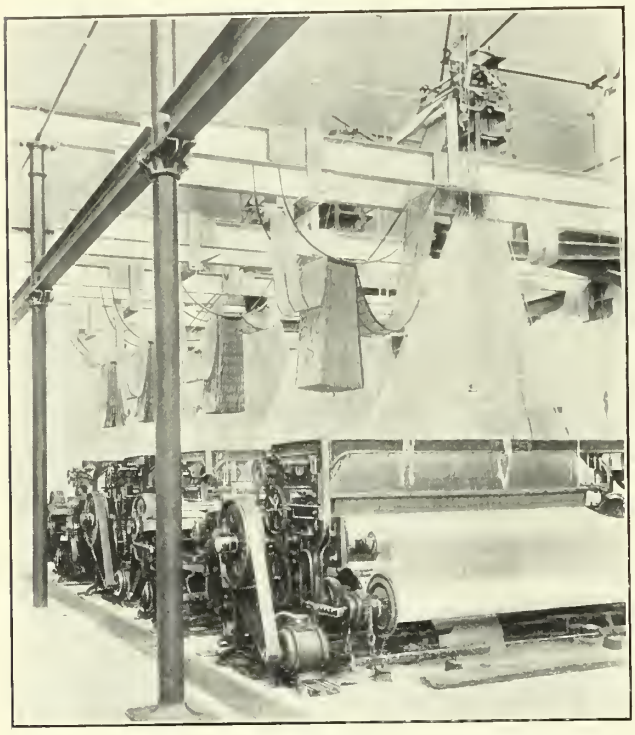


Winding Machine with Schorch Motor Drive

mills in India, it will, no doubt, be of interest for readers of this article to hear that in accordance with specification issued by Mr. A. N. Robinson, two large spinning mills in Gokak, India, will be fitted up with single-drive motors (about 500) right through. The spinning frames will be, in this instance, driven by the variable speed Oerlikon single-phase commutator motors, while all the other machinery, *i.e.*, roving frames, slubbing frames, intermediate frames, openers, &c., about 250 in number with the exception of the cards, will be driven singly by totally-enclosed ball-bearing Schorch three-phase motors. With regard to the cards, which require a great amount of power for starting and very little power while running, it has been arranged to drive the shafting for these, running at 260 R.P.M., direct from a motor.

There is, so far, not a single individual drive installation for a complete English spinning mill although there are a few single drives of spinning frames and self-acting mules, so the above-mentioned installation in India will be the first of its kind. These two Indian spinning mills are a present shaft-driven, and, of course, the whole of the shafting will now be removed. The progress that has been made may be judged by the very large orders that have been executed during the past three years, or are in hand at present for this single-drive system. In some instances, hundreds of

three-phase textile motors are being supplied, in the Bolton, Manchester, Huddersfield, West of England textile area, for some of the most important concerns. In addition to these the whole of the loom motors and three-phase motors for preparation machinery, about 350 in



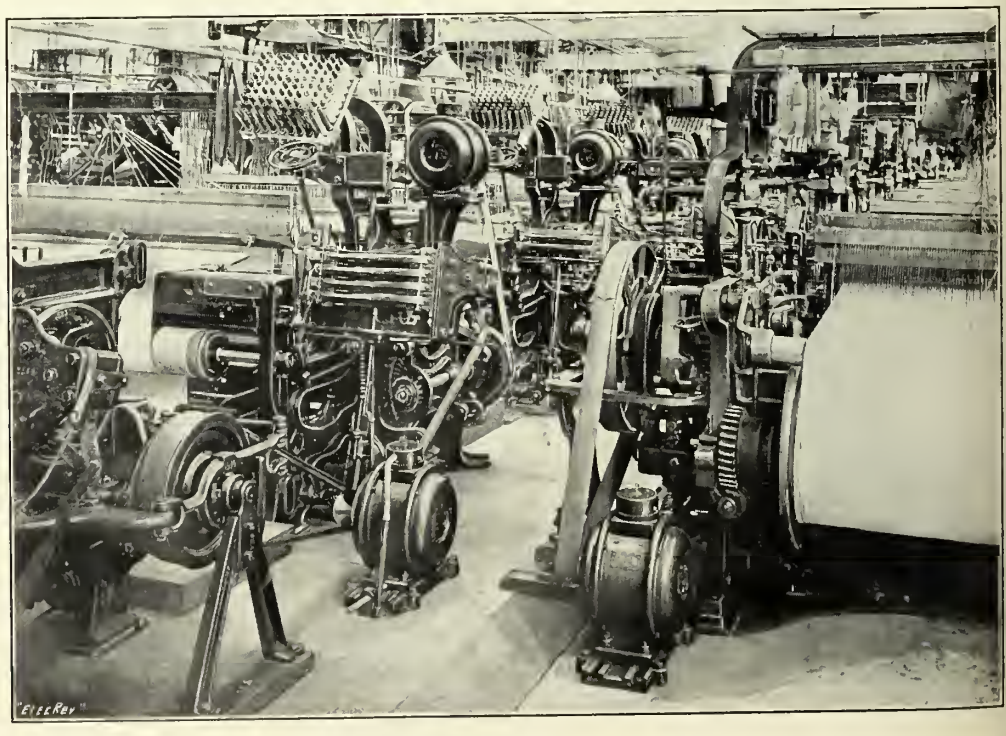
Quilt Looms fitted with Jacquards, Individually Driven by Schorch Motors.

number, for the new weaving shed in Radcliffe for the Co-operative Wholesale Society, Ltd., are now being made by the Schorch Electrical Co., who have been entrusted with this order.

A few installations on the single-drive system have been carried out by other firms who have been keen to follow where the prospects of business were so good.

And what of the future? The time is surely gone by when each prospective buyer will have to be dragged over the same old weary ground and finally insist on the scheme being tried in his own mill, to see whether it will work. After the number of important installations, of which a few significant illustrations are given, showing Schorch textile motors driving looms and other machinery in English textile mills, that have now been running for some time, the manufacturer may be legitimately expected to take the success of the scheme as being assured, and when once this is the case the road to rapid extension will be clear. As a matter of fact, there are signs of an approaching period of great electrical expansion both at home and abroad which will bring plenty of work. The contracts in hand and the prospects furnish a very encouraging outlook. The writer believes that the improvement is going to continue unless labour restlessness, which is becoming more and more threatening, takes the worst course. The adverse electrical competition in this country has been due to there not being enough work to go round. Manufacturers built new electrical factories and extended others when the period of slacker demand, which was not anticipated by anybody, was close at hand.

Under such conditions as those, attempts to enter into an understanding for the prevention of price cutting were not so likely to be successful as when more work was available; therefore, in presence of the improved prospect, the writer cannot help regarding the present as a most opportune moment for a new attempt to be made, whereby all-round better prices shall result. When one takes into consideration the vast ever-expanding prosperous textile industry in this country, the very large sums spent generally in new mills, extensions, renewals and alterations, it would seem that at least the future of the electrical textile business is great beyond all computation; although the early work has been costly and difficult, yet the writer has every confidence that the harvest will be adequate, and the result, in addition to affording selfish satisfaction to the electrical manufacturers, will place our great textile industry on a higher plane of efficiency all round, which will doubtless have a most beneficial effect in helping us to maintain our place as the greatest textile power in the world.



Dobcross Looms with Schorch Single Motor Drive.

West Hartlepool Exhibition.—At the North of England Shipping and Engineering Exhibition, which opened on 13th inst., at the Queen's Rink, West Hartlepool, the Combination Metallic Packing Co., Ltd., have an exhibit of their leading manufactures.

A Non-Ferrous Metals Exhibition.—The first meeting of the Vice-Presidents and Hon. Advisory Council of the above Exhibition was held at the Holborn Restaurant on Wednesday last week. The President of the Exhibition, Sir Gerard Albert Muntz Bart. (President of the Institute of Metals) was in the chair. Mr F. W. Bridges is the organising manager of the Exhibition, who after the chairman had referred to the origin, scope and objects of the Exhibition, explained that the show would be of a threefold character—it would show non-ferrous metals from the crude or up to the finished article, and the various purposes to which non ferrous metals could be applied; and a wider knowledge would be conveyed of the machinery employed in turning out the goods. The Exhibition takes place at the Royal Agricultural Hall, N., from May 6th to 18th, 1912.

CONTRACTS OPEN.

(*Continued from page* 826.)

orth-Eastern Railway.—November 21st. Various rials for 6 or 12 months, including the following sections:—25, arc lamp carbons; No. 26, electric lamps; No. 27, electric s and cables: No. 27A, electric lighting, sundry fittings; 33A, glasses for electric arc lamps. E. H. Clark, Stores Superident, Gateshead.
legraph stores (apparatus, and wire and line stores) for 6 or 12 ths. C. H. Ellison, Telegraph Superintendent, York.

orway.—January 31st, 1912. The Norwegian military orities in Christiania are inviting tenders for the supply of 100 of field telephone apparatus.

ilford.—November 27th. Two 1,000-KW. direct-current o-generators, for the Corporation. See "Official Notices" mber 3rd.

iam.—December 30th. Tenders are invited for five rically-driven centrifugal pumps for the waterworks at kok. Particulars, Local Sanitary Department, Bangkok.

ain.—December 6th. Tenders are being invited by municipal authorities of Pedro Bernardo (province of Avila), ne concession for the electric lighting of the town during a l of 20 years.
vember 29th.—The municipal authorities of Malagon (pro- of Ciudad Real), are inviting tenders for the concession for lectric lighting of the town during a period of six years.
ders have just been invited by the municipal authorities of zuela (Province of Cordoba), for the concession for the elec- ghting of the town during a period of 10 years.

rindon.—November 22nd. One 250-KW. Diesel oil e generating set, accessories, switchgear, &c., for the Corpora- See "Official Notices" November 3rd.

uguay.—February 6th, 1912. Tenders are invited e Port Authorities at Monte Video for the supply of 13 electric , together with 600 metres of steel rails. For further ulars, see this column for October 27th.

arrington.—November 28th. Low-tension cable, for orporation Electricity Department See "Official Notices" .

est Ham.—December 4th. Electric light installation e Gainsborough Road Schools, for the Corporation. See ial Notices" November 10th.

CLOSED.

hton-under-Lyne.—The Electricity Committee has ed the tender of the Sutcliffe Ventilating and Drying Co., or two ventilators for the roof of the engine room.

llinamallard (Co. Fermanagh).—The contract for hting of the village by electricity has been given to Mr. S. Loughnan, of Bundoran. It includes water turbine, o, switchboard and overhead mains.

rrow-in-Furness.—The T.C. has accepted the tender srs. George Robson & Co. for six coal-bunker chutes at the city works, at £184.

ldnich.—The Electric Supply Co. has placed an order he Tudor Accumulator Co., Ltd., for a new battery.

rban.—The Corporation, acting under powers lately d to municipalities to supply electric current outside their ive boundaries, is erecting an E.H.T. overhead line, supplying hase at 6,600 volts, for Messrs. Storms & Co.'s brickworks, d about five miles from Durban, and requiring about . The contract for the electrical plant for the brickworks ling to our Durban correspondent) has been secured by . T. Barlow & Son, and is for the supply and erection of the ng:—
250-K.V.A. Westinghouse oil-type transformers, three-phase, 6,600 to 500 volts, 50 periods.
H.T. Westinghouse switch pillars to control H.T. side of transformers, each fitted with three-pole oil circuit-breakers with overload releases.
312-B.H.P. Westinghouse A.C. slip-ring motors, three-phase, 50 periods, 500 volts, at a speed of 585 R.P.M.
Westinghouse liquid starters; also the necessary ammeters, circuit-breakers, &c.

sgow.—The Tramways Committee of the T.C. has ended the following offers for acceptance:—
l poles.—Stewarts & Lloyds, Ltd.
roof cable.—I.-R., G.-P. and Telegraph Works Co., Ltd.
m dust-extractor.—Hydro-Vacuum, Ltd.
er bonds.—R. R. Todd.
er strip.—Charles Henderson & Co.
l-covered cables.—British Insulated and Helsby Cables, Ltd.
ature coils.—Manchester Armature Repair Co.

er of Messrs. Mirrlees, Watson & Co. for the condensing r the new turbine at Pinkston power station has also been l.

London.—L.C.C.—The tender of the Stern Sonneborn Oil Co., Ltd., for the supply of cylinder oil for Greenwich generating station for one year, at 1s. 1½d. per gallon, has been accepted.
STEPNEY.—The B.C. Electric Supply Committee has accepted the tender of Messrs. R. A. Bradshaw & Son, at £52, for six arc lamp columns; also the tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., at £60, for rubber cable.

Northampton.—The T.C. has accepted the tender of Messrs. Wiggins & Co. for the annual supply to the tramways power station of 1,600 tons of Griff peas, at 9s. 8d. per ton.

Southampton.—The T.C. has accepted the tender of Messrs. Playfair & Toole, at £3,145, for extending the car depôt at Portswood.

Stoke-on-Trent.—The B. of G. has accepted the tender of Messrs. Blackburn, Starling & Co., of Hanley, for electric wiring work.

Swansea.—The Harbour Trust on Monday accepted the following tenders:—
Crompton & Co.—Motor and pump, £108.
Ward, Haggis & Smith.—Radial drilling machine, £145.
Isca Foundry Co.—Points and crossings, £143.

West Bromwich.—The T.C. has accepted the tender of Cox-Walkers, Ltd., for a Taylor-Scotson automatic potential regulator for controlling the voltage on a 1,000-KW. generator.

Yarmouth.—The Borough Education Committee has accepted the tender of the Borough Electrical Engineer for installing auto-transformers and metal-filament lamps at the Edward Worlledge School, at £30.

York.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Barber, Walker & Co., of Bentley Colliery, Doncaster, for coal for the works for a year, at 7s. 10d. per ton.

FORTHCOMING EVENTS.

Illuminating Engineering Society.—Friday, November 17th. At 8 p.m. At the Royal Society of Arts. Report on progress during the vacation, and paper on "Notes on the Design of Motor-Car Headlights," by Dr. H. R. B. Hickman.

Northampton Institute Engineering Society.—Friday, November 17th. At 5.45 p.m. Paper on "The Design of Electric Power Stations," by Mr. A. H. Perrett.

Junior Institution of Engineers.—Saturday, November 18th. At 3 p.m. Visit to the works of the Tottenham and Edmonton Gas Light and Coke Co.

London Electrical Engineers' Club.—Saturday, November 18th. At 7.30 for 8 p.m. At the Café Monico. First annual dinner. Members should apply to the Hon. Sec. at once for tickets.

Electro-Harmonic Society.—Monday, November 20th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' Night.

Institution of Civil Engineers.—Tuesday, November 21st. At 8 p.m. Further discussion on papers on "The Loch Leven Water-Power Works," and "The Hydro-Electric Plant in the British Aluminium Co.'s Works at Kinlochleven."

Royal Society of Arts.—Wednesday, November 22nd. At 8 p.m. Paper on "The Industrial Progress of the United States of America," by Mr. J. Douglas.

Institution of Electrical Engineers.—Thursday, November 23rd. At 8 p.m. Paper on "Automatic Reversible Battery Boosters," by Mr. R. Rankin.

Physical Society.—Friday, November 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Maximum Value of the Electric Stress between Two Unequal Spherical Electrodes," by Dr. A. Russell; "The Magnetic Transition Point of Cementite," by Messrs. S. W. J. Smith, W. White and S. G. Barker, and other papers.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leay.

The following orders are issued:—

Friday, November 17th.—"D" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.

Saturday, November 18th.—Social Club annual dinner, at 7.30 p.m., at the Café Monico.

Monday, November 20th.—"A" Company. Technical work and musketry instruction (standard tests), 8 to 10 p.m.

Tuesday, November 21st.—"B" Company. Lecture to engine-drivers, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Wednesday, November 22nd.—Gymnastic classes, 7 to 10 p.m.

Thursday, November 23rd.—"C" Company. Lecture, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Friday, November 24th.—"D" Company. Lecture, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Saturday, November 25th.—Probable run at Coalhouse Fort, Gravesend, for "C" Company.

There will be a week-end mobilisation camp at Dover for "A" and "B" Companies, leaving Victoria Station at 1.30 p.m. on Saturday, December 9th.

(Signed) P. H. Campbell, Capt. R.E., Adjt. L.E.E.

Fatal Accident.—Frederick Harwood, 36, Tipton, was on Monday working on the roof of the electric power station at Ocker Hill, when he fell to the ground. He sustained fractures of the skull and right arm, from which injuries he died the same afternoon.

NOTES.

Financial Success of Olympia Electrical Exhibition.—Mr. Hawes, secretary of the Executive Committee of the Olympia Electrical Exhibition, informs us that it has been resolved, subject to audit of the accounts, to return to exhibitors approximately 20 per cent. of the space money.

The Kjellberg Electric Welding Process. — On Friday last, through the courtesy of the Kjellberg Syndicate, Ltd., we were enabled to witness a practical demonstration of the Kjellberg electric welding process, which has been successfully applied in a number of difficult cases where reliability and uniformity of metallic structure at the joint were necessary. The peculiarity of the system is in the use of a special metal electrode, which, among other things, enables the composition of the welding material to be predetermined, and allows of successful welding from the underside. A demonstration of the genuineness of the weld, by means of a hammer and chisel, was convincing ; we hope to return to the subject in more detail in our next issue.

National Insurance Bill.—In last Friday's Parliamentary Papers, Mr. Rendall asked the Chancellor of the Exchequer whether any proposal in the Insurance Bill would be the means of relieving any employer from payment of compensation to his employés under the Workmen's Compensation Acts or the Employers' Liability Act ; whether the Insurance Bill provided that a workman should not receive both compensation under these Acts, and sickness benefit at the same time ; and whether any expression of opinion on the result of this provision had been made by the actuaries advising either friendly societies or trade unions.—Mr. M'Kinnon Wood said that the Insurance Bill did not relieve employers from any liability under the Workmen's Compensation Acts or the Employers' Liability Act : neither did it prohibit a workman from receiving both compensation from his employer, and sickness benefit from his society, if he had contracted to pay for it. It did prohibit a workman from receiving benefit in return for his contribution under the Bill in cases of accident where the amount of the compensation was more than the benefit. That prohibition was inserted in accordance with the advice of the eminent actuaries employed by the Government, and their advice had been endorsed by actuaries advising both trade unions and friendly societies, and by very many competent persons, and it was in accordance with the principles of equality upon which the Bill proceeded, for it would be unjust, when all trades paid the same contribution, to pay a greater benefit to those trades in which accidents were most frequent.

Electrical Contractors' Association (East Yorkshire).—The inaugural dinner of the above branch of the Contractors' Association was held at the Grosvenor Hotel, Hull, on Saturday evening, Councillor W. L. Harrison, the president, being in the chair.

Mr. E. M. Parson, a well-known Hull electrical contractor, in proposing "The Mayor and Corporation," said, as electrical contractors, they ought to congratulate themselves that their municipal relations were not the same as in Sheffield and other towns, which absolutely drove the contractor out of the field by doing all the work themselves. They had every reason to be grateful for the way the Corporation Electric Lighting Committee treated the contracting firms. The speaker referred to the progressive attitude of the Corporation, and added that, as electrical contractors, they were looking forward to the time when there would be some very fine wiring jobs to do in Hessle, Cottingham and district. Ald. Hanger, chairman of the Corporation Electricity Committee, in reply, stated that during the time he had been on the Council they had always spent money wisely. They had spent £90,000 to purchase the old gas company, and reduced the price of gas to consumers in the old part of the town. On telephones they had spent £60,000. On the electrical undertaking they had expended £400,000, and were projecting a big scheme of extension.

Mr. H. Hyde, in speaking of the trade of Hull, said they could congratulate themselves that the electrical trade was in a fairly flourishing condition, and he was hoping that when the Corporation had got the new plant about which there had been so much talk, they would see their way to reduce prices. They were decidedly discouraged in persuading anyone to take up electricity for heating or cooking at the present rates. He advocated the holding of an electrical exhibition.

Mr. H. Bell, the city electrical engineer, in the course of his speech, favoured an examination for members of the Association, as in the case of plumbers. Electricity, he said, was going to play a very much more important part than in the past in the industrial and domestic economy of the country.

National Telephone Co.'s Staff Dinner.—On Saturday last, the Midland province of the National Telephone Co. held a staff dinner at the Grand Hotel, Birmingham, prior to transfer to the Post Office, and to bid farewell to Mr. Alfred Coleman, superintendent of the province since its inauguration. The chair was taken by Mr. John Scott, assistant provincial superintendent, and there was an attendance of upwards of 400 members of the staff of the Midland province and guests from London and elsewhere. Mr. and Mrs. A. Coleman were the guests of the evening, and others present included Mr. S. J. Goddard, general superintendent, London ; Mr. F. Gill, engineer-in-chief to the company ; Mr. W. E. Hart, solicitor ; Mr. E. J. Eldridge, superintending engineer to the Post Office ; Mr. C. B. Clay, metropolitan superintendent ; Mr. F. J. Watson, superintendent, Scotland ; Mr. W. W. Cook, ass engineer-in-chief, London ; and Mr. R. Shepherd, superinter North-Western province.

The loyal toasts having been honoured, the chairman briefly, in view of the long programme in front of him, of the association of Mr. Coleman with the Midland province, an affection and esteem in which he was held by all who had under his influence during this period.

Mr. Williamson, test manager, Birmingham, proposed "The pany," and referred briefly to its history and development responding, Mr. Goddard gave expression to his pleasure in present, and spoke appreciatively of his long association wit Coleman. Looking back, he said that there had been faults i service, but that it was now satisfactory to the public and selves. In the beginning, members of the public had enough to put money into the concern, although the Govern regarded the innovation somewhat as a toy. Their succes company had been due to the loyalty and devotion of the me of the staff of all grades. Looking ahead, he thought th years hence, as servants of the National Telephone Co., they have nothing to be ashamed of. Personally, he had mor fidence in private than in Government administration.

The toast "The Head Officers of the Company" was put b Ruddock, district manager, Hanley. Mr. F. Gill, in respo spoke of the encouragement he had received as a young man Mr. Coleman, and referred to the great and noble traditions c National Telephone Co., which, if lived up to, would ensure future success.

Mr. Bennett, district manager, Sheffield, on behalf of the bers of the staff of the Midland province, then presented a watch to Mr. Coleman, and a necklet and brooch to Mrs. Col He spoke of the cheerfulness and upright character of Mr. Col which had gained for him the esteem of every member of th

Mr. Coleman, after acknowledging the kindness of the staff, first of early difficulties in the matter of convincing peopl they needed telephones, and secondly, of their difficulties in g wayleaves. From a shareholder's point of view they were a managed company ; their success was not due to the directo management only, but to the enthusiasm of all members staff. He urged all present not to succumb to the sometimes fying influence of red tape, but to keep alive in their work.

An excellent programme of music was arranged, and the were interspersed with the speeches, including a song "Fa N.T.C.," written for the occasion and sung by Mr. Lewis.

Institution and Lecture Notes.—Institutio Electrical Engineers (Birmingham Local Section)— Friday the fifth annual dinner of the Birmingham Local S was held at the Grand Hotel, Birmingham, and was attend upwards of 100 members and guests. The chairman, Mr. R. occupied the chair. The guests included the President Institution (Mr. S. Z. de Ferranti), Dr. Gisbert Kapp, Mr. Patchell, Mr. Robert Hammond, and Messrs. J. E. King R. K. Morcom, H. Hirst, T. Harding Churton, W. Judd, Cook, H. Faraday Proctor and P. F. Rowell (Secretary), repres the Council of the Institution.

The Chairman, having put the loyal toasts, proposed Institution of Electrical Engineers." Having thanke members for again electing him chairman for the new sessio Railing introduced the subject which he thought was uppern the minds of everyone, viz., the new Articles of Associatio expressed the belief that the Council of the Institution wa too ready to acknowledge the rights of all corporate membe to allow them full opportunity for expression of their After referring to the increasing importance of the Birmi district, he urged members to take a broad view of the situ and to support the Council in their efforts to increase the sco usefulness of the Institution, which was the main object new Articles. Mr. Ferranti, in responding, with reference new Articles, explained that the giving of the legal notice on purely formal ; he was pleased that so much interest ha awakened, and if it could be maintained the Institution prosper and extend its usefulness. He felt that the countr whole did not realise the importance of the electrical engin industry, and that stronger Parliamentary representatio desirable. This deficiency would be corrected by including membership men of standing, not necessarily technical me with this in view, the Council was proposing to rechrist Associate class, and also providing a new class for the peopl excluded from the Associates. Concluding, he rather wel the accident in procedure, as it had awakened conte elements which must finally tend to the benefit of the Insti and he urged members to regard the new proposals unselfish in a broad light.

Mr. W. H. Patchell, vice-president, in proposing the "Birmi Local Section," congratulated the city on its recent develo and strongly advocated the election of trained engineers as m of Parliament. Mr. A. M. Taylor, vice-chairman, in respo appealed to every member to do his duty and make the ne personal sacrifice that the requirements of the Inst demanded.

Mr. R. A. Chattock, past-chairman, proposed "Ele Industries and Our Guests." He referred to the rapid adva the application of electricity as shown by the recent Ele Exhibition, and advocated the hiring-out of apparatus to pop the developments taking place. Referring to the reorgan of the Electrical Manufacturers' Association, Mr. Chattock st supported the avoidance of cut-throat competition, which r in economies in manufacture that were fatal to reliabil adversely affected continuity of service. Mr. Robert Hamm

responding, asked members to regard the Council as their own Council, and not as the London Council. In reference to the electrical industries, he drew attention to the fact that electrical engineers depended upon the development of electrical industries, so he thought that the Institution should do all in its power to develop, not only the profession of electrical engineering, but the electrical industries themselves. Mr. J. E. Kingsbury, in responding, expressed the proudest hopes for the electrical industries.

Mr. M. Solomon proposed "The Chairman," who made a suitable response.

Mr. W. E. Warrilow, Mr. J. P. Kemp, Mr. G. C. Vyle, Mr. H. E. Wasser, and the G.E.C. Orchestral Band contributed in a large measure to the evening's enjoyment by performing musical and humorous items.

Physical Society of London.—At the meeting on October 27th, a paper on "Further Observations on the Afterglow of Electric Discharge and Kindred Phenomena" was read by the Hon. R. J. Strutt, F.R.S. It was shown that ozone prepared by means of the Siemens ozone tube used at atmospheric pressure was able, when mixed with nitric oxide, to give the greenish-yellow afterglow flame. A blue glow was obtained under the same conditions with sulphuretted hydrogen and ozone. The effect of sulphur compounds in improving the air glow was shown to be due to their power of destroying organic matter prejudicial to ozone. Pure oxygen does not give an afterglow. A paper on "Homogeneous Fluorescent X-Radiation of a Second Series," by Prof. C. G. Barkla and J. Nicol, was read by Prof. Barkla.

Association of Engineers-in-Charge.—On December 13th, a paper is to be read on "Methods of Dealing with Losses in Steam Plant due to Condensation," by Messrs. Geo. Wilkinson and J. Rendell Wilkinson. Mr. Frank Bailey will preside.

Mr. W. W. Lackie, chief engineer of the electricity department of the Glasgow Corporation, recently delivered a lecture under the auspices of the Glasgow Health Culture Society, on the subject of "Electrical Energy and its Relation to the Smoke Problem."

Northampton Institute Engineering Society.—A paper on "Diesel Engines" was read before the Society on Friday, November 3rd, by Messrs. T. R. Houston and F. G. Parnell.

Crystal Palace Old Students' Society.—The seventeenth annual dinner of the Old Students of the Crystal Palace School of Practical Engineering was held at the Criterion Restaurant on November 9th. Mr. Sidney R. Lowcock represented the president, Mr. Diogo A. Symons, who was abroad. Sir Fortescue Flannery, in proposing the toast of "The Engineering School," dwelt upon the advantages of theoretical training combined with practical work. Mr. Maurice Fitzmaurice, chief engineer of the L.C.C., proposed the toast of "The Old Students' Society," and Mr. Elliott Cooper, vice-president of the Institution of Civil Engineers, responded for "The Visitors." The Crystal Palace Old Students now number considerably over 2,000, and it was pointed out that during the past year the record showed that between 80 and 90 appointments, some of them being leading positions, had been gained by Old Students. A very large proportion of the members of the Society are engaged upon works abroad and in the Colonies, and many of the older members hold positions of the first importance.

Iron and Steel Institute.—The Council has unanimously elected Mr. Arthur Cooper, of Middlesbrough, to succeed the Duke of Devonshire in the Presidency of the Institute next May.

Society of Engineers (Incorporated).—On November 6th a paper on "Two-Cycle Engines" was read by Mr. R. W. A. Brewer. The author described in detail the tests carried out on a Lamplough two-cycle engine, showing the effects of the various adjustments and alterations made as the tests proceeded, and the interesting results obtained. He referred to the great possibilities of this type of engine, but admitted that very much remained to be done before it could hope to displace the four-cycle engine.

Manchester Association of Engineers.—At a meeting on Friday last, Mr. E. O'Brien, of Horwich, delivered an address on the electrification of railways. He gave an instance of the dispatch on an electrified system of the L. & Y. Co., where an electric train discharged 1,000 passengers, the time between arrival and departure being 90 seconds. For suburban traffic with short distances between the stations electric traction was indispensable when a very fast schedule with many stops was contemplated; such a service could not be run by steam trains. For ordinary services such as were run by steam trains to-day—the slow schedule with many stops—the actual running of the trains was probably more economical with electricity. The electric railway of the future, said Mr. O'Brien, appeared to be a continuous current third-rail system for suburban and inter-suburban lines, with possible stretches of straightforward main line on the single-phase system, which would preclude the movement of the suburban motor coaches or shunt engines from one district to another. The goods yard would only have the entrance electrified, and would be worked largely by separate battery locomotives. Only by this means could the prohibitive cost of the overhead construction or the unnecessary use of the third rail and the comparatively useless electrification of sidings only used occasionally by a locomotive be avoided.

Nobel Prizes.—The Swedish Academy of Science has awarded the Nobel Prize for Chemistry to Mme. Curie, of Paris, who, with her husband, discovered radium. Prof. Wilhelm Wien, of Würzburg, receives the prize for physics. The value of each prize this year is £7,773.

Wiremen's Wages Advance.—A correspondent states that the Electrical Contractors' Association has agreed to increase the wages of electrical wiremen employed in the building trades in the Manchester district by a halfpenny per hour. The advance takes effect from to-morrow (Saturday).

Manchester Smoke Abatement Exhibition.—The Manchester and Salford Smoke Abatement Exhibition was opened on Friday, November 10th, by the Lord Mayor of Manchester, and promises to be a great success. The Exhibition has been organised by the Manchester and District Smoke Abatement Society and by the chairmen of the Gas, Electrical and Sanitary Committees of the Manchester and Salford Corporations. As indicated by the support which is being extended to the Exhibition, its scope is very extensive, and exhibits of gas and electrical appliances for lighting, heating, cooking and ventilating form the chief features of the first two sections. The third section deals with the prevention of factory smoke, and in this section are to be found exhibits of various forms of mechanical stoker and other apparatus for reducing or preventing the emission of smoke from factory chimneys.

The division of the Exhibition into three sections, and the important position assigned to gas and electrical apparatus, proves that the promoters regard the problem of domestic smoke in the United Kingdom as of equal importance to that of factory smoke; and in this view they will be supported by all those who have made a close study of the smoke problem. In foreign countries the domestic smoke problem does not exist, for the closed stove, burning some form of smokeless fuel, is in general use. In the United Kingdom the general adoption of the unscientific form of open fire grate, in which the cheapest form of bituminous coal is burned, greatly intensifies the black smoke problem in all large cities, and the educational influence of the recent exhibition at Glasgow, and that opened on Friday at Manchester, cannot be over-estimated. Both exhibitions are likely to be of great service in reducing the smoke emitted from domestic chimneys.

The Mayor of Manchester, who opened the exhibition, stated that many large factories, which were formerly operated by coal, were now working with electricity or gas, and in certain cases gas was being utilised for the generation of electricity. The extension of such methods would make for the benefit of everybody concerned. He was glad to say that the Manchester Corporation had taken an enlightened view with regard to the supply of electricity for power purposes, and gave a supply at prices which were low and would compete with coal.

Miss Margaret Ashton (Manchester's first and only lady councillor), in supporting a vote of thanks to the Mayor, stated that there was room for great improvement in the use of gas for domestic purposes, and that she was trying to find a method whereby the family washing might be done with less discomfort.

The exhibition is to remain open for two weeks, and on November 21st and 22nd a Smoke Conference is to be held in connection with the annual meeting of the Smoke Abatement League of Great Britain. The programme of this Conference, so far as at present arranged, is as follows:—

Tuesday, November 21st, 3 to 5 p.m.—It is hoped that the Lord Mayor will preside at this sitting. Mr. A. Gordon C. Harvey, M.P., will deliver the Presidential Address. Mr. John W. Graham will explain the Bill, which is to be promoted by the League. Mr. Ernest D. Simon will speak on the aims and policy of the League. Dr. Des Voeux, of London, will read a paper.

6.15 *p.m.*—Annual business meeting of the League.

6.30 *p.m.*—Lectures illustrated by lantern slides:—

1. Short lecture by Prof. Cohen, Ph.D., B.Sc., of Leeds University, on "Soot, its Quantity, Nature and Effects."

2. Short lecture by A. Ruston, B.A., B.Sc., of Leeds University on the "Effects of Smoke on Vegetation."

The above will be followed by discussion. These papers embody the results of important recent research, as yet unpublished.

Wednesday, November 22nd, 10 a.m.—The engineering and technical side of the subject will be treated. Mr. G. B. Storie, M.I.M.E., of Rochdale, will read a paper on the "Effect of Smoke on Boiler Plant Efficiency," and Mr. James Bibby, engineer to Messrs. Bibby & Co., of Liverpool, will follow with a paper on a similar subject.

Councillor W. B. Smith, of Glasgow, will read a paper on "Domestic Smoke," and Mr. Peter Fyfe, Chief Health Inspector of Glasgow, one on "Air Pollution in Scotland."

In a later issue we hope to give a brief report of the above papers and discussions, together with some account of the exhibits that are likely to be of special interest to our readers.

Electro-Harmonic Society.—The next concert of this Society (ladies' night) will be held at the Holborn Restaurant (King's Hall) on Monday evening, November 20th, at 8 o'clock. Mr. W. J. Tennant, M.I.Mech.E., Fel.C.I.P.A., will be the chairman, and the programme, in brief, is as under:—Vocalists, Madame Edith Hands (soprano), Miss Mabel Braine (contralto), Signor Lenghi (tenor), Mr. Jackson Potter (bass-baritone); solo pianoforte, Miss Edith Gunthorpe; solo concertina, Miss Christine Hawkes; musical sketches, Miss Dorothy Varick; humorous sketch, Mr. Barclay Gammon; ventriloquist, Mr. Sidney Gandy; accompanist, Mr. Bernard Flanders, A.R.C.M.

Appointments Vacant.—Switchboard attendant for the Haslingden Corporation electricity department (15s.); switchboard attendant for the Erith Council electricity and tramways department (20s. to 25s.). See our advertisement pages to-day.

Inquiries.—Correspondents ask for the "Yasco" electric daylight lamp, of 200 c.p., and the names of the makers of electric beer-raising engines with automatic switches.

Royal Society Medal.—The Hughes Medal has been awarded to Mr. C. T. R. Wilson, F.R.S., for his investigations on the formation of cloud and their application to the study of electrical ions.

Change of Address.—Messrs. Siemens Bros. & Co., Ltd., announce that from November 20th the greater part of their office staff is being removed from Caxton House, S.W., to the Woolwich Works. Communications should be addressed to Woolwich for the following branches of the business: Insulated wires and cables; telegraph and telephone apparatus; line materials; measuring and testing apparatus; batteries; railway signalling; publications; accounts.

Water-Power Legislation in Switzerland.—A report on a Bill to regulate the use of water-power on Confederation lines in Switzerland has just been submitted to the Department for the Interior. The report states that the Confederation has a positive interest in seeing that the power obtained from waterfalls is rendered available to the general community—that is to say, that it is not made excessively dear for Cantonal or speculative reasons, and for this purpose the Bill restricts the charge per horse-power to a definite sum except for certain undertakings. The grant of concessions and the fixing of conditions in individual cases devolve upon the Cantons according to the Swiss Constitution, and the Cantons will therefore settle the dues and taxes which the hydro-electric works have to pay. The Confederation is empowered to place limits upon this burden, but the greatest difficulties are met with in doing so. Nevertheless, the Bill has endeavoured to restrict, as already mentioned, the charging of high prices for the energy obtained from water-power. In the case of inter-Cantonal waters, the duty devolves upon the Confederation to decide as to their utilisation in the event of the Cantons failing to reach an agreement, and in cases where waters are of an international character the Federal Council is to intervene and conduct negotiations with the country concerned, and to give approval to agreements before being concluded. The Bill also deals with the problem as to what demands the Confederation can put forward for water-powers which are required for its own purposes, as for the working of the railways. It is therefore provided that the Confederation shall have the right of disposition in regard to such water-powers, and shall not be dependent upon the goodwill of Cantons, districts or communes.

Detecting Leaks in Vacuum Apparatus. — In a letter to *Nature* of the 9th inst., Mr. F. W. Aston, of the Cavendish Laboratory, Cambridge, says he has for many years successfully localised leaks in "all-glass" apparatus with Goldstein's method, by disconnecting the kathode lead, putting in a small alternate spark-gap, and exploring over the suspected joints with the loose lead; the position of the leak is indicated by a brilliant discharge to the inside of the apparatus.

In the case of sealing-wax joints an excellent method is to wipe each joint over with a small pad of cotton-wool soaked in petrol, while the discharge is kept going; when the faulty joint is reached, the discharge suddenly changes colour. The test is extremely delicate, and is suitable for all air leaks provided that they are not so bad as to prevent the discharge from taking place.

The Melting Point and Temperature Coefficient of Tantalum.—An article in the *Zeitschrift für Elektrochemie* of October 15th gives the results of a research by M. von Pirani and Alfred R. Meyer on this subject. One of the authors had previously attempted to estimate the melting point of tantalum, but the errors introduced into the method seemed to show that too low a value (2,900° C.) had been ascribed to the melting point. The measurements now described refer to the Holborn-Valentiner scale of 1907 and the constant of Wien's law c = 14,200, and assume the melting point of gold to be 1,064° C. and of palladium 1,575° C. The melting point was determined in the present experiments by the two following methods:—

First of all a loop formed of a strip of tantalum 0·99 mm. wide, 0·041 mm. thick and 100 mm. long was suspended in an evacuated glass vessel, the relation between the current and voltage of this strip lamp, also its black-body temperature to 2,000° C., being determined. The current was then steadily increased until the strip melted through, the temperature, current and voltage being observed at the moment of fusion. The temperature observations had at the lower values to be corrected for the amount of absorption by the glass globe; and, for the observation of the melting point, for the amount absorbed by the *blackened* glass globe.

A further factor to be considered was that tantalum was not a black body, and that by reason of the reflective power of tantalum (44 per cent. for the wave-length under consideration, at which the observations were made), a correction had to be applied.

In addition to the method of observation described above, the connection between the intensity of total radiation and temperature (Stefan's law) was used. The total radiation was indicated in watts in the loop lamp, since current and voltage are observed direct, and the loop (suspended in a high vacuum), gave out again in the form of emissive energy nearly the whole of the energy sent into it.

The experiments for determining the melting point with strips might probably give a result which would be somewhat too low, since the strip may fracture in consequence of its own weight shortly before the melting point is attained. In order to obviate this danger the melting point was also determined by another method. A tantalum wire of about 1 mm. thickness was used as an anode in a mercury arc lamp, and the end of this wire fused by increasing the current. At the moment of fusion measurements could be taken on the small fusion bulb formed, this bulb adhering, by reason of its surface tension, to the wire until it had attained a size of 1 to 2 mm. diameter. The moment at which fusion occurred was very accurately characterised by small movements and deformations of the bulb in consequence of the blowing action of the arc. The current-consumption at the moment of fusing was approximately 10 to 15 amperes.

In all, 14 observations of the melting point were made by the methods indicated; the mean value 2,850° C. being obtained with an accuracy of ± 40° C. From this it is seen that the measurements carried out in the research mentioned above gave nearly the correct value, but that the sources of error of measurement were greatly over-estimated. The observations of current, pressure and temperature made on the strip-loop lamps enabled the experimenters to carry the resistance curve of tantalum considerably farther than previously, to within the neighbourhood of the melting point of platinum.

Duty on Catalogues for Australia.—The following interesting paragraph on this subject recently appeared in an Australian newspaper:—"The abolition of the duty on illustrated trade catalogues, we learn from Melbourne, was requested by a deputation of 20 importers, representing 100 British houses and the English Manufacturers' Association, introduced to the Minister of Customs on Thursday by Mr. H. Wickes, British trade representative. In putting the case, Mr. P. Rosling, president of the Institute of Electrical Engineers, urged that numbers of catalogues were really text-books of advantage to engineers in Australia. The duty prevented their circulation, and brought no work to Australia, for out of, say, 1,000 expensive catalogues printed in Britain, perhaps only 50 would be sent to the Commonwealth. The duty of 6d. a lb, or 35 per cent., meant that firms did not accept delivery of goods, and the post offices were burdened with the work of their return, or they were destroyed. In reply, the Minister stated aspects of the question had not been touched upon by the deputation. A British firm starting to manufacture in Australia would consider itself penalised if duty had to be paid on their catalogues. Before giving his answer Mr. Tudor will consult printing houses, and discover how much work the duty brings to them."

Electrical Heating of Houses.—During the coming winter the Gothenburg Electrical Works intend to start practical experiments on a large scale upon the heating of houses by means of electricity. As a commencement, electrical heating apparatus will be installed in two five-storey houses. The chief object of these experiments is to employ the energy available during the night-time, when only a fraction of the output is used for industrial purposes; it is easy to see what a great advantage it would be to employ the whole amount of available energy constantly, especially when it is derived from waterfalls and not from coal. The cost of producing the energy does not amount to more than $\frac{1}{15}$d. per KW.-hour, and it is therefore estimated that the works should do an excellent business by disposing of it for the above-mentioned purpose at a price of $\frac{1}{15}$d. per KW.-hour, which would be an exceedingly cheap price to householders.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. S. H. DANIELS has resigned his position as shift engineer at the West Bromwich Corporation electricity works, in order so take up the position of shift engineer in the power station at the works of Messrs. Cammell, Laird & Co., Ltd., Sheffield.

General.—At the Newton Abbot electricity works on Friday, November 3rd, MR. A. J. JENKINS, the late clerk, who has taken up a better position at Cromer electricity works, was presented with an engraved silver cigarette case, presented by the staff and employés of the Urban Electric Supply Co., Ltd. The resident engineer, Mr. G. E. Smith, voiced the sentiments of the donors in making the presentation.

Our Durban correspondent reports that MR. F. W. MILLS, electrical engineer of the late Natal Government Railways and Harbour, has been appointed chief electrical engineer of the railways and harbours of the Union of South Africa, with headquarters at Johannesburg. He also reports that MR. J. DENHAM, electrical engineer of the late Cape Government Railways, has been appointed electrical adviser of the Mines Department of the Union of South Africa.

MR. GEORGE RALPH, who for the past 13 years has been works manager at Messrs. J. H. Holmes & Co.'s electrical works, Newcastle-on-Tyne, and who is about to take over a responsible position with the Electric and Ordnance Accessories Co., Ltd., Birmingham, has been made the recipient of a handsome gift from his former colleagues at a smoking concert recently held. The gift, which consisted of a lathe, set of tools and accessories, were handed over by Mr. T. Carter on behalf of the donors, and a pendant was also presented to Mrs. Ralph. Mr. J. Walker presided.

MR. SHERARD COWPER-COLES has now started private laboratories at 1 and 2, Old Pye Street, Westminster, which are being fitted up especially for electrochemical and metallurgical work, the equipment including an electric furnace, for which a 100-H.P. transformer is being installed.

We understand that Mr. C. C. F. Monckton is giving up his consulting practice at Parliament Mansions, Victoria Street, S.W., to take up the newly established post of Superintendent of Telegraphs and Telephones, Fiji, and that he leaves England on November 15th. His business will be carried on by Mr. Arnold G. Hansard, of the same address, in conjunction with whom he has worked for the last five years.

Mr. H. E. Potts, of the technical staff of the British Insulated and Helsby Cables, Ltd., Prescot, who is leaving to take up a position in London, has been presented by his colleagues with a walking stick and umbrella.

Bailie W. F. Russell and Bailie Walter Nelson have been re-appointed convener and sub-convener of the Glasgow Tramways Committee, and Mr. James Willock and Bailie W. B. Smith have been elected respectively convener and sub-convener of the Electricity Committee.

Indian Engineering says that during the absence of Mr. G. B. Winter on long leave home, Mr. A. H. Smyth, his assistant, acts as electrical and signal engineer, South Indian Railway.

Messrs. Lacey & Sillar, consulting engineers, Manchester, have been retained by the Lancashire Territorial Association.

NEW COMPANIES REGISTERED.

Melksham Electricity Supply Co., Ltd. (118,263).—This company was registered on October 27th, with a capital of £2,000 in £1 shares (1,000 preference), to carry on the business of an electric lighting and power company in all its branches. The subscribers (with one share each) are:—J. H. Edwards, 127, Victoria Street, Bristol, engineer; E. L. Watts, 38, Parliament Street, Westminster, solicitor. Private company. J. H. Edwards is the first managing director. Registered by Seymour, Williams & Co., 38, Parliament Street, S.W.

Tramways Third Party Assurance, Ltd. (118,326).—This company was registered on October 31st, with a capital of £10,000 in £1 shares, to carry on the business of fire re-insurance, insurance against accidents connected with electric or other tramways, light railways, motors and vehicles, &c. The subscribers (with one share each) are:—R. H. H. Eden, Temple Cowley, Oxford, land agent; J. Whittle, 12, Queen's Road, St. Anne's-on-Sea; A. W. Johanning, Fairholme, Strawberry Hill, director; H. Bendy, 47, Milton Street, E.C., director; A. L. Sherwood, 46, Hamilton Gardens, N.W., publisher; R. A. Bendy, Fermain, Hampton, traveller; A. B. Johanning, 36, Gracechurch Street, E.C., merchant. Minimum cash subscription, whole capital. Registered without articles of association. Registered by Jordan and Sons, Ltd., 116-17, Chancery Lane, W.C.

Manorhamilton and District Electric Light Co., Ltd. (118,741).—This company was registered in Dublin on November 1st, with a capital of £1,000 in £1 shares, to acquire and carry on the business of electricians, mechanical engineers, manufacturers, workers and dealers in electricity, motive power and light, now carried on at Manorhamilton, Co. Leitrim, as Wm. Breakey Hamilton. The subscribers (with 20 ordinary shares each) are:—D. Walsh, Manorhamilton, Co. Leitrim, merchant; J. McGuinness, Manorhamilton, Co. Leitrim, merchant; J. Lynott, Manorhamilton, Co. Leitrim, merchant; Dr. R. A. Rutherford, Earlsfield, Manorhamilton, Co. Leitrim; A. A. Alges, Edenville, Manorhamilton, Co. Leitrim, retired merchant; G. W. Ballman, Manorhamilton, Co. Leitrim, merchant; J. N. Dolan, Manorhamilton, Co. Leitrim, merchant; J. McGovern, Manorhamilton, Co. Leitrim, hotel proprietor; J. Rooney, Manorhamilton, Co. Leitrim, merchant; C. M. Templeman, Manorhamilton, Co. Leitrim, auctioneer. The first directors are D. Walsh, J. McGuinness, J. Lynott, R. A. Rutherford, A. A. Alges, G. W. Ballman, J. McGovern, J. N. Dolan, J. Rooney and C. M. Templeman. Offices, The Commercial House, Manorhamilton, Co. Leitrim.

Universal Cheap Cables, Ltd. (118,401).—This company was registered on November 3rd, with a capital of £100,000, in £1 shares, to carry on the business of wireless and other telegraphists and telephonists, so far as they lawfully can, manufacturers and constructors of telegraph lines, instruments, machinery, wire and materials, to acquire the patents and rights of the Robinson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd., for transmitting printed and typewritten telegraph messages by wireless telegraphy and over cables and land lines, and for receiving them directly printed by receiving stations, &c. The subscribers (with one share each) are:—O. H. Walker, 131, Finborough Road, Earl's Court, S.W., managing clerk; J. Day, 5, Bramfield Road, New Wandsworth, clerk; W. D. Bowles, 13, John Street, Bedford Row, W.C., managing clerk; F. R. Cooper, 10, Granville Road, Wandsworth (secretary Royal Oak Benefit Society); A. Angold, Meadow View, New Barnet, surveyor; W. C. Woodford, 20, Southcote Road, Tufnell Park, N., clerk; G. Wallington, 15, Great James Street, Bedford Row, W.C., solicitor. Minimum cash subscription, £100. The number of directors is not to be less than two or more than seven; the first are W. Hohner, Wurtemberg; F. C. Michaelis, 65-6, Basinghall Street, E.C.; A. T. M. Johnson, 77, Shepherd's Bush Road, W.; and F. G. Lloyd, 40, King Street, Cheapside, E.C. Qualification, one ordinary share. Remuneration (except managing director), £500 per anuum, divisible. Registered office: 40, King Street, Cheapside, E.C.

Economic Packing Co., Ltd. (8,047).—This company was registered in Edinburgh on November 7th, with a capital of £5,000, in 4,500 cumulative preference shares of £1 each, and 10,000 ordinary shares of 1s. each, to acquire inventions and patent rights of A. A. Brown, Rutherglen, relating to boxes and packages for carrying electric lamps, incandescent gas mantles, &c. The subscribers (with one share each), are:—A. Glen, Lismore, Carmyle, Glasgow; M. Steel, Woodside, High Crosshill, Rutherglen, manager. Private company. The number of directors is not to be less than three or more than five. The first are A. A. Brown, A. Glen and M. Steel. Qualification, £50. Remuneration of A. A. Brown, as manager, £200 per annum: of other directors, as stated. Registered office: 65, Bath Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—Return dated August 29th, filed September 28th, 1911; capital £30,000 in £10 shares; 1,195 shares taken up; £5 per share called up on 1,195 and £10 per share on 96; £8,475 paid; £5,960 considered as paid on 96 shares. Mortgages and charges: £5,176 18s. 8d.

Exchange Telegraph Co., Ltd. (6,152c).—Return dated August 10th, filed August 18th, 1911. Capital £246,950 in £10 shares (8,125 "A" and 16,500 "B"); 8,023 "A" and 16,200 "B" shares taken up; £9 per share called up on 6,000 "A" and £1 per share on 2,023 "A"; £56,023 paid; £179,000 considered as paid, being £10 per share on 16,200 "B" and £8 per share on 2,125 "A"; £816 considered as paid on 102 forfeited shares. Mortgages and charges: £5,000.

Consolidated Electrical Co., Ltd. (77,054).—Return dated August 10th, 1911. Capital, £125,000 in £1 shares (15,000 preference). Al shares taken up. £1 per share called up on 15,000 preference and 757 ordinary and 5s. per share on 109,243 ordinary. £43,067 15s. paid. £81,932 5s. considered as paid on 109,243 ordinary. Mortgages and charges: Nil.

Campbell & Isherwood, Ltd.—Equitable mortgage on certain land with messuages thereon in Raleigh Street, Bootle, dated October 13th, 1911, to secure all moneys due or to become due from company to Bank of Liverpool, Ltd., 7, Water Street, Liverpool.

Johnson & Phillips, Ltd. (84,968).—Particulars of £50,000 second debentures created October 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £30,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to so much of £175,000 debenture stock created in 1905 as may for the time being be outstanding. No trustees.

Watson, Foggo & Co., Ltd. (117,891).—Particulars of £1,000 debentures, created October 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd. (54,600).—Return dated September 15th, filed September 30th, 1911. Capital £25,000 in £5 shares (3,200 preferred and 1,800 deferred). All shares taken up; £5 per share called up on 3,100 preferred; £15,500 paid; £9,500 considered as paid on 100 preferred and 1,800 deferred. Mortgages and charges: £48,100 sealed; £400 debentures applied for and paid for, but not sealed.

Foreign and Colonial Lighting, Ltd. (99,020).—Charge on certain moneys, dated October 10th, 1911, to secure £305. Holder: A. B. Beckitt, Kenmore, Higblands, St. Leonards-on-Sea.

London Electric Treatment Co. (1911), Ltd. (117,852).—Particulars of £2,000 debentures, created October 14th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—Issue on October 26th of £332 5s. debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Amazon Telegraph Co., Ltd.

Mr. George Keith presided on Tuesday at the offices, 42, Broad Street, E.C., only the seventeenth ordinary general meeting of this company.

In moving the adoption of the report, the Chairman said the accounts showed a remarkable increase in the company's business for the year under review. The unprecedented rise in the price of rubber which took place in the first half of last year led to a great increase in the rubber trade and business generally on the Amazon in which the duplication of their main cables enabled the company to fully participate. There was also an exceptional increase in official and other traffic in connection with the political troubles which took place in Manaos during October last. Altogether it had been an exceptional year, which was not likely to recur. The traffic receipts showed an increase for the year of 46 per cent., and the total revenue, including subsidy and interest on the year's cash balance, came out at £118,525, or £31,963 more than it did in the previous year. In comparing the year's working expenditure, the expenses at stations showed an increase of £1,280, and those in London were £168 more, both of which increases were to be attributed to the larger traffic. The expenses attending maintenance of cables had also increased by £2,126, due principally to the changing of the route of the Manaos Amatary No. 2 cable, which now formed part of the new duplicate cable. This No. 2 cable was laid six years ago along the Carrera Furo and always suffered from landslips in the river's bank. It was therefore considered advisable, before joining it up to the new cable, to change its route to along the Antuz River, where it had since been quite free from interruptions. The repairs required to be done to the existing cables had also added considerably to the expense of maintenance. The Rio expenses were more, and some of the other items showed an increase, all due to the special circumstances of the year's business. Altogether, the working expenses amounted to £54,945, or £5,023 more than in the preceding year. As regarded the other charges £15,000 was provided for debenture interest, and £15,000 was carried to reserve account, as provided for when the new debentures were issued, by which their redemption was postponed for two years, and the money applied to reserve for the purpose of establishing a reserve fund for the renewal and maintenance of the cables. After clearing off the debit balance of £18,493 brought forward from last year's accounts, the directors were able to recommend a dividend of 4 per cent. and the carrying forward of £5,669 to next year's accounts. He congratulated the shareholders on the result of the year's business. They had been able to establish a reserve fund for the renewal and maintenance of cables and pay a dividend for the first time in the history of the company. It was now over 16 years since the undertaking was

initiated, and he thought the company deserved well of the Brazilian Government for the sacrifice the sh reholders had made during all these years in order to establish able communication along the river Amazon, which had bee of immense benefit to the Government and the public. It had been a work of great difficulty. The laying of the first cable was only just completed when it began to break up and disappear. All endeavours to recover and repair it proved futile, and the old cable in the main river had practically to be re-laid along the side banks and side waters, in many places again and again before the system was completely restored. Since then the communication had been well maintained, except during the periodical fall of the river from June to November, when the cable still continued to suffer from the force of the river, and especially from land slips in the banks. Happily the delay had now been successfully resumed by the duplication of the cable, which was completed in March last. The expenditure incurred thereon during the year was £28,244, and this had been charged to capital account. The total cost of the new cable, not including the section between Amatary and Manaos, which was laid in 1905, came out at £171,013. The exceptionally high price of the rubber used in its manufacture greatly increased the cost, but this had been more than returned to the company by the increased revenue due to the same cause. The whole of the work was most successfully carried out by their able manager, Mr. Nosworthy, and the staff of the *Viking*. As the greater part of the new cable had been laid in side waters too shallow for their present repairing steamer to enter they were having a small steamer built of very light draught, which they expected would be ready to proceed to the Amazon by the end of the year. As regarded the current year, business generally in the Amazon continued dull and stagnant owing to the low price of rubber, and up to the present the message earnings were much under what they were last year, but better than they were the year before that. The outcome of the present year now depended upon the activity of business generally during the coming rubber season which was about to commence, and he hoped if all went well they would be able to present a satisfactory report when they met again.

Mr. Ellice Clark seconded the motion, and the report was adopted without discussion.

The proceedings terminated with a vote of thanks to the board.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Anglo-Argentine Tramways Co.—Scrip, fully and partly paid, for a further issue of £1,500,000 5 per cent. debenture stock.

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co.).—£800,000 5 per cent. 40-year first mortgage bonds of £100 each (Nos. 1 to 8,000).

Tri-State Railway and Electric Co.—$668,000 first mortgage and collateral trust 50-year 6 per cent. gold bonds of $1,000 each.

And to allow the following securities to be quoted in the Official List :—

Buenos Aires Lacroze Tramways Co.—Further issue of £50,000 5 per cent. extension mortgage debentures.

Chiswick Electricity Supply Corporation.—£80,000 4½ per cent. first mortgage debenture stock (special application).

Westminster Electric Supply Corporation.—Further issue of 20,573 4½ per cent. cumulative preference shares of £5 each, fully paid, Nos. 191,380 to 211,952.

Castner-Kellner Alkali Co., Ltd.—The directors report for the year ended September 30th that the net profit, after allowing for expenditure in keeping up the works, plant and machinery, is £178,853, plus £14,159 brought forward, making £193,012. The directors recommend the appropriation of £32,500 to depreciation reserve, increasing that account to £290,000 ; £47,500 to the general reserve, increasing it to £130,000 ; £56,250 in payment of a final dividend of 12½ per cent., making (with the interim dividend) 20 per cent. for the year, leaving £14,222 to be carried forward.

R. & J. Dick, Ltd.—At the annual meeting held in Glasgow on the 10th inst., Mr. J. Parker Smith, who presided, regretted to report a year's working in which the profits had shrunk to a fraction of their usual amount. He explained the reasons which made the directors believe that the results of this year might be expected to be quite exceptional, and that the prospects of their belting industry, so much the largest and most important branch of their business, were those of a sound industrial concern. The reduction of profits in this particular year was very untoward. Happily the reasons were not far to seek, and were of a kind that had been felt by many of the great india-rubber companies as well. The prices of belting were a matter which was extremely difficult to alter, and he need hardly say that it was absolutely necessary that the quality should be maintained, whether the profit for the moment was great or small. The report was adopted.

Continental Notes.—La Société des Usines Electriques de la Lonza, of Basle, reports a net profit of £9,084 for the last financial year, reducing the loss shown in the profit and loss account to £40,288.

The General Electric Co. of Belgium, Ltd., is the title of a new concern which has just been registered in Brussels, with a capital of £8,000.

La Société Electro-Chimique de Brignoud is the name of a company which has just been formed at Brignoud, near Grenoble, France, with a capital of £10,000.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

Sir John Wolfe Barry presided over the seventy-sixth half-yearly meeting, held at Electra House, Finsbury Pavement, E.C., on Tuesday.

The Chairman, in moving the adoption of the report, said the gross receipts for the half-year amounted in round numbers to £329,000, against £344,000 for the corresponding period of 1910, showing a decrease of £15,000, which was not surprising, seeing that in the first half of last year there was an increase of £54,000, due, in a large measure, to the rubber boom which was then at its height. The reduction during the past half-year was almost entirely in the Straits region, where the principal rubber estates were situated, the other portions of their system showing increases. The working and other expenses amounted in round numbers to £151,000, against £152,000 for the corresponding period of 1910, showing a small decrease, due to maintenance of cables having cost about £5,000 less than in the corresponding period of 1910. This more than compensated for the increased expenditure in connection with higher foreign service and other allowances, which, as he explained at the last meeting, the directors had found it necessary to grant to the staff owing to the cost of living in the Straits region having so largely increased in recent years. The net profit for the half-year was roundly £149,000, and, after adding £27,000 brought forward from the previous half-year, there remained an available balance of £176,000. The usual quarterly interim dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, and £50,000 had been transferred to the general reserve fund, leaving a balance to be carried forward of £51,698. When addressing the shareholders a year ago, he referred to a proposal submitted by the British Postmaster-General to the various cable companies interested for the introduction of a reduced rate for deferred telegrams in plain language, and he explained that the associated companies had agreed to the proposal in principle, leaving the necessary details to be worked out. Since then the proposal had taken definite shape, and been considered by the various Governments concerned, and it was expected that the British Postmaster-General would soon be in a position to make an official announcement on the subject. They would doubtless have gathered from the newspaper references to the revolution in China that the Chinese telegraph service had been seriously affected by the disturbances. As a matter of fact, most of the landlines in the north of China had been, and were still, interrupted, and confusion was reported to prevail throughout the whole Chinese telegraph service. Their cables to the Treaty Ports, and the landlines worked by this company and the Great Northern Co between Pekin, Tientsin and Taku continued to carry the International traffic, to the satisfaction of all parties. The situation had naturally been one of anxiety, not altogether free from danger in some places, to the staff, who were ably and zealously carrying out their duties under trying circumstances.

The Marquess of Tweeddale seconded the motion, which was carried without discussion.

A hearty vote of thanks to the board and staff concluded the proceedings.

Hurst, Nelson & Co., Ltd.—The directors report that for the year ended July 15th there was a profit on working of £13,715. After writing off £11,708 for depreciation on wagons, deducting income-tax, directors' fees, &c., and making adjustments there remains a debit balance on profit and loss account of £3 6s. 11d. Nothing (says the *Financial News*) has been set aside for depreciation on machinery. The special reserve fund for the payment of the preference dividend was utilised to pay the last half-year's dividend on the preference shares, and the directors regret that the state of the accounts will not permit of any further dividend being paid at this time. The disappointing results are attributed to the severe competition and to the labour troubles with which the company had to contend. The outlook is described as more hopeful, and the directors state that they are looking forward to better results for the current year.

Marconi's Wireless Telegraph Co., Ltd.—Mr. G. Isaacs presided over an extraordinary general meeting of this company held at the office, Watergate House, Adelphi, W.C., on November 9th, when the resolution increasing the capital, which was passed at the extraordinary general meeting of the company, held on October 25th, was submitted for confirmation. The chairman formally moved the adoption of the resolution, and it was seconded by Major Flood Page, and carried.

Provincial Tramways Co., Ltd.—The directors have declared a final dividend of 10d. per share, making a total dividend of 1s. 6d. per share (7½ per cent.) for the year to September 30th. They have set aside £10,000 for reserve and depreciation and £500 towards writing off the expenses of the debenture issue. £3,354 is to be carried forward as compared with £2,832 last year.

Prospectus.—*South American Light and Power Co., Ltd.*—This company is offering until Saturday an issue of £150,000 5 per cent. first debentures, at 96 per cent.

Ferranti, Ltd.

A. W. Tait presided on Friday, at Winchester House, E.C., a meeting of the first mortgage debenture-holders of the above any, for the purpose of considering a resolution to increase the wing powers of the company.

e Chairman moved a resolution consenting to the raising by id company of the sum of £50,000, by the creation and issue 50,000 additional first mortgage debenture stock, carrying st at the rate of £5 per cent. per annum, and also sanctioning nodification of the rights of the holders of the said first rage debenture stock by the creation and issue of the said 00 additional first mortgage debenture stock. He said that ular had been issued to the first mortgage debenture-holders ning them of the proposal to increase the first mortgage tures from £100,000 to £150,000, and the ordinary share- rs at their meeting had agreed to such increase. The business company had made satisfactory progress during the last two and a comparison of the accounts to April 30th with those of ears ago would show that the increase in the assets, which of course, the security for the debenture stock holders, nted to no less than £87,788. This was distributed over land uildings, £3,900; plant and machinery, tools, &c., £26,500; diture on work in hand, £34,500; stock and stores, £3,000; sundry debtors, £19,600. Even if they deducted from the amount of the depreciation reserve which had been viz., £36,500, they would still have an increase of £51,000 ne value of the assets. That was, of course, apart the further increase which would take place when the extra was issued, because the cash proceeds of that issue, after ng the outstanding prior lien debentures, would be devoted ther working capital of the company. Further working l was required not only in connection with the development isting lines of manufacture, but also because of certain pments which were taking place. Their meter business had enormously in the last few years, and the switch and instru- departments had also shown a considerable growth. They lso gone in for cooking and heating apparatus, for which was likely to be a very considerable demand. Increase of ss naturally meant increase of accommodation and plant, gh they hoped to keep that within as narrow a margin as ould. Still, there must be a certain amount of capital sunk t connection, and they hoped by the increased capital to be competently develop those two lines as well as to further p the existing departments of the company's business. He eceived an intimation from a number of large debenture- s that they thougt it would be advisable that a further increase be made to the sinking fund requirements. At present a qual to 3 per cent. of the stock must be set aside each year for g fund, and this would mean, when the new stock was issued, g aside £4,500. The suggestion was now made that this cent. should be augmented by placing half the surplus profits ch year to the sinking fund, but that the directors be at liberty to carry to reserve from time to such amount of surplus profits as they thought ble, on condition that the reserve fund should be retained e benefit of the company, and not divided amongst the olders. The board were prepared to agree to this condition, was advised by the solicitors that it was not competent to it as an amendment to the resolution, although it would ip in connection with the new trust deed. A further matter hat under the trust deed the company had to pay the sum ed to the trustees, and their only power was to redeem stock ual drawings at the price set forth in the deed. It was it it would be to the advantage of the company to have wer to purchase stock either in the market or by tender, and stockholders agreed it was intended to deal with that matter the new trust deed.

A. B. Anderson seconded the resolution, and it was agreed to it discussion.

German Electrical Companies.

esellschaft fur Elecktrizitats Anlagen of Berlin, which owns supply works, and is financialy interested in other similar akings, reports that both classes experienced a favourable oment in 1910-11, whilst the latter also yielded higher ids. After placing £4,400 to the redemption and renewal as contrasted with £4,800 in 1909-10, the accounts exhibit ofits of £32,000, as against £30,000 in the preceding year. tended to distribute 8 per cent. as compared with 7 per cent. 0-10.

Elektrische Licht und Kraftanlagen Gesellschaft, of Berlin, is purely an investment company, reports that the electric works in which an interest has been held for a long time nade further satisfactory progress in 1910-11. Some of the portant securities were disposed of at a profit, whilst on the hand, advantage was taken of the opportunity to acquire an t in other undertakings. After deducting loan and other s the accounts indicate net profits of £124,000, as compared £103,000 in 1909-10. The sum of £9,900 has been placed to serve fund, as against £9,500 in the previous year, and the e allows of the payment of 7 per cent. on ordinary share of £1,500,000, this contrasting with a similar rate on 00 in 1909-10.

directors of the Elektrizitäts Gesellschaft vorm. Hermann of Chemnitz, state that the degree of employment in 1910-11 favourable that difficulty was experienced in completing ders. As this exercised an unfavourable influence on the costs, and as the external organisation was being successfully extended, it had been decided to make a substantial increase in the works' plant. After allocating £7,700 to depreciation as against £7,400 in 1909-10, the accounts exhibit net profits of £11,000 as compared with £9,500 in the previous year. A dividend at the rate of 7 per cent. has been declared on a share capital of £125,000, the same rate as was paid on £100,000 in 1909-10. It was mentioned at the recent meeting that the value of the orders invoiced so far in the new financial year exceeded that in the corresponding period of 1910 by 30 per cent.

The report of the Deutsche Gasgluhlicht (Auer) Gesellschaft, of Berlin, which manufactures the Osram lamp as well as incandescent gas appliances, states that the gross profits amounted to £327,000 in 1910-11, as compared with £345,000 in the previous year. After making provision for depreciation, the accounts show net profits of £282,000, as against £311,000 in 1909-10. It is proposed to pay a dividend of 5 per cent. on the preference shares and 50 per cent. on the ordinary shares, being the same rate as in the preceding year. The question of quality was decisive in connection with the prevailing over-production of wire lamps, and the sale of Osram lamps had consequently further increased, whereas various makers had either collapsed or worked at a loss. This development would be more expressly manifested in the future owing to the recent reduction in prices. The favourable results for the year were attributed materially to the extension of the business in Osram lamps, which had made further progress in the first four months of the new financial year.

Swedish Telephone Companies.—A Stockholm correspondent of a Frankfort newspaper, in referring to the development of the Swedish telephone manufacturing industry during the present year, states that L. M. Ericsson & Co. extended the scope of activity in May by co-operating in the formation of the Société des Telephones, L. M. Ericsson, of Paris. The former has now established two new companies in Vienna and Buda-Pesth, which have taken over the firm of Deckert & Homalka, of Vienna, together with the branches in Brunn and Prague. The Ericsson Austrian Electricity Co. and the Ericsson Hungarian Electricity Co. are the titles of the two companies which will be controlled by the parent Swedish company, and in which both Austrian and Hungarian banks are also interested. The correspondent further states that the Swedish company has recently concluded contracts for the supply of a telephone exchange to Cape Town for 4,000 subscribers and one for Pretoria for 2,000 sets of apparatus, as well as a contract for the Rand mines. The telephone installation in this gold mining district will be underground, and in connection with the installation above ground. Roumania has become a large purchaser of telephones, and negotiations are proceeding with the Bulgarian Government with a view to the establishment of an exchange in Sofia. It is added that the manufacturing activity of the Swedish company and its branches has been brisker in the present year than for several years past.

Cordoba Light, Power and Traction Co., Ltd.—The directors report that the balance of profit to September 30th, 1911, after meeting all charges, is £19,954, plus £8,202 brought forward, making £28,156. Out of this they recommend a dividend at the rate of 4 per cent., less income-tax, on the shares, and that £9,220 be carried forward. Since the date of the last report, the company has acquired further shares of the Cordoba Light and Power Co., and now owns 97·95 per cent. of its share capital, together with the whole share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd. The accounts of both the Cordoba Light and Power Co. and the Cordoba (Argentine) Electric Tramway Construction Co., Ltd., are made up annually to March 31st. In respect of the year to March 31st last, a dividend amounting, after deduction of income-tax, to £1,883, was received on the shares of the Tramways Co., and is included in the account. The conversion of the tramways for electric traction has proceeded satisfactorily. At the end of September, 26½ miles of track had been converted, of which nearly 17 miles were in service. Another 1½ mile has since been opened, and a further important section, operating in the San Vicente district, is expected to be completed and opened for public service during this month.

Alldays and Onions Pneumatic Engineering Co., Ltd.—The directors have declared the usual annual dividend of 5 per cent. per annum, together with the usual bonus of 5 per cent. on the ordinary shares, making 10 per cent. for the year.

Dorman, Long & Co., Ltd.—The directors announce a final dividend of 3½ per cent., making 6 per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

In most departments of the Stock Exchange there is a fair amount of business going on. The continued ease in the money market, and the feeling that foreign disturbances are not likely to unsettle the home securities, have combined to lead the investor back to Stock Exchange paths; nor is the spirit of speculation entirely absent. New issues are beginning to make their appearance again, and the coming winter promises to be fruitful in a crop of electrical issues concerned mostly with power and traction undertakings abroad.

Amongst these new issues, one of the earliest will be £150,000 5 per cent. Debenture stock offered by the South American Light and Power Company. The prospectus will probably be out before we are. There is a good deal of demand for the underwriting, and, as usual, a certain amount of disappointment on the part of people who thought they had a right to be allotted more than was the case. Of recent new issues, that of the Anglo-Argentine Tramways Debenture stock has improved to 1¼ premium, while the Mexican Light and Power Second Debenture is called nominally par—that is to say, the issue price of 87. Until the underwriters have disposed of more of their stock in the case of the latter, the quotation will probably remain at about its present level.

Another new introduction to the market this week is the Ordinary share of the Manaos Tramways and Light Company. The shares were introduced at 15s., and were quickly put up to 16s. 3d. The company is doing well, and there is a dividend within sight on the Ordinary shares. It may be suggested, however, that the Ordinary shares of the La Plata Electric Tramways are, perhaps, as good an investment as those of the Manaos, and the price is half-a-crown cheaper. Manaos Debenture rose 2 points to 93 middle upon the introduction of the junior security.

The Home Railway market continues to provide excitement and rapid movements. After the meetings of the railway men last Sunday the market advanced strongly, and most of the steam stocks were put up in a substantial manner. With them rose Metropolitan Consolidated to 42¾, and Districts at 30½ showed a rise of the fraction. On the other hand, Central London Ordinary eased off a little after its rise of last week, and City and South London fell ½. Renewed attention is being directed to East London Ordinary, and the price is firm at 6⅛, which is only some 4 points lower than that of the company's "D" Debenture stock.

British Electric Traction shares are a duller market, and while it is expected that the modified scheme of the directors will be duly confirmed, the recent buyers have withdrawn their support, and the market is quietly dull. Potteries Ordinary, however, are firm, and the Preference rose 1/16 to 12s. 1½d., while the Ordinary again advanced to a similar extent. London United Tramways are easier at 3¼. The proposal made the other day that the London County Council should run motor-omnibuses sent rather a shiver through those who had been following the rise in London General Omnibus stock; and although it is not thought that the proposition will come to anything definite, the mere fact of this new bogey having been raised acts as a deterrent to buyers. Underground Electric Railways Income Bonds lost their rise of last week.

English Electricity Supply shares are distinguished by a further rise in County of London Ordinary, which has taken up the price 7s. 6d. to 8⅞. It is stated that the company has been so fortunate as to increase in a material degree its day load, and, on this, anticipations are being raised of an improvement in the dividend. Some people look for 6 per cent. in respect of the current year, and if these expectations are realised, it is quite on the cards that the shares may rise even higher. South London Ordinary rose ⅛, and Westminsters at 7¾ are better to the same extent.

The Canadian-Mexican group shows pronounced strength, and there are rises in nearly all the leading issues. Montreal Light, Heat and Power has recorded another rise of 4 points. Shawinigan Water is up 3. Mexican Light and Power Ordinary rose 2½, and the Preference 1½. Mexico Trams gained 1½, and Sao Paulo Trams 2½, the only shares in this section to show a decline being Rio Trams Ordinary, which have gone back 1½ on the fears of competition, to which reference was made in this column two or three weeks ago. Amongst the bonds the movement is in the same direction, although, of course, the improvements are on a smaller scale. There is a large volume of business being done. British Columbia Preferred and Preference stocks have improved, and Calcutta Preference rose ⅛ on the expectations of the Durbar festivities. Anglo-Argentine Tramways Second Preference at 4⅞ are ⅛ higher. Cape Electric Trams recovered the dividend of 6d. which was deducted last Friday.

We understand that an offer will shortly be made of 3 million dollars 5 per cent. Prior Lien bonds by the Puebla Tramway, Light and Power Company.

In the Telegraph list there is not much change. Marconis slipped back a trifle, but West India and Panama shares regained their little loss of last week on the announcement of another dividend of 1s. 6d. per share, the accounts showing that the company is in a position to pay at least as much again had the directors decided to adopt a less conservative policy. The Anglo and the Eastern groups are both steady. American Telephone and Telegraph Capital stock rose 3, and the Collateral Trust bonds 1, upon buying from the other side.

The feature in the Telephone section has been a rise of no less than 7 points in National Telephone Deferred, the quotation shooting up to 126, with a regular flurry amongst the bears to help it. There are rumours that the Government may make an issue of Exchequer Bills in order to pay out National Telephone proprietors at the end of this year. New York Telephone bonds are harder. The only changes in the rest of the list are ⅛ rise in Oriental Ordinary and 1/16 fall in the Preference.

Manufacturing companies are distinguished mainly for a strong rise in Edison & Swan shares of both classes. The partly-paid shares rose 5/16, and the fully-paid ⅛; the buying seems to be based on the recent report, which, while it was distinctly good, had no effect upon the prices at the time of its issue. There has been a little demand for Willans & Robinson. Telegraph Constructions put on another 10s., but lost it again. Castner-Kellner rose 3/16 on a capital report, showing that the dividend on the shares is to be raised from 17½ to 20 per cent. Babcocks continue their upward march. Brush Ordinary and Preference have had their nominal quotation lowered to 0—¼ in both cases.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Ro mi op
		£	£*		£	£*	
Aberdeen	Nov. 8	2,666	+ 34	23	36,158	+ 1,952	..
Ayr	„ 11	377	+ 8	26	9,678	+ 40	8
Bath	..	..	..	..	..	..	..
Birkenhead	„ 12	2,230	+ 19	32	37,408	+ 1,846	13·7
Birmingham Corp.	„ 4	18,897	+4,788	31	261,154	+48,080	56·4
Blackburn	„ 8	2,125	+ 168	32⅞	38,760	+ 3,282	14·6
Blackpool Corp.	„ 9	1,0·6	+ 104		55,283	+ 7,148	..
Blackpool-Fleetw'd	„ 11	566	+ 33	19	24,057	+ 1,961	..
Bolton	„ 5	4,888	+ 862	32	80,994	+ 5,436	26
Bournemouth	„ 8	3,083	+ 186	32	61,134	— 730	22
Bradford	„ 4	10,449	+ 405	31	175,179	+12,224	56
Brighton	„ 12	1,685	+ 104	32	34,372	+ 2,128	9·5
Bristol	„ 10	12,424	+1,246	..	..	..	..
Brit. Elec. Trac. Co.							
Airdrie	„ 3	468	+ 37	44	9,743	+ 111	3·65
Barnsley	„ 3	378	+ 34	„	8,1·0	+ 598	..
Barrow	„ 3	601	+ 136	„	13,695	+ 1,859	5·87
Devonport	„ 3	1,002	+ 160	„	22,105	+ 3,257	8·85
Gateshead	„ 3	2,160	+ 124	„	46,056	+ 2,482	11·25
Gravesend	„ 3	411	+ 25	„	9,490	+ 318	6·5
Greenock	„ 3	1,599	+ 377	„	32,171	+ 4,613	7·25
Hartlepool	„ 3	606	+ 82	„	12,154	+ 1,120	6·72
Kidderminster	„ 3	194	+ 3	„	5,255	+ 292	..
‡Leamington	„ 3	213	+ 11	„	7,965	+ 388	..
Merthyr	„ 3	395	— 8	„	9,260	+ 123	2·9
Metropolitan	„ 3	17,125	+2,319	„	389,640	+58,028	22
Middleton	„ 3	609	+ 14	„	15,203	+ 1,202	8·5
Mid. Joint Com'tee	„ 3	8,428	—3,491	„	234,474	—21,144	..
Oldham—Ashton	„ 3	1,145	+ 34	„	25,451	+ 966	9·13
Peterborough	„ 3	241	+ 37	„	5,752	+ 573	5·31
Potteries	„ 3	4,248	+ 290	„	86,073	+ 7,960	29
Rothesay	„ 3	81	— 6	„	9,882	+ 57	2·75
Southport	„ 3	501	+ 14	„	13,651	+ 524	8·17
S. Metropolitan	„ 3	1,544	+ 22	„	38,596	+ 1,938	..
Swansea	„ 3	2,2 6	+ 151	„	50,745	+ 2,910	12·5
Tynemouth	„ 3	3.0	— 22	„	11,888	+ 587	3·75
Weston-s-Mare	„ 3	68	..	„	8,025	+ 1,043	8
‡Worcester	„ 3	542	+ 19	„	13,216	+ 581	5·75
Wrexham	„ 3	205	+ 21	„	4,522	+ 225	..
Yorks. Wool. Dist.	„ 3	2,130	+ 133	„	46,699	+ 3,064	17
Miscellaneous	„ 3	422	+ 40	„	10,098	+ 586	..
Burnley	„ 11	2,700	+ 279	..	..	..	11·7
Burton-on-Trent	„ 12	531	— 5	32	9,551	+ 589	6·6
Bury	„ 12	2,347	+ 150	32	42,394	+ 3,661	22·5
Cardiff	„ 11	4,623	+ 403	32	80,6·2	+ 6,241	..
Chatham and Dist.	„ 9	1,664	+ 68	45	38,780	— 27	15
Cork	„ 9	952	— 13	45	22,185	+ 544	9·89
Croydon	„ 3	3,333	+ 120	31	57,800	+ 4,083	11·4
Darlington	„ 11	426	+ 22	33	7,340	+ 690	..
Darwen	„ 10	516	+ 24	32	8,761	+ 676	4·26
Dover	„ 4	437	+ 54	31	8,6·7	+ 1,283	3·75
Dublin	„ 10	10,639	+ 149	..	121,439	+10,947	54·2
Dundee	„ 8	2,216	— 82	25⅔	30,300	— 797	15
East Ham	„ 11	2,106	+ 13	32	35,712	+ 1,714	7·87
Exeter	„ 10	599	+ 23	32	11,623	+ 832	5·5
Glasgow	„ 11	38,079	+2,960	..	452,057	+31,216	98
†Hastings	„ 9	791	+ 32	..	..	+ 530	..
Huddersfield	„ 11	3,746	+ 194	32	64,175	+ 6,826	29·5
Hull	„ 11	5,827	+ 897	32	93,723	+ 4,842	14·5
Ilkeston	„ 9	243	+ 6	32	4,329	+ 75	..
Ipswich	„ 11	7.0	+ 48	32	15,248	+ 865	10·5
Kilmarnock	„ 11	239	+ 18	26	4,400	+ 357	4·25
Lancashire United	„ 8	2,482	+ 190	45	61,068	+ 2,072	39
Leeds	„ 4	14 994	+1,334	31	238,351	+16,177	50·75
Leicester	„ 11	4,878	+ 366	..	..	..	..
Leith	„ 11	1,164	+ 106	25⅝	17,642	+ 1,254	8·7
Liverpool	„ 4	23,022	+1,016	44	504,823	+15,521	116
‡L.C.O.	„ 1	86,870	+3,025	..	1,369,784	+72,644	140
London United	„ 11	11,343	+ 649	..	296,429	+ 9,905	..
Lowestoft	„ 11	380	+ 46	6	1,128	+ 20	3·5
Manchester	„ 11	81,744	+1,386	32	526,550	+27,809	182
Newcastle	„ 11	8,306	+ 817	..	138,032	+ 9,683	14·5
Newport	„ 4	1,249	+ 48	31	22,492	+ 877	14·5
Oldham	„ 12	3.832	+ 271	33	64,678	+ 2,887	28·75
Pontypridd	„ 11	236	+ 17	32	13,508	— 16	5·5
Portsmouth	„ 4	3,621	+ 96	31	68,804	— 6,195	15·25
†Preston	„ 1	736	+ 16	31	24,851	+ 1,555	..
Rotherham	..	..	..	..	..	..	..
Salford	„ 6	9,369	+ 314	31⅔	155,180	+ 6,846	..
Sheffield	„ 14	13,002	+ 798	..	213,204	+13,607	40
Southampton	„ 8	2,293	+ 216	32	41,017	+ 5,075	22
Southend-on-Sea	„ 8	1,019	+ 171	32	24,690	+ 3,681	..
South Shields	„ 11	1,145	+ 120	32	20,650	+ 2,173	..
Swindon	„ 8	306	+ 29	..	5,257	+ 582	..
Tyneside	„ 8	859	+ 170	19	10,080	+ 1,421	..
Wallasey	„ 11	1,960	+ 168	32	36,856	+ 5,275	..
Walthamstow	„ 11	1,312	+ 70	32	25,261	+ 1,610	9
West Ham	„ 2	5.350	+ 393	31	85,480	+ 7,669	15·25
Wolverhampton	„ 8	1,902	+ 95	32	32,076	+ 1,926	25
Cen. London Rly.	„ 11	10,531	— 817	19	87,901	—14,845	6·32
City & S. Lon. Rly.	„ 12	6,742	+ 18	19	59,516	— 85	7·26
Dublin-Lucan Rly.	„ 10	283	— 8	19	3,026	— 51	7
G.N. and City Rly.	„ 11	3.103	+ 54	19	26,603	+ 496	8·5
L'pool Overh'd Rly.	„ 12	2.846	+ 245	..	28,816	+ 1,615	6·8
Llandudno-Col. Bay	„ 10	290	+ 27	49½	15,008	+ 588	..
London Elec. Ry. Co.	„ 11	30,060	+1,795	19	288,860	+ 7,620	21·25
Mersey Railway	„ 11	4,149	+ 120	19	36,163	— 1,378	4·5
Metropolitan Rly.	„ 12	35,438	+ 116	19	313,207	— 5,263	24·5
Met. District Rly.	„ 11	25,260	+1,471	19	209,836	+ 9,596	24
Anglo-Argentine	„ 11	98,981	+2,527	..	2,196,174	+186,955	..
§Auckland	Oct.	16,485	+1,412	..	64,857	+ 5,028	28·3
Bombay (B.E.T.)	Oct. 13	6,388	+ 874	41	117,569	+ 7,172	..
§Brisbane	Oct.	21,320	+2,620	40	205,980	+24,290	..
Brit. Columbia Rly.	..	..	..	..	..	..	..
Calcutta	Nov. 11	8,068	+ 910	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Oct.	8,251	..	..	34,779	..	20·5
§Lisbon	..	..	..	..	..	..	..
Madras	Oct. 31	1,505	+ 148	..	29,960	+ 2,662	..
§Montevideo	Oct.	25 084	+2 022	52	298,558	+18.563	..
Perth (W.A.)	Nov. 10	8,258	+ 322	..	72,541	+16,018	29

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5⅓	5†	7¾— 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾— 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜— 10⅝	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅜— 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞— 7⅞	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5†	3⅜— ⅞	+ ⅛	6 9 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛— 4⅛	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞— 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅜— 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12½— 12¾	..	5 9 10
Do. 6 % Cum. Pref.	10	6	6	11½— 12¾	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	+1	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅝— 9⅛	+ ⅜	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜— ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½— 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾— 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾— 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	.	1⅝— 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅝— 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3½— 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	+1	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3⅜— 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	8	6†	..	..	..
Oxford	5	7½	6†	6⅛— 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	..	1⅜— 1¾	..	Nil
South London, Ord.	4	5	..	2¾— 3¼	+ 3/16	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/16— 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	½— ¾	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅛— 8	+ ⅛	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞— 5⅛	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛— 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	7†	6½— 7 xd	..	6 1 5
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	— ¼	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96½— 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	115 —120	+9	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	1 3/16— 1 15/16	+ 3/32	3 4 0
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½— 93½	..	5 9 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16— 1/16	..	Nil
Do. 6 % Pref.	1	6	6	⅝— ¾	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅜— 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	96½— 98½	..	5 1 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	91⅓— 92⅓	+2½	4 6 6
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+1½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½— 97½	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8	185 —190	+4½	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	34 — 36	..	13 17 10
River Plate, Ord.	Stock	10	..	223 —233	..	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	124 —126	+3	3 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4⅛	4½	102⅛—104½ xd	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11/16d.	1/16— 1/16	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½—108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	..	7⅞— 8½	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	143 —145	+3	5 10 4
Do. Collat. Trust	$1000	4	4	94½— 96½	+1	4 2 11
Anglo-American Telegraph	Stock	3¾	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110¾—111½	..	5 7 7
Do. Def.	Do.	30/-	..	25⅝— 26⅝	..	5 13 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6⅞— 7⅛	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87 — 89	..	4 9 11
Cuba Telegraph	10	6	6†	10 — 10¾	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8⅜— 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	7¾— 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½—101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	83¼— 85½	+ ½	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½—102½	..	3 18 1
Eastern Extension	10	7	5†	13¼— 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½—100½	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6	10½— 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12¼— 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	32¼— 33¼	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	87 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	73 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	5	..	2⅜— 2½	— 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	1⅝— 2⅛	..	..
Monte Video Telephone, Ord.	1	6	6	1⅜— 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1⅜— 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½—105½	..	5 13 9
Do. Def.	Do.	6	6†	125 —127	+7	4 14 6
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞— 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞— 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 7/16— 5 9/16	..	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100¼—101½	+ ¼	4 8 11
Oriental Telep. and Elec.	1	8	..	1⅜— 1⅝	— 1/32	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1⅜— 1⅝	— 1/16	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88½— 90½	..	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5†	8⅞— 9⅜	..	4 5 3
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼— 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 1/16— 1 3/16	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98½—100½	..	3 19 7
West India and Panama Teleg.	10	1½	..	2¾— 3	+ 1/16	4 3 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	6†	13½— 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	105½—108½	..	3 13 9
Do. 4½ % Fdg. Bonds.	$1000	4½	4½	99 —102	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	¾ —	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1⅜	— ⅛	Nil
Do. 6 % Pref.	10	1½	1½	3⅞ — 4¼	— ⅛	3 8 7
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	—1	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	—1	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	51 — 53	..	3 15 6
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1¾†	30½ — 31½	— ½	4 14 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	[illegible]	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1¼	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅜ — ⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	3 — 3½	— ⅛	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol.	100	1⅞	2†	42½ — 43	+1	3 4 0
Do. Surplus Lands	100	2¾	3†	65 — 67	..	4 2 1
Do. 3½ % Deb.	100	3½	3½	89 — 91	+1	3 17 0
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	30¼ — 30¾	+ ½	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	8½	4½†	86 — 88	..	3 13 10
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5½	5†	27/32 — 31/32	..	5 12 4
Do. Def.	1	Nil	..	31/32 — 1 1/32	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1 1/32	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100½—102½	..	4 7 10
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Potteries, Ord.	1	2	..	2 13/32 — 2 27/32	+ 3/32	..
Do. 5 % Pref.	1	5	5	4 25/32 — 4 29/32	+ 1/16	6 19 0
Do. 4½ % Deb.	100	4½	4½	87½ — 90½ xd	..	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	7/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 7/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1½†	64 — 66	—1	1 9 8
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/8 — 2 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 1/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4 15/16 — 5	+ 1/8	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	100½—102½	+ ½	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/8 — 11 1/4	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½—100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	7 3/4 — 7 7/8	+ 1/8	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	143 —147	..	5 8 10
Do. Pref. Ord.	100	6	6	124 —128	+1	4 13 9
Do. 5 % Pref.	100	5	5	109½—112½	+ ½	4 8 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 3/4 — 6 1/4	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/4	+ 1/8	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	7/16 — 9/16	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 3/32 — 5 7/32 xd	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Elec. Trms, Prf.	1	6	6	23/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	+1	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 94	+2	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	125 —127	+1½	5 10 3
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19 6
Do. 6 % Bonds	100	6	6	103 —105	+2	5 14 3
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7 1/8	— 1/8	6 18 0
Do. 6 % Pref.	5	6	6	5 1/2 — 5 3/4	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 3/16 — 1 1/8	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 1/2	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 3
Rio de Janeiro Trams	$100	4½	5†	116½—117½	—1½	4 5 5
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	..	4 17 7
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	187 —191	+2½	5 4 9
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	..	4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	9/16 — 11/16	..	Nil
Do. 6 % Pref.	1	9	6	23/32 — 25/32	..	7 2 2
Babcock & Wilcox	1	26	24†	5 15/16 — 6 1/16	+1/16	4 6 0
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/8 — 7 1/8	..	6 17 11
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westingbouse, Pref.	3	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	— 3/32	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	— 1/8	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 29/32 — 3 31/32	+ 3/16	6 13 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10
Dick, Kerr	1	5	..	3/16 — 7/16	..	5 14 3
Do. Pref.	1	6	6	1 5/16 — 1 1/16	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	1 3/16 — 1 13/16	+ 5/16	Nil
Do. fully paid	5	Nil	..	1 5/8 — 2 1/8	+ 1/8	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/8 — 3/16	..	6 13 4
Do. Pref.	2	7	7	1 13/16 — 1 15/16	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7 7/8 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9 1/2	..	5 5 3
Do. Deb.	100	4	4	86 — 91	..	4 7 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/8 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	106½—108½	— ½	4 2 7
India-Rubber, G. & T.	10	10	..	12 5/8 — 14 1/8	..	6 17 11
Do. Pref.	10	5	5	9 3/4 — 10 3/4	..	4 16 5
Telegraph Construction	12	20	10†	36½ — 38½	..	6 2 1
Do. Deb.	100	4	4	100 —102	..	3 18 6
Willans & Robinson	1	Nil	..	1/16 — 1/8	+ 1/16	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

SWEDISH EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical and similar goods from Sweden during the year 1909, have been taken from the recently issued official trade statistics; details for 1908 have been added for purposes of comparison, and notes of increases and decreases have been given :—

	1908. Kronor.	1909. Kronor.	Increase or decrease. Kronor.
Electric meters.—			
To Germany	12,000	8,000	— 4,000
,, Other countries ...	1,000	1,000	—
Total ...	13,000	9,000	— 4,000
Electric incandescent lamps.—			
To Finland	20,000	30,000	+ 10,000
,, Russia...	37,000	51,000	+ 14,000
,, Denmark	12,000	18,000	+ 6,000
,, Germany	8,000	11,000	+ 3,000
,, Netherlands	25,000	—	— 25,000
,, Great Britain... ...	25,000	33,000	+ 8,000
,, Argentina	32,000	38,000	+ 6,000
,, Other countries ...	25,000	21,000	— 4,000
Total ...	184,000	202,000	+ 18,000
Dynamos and parts thereof.—			
To Norway	113,000	183,000	+ 70,000
,, Finland	391,000	80,000	— 311,000
,, Russia...	1,000	56,000	+ 55,000
,, Denmark	74,000	19,000	— 55,000
,, Germany	25,000	36,000	+ 11,000
,, Great Britain... ...	67,000	27,000	— 40,000
,, Spain	8,000	26,000	+ 18,000
,, Portugal	35,000	13,000	— 22,000
,, Italy	—	29,000	+ 29,000
,, Australia	36,000	43,000	+ 7,000
,, British N. America ...	4,000	182,000	+ 178,000
,, Argentina	30,000	26,000	— 4,000
,, Other countries ...	18,000	7,000	— 11,000
Total ...	802,000	727,000	— 75,000
Electric motors.—			
To Norway	110,000	2,000	— 108,000
,, Finland	21,000	19,000	— 2,000
,, Great Britain... ...	49,000	59,000	+ 10,000
,, Australia	—	14,000	+ 14,000
,, British N. America ...	14,000	60,000	+ 46,000
,, Argentina	68,000	43,000	— 25,000
,, Other countries ...	24,000	24,000	—
Total ...	286,000	221,000	— 65,000
Transformers.—			
To Norway	10,000	6,000	— 4,000
,, Great Britain... ...	15,000	—	— 15,000
,, British N. America ...	—	11,000	+ 11,000
,, Other countries ...	1,000	1,000	—
Total ...	26,000	18,000	— 8,000
Telephone apparatus.—			
To Norway	21,000	51,000	+ 30,000
,, Finland	319,000	236,000	— 73,000
,, Russia...	718,000	719,000	+ 1,000
,, Denmark	321,000	595,000	+ 274,000
,, Germany	26,000	3,000	— 23,000
,, Netherlands	41,000	65,000	+ 24,000
,, Great Britain... ...	1,063,000	794,000	— 269,000
,, France	3,000	78,000	+ 75,000
,, Roumania	21,000	22,000	+ 1,000
,, Other countries ...	19,000	36,000	+ 17,000
Total ...	2,552,000	2,599,000	+ 47,000
Petroleum and benzine motors.—			
To Norway	259,000	359,000	+ 100,000
,, Finland	185,000	170,000	— 15,000
,, Russia...	712,000	1,808,000	+ 1,096,000
,, Denmark	23,000	86,000	+ 63,000
,, Germany	119,000	258,000	+ 139,000
,, Netherlands	19,000	64,000	+ 45,000
,, Belgium	19,000	41,000	+ 22,000
,, Great Britain... ...	20,000	18,000	— 2,000
,, France	7,000	28,000	+ 21,000
,, Italy	32,000	162,000	+ 130,000
,, Austria	34,000	125,000	+ 91,000
,, Argentina	21,000	29,000	+ 8,000
,, Other countries ...	28,000	53,000	+ 25,000
Total ...	1,478,000	3,201,000	+ 1,723,000
Turbines.—			
To Finland	33,000	42,000	+ 9,000
,, British N. America ...	—	11,000	+ 11,000
,, Other countries ...	8,000	19,000	+ 11,000
Total ...	41,000	72,000	+ 31,000
Accumulators.—			
To Norway	2,000	10,000	+ 8,000
,, Finland	6,000	10,000	+ 4,000
,, Germany	15,000	1,000	— 14,000
,, Other countries ...	6,000	4,000	— 2,000
Total ...	29,000	25,000	— 4,000
Rheostats.—			
To Norway	26,000	10,000	— 16,000
,, Denmark	4,000	3,000	— 1,000
,, Germany	7,000	5,000	— 2,000
,, British N. America ...	1,000	5,000	+ 4,000
,, Other countries ...	9,000	2,000	— 7,000
Total ...	47,000	25,000	— 22,000
Copper wire covered with textiles.—			
To Russia...	65,000	62,000	— 3,000
,, Denmark	120,000	101,000	— 19,000
,, Great Britain... ...	85,000	99,000	+ 14,000
,, Other countries ...	66,000	34,000	— 32,000
Total ...	336,000	296,000	— 40,000
Copper wire covered with rubber.—			
To Russia...	39,000	85,000	+ 46,000
,, Other countries ...	27,000	18,000	— 9,000
Total ...	66,000	103,000	+ 37,000
Steam turbines.—			
To Norway	—	23,000	+ 23,000
,, Finland	34,000	10,000	— 24,000
,, Russia...	66,000	192,000	+ 126,000
,, Germany	22,000	10,000	— 12,000
,, Netherlands	16,000	20,000	+ 4,000
,, Argentina	37,000	6,000	— 31,000
,, Other countries ...	29,000	8,000	— 21,000
Total ...	204,000	269,000	+ 65,000

Krona = 1s. 1½d.

New Zealand Budget and Electricity: Possible Developments.—The Budget proposals of the New Zealand Government contains some interesting references to the proposals for electrical development. "Inquiries are being made," said the Premier, "with a view to establish within the Dominion new electrochemical industries which would obtain their power supply from the Government mains. One of the most promising is the manufacture of chemical fertilisers, for which there is likely to be a large and increasing demand throughout the world. With the natural conditions obtaining in New Zealand, it is probable that products of this nature could be manufactured on a scale and at a price which would make the industry profitable in itself and of benefit to the whole community.

"Another feature of the development of our water powers on a large scale which would have an important bearing on the social life of the people, is its possible influence in the home. The problem of assistance in carrying on domestic work under existing conditions is one which is steadily becoming more acute in most civilised countries. A practical solution seems difficult of attainment, but will, doubtless, ultimately be reached by reducing the amount of personal effort required to attain a given degree of comfort. In my opinion, the day is not far off in New Zealand when, with an abundant supply of electrical energy available at a cheap rate, it will be within the power of most people to utilise the new power for all the lighting heating and cooking required without any trace of dust, dirt or excess of heat. The estimates of expenditure and revenue in connection with the Lake Coleridge project indicate possible prices for the supply of current which warrant the hope that such a consummation is within the range of practical development in New Zealand."

Sir Joseph Ward went on to say that the important question of electrifying the Lytellton Tunnel has been given careful consideration, and the electrical engineer, Mr. Parry, has been instructed to report upon this matter without delay, and to prepare the necessary plans with a view to the work being put in hand at an early date. He has also been instructed to furnish a report upon the utilisation of Lake Warkaremsana for the supply of electrical power for lighting and industrial purposes in the North Island. This is expected to be available at an early date, and it is hoped that the waste power latent there will before long be made available for the uses of the people.

NOTES ON THE INSULATION TESTING OF ELECTRICAL MACHINES.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

There is a wide divergence of opinion among engineers, as indicated by the insulation tests demanded in specifications for electrical machines, as to the real function of certain of the tests that are commonly applied. Some engineers pay special attention to insulation-resistance measurements, others to high-pressure tests applied either instantaneously or for a prolonged period. Again, some engineers specify all tests to be made cold, others hot—while, in some cases, the temperature conditions, which are very important, are entirely disregarded.

As regards insulation-resistance measurements made on complete machines, these really show the condition of the insulation as regards cleanliness and dryness, and afford no guide whatever as to the quality and reliability of the insulation employed. There is considerable misconception on this point, and it is frequently assumed that the insulation resistance of a machine is a measure of the quality of the

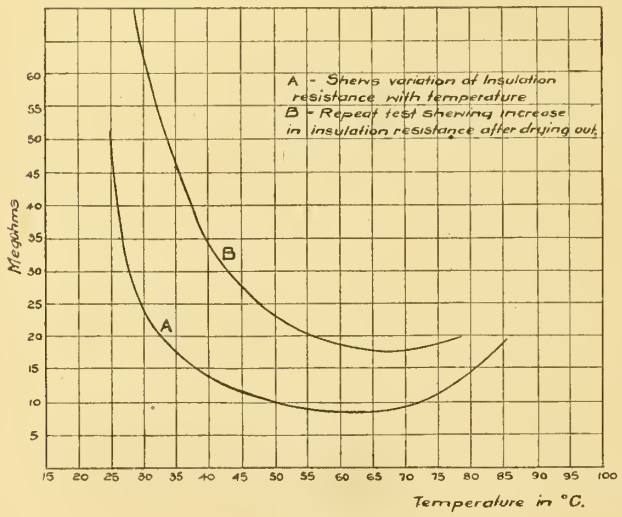


Fig. 1.

materials used. That this is not the case is evident when it is understood that no matter which of the commonly used materials, such as cotton fabrics, papers, mica and asbestos, are employed, prolonged drying will raise the insulation resistance to an almost unlimited extent, provided always that the surfaces of the insulation are perfectly clean.

In fig. 1 a comparison of curves A and B shows the increase in insulation resistance resulting from the drying-out of the windings of a 2,000-volt induction motor where the insulation consisted of paper, mica and tape. The curves also show the effect of temperature on the insulation resistance, and are typical of machines irrespective of the kind of insulation used, although as a general rule the decrease in insulation resistance as the temperature is raised is greater where organic materials, such as varnished papers and fabrics, are used than where those of a partly inorganic nature, such as micanite, are employed.

From the foregoing it might be inferred that a comparison of a number of insulation-resistance measurements obtained on machines over a certain period of time, and under similar temperature conditions, would afford a measure of the facility with which the insulation absorbs moisture. Such, however, is by no means generally the case, since in a moist atmosphere, long before the slot insulation has absorbed sufficient moisture to affect appreciably the insulation resistance, the exposed surfaces on the ends of the windings outside the slot portions will have become slightly conducting, due to deposits of moisture. The resistance will then be found to be greatly reduced solely through leakage over the surfaces from lightly insulated portions of the winding, or from bare copper, as in the case of direct-current machines. In the latter the insulation resistance is dependent almost entirely on the condition of the insulating surfaces between the commutator and iron, the actual leakage through the slot insulation usually being negligible. It will, therefore, be seen that insulation-resistance measurements of a machine are of negligible value as a guide to the quality of the insulating materials employed. On the other hand, both after erection and periodically during the operation of machines, they are of considerable value in indicating to what extent moisture and dirt are accumulating on the windings, and afford a warning as to the need for cleaning and drying.

Machines installed in chemical works may be cited as an example of this, where excessive leakage over end windings due to the formation of conducting deposits is particularly liable to cause failure. It must always be borne in mind, however, that it is the variation of insulation resistance from a well-seasoned condition, and not the value of the insulation resistance itself, which is of importance, and no hard and fast figure can be laid down as safe for machines under any particular condition. As a rough guide, however, the recommendation of the American I.E.E. may be taken, namely, "the insulation resistance of complete apparatus should be such that the rated voltage of the apparatus will not send more than 1/1,000,000 of the rated full-load current at the rated terminal voltage through the insulation. Where the value found in this way exceeds 1 megohm, it is usually sufficient."

As regards investigations of the properties of insulating materials themselves, while insulation-resistance measurements are of undoubted value in establishing comparisons, the importance of such measurements is often greatly overrated. Measurements carried out with the necessary precautions taken to avoid surface leakage, can be made to show the comparative facility with which different materials absorb moisture. It frequently happens, however, in the case of fibrous insulation, that those materials showing the highest insulation resistance, and being the least absorbent of moisture, are by no means those most suitable mechanically, and in general the mechanical characteristics, such as flexibility, are of the greater importance. Any fibrous insulating material can, of course, be made to show a high insulation resistance simply by prolonged drying-out. It should be noted, however, that this often results in the removal of certain of the natural moisture which is necessary to give a fibrous material strength, so that an excessively high insulation resistance may merely indicate that the material has been ruined mechanically.

As regards pressure tests, these in general are only necessary during the time the machine is in the manufacturer's hands, *i.e.*, prior to putting into service. The principal function of a pressure test is to determine whether there is any mechanical damage to the insulation between windings and ground. The test at the same time affords some indication as to the sufficiency of the thickness and

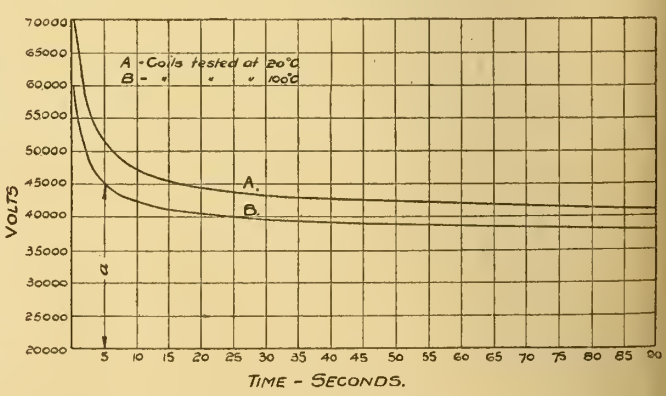


Fig. 2.

quality of the insulating materials used. It is evident that such a test affords no guarantee as to the reliability of the machine, since it imposes no test on the internal insulation, *i.e.*, between turns and sections of the winding, these being usually the more vulnerable parts. Such parts can only be tested at an early stage in the process of manufacture.

Further, a pressure test has no bearing whatever on the possibility of deterioration due to ageing of the insulation, this being determinable only by investigations of the characteristics of the materials themselves.

There is some risk of pressure tests weakening insulation, and the conditions under which such tests should be applied to prevent this have been the subject of much discussion among engineers in this country, on the Continent and in America. The principal risk likely to occur is that of the charring of the insulation due to internal heating, caused by the dielectric loss which is set up in insulation when it is subjected to alternating electrostatic stresses, this heating being more or less proportional to the square of the voltage. In a lesser degree, also, chemical action set up in occluded air spaces, as the result of electrostatic stresses, may cause some deterioration. Further, an effect similar to over-straining may also contribute to this weakening.

Since all these effects are intensified as the voltage increases, many engineers have advocated a moderately high-pressure test applied for a long period as preferable to a

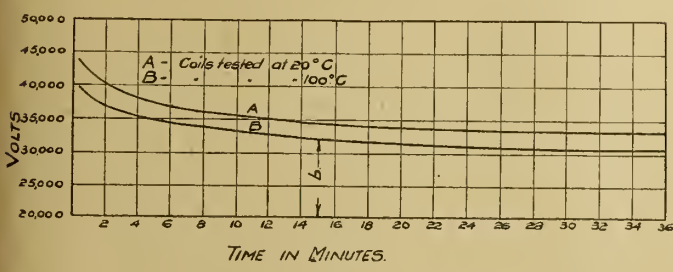


Fig. 3.

much higher pressure applied only for a very short time. Considered solely from the point of view of weakening due to internal heating, the problem resolves itself into determining the correct relationship between varying periods of time and the corresponding voltage necessary to produce breakdown.

Curves shown in fig. 2 indicate this relation for completely insulated coils tested under working conditions. From these curves it will be seen that a voltage *a* applied for five seconds produces the same tendency to breakdown—within the limits of uniformity of the value of the insulation—as a voltage *b* applied for 15 minutes.

Fig. 3 shows the same curves taken over a greater period of time. These curves are typical of all kinds of insulating materials.

An examination of the insulation thus tested indicated that the failures were in all cases due mainly to internal heating, the charring, however, being much more local in the short-time tests than where the voltage had been applied for a considerable time. While, therefore, a long-time test at a low voltage, or a short test at a higher voltage, may equally well cause a partial breakdown of the insulation, in actual practice cases of this kind are rarely experienced, since the factor of safety is usually very high, and, further, the insulation of the slot portions of the winding which are most severely stressed during testing is usually mainly of an inorganic nature, and, therefore, least affected by internal heating.

Where the slot insulation of the windings of a machine is made up of materials of widely differing specific inductive capacity, there is a danger, during the application of a high

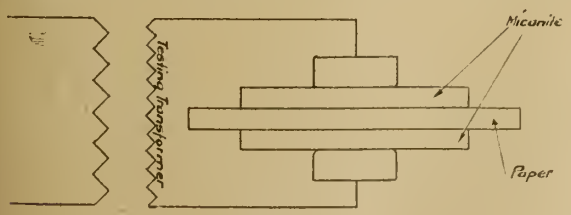


Fig. 4.

testing voltage, of actually causing disruption of the materials of lowest specific inductive capacity without producing any apparent weakening of the rest of the insulation. An experimental demonstration of this was made in the following manner :—Twelve sheets of paper ·005 in. thick were sandwiched between two sheets of ·06 in. micanite, the whole being placed between two flat electrodes of small area with all corners carefully rounded. The arrangement is shown in fig. 4. An alternating E.M.F. of 20,000 volts was applied between electrodes for a few seconds. The paper was then removed and examined microscopically, and numerous minute perforations were found in the portions under the electrodes. These portions were separately tested between the electrodes, and broke down when a pressure of 3,000 volts was applied, while those not coming under the electrodes required a voltage of approximately 10,000 to effect the puncture. It was, therefore, evident that the distribution of potential had been such as to impose a pressure exceeding half the applied voltage on the paper, though the latter constituted only one-third the total thickness of the dielectric.

Considered from other points of view, the high-voltage short-time test has some advantage over the low-pressure long-time test, inasmuch as it affords a better test of surface insulation, and is more likely to detect weaknesses due to defective workmanship. On the other hand, the duration of the test should not be so short that there is likely to be any serious error introduced in the time of application, since, as seen from fig. 2, there is a very considerable difference in the voltage which insulation will withstand if the pressure is applied for one second or two seconds. It would therefore seem that the test duration of one minute now standardised by the German Normalien, as well as the American Institute of Electrical Engineers, is a reasonable one. As regards the relationship between the pressure test and the working voltage, the agreement between the American and Continental engineers, that except with comparatively low-voltage work, the testing voltage shall be from twice to two and a half times the working voltage, appears to meet general requirements.

A danger not often recognised in applying pressure tests between windings of machines and ground lies in the possibility of causing short circuits between adjacent turns of

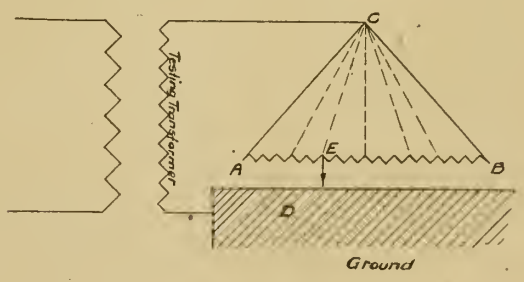


Fig. 5.

the coils. This is likely to occur if the test produces a breakdown to ground at a point in the winding, or if a flash-over occurs from the end of the winding to ground. This will be appreciated if reference is made to fig. 5. The entire winding of the stator is represented diagrammatically by A B, and connection from the testing transformer to winding and ground is shown made at the two points C and D. If now failure occurs to earth at the point E, either through the breakdown of the insulating materials surrounding the coils, or by a flash-over from the windings across the air-gap to the armature iron, the potential at the point E is suddenly reduced to zero, and the full testing voltage is thrown across the portion of the winding A E and B E, the slope of potential being greatest across those turns nearest the point E. The momentary voltage across these turns may easily be sufficient to puncture the insulation between them, and cases of failure due to this have been investigated by the writers.

The risk may be minimised by connecting the testing lines to as many points as possible on the winding, as indicated by the dotted lines. This also affords similar protection against the effect of surges liable to be set up if the testing voltage is suddenly switched on or off.

Turin Exhibition Awards.—The Swiss Insulating Works, Ltd., of Breitenbach-Basle (London representative, Mr. Archibald Campbell, Chancery Lane, W.C.) were awarded the Grand Prix for their insulating materials exhibits at Turin.

THE THREATENED NATIONAL COAL STRIKE.

By INTERESTED.

Some readers may think this matter has little in common with the electrical industry, but I can assure them it is very relevant. Electricity supply stations have hardly recovered from the lack of coal supplies consequent upon recent strikes, and the position of affairs now looming on the horizon, viz., the National Colliery Strike and Railway Employés' Strike, cannot but give rise to uneasy feelings regarding future supplies. The period of trouble through which this country has quite recently passed depleted the stocks of coal in most supply stations, and sufficient time has not elapsed since then to enable fair stocks to be accumulated again. Supplies have been intermittent and uncertain. Promises of early delivery have proved futile ; and the prospect of supplies being received in sufficient quantities in the near future is shrouded in uncertainty. Inquiries made at the colliery districts have only elicited vague replies.

To think what might occur in the event of a general colliery strike before many months pass is appalling. The threatened position of affairs is very serious indeed. Electricity works, and gas works too, for that matter, without coal would be *hors de combat* in a few short weeks, so far as the provision of the necessary means of illumination for both private and public purposes is concerned. In Liverpool recent events cast a light upon the state of things which might be expected elsewhere under similar circumstances.

Everyone concerned—and the effect would be felt by many who, perhaps, are reposing in peaceful restfulness at present—must recognise the danger ahead ; but what steps are being taken to guard against it, and to put their craft in readiness for the gathering storm, should it break eventually with renewed force upon us ? No time should be lost in making provision for a probable stoppage of coal supplies. Quite a number of works there are whose storage space is limited, and those which have space and to spare cannot get coal to store just now. Barely sufficient free burning coal is obtainable to keep the plant running under normal conditions. Although I mention here free burning coal, the remark in some cases refers equally well to other classes of fuel.

What can be done to alleviate the trouble if matters take a bad turn ? There seems to me to be one way only out of the difficulty, and that is, that large coal consumers such as electricity supply works must become ship-owners. More than once in articles appearing in the Electrical Review I have demonstrated the advisability of London stations having their own colliers. Now I speak in a more general tone, and refer to all works around the coast, at least in the more southern counties. We have already co-operative publicity : why not co-operation in the way of coal supplies ? I certainly think such a scheme would be more successful than the publicity business. What is wanted, and wanted immediately, is that arrangements shall be made whereby coal can be carried direct from the most suitable seaport near any particular coalfield direct to any port in the country without interference from secondary interests. Take a concrete example. Suppose, for the sake of argument, that all works situated in the London area, within eight or ten miles of the coast line or river banks, were to combine and purchase two or more suitable ships for carrying coal. A big strike would then affect them in only one way, *i.e.*, difficulty in obtaining supplies and loading the same at the coalfield seaport. That could be overcome to a great extent when placing orders, by agreement with the colliery-owners. In the event of a combined coal and shipping strike, a little trouble might be experienced in loading the supply works' ships, but there the trouble would cease. In the event of many trades striking simultaneously, as recently proved the case, then away go the ships to fetch German coal. That is the other alternative ; and it would prove a very useful lever in negotiating agreements with colliery-owners when stipulating for special arrangements for supplies during temporary stoppages of work.

These ships would be valuable assets in strike times, and, in addition, would be the means of saving many hundreds of pounds in coal bills for many works during times of peace. I mean that profits now gained by certain ship-owners, who control a big share of the carrying trade from Wales and the North, would be deflected into the pockets of those undertakings in the combination. Each works would have a free hand to purchase coal when and where it liked, the only agreement necessary being to arrange for deliveries by the ships so as to work one in with another. A council composed of one representative from each station could very well arrange a programme of working suitable to all.

Of course, there would be opposition to such a scheme as here outlined being inaugurated ; that is to be expected. The rival interest—gas—has met the opposition already, and beaten it with gratifying results. And why not electricity works ?

ECONOMIES IN ELECTRIC THEATRE WORKING.

[COMMUNICATED.]

If criticism is anything to judge by, then the kinematograph theatre has now reached its zenith, and as industries of this class do not stand still, the chances appear favourable to a decrease in the popularity of this form of amusement. This, of course, will bring corresponding financial depression.

As the whole industry of "moving pictures" is dependent on the class of film subject placed before the public, the manufacturers of these will be responsible if the fickle public do get tired of "pictures." That, however, is not exactly a matter for the engineer, although all branches are really linked together with that unstable coupling, £ s d.

Nevertheless, whatever happens to the film-making side, there is no doubt that economies must be made in the electrical side, immediately the pay-box receipts begin to fall off.

If not the greatest expense, the energy bill is certainly next to it ; and though it may please the station engineer to see the units being eaten up, it is only a short-lived pleasure if the heavy bills help the consumer to bankruptcy.

As to what is the minimum current required to produce satisfactory results it is a little difficult to say, as so much depends on the quality of the projection lenses on the machine. It will be found that the ordinary commercial kinematograph lenses are very wasteful in light, and hence power ; but by substituting lenses of the first quality, the energy bill can often at once be reduced by almost 30 per cent.

Another point where saving can be gained is the shutter. By using a shutter which opens in several places at a time, on the lines, perhaps, of an iris diaphragm, there will be a considerable decrease in the time required to change each picture, and this will allow more time for each individual picture to be left on the screen, resulting thereby in less dependence on the "persistence of vision," and giving a corresponding saving in energy.

Apart from the purely optical leakages, there are, however, many outlets for waste of energy due to the electrical equipment.

First, poor efficiency in the converter or motor-generator set may cause quite a considerable amount of loss in the course of a year, far outweighing the saving in the original cost of the "cheap" machine. That cheap means dear in the long run is, however, an old story.

The correct voltage for the generator is a very important matter. Although "plenty of volts" may be liked by the unskilled operator, yet the practice is very wasteful in resistance heating, which has of course to be paid for. A very satisfactory pressure is 65 volts. If higher, it is wasteful ; if lower, there is apt to be unsteadiness in the arc.

With regard to arc voltage, the best results seem to be obtained with a lamp terminal voltage of 50 volts on D.C. and in the few cases where A.C. is used 35 volts is usually ample.

When will kinematograph workers and proprietors fully realise that the "length of throw" has nothing whatever t

do with the current required for a picture? It is the *area* that matters, so that when the electrical engineer is called in to advise on cutting down current, he should remember that considerable saving will accrue from reducing the area of the picture a little, and this should not detract from its quality; in fact, in many cases it will improve the steadiness of the picture on account of the reduced size.

The most satisfactory way of reducing the electricity bill is, of course, to reduce the price of energy, and there is no doubt that in many cases this really ought to be done, as many supply charges are abnormally high. Surely there is no real reason why electricity for kinematograph arcs should not be charged at power rates?

Perhaps some station engineers may have some excuse for charging at full lighting rates, but this is generally on account of the difficulty of maintaining a satisfactory supply, especially as the "kine" load is always on when least wanted, *i.e.*, at the "peak." In this respect it seems rather surprising that more use has not been made of accumulators, for it appears that a storage battery would give great satisfaction to all parties. Current would only be taken from the mains at night and morning, making a perfect "day" load, the discharge being during the "peak."

Practically, the arrangement would be to charge the cells in series and to discharge them in parallel. Thus, for example, on a 240-volt circuit at 2·5 volts per cell for the charging voltage, 96 cells would be required, and these, divided into three parts for discharge in parallel, would give from 67 volts to 58 volts (*i.e.*, from 2·1 to 1·8 volts per cell).

This is a most suitable arrangement for the cells, and they are worked under ideal conditions, being charged and discharged regularly. No regulating cells are required, for any variation in current, due to drop in voltage or other cause, is controlled by the series arc resistance.

Lighting for the hall is, of course, put direct on the mains: seeing that it forms only a small proportion of the total consumption, there is nothing to gain by putting it on the battery, as regulating switches, cells, &c., would then be necessary in order to keep the voltage constant.

Energy supplied from accumulators in this way would probably be quite as profitable to the supply station at power rates as energy supplied in the ordinary way at lighting rates.

Accumulator current is ideal for arc work, and more especially for kinematograph work, where steadiness is so necessary to good results.

On voltages lower than that given in the example, the line resistance has to be correspondingly reduced, but owing to the current being supplied from a battery, this does not have the detrimental effect it otherwise would.

If, however, more resistance, and hence a lower voltage be desired, the flame type of carbons may be used to advantage.

Current can often be saved in considerable amounts by changing the scheme of outside lighting. For example, the present popular idea is to have as much light outside the theatre as possible to attract the public, as though they were moths, and therefore unable to resist the bright light, into which they plunge! But surely it is possible to make the place quite as attractive with a far smaller current consumption.

For instance, the usual flame arc lamps could at once be displaced by, say, one mercury vapour lamp, which, placed fairly high up, would be quite as attractive owing to its mysterious colour.

Then, again, if every incandescent lamp on the front of the theatre were, say, red or green, the building would at once have such distinctiveness that it would immediately be called into prominence. The attraction depends on the quality, not the quantity of light.

The problem of running kinematograph arcs direct off alternating current is very attractive owing to the high efficiency which can be obtained, but practically it is found very objectionable owing to the alternation of the current.

The kinematograph pictures are in themselves sufficiently "alternating" in light and darkness without the addition of an alternating illuminant, and it is this reason that makes operators fight shy of A.C. It has been found, however, that the troublesome effect of the alternations may be considerably modified by using impregnated carbons, which tend to give a more "continuous" flame than the ordinary cored carbon.

There is no doubt that considerable savings can be made in the energy consumption at the general run of theatres without in the least affecting the qualities of the pictures, or the attracting power of the outside illumination. In short, this class of consumer is well worth looking after for his own, and hence our, sake.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Arising out of the success of the work of the Hydro-Electric Power Commission of Ontario comes the suggestion that the Dominion Government should create a new department, under the control of a Cabinet Minister, to look after all matters connected with the utilisation of water powers throughout the country.

A Commission, called the St. Lawrence River Commission, was recently appointed to inquire into all matters affecting the navigability of this great waterway. As there are many power schemes under consideration at the present time, which may interfere with navigation, this Commission will report on these in so far as they affect this question, and will also formulate principles to govern such schemes in the future.

In New Brunswick two hydro-electric power schemes are being considered. At Lepreuse, which lies some 20 miles south-west of St. John, power is to be developed from streams and lakes, and it is proposed to supply St. John itself with electric power. The second proposal, by the Eel River Light, Heat and Power Co., is to transmit power to Fredericton and other towns from a point on the Eel River, about 40 miles away.

The Grand Trunk Railway has abolished gas lighting in all sleeping cars running on routes from Montreal to Toronto, Detroit, Chicago, New York, &c., electric lighting by storage batteries having replaced the gas.

The municipal power station at Lethbridge, a rapidly growing town in Alberta, contains Babcock & Wilcox boilers and coal conveyors, also Belliss & Morcom engines, while all the steam piping and valves have been supplied by Messrs. Stewarts & Lloyds; this is a good record for British firms, but where are the electrical manufacturers? The electrical equipment was all supplied by a Canadian firm.

THE DELHI DURBAR, 1911.

[FROM OUR INDIAN CORRESPONDENT.]

In preparation for the Royal visit in December, the camping ground to the east of Delhi has undergone a complete transformation within the last few months. What was formerly a huge area of waste level ground behind the historic Ridge, is now a busy camp colony; miles of streets have been laid out, wide, straight and well metalled. On each side of these the various native chiefs have been allotted camping space. The areas of these allotments and their proximity to the Royal Camp vary roughly as the importance of the chief himself, and the number of gun salutes to which he entitled.

The Circuit House, where the Royal visitors will stay, the centre from which radiate, in the form of a huge three-quarter circle of about four miles radius, the various encampments. For the King and Queen and their guests spacious tents are arranged and luxuriously furnished. The *tout ensemble* forms a city of canvas, which has grown up with mushroom-like rapidity.

The first important problem which the Executive Committee of the Durbar had to consider was that of efficient

sanitation for the whole camp area. Expert opinions were sought early in the year, and with the experience gained at the 1903 Durbar, it is safe to predict that the sanitation of this Durbar camp will be excellent, considering the exceptional circumstances.

The next serious problem to engage the Committee was the provision of a pure and regular water supply. This has now been successfully arranged, and very great credit is due to the engineers who designed the scheme and carried out their arduous work and practically finished the whole water supply installation in a few months. There is a completely equipped pumping station on the banks of the river, from which a filtered supply is pumped direct to the mains. It is not easy to realise what a plentiful supply of pure water means to the native ; he needs it for his daily ablutions before meals, for cooking his rice and for drinking purposes ; and he requires a lavish supply. He is indifferent as to its purity so long as it *is* water, and it is therefore imperative on the authorities to provide a filtered supply only, so as to avoid sickness in camp.

The third serious question which occupied the thoughts of the Executive Committee was that of a thorough and efficient electric lighting scheme for roads and camps. At the 1903 Durbar, each camp was a law unto itself, no uniform system of electricity supply obtained, with the result that a forest of ugly, smoky, portable engine chimney stacks sprung up, which were not only unsightly, but were a positive source of discomfort and dirt.

All sorts and conditions of new and second-hand engine tackle were loaned to camps ; confusion and chaos, and very often complete darkness, reigned supreme in and around the temporary "power house."

Many of us who had charge of the operation of these isolated plants in 1903 are glad, indeed, that matters are simplified this year. Thanks to the initiation and foresight of the U. P. Government Electrical Inspector and his staff of assistants, a central distribution system, thorough in its completeness, has been laid down, and is at present ready for operation.

The central power house, which is situated outside the camp centre, consists of a large battery of Babcock and Wilcox boilers of a total evaporative capacity of 90,000 lb. of water per hour at a steam pressure of 100 lb. These are provided with chain-grate stokers and all the most modern types of pumps and economiser gear.

The smoke stack is a self-supporting steel chimney about 170 ft. high—an excellent piece of work for a temporary plant, and its erection was completed in record time. A few days after its finish a cyclone burst over Delhi, but this huge chimney weathered the storm without damage. Some Europeans expected, and the native was almost certain of, trouble, but engineering skill and sound workmanship baulked their anticipations.

The engine room is, as might be expected, cramped and congested ; but it is well equipped. It contains three generating sets of 750 KW. each, at 460 volts. The engines are by Belliss & Morcom and the dynamos by Siemens Bros. In addition to these large sets there are also some smaller units for light day loads ; and also some high-voltage A.C. sets for the military camps, which are a good distance away.

There is a well-equipped marble switchboard ; simple, yet complete, and of high-class workmanship. The arrangement is well thought out in its detail. A small battery of transformers for the A.C. sets, completes the power house equipment. All the above machinery was imported and erected in record time, in spite of the fact that towards the end of September the engine house floor became a veritable quagmire, due to a cyclone.

The mains for the whole camp are almost entirely overhead. Hamilton type telegraph poles are used, and no less than 400 tons of copper wire has been already fixed. The overhead network is simply arranged and neatly executed. The camp streets are laid out with the regularity and parallelism of a new American city ; at the side of a street the aerial mains are run, and from these latter the power and lighting feeders for adjacent camps at either side are connected and correctly balanced. The poles carrying the aerial mains also support water-tight street lighting brackets, of which there are thousands.

Alipore Road, the main thoroughfare, is already lighted, and the effect is good. When the whole camp is in full swing, all the miles of road lamps alight, and all the various native camps ablaze with illumination, the view from the flagstaff tower should be a magnificent one indeed.

The King's camp, which comprises the quarters in preparation for their Majesties and their personal guests, the Viceroy's camp and the camps of the various provincial governments will be handsomely and tastefully lit, and also will be provided with electric heaters (for the weather is intensely cold at night in December at Delhi).

The native chiefs' camps will be as gorgeously illuminated as the kilowatts allotted to each will allow. The kilowatts are allotted, as also the lamp space, roughly as the magnitude of the chief himself and the number of guns salute to which he is entitled, from the Nizam with his tens of kilowatts to the solitary chief who, it is said, is adverse to modern improvements, and who, as he must have electric light, has sanctioned one solitary 8-C.P. lamp for his gateway.

The whole of the wiring work is being carried out by about five firms of reputable contractors, the price per light having been fixed by Government at fair rates, and the work split up among those firms who were on the Government list. About 1,500 native wiremen are employed, each with his coolie, and superintended by about 30 skilled European engineers.

The central station equipment was supplied by Messrs. Siemens Bros., Belliss & Morcom, and Babcock & Wilcox, under the immediate supervision of their local resident engineers. The aerial mains were all erected by the Government Telegraph Department Engineers, who have also erected a wireless telegraph station and a system of telephones.

The entire equipment has been carried out under the direct and personal control of the United Provinces Electrical Inspector, Mr. J. Pit Keathly.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"D.C." writes : "A local authority, having obtained a loan for the purpose of establishing a supply of electricity, have now a certain surplus balance remaining, over and above the cost of the final scheme carried out. It is anticipated that the first two or three years' working of the undertaking will result in a deficit. The said local authority wish to avoid, if possible, drawing on the rates in order to meet this deficit. Can the deficits, during, say, the preliminary three years, be met by drawing on the balance of the loan ? Or, alternatively, can the local authority overdraw on the bank during the said period of time by special arrangement with the bank authorities ? Is either action legal, or permissible under the provisional order ?"

*** This query involves a discussion of the question whether money authorised by Parliament to be raised for one purpose can be devoted to another purpose. A search through the various Acts which authorise a local authority to borrow money fails to reveal any provision for the disposal of a surplus which may remain after the express objects for which the loan was raised have been carried out ; but it would be a dangerous experiment to devote that surplus to an unauthorised object. The auditor of the Local Government Board would probably surcharge those who made such a use of public money.

THE LONDON OPERA HOUSE INSTALLATION.

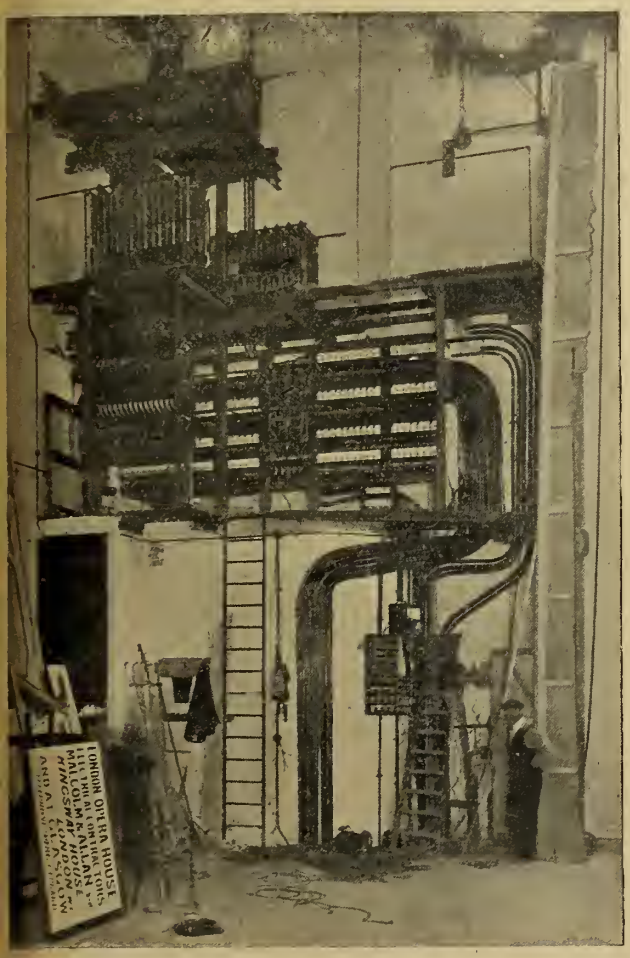
THIS, the most recent addition to the numerous places of amusement in London, is situated on the east side of Kingsway, and contributes not a little to the architectural features of what promises to be one of the finest thoroughfares of modern London.

It is almost unnecessary to add that the building and its appointments are in the first rank, and that a very extensive electrical equipment has been provided for both lighting and power, Messrs. Malcolm & Allan being the contractors for the work.

For the supply of electricity to the new buildings, services have been run by both the Charing Cross and Metropolitan Electric Supply Companies ; by the former to (*a*) the stage switchboard for stage and part of the general lighting, and to (*b*) a one of two front of

the house switchboards for other general lighting; by the latter company to (*c*) a power and special effects switchboard, for the supply of power, heating and for stage effects, to (*d*) a dressing rooms switchboard, and to (*e*) the other front of the house switchboard for supplying the rest of the general lighting. The lighting is on the three-wire system throughout with 200 volts across the outers, and the power service is at 200 volts pressure.

The stage is a large one, 84 ft. wide and 65 ft. in depth, while the proscenium opening is 45 ft. wide and 50 ft. high. The stage



THE STAGE SWITCHBOARD, LONDON OPERA HOUSE.

switchboard, on the "prompt" side, is some height above stage level and gives an excellent view over the stage; it is constructed in black slate, divided into four "circuit" panels and one panel for "black-out" switches for rapidly switching out the stage and auditorium lighting controlled from that point.

The service mains are of ·9 sq. in. V.R. lead-covered steel-armoured cable; the four "circuit" panels control 78 circuits in all, with an aggregate capacity of 1,500 amperes, and have all the connections arranged in front in compliance with the L.C.C. regulations. The circuits, which are each controlled by a S.P. switch and D.P. "Zed" fuse, comprise 12 to the stage arc lights, &c., 32 stage circuits through dimmers, 20 auditorium circuits, also through dimmers, and 14 general stage lighting circuits. The regulators for the dimmers are mounted on the same platform as the above panels, while the dimmer resistances are on an overhead platform, the resistance contacts being coupled to the regulators below by means of wires passing over pulleys.

A feature of these resistances is a small carbon break switch, which the contact maker on its downward travel, when it has switched all the resistance into the circuit, finally opens, thus obviating unnecessary heating. The switch, of course, automatically closes again, when the contact maker commences its reverse travel. The whole of the stage switchgear is of Messrs. Siemens Bros. & Co.'s make, which was described in connection with the Palladium Theatre installation (ELECTRICAL REVIEW, January 20th).

In all about 2,300 metal lamps have been used for the stage lighting, including eight battens of 200 lamps, each in white, red, blue and amber colours, these being supplied through cast-iron connecting boxes in the flys, fitted with copper links and wing nuts; the battens are suspended over the stage from hand winches.

For the footlights there are 250 lamps in four colours, and 50 others for the proscenium in three colours. There are also 14 24-lamp "lengths" and six 12-lamp "bunch" lights, while 13 stage plugs are provided for arc and incandescent lighting. Six "lightning" arcs are provided, with a special switch at the prompt corner, also a similar number of stage projectors, with scissor shutters for colour, cloud, water and other effects, and two porthole projectors for special effects.

Illuminated word signal boards are provided in both flys, and a similar one in the prompt corner, with a 12-switch operating board below it for the stage manager, which allows of the latter verifying his instructions.

The stage service cables—as in the case of other services—enter a special intake chamber passing through the supply company's meters and a 750-ampere triple-pole knife switch and fuses in a locked iron case.

In the case of the service for the power and special effect switchboards, a similar arrangement obtains, but two 100-ampere power circuits and one 25-ampere power circuit, each with a D.P. switch and two-way fuses, are provided, for supplying a deep well pump, ventilating fans and for stage power, the circuits running through ironclad distribution boards. Cables also run from the main board in the intake chamber to the special effects board at the back of the stage.

For ordinary lighting the services are connected to two switchboards, one on each side of the main entrance, and controlling 37 and 78 circuits respectively; also to a dressing-rooms switchboard near the stage entrance, with 24 circuits.

All these boards are of similar design, with black enamelled slate panels, fitted with one tumbler switch and two "Zed" fuses per circuit. These boards were made by Messrs. Siemens Bros., and are enclosed in teak cases with glazed locked doors.

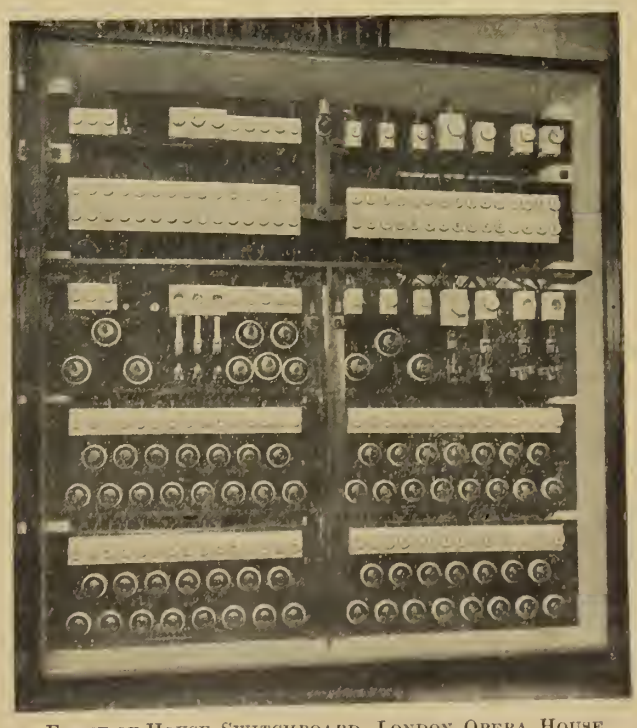
The bulk of the wiring has been carried out with 600 megohm C.M.A. cables and wires (of Siemens make) in screwed solid-drawn steel barrel, with Malcolm & Allan's special boxes; the wires were drawn through and looped-in throughout.

In all 38,000 yards of cable and wires and 30,000 ft. of tubing have been used. The dressing rooms, work rooms and staircases in parts of the house are surface wired with "Stannos" wiring.

Perhaps the principal feature of the auditorium, and of other parts of the house open to the theatregoer, is the concealed lighting. Thus, the ceiling of the auditorium contains a painted oval centrepiece surrounded by 400 lamps concealed behind the cornice, with Siemens reflectors, and in the centre of the centrepiece there are 160 lamps in four tiers, behind a glass sunlight disk, the fitting weighing a ton and being arranged for lowering to the ground. In the vaulted ceiling there is further concealed lighting, while electroliers, flambeaus, brackets, &c., provide the nearer illumination. In the vestible there are 115 lamps with Siemens reflectors concealed behind the cornice, and similarly in the box foyer 300 concealed lamps, together with conical bowl pendants, brackets, &c.

For the lighting of the verandah over the pavement some 300 lamps are used, while large candle-power metal lamps are also employed for exterior lighting.

In fact, metal-filament lamps are used throughout the building, for incandescent lighting—some 5,300 in all, representing about 200 KW.



FRONT-OF-HOUSE SWITCHBOARD, LONDON OPERA HOUSE.

Wherever the public has access to the building the dual lighting system (with two distinct sources of supply) has been adopted, so that a portion of the lighting in the auditorium, passages, boxes, saloons, &c., and on the stairs, will always be intact.

We may add that the interior fittings were specially designed for Mr. Crewe, the architect for the building, by Messrs. Veritys, Ltd., and are mostly of brass with gilt finish.

Reference has been made to the artesian well in one corner of the building, 450 ft. deep; from this a motor-driven pump lifts water to two 800-gallon roof tanks, which in turn feed other tanks for supplying lavatories, water heating, dressing rooms, &c.

The Plenum system of ventilation has been used, the two main ducts being formed at each side below the level of the stalls floor, from which branches formed in the concrete partitions, or of galvanised iron trunks, are carried to all parts of the house, in connection with four electric fans in the auditorium roof. The air heater is capable of raising the temperature 40°.

In conclusion, we are indebted to Messrs. Malcolm & Allan, the electrical contractors for the installation, and to Mr. Davidson, their manager, for enabling us to inspect the building and affording us facilities for this description.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

MOZAMBIQUE.—The Board of Trade has received definite information as to the actual amount of duty leviable on goods imported into Mozambique. From this information it appears that goods of foreign origin for importation into the territories of the Mozambique province, under the direct administration of the State, are subject to the following tariffs :—

1. Customs Duty.
2. Municipal Dues :
   (*a*) "Municipal," 50 % of the Customs duty.
   (*b*) "Commercial" 25 % of the Customs duty.
3. In addition, on goods imported into the territory south of the River Sane, a commercial contribution is levied at rates varying from 2 % to 15 % *ad valorem*.

ARGENTINE.—The Argentine Government has issued a decree providing that exemptions from Customs duty accorded by special laws in respect of machinery and materials for the installation of industries in the Republic shall, in cases where the respective laws establish only the amount of duty to be remitted without specifying any period of duration of the exemption, remain in operation for a period of two years after the enactment of the law. As regards tariff concessions in force prior to the promulgation of this decree, if the period of two years has already elapsed, a period of six months is accorded from the date of this decree (August 26th) in which to effect duty free importation.

CUBA.—With reference to Cuban requirements as to the certification by Consular officers of bills of lading for shipments to that country, the Board of Trade are informed that shippers may, when it suits their convenience, present, instead of the original set of bills of lading, an exact copy thereof bearing the following declaration : "*Este Conocimiento consular no es negociable, y son válidos sus efectos solamente para la Aduana.*" (This Consular bill of lading is not negotiable, and is valid only for Customs purposes.)

Nevertheless, persons in Cuba must, on declaring goods for entry at any Cuban Customs house, produce, together with the copy viséd by the Consul, the original bill which they receive as consignees of the goods, or which is endorsed to them by the consignees whose name appears on the bill or which is duly endorsed in case of consignment "to order."

NEWFOUNDLAND.—An Act (No. 11, of 1911) to encourage the manufacture of explosives in Newfoundland, provides for the exemption from duty, when imported by the British-Canadian Explosives Co., Ltd., London, for use in connection with their works and business in the colony, of all machinery and apparatus for the original installation.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,950. "Carbon-feeding mechanism of arc lamps." F. S. WORSLEY. October 30th.

23,960. "Sparking plugs of internal-combustion engines." F. A. L. JOHNSON. October 30th.

23,974. "Electric safety lamp." J. MCCALLUM. October 30th.

23,979. "Flange electric holder and flange electric lamp terminal fitting together making a true and perfect connection." C. HARVEY. October 30th.

23,990. "Electric arc lamps." A. H. RAILING and A. E. ANGOLD. October 30th.

24,003. "Electric switch." R. HEILBRUN. (Convention date, November 3rd, 1910, Germany.) October 3th. (Complete.)

24,017. "Electrical heating or cooking apparatus." L. NEWITT and F. P. FLETCHER. October 30th.

24,027. "Electrically-heated cooking ovens and the like." A. F. BERRY. October 30th.

24,030. "Protection of feeders of electrical distribution systems." C. H. MERZ and P. V. HUNTER. October 30th.

24,031. "Dry battery cells." J. RUDOLPHS. October 30th. (Complete.)

24,040. "Incandescent electric lamps." G. V. DEAKIN. October 30th.

24,098. "Process for swelling the sound by microphones, ear-end speaking trumpets, and the like." H. C. PETERSEN. (Convention date, November 11th, 1910, Denmark.) October 31st. (Complete.)

24,105. "Automatic regulating apparatus for electric supply systems." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckert Werke, G.m.b.-H., Germany.) October 31st. (Complete.)

24,122. "Electric transmission of power." H. B. VAN DAALEN and H. P. SCHREIBER. October 31st.

24,133. "Electrical switch." A. J. BONNELLA. October 31st.

24,141. "Electric timing devices." H. S. HATFIELD. October 31st.

24,146. "Electric magnets." A. QUARTENBERG. (Convention date, November 14th, 1910, Germany.) October 31st. (Complete.)

24,154. "Electromagnetic relay apparatus." J. P. COLEMAN. (Convention date, November 2nd, 1910, United States.) October 31st. (Complete.)

24,158. "Electric lighting of vehicles." W. A. TRIER. October 31st.

24,183. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) October 31st.

24,191. "Means of controlling current in electrically-heated apparatus." J. A. ABBOTT. November 1st.

24,215. "Manufacture of electric steels." V. STOBIE. November 1st.

24,227. "Dynamo attachment for motor-cars and the like." J. S. MATTHEW and P. BURT. November 1st.

24,232. "Switches and resistances." C. W. DENNY. November 1st.

24,238. "Process and apparatus for the electrolysis of aqueous solutions of metallic salts." R. CARL. (Convention date, November 3rd, 1910, Germany.) November 1st. (Complete.)

24,250. "Long tubular metallic-filament electric lamps." H. E. ANGOLD and J. F. POYNTER. November 1st.

24,258. "Insulating compounds." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) November 1st.

24,300. "Stand for supporting and facilitating the manipulation of photographic electric arc lamps." B. A. QUINT. November 2nd.

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24,333. "Hand-feed arc lamps." L. KAMM. November 2nd.

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24,352. "Electrical resistance heating cores." Sir R. A. S. PAGET and J. F. BOTTOMLEY. November 2nd.

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24,383. "Electric illuminating devices especially suitable for use on motor-cars." A. J. BONNELLA. November 2nd.

24,384. "Switch especially applicable for operating electric motor horns." A. HOFFMAN and UNITED MOTOR INDUSTRIES, LTD. November 2nd.

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24,448. "Apparatus for electrically-igniting gas." E. W. HAVERS and TELEPHOS DOMESTIC AND STREET LIGHTING Co., LTD. November 3rd.

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24,575. "Apparatus for obtaining a uniform longitudinal seam in tubes welded by electricity." GES. FUR ELECTROTECHNISCHE INDUSTRIE, M.B.H. (Convention date, November 5th, 1910, Germany.) November 4th. (Complete.)

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1909.

TELEPHONE RECEIVERS. B. O. Willis. 24,583. October 26th. (October 28th 1908.)

1910.

AUTOMATIC REVERSING STARTERS FOR ELECTRIC MOTORS. Höfle. 23,757 October 13th.

DEVICE FOR MAKING ORDINARY CLOCKS RELIABLE ELECTRIC ALARMS. S. H Walker. 23,780. October 14th.

ELECTRIC TIME-ALARM APPARATUS. H. Penner. 23,947. October 15th.

HIGH-FREQUENCY ELECTRIC APPARATUS. M. Sanchez. 24,143. October 18th (Convention date not granted.)

ARMATURES PARTICULARLY APPLICABLE TO MAGNETS FOR VIBRATING DIAPHRAGMS W. D. Kilroy, J. C. Needham and Evershed & Vignoles, Ltd. 24,272 October 19th.

INSULATING FITTINGS FOR OVERHEAD ELECTRIC TRACTION SYSTEMS. F. M Munro and Railless Electric Traction Co. 24,475. October 21st.

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METHODS OF STARTING ELECTRICAL INDUCTION MOTORS. G. H. Fletcher and E. A. Gatehouse. 27,119. November 22nd.

INCANDESCENT ELECTRIC LAMPS. S. Horvath. 27,401. November 24th.

CONNECTION FOR A RESISTANCE-MEASURING ARRANGEMENT. Firm of G. A Schultze. 29,465. December 19th. (December 20th, 1909.)

THE
ELECTRICAL REVIEW.

VOL. LXIX. NOVEMBER 24, 1911. No. 1,774.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

ELECTRICAL ACCIDENTS IN MINES.

THE latest Blue-book on "Mines and Quarries" by the Chief Inspector of Mines, recently issued by the Home Office, contains a short report by H.M. Electrical Inspector of Mines dealing with the application of electricity, and a brief review of the accidents resulting therefrom during the year 1910. The latter were dealt with in some detail in our columns a few weeks ago from the reports of H.M. District Inspectors of Mines, as far as the information contained therein would allow, but none of the reports—considering the very great importance of electricity in mines, and the necessity of bringing before both manufacturers and mine managers, the weak points in installations and defects in apparatus—are so full of detail as they might be. Certainly some accidents are very fully described, but the descriptions would have been very much improved had they been accompanied by explanatory diagrams and sketches.

As regards the installation of electricity, Mr. Nelson states that there are no means of determining what increase or decrease in the aggregate horse-power of electric motors has been made during the year, as under the existing rules only notice that electricity has been introduced is required to be given, without any particulars of the plant installed. This omission, however, is provided for in the new Coal Mines Bill now before Parliament. It is very satisfactory to note, however, that in spite of all the objections that have been raised against it, no fewer than 40 collieries newly introduced electrical plant during the year 1910. It would certainly have been of interest as showing the trend of modern mining practice if particulars of the plant so installed could have been given in the report.

There were 21 fatal accidents in coal mines resulting in the same number of deaths, but no fatal accidents due to the use of electricity in metalliferous mines were reported. Of the above 21 accidents, 20 were due to electric hock ands one to suffocation as a result of an underground fire, but not a single case of fatal ignition of fire-damp caused by electricity occurred throughout the year. In 1909, 15 fatal accidents caused 23 deaths, so that though there are two fewer deaths for the year 1910 it is to be regretted that there are six more accidents.

As regards the underground fire, which might have had serious consequences, Mr. Nelson says: "On June 17th, a road repairer at the Devon Colliery . . . was suffocated by the smoke and fumes from a fire which is thought to have originated in an oil-filled motor controller. No one was present at the time the fire started, but from the evidence given at the fatal accident inquiry this occurred in a pump room containing a 70-H.P. motor-driven three-throw pump . . . and consequently when the fire was

extinguished the motor controller alone of the electrical apparatus was found to be seriously burnt. There was no lamp in the pump room, and no possible source of fire apart from the electrical apparatus. Some failure of the latter was, therefore, not unjustifiably assumed. The pump room contained a good deal of timber, and smoke from this and from burning cable covering was carried in-bye.

"In the year 1909 a very similar fatal accident occurred at the Blaenant Colliery, in South Wales, and a number of fires have occurred unattended by fatal results, all indicating the desirability of avoiding the use of inflammable material, such as timber, in the construction of motor-rooms below ground; unless, as an *alternative*, the electrical apparatus is itself so constructed and worked as completely to remove the risk of fire. Where neither condition is fulfilled there is the need for *constant attendance during the working of the plant*." The italics are ours, and we are sorry to note that an authority like H.M. Inspector should even suggest there should be an *alternative* to electrical apparatus being "so constructed, and worked as completely to remove the risk of fire." There ought to be absolutely no question about this, as under no circumstances should any electrical apparatus be allowed either above or below ground that is not so constructed and capable of being operated without the slightest risk of fire. It is certainly not enough to rely upon "*constant attendance*," as it is the failure of the "human element" that is the cause of probably most of the accidents in mines, and evidently in the case quoted the pump and motor were running without anyone in charge: beyond a man occasionally calling at the pump room for the purpose of inspection and oiling, no attendance is required, as a permanent attendant would have nothing whatever to do, and the probability is—as he would possibly be neither highly intelligent nor well paid—that he would either get into mischief or neglect to do something at the critical moment. No; there must be no "constant attendance" in lieu of proper fire-proof apparatus. In addition to the fire at Devon Colliery, three other underground fires were reported during the year. In one "a set of full tubs knocked over a timber structure supporting a cable junction box, drawing the cables out of the box and causing a 'short.' The arc fired the timber which had been supporting the box, and burned the insulation at the ends of the cables." The other two were very similar, and "in each case a cable fused at or near the entrance to a pump room, setting fire to the adjacent timber. The second fire was the more serious of the two, and the colliery rescue brigade had to be requisitioned to subdue it. In each case the fire is thought to have originated at a place where there was no protective metallic covering surrounding the cables. Without such a covering, efficiently earthed, arcing from a fault may continue for some time before causing the means provided for opening the circuit in case of a fault to operate, and there can be little doubt that such arcing caused the fire in each case." These are very serious occurrences, and it is rather unfortunate that the cause of the cables fusing is not given. It is in such cases as these that a detailed description, with explanatory sketches, would provide useful information for the colliery manager and manufacturer, as showing them clearly what to avoid.

As regards accidents from electric shock, 4 of these took place on the surface and 16 underground. Of the former all occurred with three-phase current, three on "medium" pressure, and one on "high" pressure current. Three of the accidents were due to the deceased men not taking the very obvious precaution of switching off the current before carrying out their duties of oiling or adjusting machinery. The remaining accident was due to "the breaking of an insulator on an overhead line, which allowed a live medium-pressure wire to make contact with a steel stay wire." Mr. Nelson says: "It may, I think, be justly held that, with the exception of the accident last described, each of the above accidents is attributable mainly to neglect of ordinary precautions, qualified most likely by lack of appreciation of the danger of an electric shock. The accident to which the victim cannot be held to have contributed in any way would, no doubt, have been avoided had the stay wire not been secured to the top of the derrick in the neighbourhood of the live wires, or had the stay wire been connected to an earth wire. The accident illustrates a risk which I believe to be fairly common, and I would venture, therefore, particularly to call the attention of mine manag to it."

Of the 16 underground accidents, two occurred on lo pressure three-phase current systems; seven on mediu pressure three-phase; five on medium-pressure dire current systems; and two on high-pressure three-ph systems, and they are summarised as follows:—

Absence of, or inefficient, earth connection	6
Defective insulation of cable system	6
Contact with uninsulated live parts	3
Misadventure	1

The last-mentioned accident was one where a haulage lad supposed to have been probing with a piece of wire among the live terminals of an unenclosed terminal box. We c scarcely agree with Mr. Nelson that the accident was one "misadventure," for, as we have already pointed out, in t articles alluded to above, the terminals ought to have be fully enclosed. It is the sort of "misadventure" that mig be expected from a boy with a lighted candle a a barrel of gunpowder. Mr. Nelson goes on to say: "Of the remaining 15 accidents, not one can regarded as in the circumstances altogether unavoidable with proper care and the exercise of a small amou of common sense in the construction and administr tion of the installation, most, if not all, of the accide would have been prevented. This, as we have over a over again pointed out, is due mainly to the employment persons to install and look after electrical plant who a hopelessly incompetent to do so, and we are glad to note th Mr. Nelson fully confirms this, though very indirectly. I says:—"The admission that much of the electrical pla in use below ground is not by any means all it might be quite commonly made by those well qualified to offer opinion, and I agree with that view; but that the accidents which occur are thereby explained does not, as frequently assumed to be the case, immediately follo Though it is probable that something remains to be done replacing plant which is actively or potentially dangero from the point of view of the risk of electric shock, *it is ce tain that there is much more to be done in improving t standard of upkeep of electrical plant below ground*." M Nelson also admits that a great "proportion of the acciden might have been avoided by systematic and thorough mai tenance of the various plants," and he goes on to blame more less the colliery electricians for not being more attentive their duties. This is not fair, as Mr. Nelson must kno that at many collieries the electrician (so called) is whol incompetent for the duties, or is run off his feet by attendir to little complaints and faults in signalling, lightin and power systems, and in addition has no real responsibilit but is merely a "repairer" who is supposed to understan electricity much in the same way as a "watch-maker" clea or repairs a watch. This is the sort of thing that ought t be remedied, by dividing the responsibility now held by th colliery manager with a trained and certificated enginee who shall be responsible for the whole of the mechanical an electrical plant. Failing this, let the manager be guided b some consulting engineer who has had colliery undergroun experience, and who can select a good man to work unde him. We would enlist Mr. Nelson's services to secure th very much desired end.

L.C.C. Loans for Electricity and other Purposes.

We print elsewhere the salient detail of an extremely interesting report whiel has been prepared and submitted by th Finance Committee of the Londo County Council.

In a recent address to the members of the Institute o Bankers, the President stated that the position of banker with regard to advances, whether by loan or over draft, to municipal authorities and other local bodies, was no satisfactory unless the borrower had obtained the sanctio of the L.G.B. and such other statutory sanction as wa required, a statement which would appear to be somewha too obvious to be necessary.

Municipal authorities, as we know, have no capital and principally employ borrowed funds, the borrowing of which is subject to very rigid supervision by the L.G.B., whose sanction is usually necessary, and the application of the money must be strictly confined to the purposes for which it is borrowed.

The unsatisfactory position in question appears to have its origin in connection with those local authorities which sometimes apply to bankers for loans or overdrafts in anticipation of their income.

To overcome such a difficulty the Municipal Corporations Temporary Borrowings Bill was introduced in the last session of Parliament, but some of the clauses in it do not seem to be regarded with approval.

Why should not bankers adopt the practice of the L.C.C. Finance Committee, which is apparently more wideawake than they? Perhaps the reason is that bankers, who are usually credited with being well able to look to their interests in matters of finance, are too keen to make short-dated loans or advances to municipal authorities. A large proportion of the money which our great banks owe to the public such as on deposit and current account, and which they feel they can safely invest, finds an outlet in loans and other forms of investment at call or short notice in which fear of loss of capital is extremely remote. The reason for this course is that it is necessary for the banks to retain such money in a much more liquid state than that representing the paid-up capital of their own shareholders and their reserves, and it is invested in first-class securities.

No application for loan, or advances, is dealt with by the L.C.C. Finance Committee unless the borough council has statutory authority to incur the expenditure in question and to borrow to defray the same, and the L.C.C. does not advance loans of a smaller amount than £1,000 except when the loan is required for the purpose of completing any work for which a loan has been previously granted, or when there are exceptional reasons which justify a loan of a smaller amount.

French Lamp Taxes.

It would seem that taxes on lamps are to become very popular among Ministers of Finance, M. Klotz (France) being the latest advocate of the peculiar view that artificial lighting is a "luxury." Acting on this supposition, he now proposes to wipe out some of the enormous Budget deficiency of 170 millions of francs by the imposition of the following taxes :—

1. 0·005 fr. per KW.-hour on electrical energy and 0·01 fr. per cb. metre on gas used for lighting and heating (electrical energy or gas used for public and vehicle lighting, or for heating furnaces or other industrial applications, being exempt). Acetylene is to be taxed by a duty of 4 fr. per 100 kg. on calcium carbide.

2. Incandescent filament lamps are to be taxed according to the following schedule :—

	Carbon.	*Metallic.*
Up to 10 watts ...	5 centimes	10 centimes
From 11 to 60 watts ...	5 ,,	15 ,,
61—100 ,, ...	10 ,,	30 ,,
101—200 ,, ...	15 ,,	50 ,,
201—300 ,, ...	25 ,,	70 ,,
301—400 ,, ...	35 ,,	90 ,,

Incandescent vapour or gas tubes will pay a tax of 3 fr. per metre of length (a basis which will obviously favour the high-voltage mercury lamp, this having the highest C.P. per unit length among this class of lamp). Arc lamp carbons are to pay 20 centimes per kg.

M. Klotz claims, as his precedent, the taxes on lamps and lighting accessories already enforced in Spain, Italy and Germany, and points out that candles and petroleum oil already pay taxes in France. But, as *L'Industrie Electrique* so pertinently remarks, the tax on candles was imposed after the war of 1870, and was announced as "exceptional and temporary," so that the justification for the new taxes is largely based on imposts which are themselves illegal and unjust.

On every hand the French technical Press raised a storm of protest against the prevalent corruption, incompetence and maladministration in Government departments, and suggested that the required funds had better be raised by setting the State officialdom in order, rather than by taxing something which is as universally essential and free by rights as water and air. Whatever the issue, the industry does not intend to allow itself to be *égorgé sans crier!*

The I.E.E. Articles.

Elsewhere in this issue we give a full report of the proceedings at the second "informal meeting" of the Institution on Thursday last week. It will be seen that a much calmer tone prevailed than at the first meeting, and there can be no doubt that the hostile spirit evinced on that occasion was very largely due not to the nature of the proposals put forward, but to the short notice given. The Council has made ample amends; not only is the final decision relegated to the distant future, but further informal meetings will be held if necessary, and in the meantime the President and some members of the Council are paying visits to the provincial centres, to meet the members of the Local Sections and to discuss the new Articles with them in person.

Already we have received reports of the proceedings at some of these meetings, but in view of the large space we have given to the London meeting, we are compelled to defer their publication to our next issue. We have also received several letters, for which we cannot find room in this issue; if their length could be taken as a criterion of the intensity of feeling experienced by their authors, it would appear that the Institution had been shaken to its very foundations! Some of the points raised in these communications are of exceptional interest.

Regarding the discussion on Thursday last week, we must admit that we shared the disappointment of the President, who deplored the lack of breadth of vision displayed. Members dwelt too much upon details, instead of discussing the broad principles which underlie the Council's proposals.

The main question is whether the Institution shall be a high-and-dry scientific and technical body, of restricted dimensions and narrow scope, or whether it shall embrace the whole industry and be, in fact, an Institution of Electrical Engineering, serving the needs of every branch of our great industry, and affording assistance and protection to every person engaged in it.

Here is a magnificent opportunity: it may never occur again—and we sincerely hope that, for their own sakes and for the benefit of all associated with electricity, the members will seize it and turn it to the best advantage.

Lamp Exports and Imports.

Month by month for the past seven years the Electrical Review has published a classified return, based on official figures, showing the nature, value and distribution of British electrical trade abroad and dealing similarly with the importation of foreign electrical material into this country. We have reason to believe that the information contained in this return has proved of considerable value to the British electrical industry—indeed, the returns themselves bear witness to the enormously increased interest of the home manufacturer in the foreign and Colonial markets, as compared with a few years back.

In order still further to increase the usefulness of these monthly figures, arrangements have now been made whereby the value of the exports and imports of *(a)* glow lamps, and *(b)* arc lamps and lamp parts, will appear separately, instead of under the common heading of "Electric Lamps and Parts," as heretofore; the new arrangement commences in the October return included in this issue.

The English glow lamp industry is a rapidly growing one, but despite the large number of new factories which have been opened during the past year or two, the importation of glow lamps into this country still maintains large proportions, while our foreign and Colonial lamp trade has made but little advance so far.

It is in the hope that the extended information may be of assistance to the lamp manufacturer and others that these monthly returns, *which are exclusively published in the* Electrical Review, have been recently amplified.

ELECTRICITY SUPPLY FROM THE CONSUMER'S POINT OF VIEW.

By "K."

Having recently visited the Electrical Exhibition at Olympia, and, further, having had time to digest some of the literature annexed while there, the writer feels impelled to offer a few remarks for the consideration of the technical men as to how the consumer looks at the question of electricity supply.

One supposes that most men are in a similar position to the writer, with a house in the suburbs on the mains of one company, and with offices in town on the mains of another company: this brings one to the first point which irritates the consumer, and that is, that nothing which he buys for his office is any good at home, and *vice versa*. As a case in point, the writer noticed a very nice electric kettle about six months ago in a shop window, and after recovering from the shock of ascertaining the exorbitant price demanded, obtained one for about half that price from an electrical friend, for use in making tea at the office when no fires were on.

When the cold weather came along, and fires were again available, it struck me that it would be just as useful at home for afternoon tea in the drawing room, so after carefully explaining the procedure to the domestic, I left it in her care.

Result, an urgent telephone call that the kettle had "exploded," and no light at home on my return in the evening. My electrical friend, after charging me 8s. 6d. for repairs to the kettle, explained that it was due to the different voltage, which also explains, one supposes, why a lamp which is quite happy in my office, treats one to a flash of lightning at home and then expires. Another point which is excessively irritating is that, having discovered some interesting and useful piece of apparatus, such as the aforesaid kettle, and saved up sufficient money to buy it, one suddenly finds one's bill for electric light leap up to an enormous sum, and after wild expostulations with the company, one finds that one can have electricity for anything but lighting apparently at about a quarter of the cost for lighting, if one will only have the place rewired at a cost of about £8, and the hire of a second meter.

I have vainly endeavoured to discover why I may boil my kettle for 1d. a unit, while I must pay 5½d. a unit for my light.

A suave gentleman from the company tried to convince me that it was something to do with when I used the kettle, but as I pointed out to him that I usually wanted the light in the office about tea time, which was when I wanted to boil the kettle, he smiled and said, "Yes, of course," and went off.

Apparently if I liked I could have my electricity for 1d. during the morning, and this I can quite believe, as when we get a fog, the kind of light the company is good enough to let us have is merely a further electrical exasperation.

The worst mode of irritation is the hobby which the companies have of making you rewire your premises.

I remember about three years ago, shortly after the offices had been wired and redecorated, a breathless young man calling to explain why my account was so viciously high. After a long tirade about the Meteorological department's returns showing that it had been the darkest January for 40 years, he proposed that I should have all the fittings altered so that I could use some new lamps in pairs, and add a lot of points to bring the total number even. He estimated this at "about 2s. a point." I had it done, and having originally had 43 lamps in all, some in three-light fittings, I acquired 58 lamp points at a cost of £8 11s. 6d., and then had to pay 2s. 3d. each for his new pet lamps, which were vile. My bill, including renewals, was much higher next corresponding quarter, and this year I have had to rewire again so as to utilise a new lamp *singly*, which I was assured would be impossible three years ago!

And all this without reference to extra wires for my kettle and a radiator, which cost me £3 10s. to install, apart from the kettle and radiator.

Another hobby of the company's is meters. My office extend over four houses, and they originally wanted me t have, *and pay for*, four meters, but on my refusal consented t supply me in two places, each extreme flat, and only charg me for two meters, while I had to pay for the joining up of th other two circuits. I now have four meters, two for lightin and two for my kettle and radiator, which happen to b used at opposite ends of the building.

I have no doubt all these plaints seem very feeble to th technical man, but when I realise that I might have accepte the gas company's offer to lay new pipes to all my 18 room for lighting and fires for nothing, and give me one servic through one meter for the whole lot, with 25 per cent. dis count because of the stoves, and charge me—I think it wa 1s. 6d. per quarter per room to look after the whole lot—wonder whether I am not a bigger fool than I look!

But why do electricity supply companies do these things

PROCEEDINGS OF INSTITUTIONS.

The Institution of Electrical Engineers.

Special Informal Meeting.

On Thursday of last week an adjourned informal meeting of the Co porate Members was held to consider further the proposed ne Articles of Association. Mr. S. Z. de Ferranti occupied the chai and there was a large attendance of members.

The President said they hoped to have the benefit of the expre sion of opinion of those members particularly who had no chanc of speaking at the last informal meeting. They would like to hav as general views as they could get. After the members ha spoken, he believed there were some members of the Council wh would like to say something with regard to the Articles. They ha had suggestions coming from all directions, and he would rea them out:—

Article 9.—"Only Members and Associate Members to us official abbreviations."

Article 12.—"That the Council be empowered to admit in specia cases Members under the age of 30." "That Members be designate Fellows (F.I.E.E.)." "That only two electrical (Science) Member (Article 12 c) be elected each year." "That the 100 non-technica Members (Article 12 d) be omitted." "That service in law o science be omitted from this class."

Article 13.—"That all existing Associate Members be transferre and designated Members (M.I.E.E.)." "That it should be com pulsory (instead of permissive) for the Council to requir Associate Members to pass an examination." "That a existing Associate Members be made to sit for an examination. He (the chairman) was sure he would fail—but he was not a Associate Member. They had not included those who had sent i expressions of approval of what the Council had done.

Article 14.—"That Associates be termed 'Affiliated Members.'" "That the definition of Associate include the words 'although no eligible as a Member or Associate Member.'"

Article 15.—"That Licentiates be omitted." "That Licentiate be termed 'Subscribers,' 'Graduates,' 'Probationers' or 'Students.'" "That Licentiates be called 'Graduates' or 'Students,' and Student be allowed to remain Students as long as they wish; and that th subscription of Students be increased to 2 guineas at the age of 2 and 3 guineas at the age of 28."

Article 19.—"Elections to be abolished or made more effective."

Article 20.—"That the signatures of one M.I.E.E. and two othe Corporate Members be sufficient. (The same to apply to transfe from Students to Licentiates, Article 23.)" "That candidates re siding abroad be given no special facilities in regard to signature on their election forms."

Article 27.—"That this proposal be subjected to the decision o the whole of the Members by means of a referendum." "Tha country members residing more than 30 miles from London or Local Centre pay a lower subscription." "The subscription o Licentiates should, after the age of 30, be the same as that o Associate Members," and "The age of 19 seems rather low for Student's subscription to be increased." "That subscriptions be a follows:—Inside 50 miles' radius from London: Members, 4 guineas Associate Members, 3 guineas; Associates, 3 guineas. Outsid 50 miles' radius from London: Members, 3 guineas; Associat Members, 2½ guineas; Associates, 2½ guineas." "That the sub scriptions be as follows: Within 30 miles' radius from London Members, 4 guineas; Associate Members, 3 guineas; Associates 3 guineas; Probationers, 2½ guineas; Students, 1½ guineas. Out side 30 miles' radius from London: Members, 3 guineas; Associat Members, 2½ guineas; Associates, 2½ guineas; Probationers 2 guineas; Students, 1¼ guineas." "That subscriptions of existing members be not increased." "That subscriptions of new members elected after July 1st, 1912, or transferred after July 1st, 1913, b according to the new schedule in the case of London members, and that members living more than 20 miles from the Institution building continue to pay at present rates."

Article 30th.—"That members elected between October an December be excused from paying the subscription for the curren year."

Article 33 (Life Compositions).—"That a graduated system according to age be adopted." "That the life composition fee be fixed at 50 guineas assuming an annual subscription of 4 guineas."

Article 42 (Professional Conduct).—Add "He should not in any report likely to be published or advertised or generally circulated describe himself in connection with the Institution as an Officer or Member of Council of the Institution or otherwise than as a Member thereof." "Omit the words 'or shareholder in' and 'or have any financial interest in such business' in Article 42 (E)." "Omit the word 'improperly' in 42 (E)." "The words 'improperly solicit' to be explained in 42 (E)." The suggestions which had been sent up showed the broad way in which people had been looking at these matters, and he would remind the members that in this question of professional conduct the Council had endeavoured to follow the older body, viz., the Civils, who had been into the thing at very great length.

Article 48.—"That the Honorary Treasurer serve not more than 3 years in succession."

Article 49.—(Ordinary Members of Council).—To consist of 12 Members, 4 Associate Members, and 2 Affiliated Members (Associates).—"To consist of 18 Members, 3 Associate Members and 3 Associates." "10 Members, 6 Associate Members and 2 Associates." "That non-Corporate Members be not represented on the Council; but if so represented, the numbers to be 4 Associate Members and 2 Associates."

Article 51.—(Nomination of Members of Council).—To be made by 10 M.I.E.E. instead of 25 Corporate Members." "To be made by 12 Corporate Members instead of 25."

Articles 51 and 52.—"That the election of Council remain as at present, except that the list of the Council's own proposals be sent out to each Corporate Member six weeks before the Annual General Meeting inviting further nominations within three weeks."

Article 55 (Powers of the Council).—"That the management of the property and funds of the Institution be left as in existing Article 68."

Article 57 (Votes of Past Presidents).—"The word 'present' in line 5 should be deleted."

Article 60.—"That the reports of Committees be received by the Council before any definite action is taken." "In line 3 of Article 60 insert after the word 'Committee' the words 'chosen from their own.'"

Article 64 (Pensions).—"That a tabulated scale depending on the length of service and amount of remuneration during that service be included in the Article."

Articles 66 and 69.—"That the powers of the Council be subject to the sanction of two extraordinary general meetings."

Article 69 (Incorporation of other Societies).—"To be permissible only by special resolution of the Corporate Members, of which 21 days' notice is to be given."

Article 79 (Alteration of Articles).—Add "But no resolution for this purpose shall be deemed to have been passed unless approved by two-thirds of the Corporate Members of the Institution."

Article 83.—"That the Local Sections be abolished in view of the small attendances at their meetings and their tendency to develop into a sort of drivel or trade-union aspect."

Article 86.—Add "If any paper has not been published in full by the Institution within 12 months of its acceptance, the author shall be at liberty to publish it elsewhere."

Benevolent Fund.—"That sufficient power be taken for the complete handling of the Benevolent Fund by the Institution."

Library.—"That it should be opened in the evenings." They would remember that that was one of the things that had been suggested, but that, of course, meant more expense. Unfortunately, anything that they wanted always cost money; the things that they did not want they could get for nothing. "That they should establish a lending library," and that was a thing the Council wanted to do; but again, it was a question of money.

Postal Vote.—"That a postal ballot of Members and Associate Members be taken in regard to the admission of the 100 non-technical persons to full membership; the raising of subscriptions of existing members; and the formation of a Licentiate class, unless there is unanimity at the meeting on November 16th."

Those were all the suggestions they had received. The Members of the Council were going to attend meetings in the various local centres. On Tuesday he would be in Manchester to hear the views of the members in that part of the world; on Wednesday he would be at Birmingham; on Thursday they would have their Council meeting, and on Friday he was going to Glasgow to hear what the members there had to say. It would be seen, therefore, that they hoped to get the views of the bulk of the members of the Institution, and hear substantially all that there was to be said on the matter. He felt sure it was in all their thoughts—that they wanted to make the Institution the best success they could, and of the greatest use to the general body of members; and if they tried to regard the matter from that point of view, and to sink their own personal views in favour of anything better that came from someone else—he was sure that the meeting would bear good fruit.

Mr. A. P. Trotter said they were met that evening under different circumstances to those of the last meeting. The Council were giving the utmost facilities for discussing the matter; therefore the asperity which was perhaps visible at the last meeting should be dropped, for they were met together to see what they could do to carry through the best possible amendment for the Institution. It was impossible to govern an institution like that by means of all the members; they must have a Council, and they relied on that Council to do their very best. He had seen a good many country members since the last meeting, and as most of them were aware, it was a serious matter to increase the subscriptions of those country members who could not attend Local Sections. They had the privilege of writing some letters after their names, and they had the *Journal*, and as Mr. Hammond told them they had the dignity of belonging to an institution which could live in such a building as that in which they had now met. He did not know that that amounted to much—many of them had never seen it. He did think that one of the most important things was that the subscriptions of the local members who could not attend Local Sections should be left as they were, because he did not see what they were going to get out of it. With the London members it was different. They had settled themselves in a house three times too big for them, and not only that, but they had embellished it in a way which he found made the country members grumble. Their hon. treasurer told them at the last meeting that the expenses they had to meet were not due to the building. That was a statement not supported by detailed figures. Their President told them some of the reasons why they wanted more money, and they were very praiseworthy indeed. But a few years ago they had ample money; they were flourishing until they saddled themselves with that building, and they could then have done some of these things. He thought he was right in saying they had fairly crippled themselves, and that to do anything further they must increase their subscriptions. He did plead for the country members, to whom it would mean practically nothing. He felt very strongly regarding the new class of so-called Licentiates. A Licentiate appeared to be someone licensed to do something, and he did not see how they were going to stop a most intelligent licensed plumber from putting over his door "Licentiate Member of the Institution of Electrical Engineers." If such a class was allowed—and he did not see why they wanted him—he should not be allowed to put up such a title, or they should give him a title which he would not want to put up. He thought the suggestion to gave him the title of Subscriber was an excellent one, for that was all he would do, and all that they could ask him to do. They heard that this building was going to help them to keep up the dignity and prestige of the Institution, and so on; now they were introducing the member who could not get through an examination of any sort. Such a class of member must inevitably dilute the Society. They stood now as a learned society; as one of the scientific societies of the country. He hoped the Institution would not dilute its intellectual standard.

Mr. F. Bailey said that in the 28 years he had been a member he had seen several revisions of the Articles, and he did not remember seeing any revision which altered things so materially as this, and altered them for the worse. The old Articles of the Telegraph Engineers were designed to meet only one class of member. They were no longer confined to telegraphy, but branched off into all sorts of ramifications—transmission of power and generation of energy, and telephony and telegraphy were now all mixed under one rule. He quite appreciated, therefore, the difficulty attending the revision of the Articles. It seemed to him that this was a very timid revision, and did not appear to grasp the real problem before them, which was to make the Institution of more value to the members and make it sufficiently important to justify other members in coming in. If many of these alterations were prompted by the mere emptyness of the cash-box, he thought it very deplorable that they should have taken the form of lowering the dignity of the Institution in any way, and particularly by the introduction of the Licentiate. So far as many of the revisions were concerned, they seemed to desire to give more power to the Council; it came rather badly from them to suggest that some power be given to them to the exclusion of the right of veto on the part of the members. He disliked the whole thing so much that he was compelled to ask the Council to withdraw the matter and reconsider it. All the bad points in the old Articles had been repeated in this revision, and they were made worse by including other words. For instance, in regard to members, they read, "That he has been regularly educated as an electrical engineer." The word "regularly" had been put in. He denied, after 30 years' experience, that they could make an engineer at all by experience. They *trained* an engineer, and he ought to be educated first. The student was the only man who had been trained, and he was trained before he became a student. He was not at all clear by what authority the Council now suggested that they did not desire to come to the members for authority to borrow money on loan. Who ever heard in a limited liability company of the shareholders not being consulted before debentures were issued? In Clause 69, the Council again wished to take the whole discretion of fusing with other societies without consulting the members. Were they to allow that? They had heard no explanation at all as to what the examinations were to consist of. Was it to be a technical examination or was it to be an examination to see if the member was of good education? If it was assumed that the examination was to be a technical one, what were they going to ask him? The careers possible for any member of that Institution, so far as he could see, were about 12 in number. In which of those was the man to come in and graduate? He would propose that this revision be withdrawn absolutely, and that another committee be appointed, with wider scope and with their eyes open to the fact that the Institution was no longer for telegraph engineers only, but should be a great Institution, embracing all these 12 careers, and that for this purpose the Institution should be divided into certain heads. Members should be asked under what head they intended to devote their career. These different sections should meet and select their own committees, and let the chairmen of the sections form the Council. Each of these sections could, through their own committees, receive papers and hold meetings for discussion, and they could send their best papers to the Council for discussion by the whole Institution, and the opportunity could then be given to the younger members of the Institution to gain experience in speaking. Something was wanted to encourage the younger members to prac-

tise speaking. Many knew a great deal, but they did not care to say much. He considered the matter of such vital importance that he asked all the members to join him in asking that this revision should be withdrawn. It would be ten thousand pities if the matter was pushed on and if the members should be forced to overwhelm the Council. Referring to the proposal of the Licentiate, he must say that the Licentiate would seem to be an awful being who was perfectly illiterate. He could not pass an examination; he had no particular qualification, but he might add a few shillings to the cashbox.

The President said it was a great pity Mr. Bailey did not give facts. He would see that a Licentiate must be a person of good education.

Mr. Bailey said he meant he could not pass an examination.

The President: It is a question of keeping to facts. There are 20 things which you are incorrect about.

Mr. Bailey said he was not quoting directly from print. He asked the members seriously to put an absolute veto on this revision.

Mr. W. E. Warrilow said he would like to touch on the commercial aspect of the Institution. He suggested with regard to the new classification of members, which seemed to him to be necessary, that it be carried out under two heads—the professional and technical, and the commercial. Under the heading of technical and professional, they might have associated members and students, and under the heading of commercial they might have associates. There were many commercial men identified with the electrical industry who at present had not the opportunity of speaking or reading papers on subjects which were of vital importance to the development of the industry from the commercial point of view.

Mr. A. Kirk said it seemed to him that the discussion ought to start upon the basis—was this to be an Institution of Electrical Engineers or not? At present they were not an institution of electrical engineers, and under the proposed new rules they would be still worse.

Mr. E. MacGregor Duncan said that as a consulting engineer he was particularly interested in the new Article No. 42, dealing with professional conduct, and he welcomed any step that the Council might take for dealing with this matter. It might certainly be assumed that the Council had felt the need of safeguarding the public in their dealings with the consulting engineer. That this feeling existed was, he thought, generally admitted, and it was probably known to all present that steps had been taken by a number of consulting engineers to form an association for the mutual protection of the public and themselves. He could not help feeling that this Institution was the proper body to deal with that matter as far as its own members were concerned, and he suggested that the Council should consider whether it was not desirable to provide the necessary machinery so that the members affected might be at once distinguished from their fellows. Briefly, his suggestion was that all members of any class regularly practising as consulting engineers should be required to forward their names to the Council for registration as such. It was only, perhaps, those of them who had to deal with the smaller engineering works, who knew how great the present evil was, and how urgently it needed controlling with a very firm hand.

Mr. J. F. C. Snell asked to be allowed to speak, not as a member of the Council, but as one of the rank and file of the Institution. In passing, he might correct Mr. Bailey in one respect. Mr. Bailey seemed to think with regard to consulting engineers that anyone could put up a brass plate on his door for seven years and become a member of the Institution, but Mr. Bailey could hardly have read the qualification at the end of the section, which said that he must have acquired eminence in the profession. As to the Licentiates, it was the principle they had to deal with. Did the Institution want to restrict its membership of whatever class to purely professional engineers or did it not? Let them not forget that under the new proposed regulations they were going to impose certain further restrictions upon the membership of the Institution. Before they could become corporate members at all, people would be required to pass an examination, or might be required to pass an examination, and they had to pass certain other qualificatory tests; the object being, of course, that those who became Associate Members and full Members should be properly educated and properly trained electrical engineers. That of course, would entirely exclude anybody who was connected with the electrical industry, but who had some important part to play in their work either from the commercial, financial or legal sides. The class of Associate in the past had included all and sundry. It was desired, as in the case of the Institution of Civil Engineers, that the Associate in future should be a person who occupied a high position as a barrister or lawyer, or commercially or financially, and who played an important part in the control of their industry. There were many Students in their Institution who, having had a proper training, got put into positions which did not give them facilities to pass an examination as Associate Members. When they were actually engaged in practical work, they did not care to be called Students when they had reached a certain age; and yet, if they were abroad, or for other reasons, were unable to get the opportunity to pass the necessary qualificatory examination, were these people to be turned out of the Institution? They could not become Associate Members very well, and they could not remain Students. Was there any objection to providing a sort of intercalary class, in which they could be put for the time being? Whatever they called this class, the entrants must be persons of good education. He thought it would be a very great help to them if the members present could express an opinion as to whether or not they should go on in the future purely as a professional institution, leaving aside altogether the commercial and financial and legal supporters of it, or whether they were going to adopt the broader and, in his opinion, the better policy of including those gentlemen. They knew that a great many people outside, as he thought with some good reason, had complained that the Institution in the past had only looked at the purely academic and scientific side of things. If they were going to take this more catholic and more comprehensive grasp of things in the future, then he thought they would find when they came to analyse things properly that there was room for this intercalary class. If they could decide whether the principle or not should be adopted, then the question of name could be got over. He quite agreed that the name was one they did not like, and it was perhaps a name capable of misuse. Many other names had been suggested—Graduates, Subscribers, Probationers, Junior Members, Senior Students and Junior Associate Members, and he also believed Companions. None of those names were particularly good. The Institution of Mechanical Engineers adopted the term Graduate, but that was a misnomer, although it might be better than Licentiate. He thought that perhaps on the whole, Graduate might meet the position.

Mr. H. Prideaux said they did not like the name of Licentiate, as it seemed to give a licence to a person, and the Institution could not do that. Secondly, he did not think they wanted the class at all. With regard to the examination of the Associate Members, they ought to know a little more about it.

The President said it was all in the annual report.

Mr. Prideaux said a good many of them objected to the new Articles generally, as they gave too much power to the Council. He also thought it was unjust that after paying an entrance fee, in a couple of years a member should have his subscription raised.

Mr. J. G. Lorrian said that with regard to Clause 42, dealing with professional conduct, he would like to see a further clause to the effect that in any report a member might make, he should not describe himself as a member of the Council or an officer of the Institution. He wanted, if possible, to put a stop to certain abuses which existed some years ago, and which might easily exist again. He suggested that when members drew up reports which were likely to be advertised, they should sign themselves only Member or Associate Member. It could not be for the good of the Institution to see, after a company had failed, a report signed by a Past President or something of that kind. An Institution of which he had the honour to be a member of the Council had found it of the utmost use to have that clause.

Mr. Dykes said he would like to congratulate the Committee drawing up the Articles. He had gone carefully over them and had noted the points raised and heard the arguments, and, on the whole, he was inclined to think the proposals as put forward by the Council presented the best solution that could be found. He thought they should call this new class of members Graduates and not Licentiates. With regard to the suggestion that those members who desired to practise as consulting engineers should be starred as a separate class of members, there were serious objections to that. The consulting engineers represented only a small proportion of the members, and he hoped the effect of including these rules would be that the Institution could gather together into one body those members who desired to help the profession.

Mr. Madgen said he supported the last speaker in congratulating the Committee which had dealt with this matter. He did not know that he had ever listened to such a strong indictment against any body of men as Mr. Bailey had put forward, but he was bound to say that seldom or never had he heard one in which such little care was taken to verify the references. Mr. Bailey deplored the circumstance that the new Articles did not begin by stating the reasons for their existence, but if he had taken the trouble to read the document he would have seen that the whole of that was detailed very properly, where it ought to be, in the memorandum. The memorandum of an organisation could not be changed except by permission of the Courts, and thus their memorandum stood where it did and plainly stated what their objects were, but he, for one, thought they had failed dismally in fulfilling the last Sub-Section of Clause 3, which was "To do all such other lawful things as are incidental or conducive to the attainment of the above objects"; one of these objects being "To promote the general advancement of electrical and telegraphic science and its applications." This was clearly indicated by the fact that other bodies had been formed for particular purposes. The consulting engineers did not feel that their interests had been looked after, and he believed they had actually started a separate body for the purpose of carrying out the views of that section. Then the Tramway and Light Railway Association had been formed for the purpose of looking after that section of the business, and he sincerely believed that that Institution failed in doing that work. Another body that had been formed, called the Committee for the Protection of Electrical Interests, of which he (Mr. Madgen) happened to be a member, was brought into existence because the Institution failed to have sufficient regard to the real requirements of the industry. Then again, the Institution of Mining (Electrical) Engineers was formed for the same reason, viz., that the Institution of Electrical Engineers did not devote sufficient attention to that very important branch of the business. If they wanted to make any real progress not only with the science, but with the electrical industry, they would have to reorganise the Institution on a more catholic basis. With regard to the admission of Licentiates, he thought the name "Subscriber" was better, or the name "Associate." He thought that the proposals represented a sincere and earnest attempt on the part of the Council to bring the Institution up to date in relation to the different branches of the industry, and he for one felt that he owed them a debt of gratitude for their labours.

Mr. J. J. Wolff said the Council wanted to convince them of the need or the advisability of increasing the subscription, but they

had not put forward any figures showing how they intended to spend the additional subscriptions. He thought that if the Council could give them some information on that point it would help to convince the members, and to make them agree to pay the additional subscriptions. Under the old rules an Associate Member must have had at least two years' employment in a responsible situation as an electrical engineer ; in the new rules the words "in a responsible situation" had been dropped—in other words, the the Council was making it more easy to become an Associate Member than it had been in the past. He admitted that the rule was qualified by the remarks at the bottom of Article 13, "provided that the Council may require candidates to pass an examination." Was it definitely proposed that the candidate should undergo an examination ?

The Chairman said that the question as to examination was dealt with as follows :—"Provided that the Council may require candidates for associate membership to pass an examination, or, in their discretion, grant exemption therefrom in approved cases."

Mr. A. J. Cridge said he would like to know precisely what the Council were going to give the members in return for the larger subscription. They had heard something of what they could do, but he would like to know what they really proposed to do. Another point he wanted to raise was, why did the Council propose to alter the method of transfer from one class to another by submitting the transferred member to a general meeting, after he had got past the Council ? He thought the rule as to transfer was all right as it originally stood. Could they use the term "Bachelor" instead of Licentiate ? With regard to the election of the Council, if they wished to elect a man on a borough council—quite an important body—a proposer and seconder, and eight supporters, were quite sufficient. It had always been so in their Institution, and he thought that 25 names was an excessive number. He would like to see that rule left as it was, and that 10 members should be sufficient to nominate a man for the Council. Moreover, he thought they ought still to have the privilege of making nominations after the lists had been issued. There was one other point which he would touch upon with very great respect, and that was the constitution of the Council. Why did they include the Past Presidents always ? The Municipal Electrical Association, to which he belonged, did not do that. When a man had passed through his past presidentship, which lasted for three years, if he wanted to get on the Council, he went on the floor and got elected as an ordinary member. A great politician retired the other day because he felt he could not keep in touch with changing circumstances, and he submitted, with all respect, that that might apply to some of their past presidents. Referring to examinations, he thought they might take it for granted that the Council would put alternative papers up in the same as their friends the Civils did.

Mr. J. E. Kingsbury said that the criticisms that they had had upon the particular Article which referred to the subscriptions had mainly been on the lines that if there was to be any increased subscription, somebody else should pay it. The object of the increased subscription was to get more money. The position, shortly, was that more money was required for the purposes of the Institution. Mr. Trotter had referred to the fact that Mr. Mordey stated that no increased subscription would be necessary. Mr. Mordey also said that no levy on the members would be necessary ; and there had not been any levy on the members, and he would remind them that Mr. Mordey spoke in 1908. A plain statement of facts and figures was put before the members by the Council. The cost of the building was £50,000, and the cost of the extensions was another £6,000. They had expended on the building and in alterations, in accordance with last year's accounts, £18,000. The total cost of the buildings, in accordance with the building fund, had been £73,000, and it would therefore be seen that they had to deal with a totally different set of figures to those contemplated in 1908. He would like to point out the great advantage which the Institution had obtained from having departed from that modest estimate that was placed before the members at the start. They had a new building of which they had reason to be proud ; they could see what a terrible mistake it would have been to carry out the original proposition ; they had widened the area of the theatre, and they had extended the walls, but they had done something, to his mind, far more than that—they had extended their outlook ; they had a greater perception of what the Institution was, and what it could be. Before he left the question he would say that it was not entirely the buildings that needed a new subscription. The wider scope of the Institution, which was so obviously necessary, had really as much to do with the case as the building itself ; but, still, the building had a great deal to do with it. They were now in the position of having their income and their expenditure so nearly balanced, that it was not a safe thing for the Institution—they needed a wider margin, and the Council considered in the propositions that had been put before them, that that larger margin should be obtained from the present subscribers. The suggestion had been made that there should be a difference, and that the country members should pay less. The example of the Civil Engineers was brought to their notice, but what were the conditions ? The Civil Engineers had no Local Sections ; the Electrical Engineers had Local Sections. Those who resided in the country had the idea that that building was more or less the property of the London members ; that idea seemed to him not to take sufficiently into account the importance of the Institution and its need of a home. The expenditure incidental to the Local Sections was about £1,400 a year, and the rental value of the theatre and such other portions of that building as might be considered only habitable for the London members was about £1,900 a year. They would therefore see that the ordinary idea that the country member had not the facilities, and therefore should not pay as much as the London members, hardly applied to their conditions, for, as they would see, there was really very little difference between the expenditure on the Local Sections and the expenditure due to the building. There were, of course, a very small number of members who were not within the area of a Local Section and who were not within reasonable distance of London. Those members logically, were undoubtedly entitled to the benefits which were made for country members, but their number was small, and it was not possible for an Institution like theirs to have such a varied scale of rates as would ensure that every member should get value for what he paid. He would like to remind members that there was a theory governing such Institutions as theirs, and that theory was that each member was contributing to the advancement of the science. All that the Council was suggesting was that the Institution should be placed on a par with other institutions having similar aims. He would like to remind them that, of the £73,000 at which that building stood in the books, £37,000 had been contributed by members of the past. That seemed to him to be a reason why they should not put too much on to the future.

Mr. H. Hirst said that he had had some experience of what was good for technical men ; it had been his lot to nurse engineers through their days of nursing, and then contact with commercialism had not in any way affected their character as scientists or strictly technical men. It had, indeed, rather been the other way. When in former years there were differences between members of the Institution and the Council, one heard words such as "clique" and "past presidents." It struck him on joining the Council that never was there such a democratic representation as they had at present. With regard to the debate, the question was whether they agreed to the principle of the new articles. It appeared to him the idea was to follow up the policy of the building, and by building he did not mean that edifice only, but the ideal of the building and what was incorporated with it. From the earliest days a building fund was in existence, which was started by those who preceded them. Did they think those people started the building fund as a mere cheap investment ? He was quite sure they had no such idea. What a splendid thing it would be if they could offer hospitality to all those institutions which Mr. Madgen had mentioned, and which had formed themselves into separate bodies because they thought their interests did not receive all that care which was necessary. In doing this they could prevent the different sections doing work twice over. He did not think it was sufficiently known what the Institution had already tried to do. Since he had been on the Council he had learned that there was a commission appointed, partly by the Institution and partly by the members of trades and businesses, to study electrical driving in textile mills. Why should there not be similar committees sitting with regard to rolling mills and ship building and motor-cars and coal mining, or any industry they could think of. It might be thought an advantage if the Institution had an employment bureau. They might also with advantage put apart in that magnificent building rooms and offices for the free use of the country members and those who came from their overseas dominions. Other things had been mentioned, such as Parliamentary and other work, which the Institution might with advantage take up. If they wanted to do more work, it meant more money. More money could only be obtained by more members ; more members meant more power ; and more power meant more prestige, and this was after all the way to success in whatever they wanted to do. With this idea the Committee had gone to work admirably, and had fixed irrevocably and irremovably that the future of the Institution was to be secure in the hands of its corporate members. There were members of other professions who were busy all the year with electrical problems. What was wrong in asking these people to become members of the Institution as a class by themselves ? When they once realised how useful that class could be, they would understand that room for them must be found.

Dr. H. Borns said that if examination had been imposed 30 or 25 years ago, it would have been right, but now there were many Universities in England and any number of excellent technical colleges. Considering this, why must they as an Institution undertake examinations, which might surely be left to the colleges ? He did hope the examination idea would be done away with.

Mr. W. R. Cooper said he had raised the question of the subscriptions before he saw the tables issued by Mr. Hammond, and if he had seen those tables he did not think he would have made the suggestion. There was a very great difficulty in putting any financial question to the ballot, because they could not put all the information that the Council had before the various members. If, for instance, he received a postcard asking whether he would like his subscriptions raised or not, he replied "No," but if he had full information before him, possibly he might reply "Yes." He hoped that the Council would give as full information as possible, in order that the members might be able to judge these questions for themselves.

The Chairman said perhaps for that evening they had had enough. Some of the Council were going to meet the various Local Sections to hear what they had to say on the matter. That would be the next thing, therefore, that would take place. That was an informal meeting, and they might have another. The principal thing was that they had plenty of time ; there was no particular hurry in the matter, although it did appear to some at first that the Council had reason for an unholy haste ; but that was not the case. The Licentiate class had been spoken of as a new class, but it was not a new class. What was really new was the Associates who existed at present. What they wanted to see, and what they believed was for the good of the Institution, was to have an Associate class, which was an honourable one for the kind of man that they thought it would be to the Institution's advantage to have. Suppose, for example, they had a man who managed

a big business and who had a considerable knowledge of electricity, but having been brought up as a business man, and having come into electricity and simply learned it as he had come on in life, however good his knowledge might be, he would not presume to become an ordinary member of the Institution. Imagine their trying to get such a man to come into a class which had his junior assistants in the test room as members—quite young fellows who had just come away from College, and who were not old enough, or who had not got on far enough, to become Associate Members. It was not that they sought to do anything new, but at present the thing was so hopelessly inefficient that they could not hope to get the people into the Institution that they thought would be of benefit to it. It was really a process of straightening out the Associate class, which necessitated a stepping-stone olass of a lower grade for the technical men between the Students and the Associate Members. He confessed that he felt disappointed with the proceedings that evening: so little consideration had been given, and so few words said on what he considered the all-important subject of the scope of the Institution. Now that their proceedings had got so much less interesting than they used to be in the past, when everything connected with the industry was new, and when it had the greatest fascination for them all, he felt they were more likely to die down in interest, and therefore in the support accorded to the Institution, and that the Institution might go down from the very high position which it occupied to-day. He thought that where they took a single subject like electrical engineering, although it was a big one, their only way was to provide an Institution to look after and to take an interest in the whole wide field of the industry, and not just the purely technical part. They had got to a point where he felt sure they would go down unless they broadened their basis. On the other hand, electrical developments and new electrical inventions were getting greater every day, and he believed they would be multiplied tenfold in the not distant future, and it did seem to him that those were interests which required looking after and fostering. Who better should do that than their Institution, if they would only put themselves into the position to do what was required? He wanted all of them to think of the matter from that point of view, and to look at the question for themselves and work out their own salvation. The success of the Institution would not be brought about by the Council forcing on any measure or overriding the members. Their object was to obtain the support and to get the views of the whole of the members, and they would have wasted their time and done no good unless they got the support of the members. It was a serious question for them to face. Were they going to continue the Institution on its old basis as a purely technical society, with a few other people who were let in by accident or for other reasons?—or were they going to broaden it out into a society which would take into it the best of science and the best of business combined, and which would look after all electrical interests? For the younger members of the profession, surely it was to their interest to be brought into touch with their markets. They were all trying to find their customers—whether it was the scientist or the manufacturer, they wanted their customer. The customer for the young man was the commercial man who developed electrical undertakings, and if the younger man had a chance of speaking and the older business man was there, how did they know where the benefit to those young men would stop? It was just their opportunity. They were not asked to have the society in any way lowered. The admission to membership was made more difficult. The Council, in his experience, for the last two years or so had been more and more strict about letting people in. They must get the best science that they possibly could, and the best business knowledge that they had, because science must live on the business that was done by it. He hoped that before they had another meeting those views might be fully considered. They were the feelings of a great many among them. The Council would notify the members when they had got a stage further.

Modern High-Voltage Power Transformers.

By William T. Taylor, Member.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, November 9th*, 1911.)

Manufacturers of transformers are now prepared to build them in units above 15,000 kw. and at 200,000 volts. One large factory is using annually about 6,000 tons of steel and about 2,000 tons of copper in the manufacture of transformers.

Commercial transformers have already been built for and are operating at voltages as high as 500,000 volts in small units of 200 kw. The author believes there will shortly be transformers in operation in testing departments at much higher voltages than even this, and also that power transformers will be built in units of 20,000 kw. at 200,000 volts.

Whenever water is available and not expensive, water-cooled transformers are preferable to air-blast transformers of large and modcrate sizes (2,000 to 10,000 kw.), as it enables the operation of transformers at lower temperatures and thus allows more margin for overloads.

The fire risk of air-blast and oil-filled transformers depends as much on surrounding conditions and the location of the transformers as on their construction. The air-blast transformer contains a small amount of inflammable material compared with the oil-filled transformer, but this material is much more readily ignited. The chances of an oil-filled transformer catching fire on account of any short circuit in the windings are extremely small, as the transformer is completely submerged in oil, and no air can get to it. Moreover, the oil used in transformers is not easily ignited. The idea of placing oil-filled transformers in separate compartments is not thought so necessary now as it was some years ago.

The "all-day" efficienoy is an important matter to operating engineers, and in general it is found that transformers will operate economically and quite satisfactorily when worked at their limiting temperature risc. The increase in first cost of transformers which are too large is greater than the capitalised cost of the reduced losses, and a careful study of the conditions governing the loads should be made before a final decision is taken as to the exact size to adopt for a given service. It is unwise to follow strictly a rule of choosing equal kilowatt capacity for equal generator units, although in some particular cases this will hold.

TABLE I.

	Output in kilowatts.	Load efficiencies. 100 %	75 %	50 %	25 %	Gallons of oil.	Gallons of water per min.
25 cycles.	100	95·3	95·0	94·1	90·2	200	2·0
	200	96·4	96·2	95·3	92·0	250	3·0
	500	97·3	97·4	96·9	95·4	750	5·0
	1,000	97·8	97·8	97·4	96·2	1,400	8·0
	2,000	98·3	98·3	98·0	97·1	1,800	13·5
	4,000	98·7	98·7	98·5	97·7	2,300	21·0
60 cycles.	100	95·6	95·4	94·4	90·8	100	2·0
	200	96·6	96·3	95·3	92·0	200	3·0
	500	97·3	97·0	96·3	93·5	600	5·0
	1,000	98·0	97·8	97·2	95·2	650	7·5
	2,000	98·4	98·2	97·8	96·1	1,600	12·5
	4,000	98·8	98·7	98·3	97·0	1,950	19·5

Not very long ago a transformer was designed known as the "forced-oil type," the first designs having their oil-cooling outfit external to the transformer. Modern designs of this type have their cooling coils located within the transformer tank, being separated from the main body of oil by a sheet-steel diaphragm. The heated oil is pumped from the top of the transformer and discharged into the upper part of the cooling compartment, and by continuous operation of the pump the cooled oil flows out from the bottom of the compartment and up through the spaces or ducts between the windings and the core. The forced-oil cooled transformers are used in sizes above 2,500 kw. for single-phase and 7,500 kw. for three-phase.

In Table I there is shown a class of single-phase oil-filled water-cooled transformers, for 25 and 60 cycles respectively, 66,000 to 6,600 volts, giving the efficiencies at various loads, with a maximum temperature rise of 40° C. at full load.

The regulation of the 25-cycle transformers for non-inductive load varies from 2·5 per cent. to 1·6 per cent. in sizes up to 300 kw., and to 1·2 per cent. at 4,000 kw.; while the regulation of the 60-cycle list varies under non-inductive load from 2·3 per cent. to 1·4 per cent. in sizes up to 300 kw., and to 0·90 per cent. at 4,000 kw.

The usual designs of core-type transformers made have a uniform distribution of dielectric flux between high- and low-voltage windings, except at the ends of the long cylinders, where the dielectric flux will be greater and its distribution irregular.

The "shell-type" water-cooled transformers and forced oil-cooled transformers are built in larger sizes than the core-type transformers, the former type having been built in 6,000-kw. single-phase units and 10,000-kw. three-phase units.

In a three-phase shell-type transformer constructed so as to form a single structure, the reduction of steel for the magnetic circuit amounts to from 10 to 20 per cent. of that used in three single-phase transformers placed side by side.

In this type of transformer it is difficult to insulate the large number of edges and sharp corners exposed between adjacent high and low-voltage windings and between windings and core. At these places the dielectric density is very great, and it is a much more difficult matter to insulate them than the ends of the cylinder coils of a core-type transformer. Much more insulation is required, and consequently a larger space factor. The result is lower efficiency and worse regulation, and consequently a heavier and more expensive transformer for a given output and efficiency.

Air-blast transformers are regularly built in capacities up to 4,000 kw. and for a voltage of 33,000. Their efficiency, in good designs and with the required amount of air pressure, is slightly better than that of the oil-filled water-cooled transformer of the same capacity. The general design is very much like that of the ordinary shell-type transformer, with the exception of a few modifications in the iron assembly, where certain air spaces are left open for the circulation of air. The temperature of the outgoing air compared with the temperature of the ingoing air is the best indication whether sufficient air is passing through the transformers; if there is not more than 20° C. difference, the supply of air will be found sufficient. As transformers are generally designed on the basis of 25° C., the best results are obtained when the temperature of the incoming air is not greater than this value.

Very special care and knowledge are necessary on the part of those whose duty it is to dry-out transformers, for the difficulty is not so much in drying the coils, but in drying the whole insulation surrounding them and the core. No matter for what factor of safety the transformer has been built, it avails little in the case of carelessness or neglect to dry out the transformer properly.

Before transformers leave the factory they are given a high-voltage test, the standard being to apply twice the rated voltage

between the high and low-voltage windings, the latter being connected to the iron core. It is now believed that the greatest cause of failure in high-voltage transformers arises from punctures between *turns* and not between the high and low-voltage windings.

In the air-blast transformer careful examination should be made about once a month to see that the air-circulation ducts are quite free from the accumulation of dirt and dust. In the case of oil-cooled transformers, samples of the oil should be drawn from the bottom of the tank about once a month and tested, and a record

TABLE II.—Oils for High-voltage Transformers.

	Quality (*A*).	*Quality* (*B*).
Flash-point	185° C.	129° C.
Fire test	210° C.	149° C.
Viscosity	105 seconds	39 seconds
Breakdown test	30,000 volts	40,000 volts

kept of its condition. It is desirable, for the purpose of preventing condensation on the oil surfaces and other inside transformer surfaces, to keep the oil at all times at least 10° C. above the room temperature.

The most important characteristics of transformer oil which interest the operating engineer are summed up in Table II. These values are a standard minimum for 0·2 in. gap. Quality (A) is for oil-cooled, and (B) for water-cooled transformers.

For oil-filled water-cooled transformers it is customary to use another grade of oil than that used in the self-cooled type, the oil operating at a lower average temperature, consequently a high flash-point is not of so much importance.

Usually oil is received abroad testing less than 30,000 volts per 0·2 in., but before it is placed in the transformer it is brought up to test at least 30,000 volts per 0·2 in. for transformers designed for an operating voltage of 44,000 volts and under; not less than a 44,000-volt test per 0·2 in. is required for oil used in transformers operating above 44,000 volts. The water present must not exceed 0·001 per cent. in order to obtain a dielectric strength of 40,000 volts in the standard test (0·2 in. between 0·5-in. disks).

Some people think that once a transformer has been put into successful operation it will continue to operate satisfactorily for an indefinite time without any attention. This is a wrong idea. Transformers require attention, and must be given attention, or else they will not give good service.

The efficiency of a transformer is usually considered its *most* important feature by the majority of station engineers and managers operating local distribution systems. By transmission engineers this feature is not considered to be the most important, but rather the insulation of the transformer, and consequently its reliability, next to which comes safety, then efficiency.

Many breakdowns of large power transformers have been recorded resulting from the stoppage of the cooling medium, all of which could have been saved if proper care had been shown. Hourly temperature readings are the best indications of anything wrong in this direction. In case the circulation has been stopped by any cause, the transformer may be operated until the coils at the top of the transformer, in the case of an air-blast, or the oil, in the case of a water-cooled transformer, reach an actual temperature of 80° C. This temperature limit, under ordinary conditions, will permit the transformer to continue delivering power for about three hours; a very close watch must be kept of the temperature, and the transformer must be taken out of service as soon as it reaches this limit.

TABLE III.—Modern High-Voltage Power Transformers operating above 62,000 Volts.

Systems.	Kilowatt capacity.	Voltage of line.	Connection of system.	Phase ϕ^*
Stanislaus Power Co. ...	3,750	138,500	Star	1
	2,233	104,000	Star	1
Great Western Power Co.	10,000	110,000	Delta	3
	5,000	90,000	Delta	1
Grand Rapids Michigan Power Co.	3,750	110,000	Delta	3
Hydro-Electric Commission	1,250	110,000	Delta	1
Great Falls Power Co. ...	1,200	102,000	Delta	1
Central Colorado Power Co.	3,330	100,000	Delta	1
Southern Power Co.... ...	3,000	100,000	Delta	1
Mexican Light and Power Co.	6,000	85,000	Star	1
Telluride Power Co.... ...	1,500	80,000	Star	1
Edison Electric Co. (Los Angeles)	1,660	75,000	Star	1
Pennsylvania Power Co. ...	10,000	70,000	Star	3
Missouri River Power Co. ...	1,500	70,000	Star	1
Southern Wisconsin Power Co.	1,000	70,000	Delta	1
Connecticut River Power Co.	5,000	66,000	Star	3
High Falls Development ...	1,100	66,000	Star	1
Canadian Niagara Falls Power Co.	1,250	62,500	Star	1

*This refers to the type of transformer, whether single-phase or three-phase.

In the operation of transformers the delta connection has an advantage. With one grounded conductor the service need not be interrupted, except perhaps if the ground is an arcing one, which might set up continuous high-frequency surges, producing high-voltage stresses on the transformers in circuit. Comparisons of different systems are shown in Table III, which are representative of practically all the most modern high-voltage transformer installations in the world. There are one or two of equal importance under construction.

From the standpoint of the operating engineer (neglecting all losses) the single-phase transformer is at the present time preferable where only one group of transformers is installed and the expense of a spare transformer would not be warranted, as in the delta-delta connected system. If one of the three transformers should become damaged it can be cut out with a minimum amount of trouble, and the other two can be operated at normal temperature on open delta at approximately 58 per cent. of the total capacity of the three. With a three-phase transformer a damaged phase would cause considerable inconvenience, for the whole transformer would have to be disconnected before repairs could be made.

Apart from the decrease in manufacturing cost with increase in size of units, the three-phase transformer possesses the advantage of requiring less material, and is more efficient than any other single-phase combination of transformers of the same kilowatt capacity; three single-phase transformers weigh 17 per cent. more than, and have 17 per cent. more losses than one three-phase transformer.

Where a large number of three-phase transformers is installed in one building, say, three groups or more, there is unquestionably a great saving over any combination of single-phase transformers.

The relative advantages of the delta-delta and delta-star systems are still disputed, and are open to discussion. From the point of view of first cost, the delta-star is unquestionably the better. The question will be largely governed by local conditions, and no definite system of connections can be given to suit all cases.

Whichever scheme of connections is decided upon, it will be always found advisable to keep to that scheme throughout the system; otherwise complications might result. This is particularly applicable on some of the larger systems of 100 megawatts and over, where networks of high-voltage transmission lines and substations are numerous.

Large power transformers operating high-voltage transmission lines should be protected against excessive currents, and also against excessive voltage above normal. Some protective apparatus or device should be used, even if it is only an overload device. Protection should be given against external and internal short circuits, such that the transformer will be disconnected in case of an internal short circuit, and that section of the transformer system relieved from any external short-circuit. For external short-circuits the external reactance is being favourably considered in limiting the flow of current. To get absolute protection of a system of transformers from internal and external causes is difficult, and in some cases impossible.

The more we centralise electric power systems the more we shall require the three-phase two-phase method of distribution, which will come about through the transformation from three-phase high-voltage transmission.

It is well recognised that any combination of the two-transformer method requiring a change from three-phase to two-phase, or from two-phase to three-phase, is made at the expense of regulation, as well as involving a loss in efficiency. If the connection is used to step up from two to three-phase, similar connections should be arranged for stepping down at the receiving end; in this way the possibility of cross currents or asymmetry will be avoided.

Continuity of service is now one of the main factors to be aimed at, and the three-transformer method shown in fig. 1 is in some respects superior to the two-transformer method. If one of the transformers in the three-transformer system should become damaged, making it inoperative, the two remaining transformers may be, in a very short space of time, temporarily connected in open-delta and service continued until the other is repaired, thus

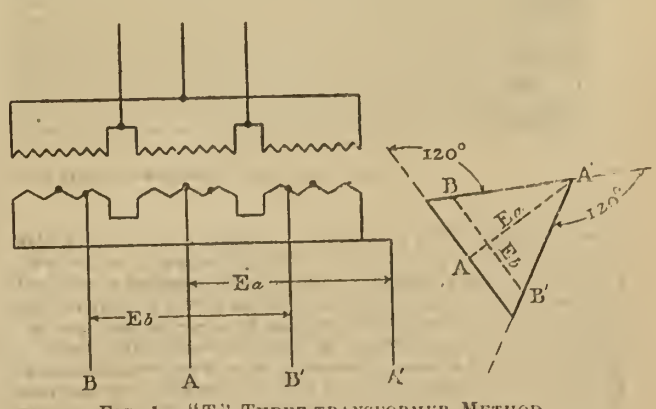


Fig. 1.—"T" Three-transformer Method.

avoiding the necessity of carrying a spare transformer in stock. And if a transformer is kept in stock, its kilowatt rating need only be approximately 67 per cent. as great as that of a spare transformer for the two-transformer system.

This system was only applied to practical city distribution a short time ago, and it is surprising what great strides have been made. It also claims the advantage of supplying both three-phase and two-phase currents to a secondary distribution of four wires, this being a special advantage in cities where there already exist two or more electric power companies operating both two and

three-phase systems, as no transformers are required for connecting either a three-phase or a two-phase motor. From the point of view of reliability of operation the three-transformer system has far greater advantages than the two-transformer system.

It is feared by some transmission engineers that the high-voltage transformer will again become the limiting feature of high-voltage transmission because of the internal effect due to corona. This effect so far has not been very noticeable, but as line voltages are increased above present-day practice (110,000 volts) certain effects due to this discharge may arise which may radically change the present methods of design in high-voltage transformers. Whenever possible, transmission engineers recommend switching-in first the transformers at the far end of the line and afterwards the transformers at the generating station.

With the large systems now being operated, consisting of 100 to 150 megawatts in generator and transformer capacity, and hundreds of miles of transmission lines supplying thousands of customers of all classes, maintenance of a very high degree of reliability is *the* principal problem of the engineer. The question now before us is that of limiting the amount of energy which can flow into a fault or short circuit, and the only real practical solution applied so far is the use of reactance, which is the enemy to voltage regulation.

Discussion.

Mr. W. B. Woodhouse, in opening the discussion, pointed out a number of obvious errors in the paper. The author referred particularly to transformers used in connection with water-power plants, where efficiency was not of such importance as with coal-fired stations. He also understated the regulation. Transformers with close regulation were often not robust enough for overloads, and it appeared that, with long-distance lines, one must submit to poor regulation. He thought the practice of air cooling without oil insulation was dead; it was so difficult to avoid moisture in the air. An enormous quantity of oil would be required for natural oil cooling, and the alternative was to blow air on to the case to cool the oil. One good measure of dryness in a transformer was to take periodical core-loss readings, as they increased with damp. The question of shell *v.* core construction was simply one of cost; and the balance of opinion appeared to be in favour of the star connection of the H.T. line. An over-pressure test of 30 per cent. was a good one for picking out the weak places in a transformer.

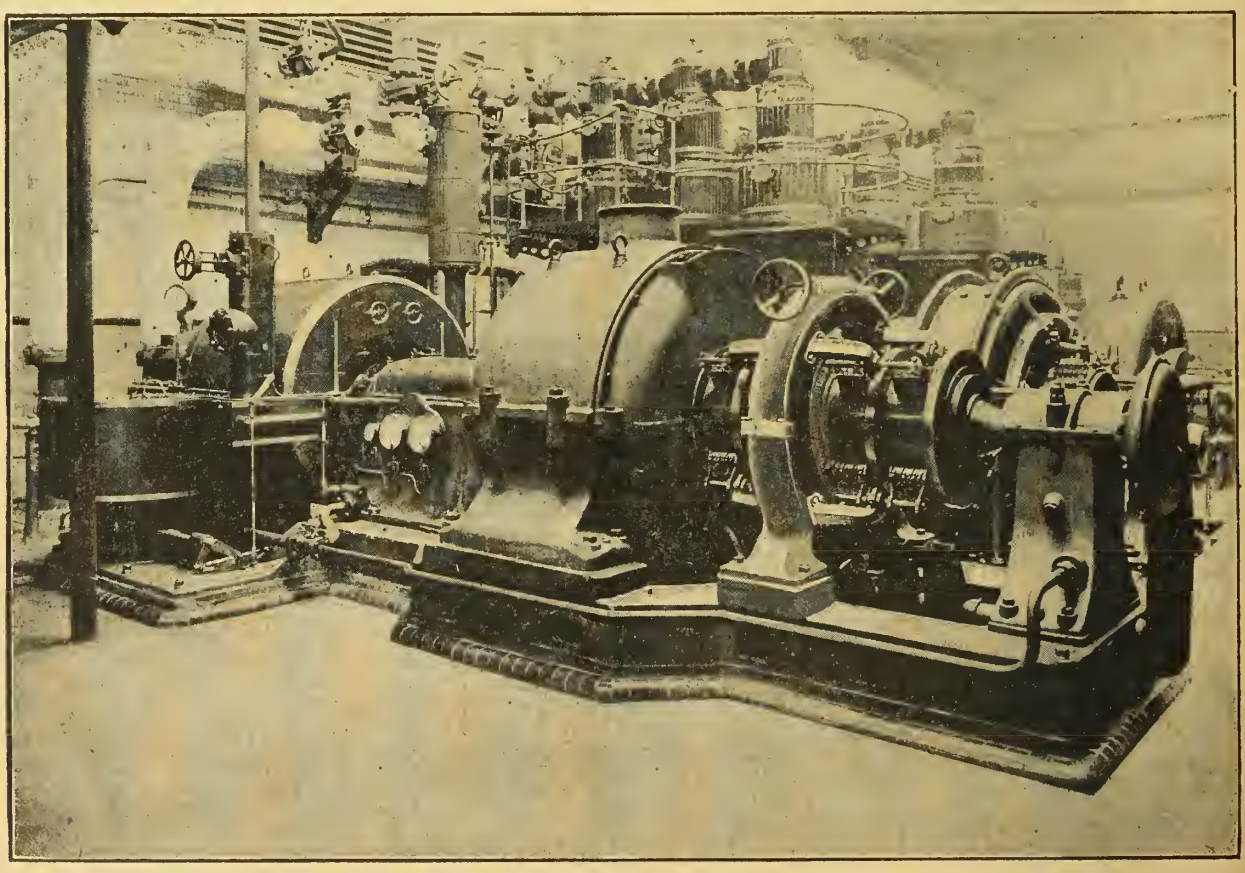
Mr. C. H. Merz said he was surprised that the author appeared to ignore the difficulties of transformer design, the chief of which was to produce a transformer which would withstand mechanical failure of the coils. He thought that all large makers of transformers were having some trouble. The only suggestion to-day was to make the regulation worse, and this was inadmissible; if automatic regulation was desired in the sub-station, the regulation must be within 2 or 3 per cent. It was very necessary to design transformers so that there were no hot places; he thought that in America they were not so careful in this matter. He found them satisfied if cleaning did not take place oftener than once or twice a year, but in this country transformers were expected to run for years without cleaning.

Mr. J. S. Peck said the paper was full of small errors, and very difficult to understand. The author strained every point in favour of shell construction. In a modern works the tendency was now to ship the transformer complete in its tank, without terminal bushes, which were fitted after erection. He did not consider that the core transformer described by the author would be good enough for this country, while the proportions of the shell transformer shown in the paper were obviously wrong. Water-cooled coils tended to freeze in cold weather and burst the pipe; it was difficult to get the water out of such coils. As regarded oil, it was difficult to obtain one which would not throw down a deposit when heated. This deposit covered the cooling pipes and heat-insulated them, so that the cooling effect disappeared and the transformer heated up, possibly, until it failed. In conclusion, he found many discrepancies in the diagrams of transformer connections shown in the paper, some of which were impossible.

PLANT EXTENSIONS AT SOUTHWARK.

We recently referred to the starting-up of a new mixed-pressure turbo-plant at the Southwark Borough Council's generating station in Penrose Street.

The plant consists of a Belliss turbine of the impulse type, the H.P. stages being compounded for velocity and the L.P. stages for pressure; the latter stages are drum built.



Belliss Mixed-Pressure Turbine and General Electric Dynamo at Southwark.

Both high and low-pressure governor valves are provided, as the turbine will be required to run on occasion on different circuits to the reciprocating sets supplying the exhaust steam; the governor gear includes separate oil relay systems for both main and emergency valves.

The turbine exhausts into a Worthington surface condenser, with a three-throw air pump and attached hot-well pump, motor-driven, as well as a 12-in. centrifugal pump for circulating the condenser water to a Devonport cooling tower erected over the boiler-house roof.

The turbine set operates at a speed of 1,500 R.P.M., driving a General Electric D.C. generator, with an output of 600 KW. at 500 volts. The generator is of the enclosed type with self-contained fan ventilation, the air being drawn through a duct in the foundation and expelled from an outlet at the top of the frame. The field system includes four commutating poles, and a compensating winding distributed over the whole face of the main magnet poles. The rotating portion of the machine consists of an armature of high permeability steel stampings supported and keyed directly on to the shaft, and clamped together by two rigid cast-steel end plates which, at the same time, form a support for the projecting portion of the armature winding

The armature is fitted with fans, which give both axial and radial ventilation to ensure cool running under all conditions of load; the armature winding is bedded in slots in the core, and held in position by strong maple wedges, the ends of the windings being bound down solid their whole length to prevent any movement. The armature reaction, which in a machine of this kind would be rather stronger than usual, is neutralised entirely by the action of the compensating winding mentioned above. The commutator is assembled on steel cones rigidly keyed to the shaft and clamped in position by large nuts threaded on the shaft itself. The brush gear of the machine is of entirely special design adapted for running with the high speed. This is most important if one remembers that the peripheral speed of the armature corresponds to 14,000 ft. per minute, and the peripheral speed of the commutator is about 8,500 ft. per minute.

In order to ensure cool running of the commutator a special fan is fixed on the outside of the bearing, which blows air on to the commutator surface from the under side of the machine. This, at the same time, removes any dust or small particles of carbon which may become detached from the brushes.

The brush-holders are arranged so that the tension of the brushes can be altered whilst the machine is running, and also any brush can be lifted off the commutator at any time independently of all others.

The terminals of the generator are arranged at the bottom so as to be out of the way.

The generator is also fitted with three slip rings and the necessary brush gear which are connected to the armature of the machine in such a way that a portion of the output can be obtained from them as alternating current, whereas the main portion of the output will be continuous current only.

Before being sent out to work, the machine was subjected to insulating tests between the bars of the commutator made by applying 400 volts between each bar; the actual working voltage between bars is only 16·7; a breakdown voltage and flash test on the commutator between the rings and the working portion with 3,000 volts A.C., the actual working pressure would never exceed 500 volts; a test on the armature winding with 2,000 volts A.C. applied for a quarter of an hour and a 2,500-volt flash test; a field winding test with 2,500 volts between the live parts and the frame as well as between the different parts of the winding.

After assembling, the whole machine, including the brush gear and the connecting leads, was flashed again with 2,000 volts, which is equivalent to four times the working pressure.

AUTOMATIC CIRCUIT-BREAKERS WITH RETARDED OPERATION.

It is now an accepted axiom that automatic circuit-breakers of the overload type should be fitted with retarders or time lags which will prevent the supply being cut off unnecessarily when overloads of very short duration come on a feeder.

These short peaks occur very frequently, and are due to various causes, such as the starting-up of motors. Engineers, however, have often preferred to dispense with time lags rather than impair the reliability of the circuit-breaker by a device that might fail to act in an emergency.

A retarder, or time lag, if it is to be depended upon in actual service (where it will rarely get any attention) must be devoid of delicate and intricate mechanism, and the principle of its operation must be such that under no conceivable conditions can it prevent the circuit-breaker from operating if an overload has been on long enough to be dangerous. Also, it should be capable of easy adjustment; that is, be so arranged that the time of retardation can be altered at will to suit the actual, and sometimes varying, conditions of the service of the particular feeder or circuit protected by the circuit-breaker.

It is claimed that all these features are realised in the Ellison patent adjustable time lag, the principle of which is based on the flow of oil in a dashpot. The latter, as will be seen in fig. 1, is of very simple construction. The periphery of the piston is tapered slightly, and at one end the cylinder is correspondingly bored. Adjacent to this end the cylinder rapidly increases in diameter. The piston is attached to the solenoid plunger or armature of the circuit-breaker. When the plunger is drawn up (by an overload), the oil escapes through the annular passage between the piston and the cylinder from the upper to the lower side of the piston. The object of the tapered form of the piston and cylinder is to permit adjustment by varying the clearance between them.

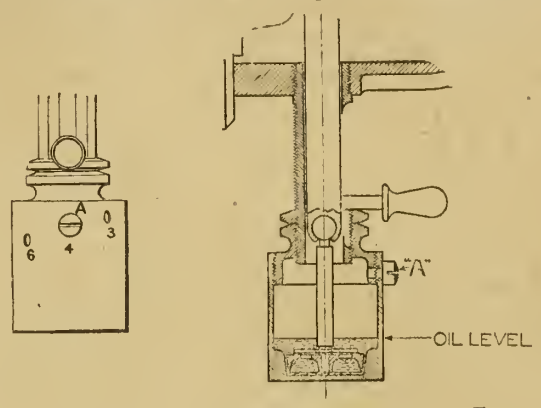


Fig. 1.—Ellison Patent Time-lag: Section and Elevation of Dash-pot.

As the time occupied in raising the piston is determined by the rate of flow of the oil, it is evident that if the aperture round the piston is increased by lowering the cylinder, the rate of flow is increased and consequently the time required to pull up is reduced. The cylinder is provided with a number of holes or settings, and by turning the cylinder round, the holes will each in turn coincide with the tapped hole in the cap and allow the screw "A" to be screwed home, locking the cylinder in the position where the required retardation is obtained. It will be seen that this time lag is so simple that it can hardly fail to act when required.

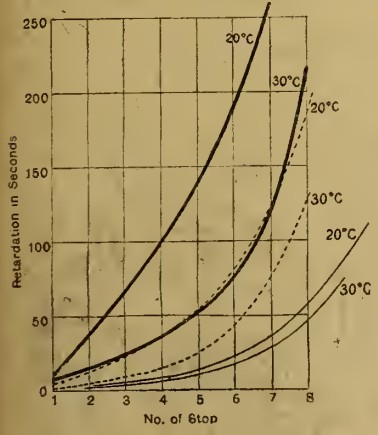


Fig. 2.—Time Lag Settings with Thin (Cycle) Oil, Thick Oil and Glycerine.

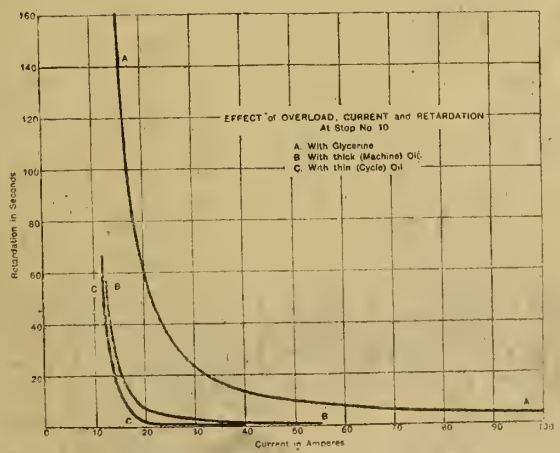


Fig. 3.—Overload Tests.

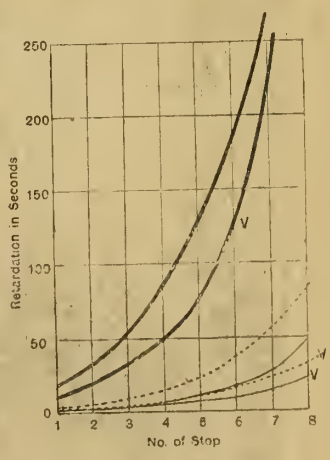


Fig. 4.—Effect of V on Time La ibration

Thin oil ————————; thick oil - - - - - - - - - - - - - - -; glycerine ————————.

The time lag has been tested by the National Physical Laboratory at Teddington, and the following is an abstract of the report, with the test curves obtained:—

The circuit-breaker tested was rated for a normal maximum current of 10 amperes, and the time lag was set initially so that with thin oil the retardation at No. 1 setting was about 3 seconds. Tests were made of the time of retardation with thin and thick oil, and with glycerine, at the various settings, and the results are shown on the accompanying curves (fig. 2), which, says the report, may be regarded as typical of the results to be expected with these liquids. During these and other tests of the various settings, the current was kept constant at 13 amperes, an interval of one minute being allowed between observations to enable the piston to settle again in the fluid.

The time lag with various overloads up to 100 amperes, with each of the retarding fluids named, was tested at the No. 10 setting, and the results are given in fig. 3. In order to ascertain the effect of vibration on the time of retardation, tests were made while the circuit-breaker was subjected to considerable vibration; as will be seen by comparing figs. 2 and 4, the effect was to reduce the time of retardation by about 50 per cent. Slow oscillations over an arc of 17°, as on board ship, had no appreciable effect upon the results, which were practically identical with those obtained when the circuit-breaker was erected on a level immoveable base.

There are 11 different time settings in this time-lag, and an examination of the curve, fig. 2, demonstrates that it can be set to give any retardation that may be desired from 1 second up to as much as 5 or 6 minutes. Fig. 3 shows that the time-lag has a true inverse time element—that is, that as the overload increases, the retardation diminishes. It will also be seen that, by using a different kind of oil, the curve can be altered to suit the requirements.

Fig. 4 shows that considerable vibration only reduces the time of retardation, and as there are 11 settings, there is no difficulty in obtaining the exact time of retardation required.

The makers have supplied these time-lags to Corporation electricity supply power stations and other important installations, where they are giving entire satisfaction in actual service.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrostatic Pressure Indicator.

The Allgemeine Elektricitats-Gesellschaft, of Berlin, has just brought out a neat little device for indicating whether a bus-bar or other bare conductor is charged or not ; it is suitable for pressures from 3,000 to 75,000 volts. It acts on the principle of the Kelvin voltmeter, and consists of a cylindrical box of insulating material with a clamping terminal, which is connected to a



A.E.G. Electrostatic Pressure Indicator.

vertical metal bridge carrying a pivoted aluminium vane. The instrument is permanently clamped to the conducter under test. When the conductor is dead, the vane rests in a vertical position behind the bridge, but if the conductor is charged, the vane is deflected more or less, according to the pressure, as shown in the illustration.

For pressures between 3,000 and 10,000 volts an earth connection is necessary to increase the sensibility of the device. A portable form is also made.

LEGAL.

Automatic Telephone Patent.—Extension Petition Withdrawn.

The petition, under the Patent and Designs Act of 1907, for an extension of a patent granted to one Thompson in 1898 for automatic telephones, was before Mr. Justice Parker in the Chancery Division for hearing with witnesses, but upon being called on was withdrawn.

Mr. Courtnay Terrell, for the petitioners, the Automatic Electric Co., said that with the consent of all parties he had to ask for leave to withdraw the petition upon terms ; these terms would include the payment of the respondents' costs of the petition.

Mr. Walter, K.C., representing one of the respondents, confirmed the agreement come to.

Mr. Gray, for another, said that no terms had been submitted to him, but as the Act only allowed for one set of costs for all the respondents, he was not concerned with them.

Mr. Astbury, K.C., representing the third respondent, asked that the costs should include the costs of the two previous applications which had been reserved.

Mr. Terrell said he could not resist that.

His Lordship accordingly allowed the petition to be withdrawn upon the terms agreed.

Doxford & Sons *v.* Wearmouth Coal Co.

In the Official Referee's Court on Wednesday, November 15th, Mr. Edward Pollock continued the hearing of a claim for damages amounting to £190,000 by plaintiffs, shipbuilders of Sunderland, against the defendants in respect to injuries caused to plaintiffs' shipyard, and notably to their large electric cranes, by land subsidence, alleged to be set up by the defendants' colliery workings.

The hearing was opened before Mr. Pollock at the Moot Hall, Newcastle, and was adjourned to London for further evidence to be heard.

Mr. Doxford, a director of the plaintiff company, and an engineer of 22 years' standing, gave evidence, and stated that their present electric crane plant was re-erected in 1901. In 1909 they noticed that the wheels of the travelling crane in their workshops were out of plumb, and the columns also canted two inches out of the straight. To true-up the shop it would be absolutely necessary to raise the iron girders until they again reached a horizontal position, and to raise the roof of the workshop a similar amount. As manager of the plaintiffs' shops, he could not think of working the machinery in such a state. Giving further evidence, witness, by the aid of plans, showed subsidence of plaintiffs' huge travelling crane or gantry situated on the quay-side. It had sunk a considerable distance and the bedplate had cracked. As a result of this sinking, plaintiffs had had to stop the work of heavy lifting from ships at the quayside at high tide, because it was impossible to lift the weights clear of the ship's casing. The delay thus caused amounted to two or three hours a day, which was serious and involved great loss.

Mr. Bailhache, for defendants, submitted that the damages claimed by the plaintiffs were outrageous. They were entitled to a reasonable sum which would put their yard into a proper and efficient state of repair, but they were not entitled to an amount which they considered necessary to meet their own peculiar views on shipbuilding.

Expert evidence was then given for the defence.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

As an adequate discussion of the proposals of the Council can only be obtained by means of the technical Press, I beg to address to you some ideas which have occurred to me regarding this matter, more particularly concerning the proposed examinations for admission to Associate Membership.

With some of the other suggestions of the Council I am in agreement, but to this one I must give the strongest possible opposition. According to the remarks of the honorary treasurer, at the meeting on November 2nd, the examinations are to be started in order to secure a "warranty that a Member or Associate Member is a duly qualified electrical engineer." That the Council should endeavour to establish such an examination test is really a matter of great surprise, as I have always understood that we counted among the members thereof, as well as among our past presidents, several gentlemen who have stood in the forefront of the battle against the old fetich of the examinational system. Recently it has even been proposed to do away with the system of examinations through which a medical student has to pass in order to qualify for admission to the medical profession. That it is possible to determine by examination that a man is a "duly qualified electrical engineer" is, to my mind, absurd. To select such a test is a distinctly retrograde step.

I would also venture to prophesy that the system will not work in practice. The main function of any system of education is to train the mind and body of the student. Examinations conducted during the course of such training serve a useful purpose in determining whether the student is taking advantage of his opportunities. It cannot be said, however, that the effect of the training is lost, if after a few years the student is not able to polish off college exercises with the facility he possessed when he was a raw student.

Everybody who knows anything about engineers is acquainted with many men who would be most suitable members of our Institution who would be stumped if you gave them a differential equation to solve which they would have snapped their fingers at when they were students ; for after all the "duly qualified electrical engineer" has to know such a lot nowadays that his "book-learning" often gets somewhat rusty, and my chief objection to the proposed examination is that it must of necessity be largely a matter of "book-learning."

Consider, again, a case somewhat of the following nature :—A man during his apprenticeship becomes a student of the Institution. At the conclusion of his period of training he is transferred to the suggested new class of

Licentiates. He rises in his profession and becomes, let us say, chief draughtsman in a large firm of engineers, or chief assistant engineer to an important corporation, and, perhaps, attains the age of 28 or 29 years. He is now a very desirable candidate for Associate Membership. I would now ask, is it likely that such a man, after occupying positions of high responsibility, will submit to the indignity of entering for an examination to test his qualifications, very likely at the same time as one of his own juniors fresh from College, who has probably much more chance of distinguishing himself in the examination than his own chief? The thing only requires to be stated to demonstrate its impossibility.

By all means let the Council "tighten the net" and render the conditions of admission more stringent, but let this be done in a rational manner. I would suggest that local committees might be formed which could advise the Council in London as to the actual positions and work of the applicants. More members might be required to support an application. Candidates might even be required to have a personal interview with the Selection Committee, and there are numerous other means which the Council could employ to the desired end without reverting to an old-fashioned vicious examination test.

Charles C. Garrard, M.I.E.E.

Sutton Coldfield,
November 13*th*, 1911.

In your leading article on the above subject in yesterday's issue, occurs the following passage:—"Perhaps the most difficult question to solve is the designation of the new class for which the term 'Licentiate' was suggested. After long consideration of the matter, we are driven to the conclusion that this title is absolutely inadmissible; the objections to it are insuperable."

A purpose of the Council in founding this class is, *inter alia*, to give men the benefits of the Institution, the training which membership brings, and the increase of knowledge derived from attendance at the meetings . . . . men who may later be sufficiently experienced to become corporate members.

The Institution with its various classes may be likened to a tree with its several branches. It is desired to add a new branch of the same species but different in quality, and so with a bit of string and a daub of clay, one sticks on a shoot containing a bud of considerable merit, which becomes in time incorporated with the tree, and derives sustenance therefrom.

As with yourselves, so with the Council. They met a difficulty in selecting a name that would suitably express the quality of the class—a name not too long or kakophonous.

I find that the word "graft" (of which a dictionary definition is "a small shoot inserted into a tree as the stock which is to support and nourish it") fulfils all the required conditions, and, moreover, the abbreviated title "G.I.E.E." or "Graft I.E.E." is both expressive and euphonious.

Sidney Sharp.

Westminster, *November* 18*th*, 1911.

The Demand for Technical Men.

One cannot but admit that "Observer's" letter in last week's Review has shed some light on the cause of the failure of "The Demand for Technical Men." But is it not also true that the engineers and managers of concerns actually encourage this failure, by asking for qualifications only very remotely connected with the positions they are seeking to fill?

How many men are there who stick to one job for a number of years with the idea that a good experience in it will enable them to obtain better positions, only to find that experience of a totally different nature is demanded for a similar job when advertised?

Should a man seek this other experience? Nine times out of ten he is forced to take an appointment in the branch he wants the experience in at a lower position and salary than he previously held. Then when he next tries to obtain a higher berth *his existing position* has frequently more influence in deciding the question of appointment than his experience.

A. C. E.

November 15*th*, 1911.

Corruption.

Your leading article on the subject of corruption tempts me to write a reply. First of all, the "old law," dealing with municipal life, to which you refer, was passed only in 1889, and the working of the Public Bodies Corrupt Practices Act showed that legislation was necessary to combat an evil which was even more widely spread and more difficult to detect.

There have been no prosecutions, and so far as I know, no attempt to prosecute, in the case of trivial and innocent tips. This is effectively guarded against, inasmuch as the Prevention of Corruption Act provides that the Vexatious Indictments Act, 1859, shall apply. You say that the convictions have been almost all of a most trivial character, but it is not wise hastily to pass judgment without a full knowledge of the facts. You add that on two occasions men have been punished for giving some pence to draymen for carrying messages or parcels to their next place of call. This may seem trivial, but the offence which it was desired to stop was not trivial. On the contrary, the carrying companies found that their employés were being bribed on quite a wholesale scale to carry parcels during their working hours, the men neglecting their proper work and putting the bribes (less, of course, than the legitimate charges would have been) in their pockets. You should take the costs into consideration. In one case a man was fined 40s., but his costs came to nearly £80; in another a man had to defray the costs of protracted police-court proceedings, and of two days' trial at the Assizes, in addition to the apparently "trivial" fine of £10.

If you will examine the list of convictions published by the Secret Commissions and Bribery Prevention League, you will see that "the kind of bribery which was aimed at" has not escaped. Only recently a member of a well-known Institution, to which many of your readers belong, was sent to prison for six months with hard labour, without the option of a fine. In another case, a West End solicitor was fined, including costs, £142.

As one of those present at the Mansion House, I may be allowed to say that the meeting was not "convinced that the evil was unchecked and growing," but that it is "still rampant and corrupting all classes," which is quite a different thing. It would be idle to pretend that the Prevention of Corruption Act has not checked the evil in many quarters, though not to the extent that inexperienced enthusiasts hoped for. Rome was not built in a day, and one cannot expect in a few months or years to eradicate an evil which the late Lord Russell described as a malignant canker.

With regard to the Attorney General's fiat, I speak from personal knowledge when I say that at least one important action has been prevented by the law officers. The weight of evidence is overwhelming. As Sir Edward Fry's letter, read at the Mansion House, stated—

> The notion that it in any way diminishes the possibility of blackmail or that there is more probability of blackmailing in prosecutions of this kind than in any other, seems to me to be groundless. The great difficulty of the working of the Act consists in the scarcity of evidence, and I think that attempts to put the Act in force should be relieved from the burden of two trials, the one in camera before the Law Officer of the Crown, and the other before the Justices, with the possibility of a committal to the Assizes. The necessity of putting evidence before the Law Officer increases the expense and also causes delay, which in this case is especially serious.
>
> But the most weighty objection of all to this condition arises from this: that it vests in the Law Officer of the Crown for the time being a real dispensing power—that is, that it places in his hands the capacity of preventing the enforcement of the law of the land, and the mischief which might be done by a narrow, though honest, interpretation of the Act, might be incalculable.
>
> Furthermore, the provision is one which is, I believe, previously entirely unknown to our law, with the single exception of the Public Bodies Corrupt Practices Act, 1889, but there the condition may possibly be justified on the ground that, in the case of public bodies, the representative of the Crown, *i.e.*, of the public, is the proper authority to intervene, whereas, under the Act of 1906, private as well as public wrongs are dealt with.

Your contention is, that the real trouble is that there are only two parties to the crime and no witnesses, and the law holds both equally culpable. As regards the first point, there is more likelihood of detection when there are two parties to the crime than one. Yet no one would condemn the law dealing with murder. In theory, the law does hold giver and receiver equally culpable: in practice, the receiver may get off, but the man who asks for a bribe runs the greatest risk of detection—greater even than the man who offers or gives the bribe. If giver and receiver are equally involved, then I submit that the responsibility of the giver is the greater, as he is generally richer and better educated than his co-criminal. I recognise the difficulties of dealing with this great evil, but the task is not impossible.

With your last paragraph I am in entire agreement. The cultivation of a strong and healthy public opinion is all-important, and compared with it convictions are comparatively unimportant. Immorality is hardly decided by the number of convictions. One does not ask the police how many thieves are not found out. To create a strong and healthy public opinion has been the principal object of the Secret Commissions and Bribery Prevention League, which, I am glad to say, ranks among its members many connected with the engineering and electrical industries.

The Secretary of the League.

London, E.C., *November 20th*, 1911.

[We are glad to give this letter publicity, but we regret that the League should appear so hostile to some of our contentions, as we know it to be an influential body: and we believe that it has the opportunity of being one of the main factors in cleansing the Augean Stable. But it should adopt a less combative attitude towards its fellow workers. We repeat that in the main the prosecutions have been for trivial offences. We did not say the penalties had been trivial. We are very glad to admit that two recent cases dealt with the main evil about which we wrote.

We enjoy being called "Inexperienced enthusiasts"—it makes us feel young again—but we must not be accused of expecting that "Rome would be built in a day" by the Corruption Act. We have always taken rather a pessimistic view, holding as we do that the Act is fundamentally wrong in punishing both the giver and the receiver of a bribe.

We still hold that as there are only two parties to the crime, and no other witnesses, the fact that the law holds both equally culpable tends to prevent disclosure; in fact, generally prevents it. Our correspondent says that there is more likelihood of detection when there are two parties to the crime than one. We quite fail to see how there can be less than two parties present when a bribe passes, unless it become customary to place it in the coal-scuttle, to be found by the blackmailer on his return. What we said was that the punishment of both prevents either from telling, which appears to us to be an incontrovertible proposition.

To say that the giver is generally richer and better educated than the receiver simply shows that the Secretary's mind is still running on tips and trivial gifts to railway porters and menials; and that he has missed the whole point of our article, in which we contrasted the position of a commercial traveller, who has to live upon his sales, with that of a salaried or well-paid buyer who gets his living no matter whose goods he recommends.

The citation of *one* important case in which the Attorney-General's fiat was used, wrongly in the opinion of our correspondent, by no means convinces us that this important safeguard should be removed. We humbly suggest that the Secretary of the Secret Commissions and Bribery Prevention League should read our article again; and we may add that we shall be the first to rejoice if he can put a stop to commercial blackmail, either with or without the alteration of the law which we have suggested.—Eds. E.R.]

Parliamentary Applications.—As is usual at this time of the year, notices of application to Parliament and the Board of Trade for powers for electrical and other new undertakings are now being filed in the *London Gazette*. In accordance with our custom, we shall deal with the whole when the *Gazette* notices are complete.

TRADE METHODS IN BRAZIL.

Reference has been made in the Electrical Review from time to time to methods which should be employed by firms desiring to secure trade in Brazil, a country in which there is an excellent opening for electrical development, and in which the demand for machinery of all kinds is steadily increasing. Recent reports from British Consular Representatives in Brazil again call attention to defects which must be remedied before extensive trade can be hoped for. The Acting Consul-General in Rio de Janeiro, writes as follows:—

"The possibilities of this district, which includes the Federal capital, are very great. Mention was made last year in a report from this Consulate-General of the absolute need of the personal element in business in Brazil. I have become more and more convinced of the uselessness of a very large proportion of the catalogues which are sent to this capital. Possibly a certain amount of trade can be obtained by this means of canvassing, but in that case it behoves the canvassers to see to it that this, their only means of canvassing, is quite up-to-date and adapted to the needs of the market. I have made a special point during the past year (March, 1910, to March, 1911) of carefully studying each of the numerous catalogues sent to this Consulate-General, and I venture to express the opinion that the majority of them err on the side of not giving sufficient information of the right sort. The article for sale is often quite well described and its use sufficiently explained (in the English tongue), but terms of business are not mentioned. Nothing is said about discounts, modes of payment, commission, &c. Possibly firms are not desirous of publishing such information in a catalogue, but if a catalogue or a circular letter is the only means employed to bring the name of a firm before possible buyers, it would seem that some such information must be furnished in order to secure orders. If a local house cannot give a price immediately to a prospective buyer the chance of trade is often lost. Not more than three or four catalogues printed in Portuguese have been received at this Consulate-General.

"It is satisfactory to note that there has been a slight increase in the number of British business men visiting Rio de Janeiro during the period under review.

"What is, I believe, eminently desirable, is that the heads of firms should visit Rio de Janeiro more constantly from the United Kingdom. The conditions of the country have changed and are changing with remarkable rapidity, and it would seem that British trade can only keep pace with such changes if the managing interests at home have an accurate knowledge at first hand of the ruling conditions of the market. They would thus be able to support their representatives out here with greater effect. The firms that are doing the best business are undoubtedly those that are managed on the spot by the heads of the firms themselves; and though the presence of these gentlemen is obviously impossible in all businesses, yet periodical and constant visits would, without a doubt, be of much use to all parties concerned.

"The number of British business houses here now is considerably less than in the past. Possibly those that exist do a bigger business but it would seem to me, from letters I receive, that a great deal of the business which firms in the United Kingdom are desirous of doing is much too small to be worth the consideration of the larger commission houses, and a smaller commission house might be able to handle such business successfully. For this a thorough knowledge of local conditions is essential. It is doubtful whether commercial travellers working entirely independently can be very successful here in new articles, and firms wishing to open up a new trade in Brazil might do well to come to some arrangement with one of the well-known commission houses here, by which the traveller sent out (who would speak Portuguese) could work in conjunction with such a house. Whatever trade our foreign rivals in this market have taken from us, has been acquired by virtue of a close study of the local market and of local conditions and requirements, such as is well within the capacity of British business men to acquire, and which the big British firms here have acquired and make use of. If exporters at home really desire to extend their operations in this country, there is no reason why they should not be able to do so. They must, of course, be prepared to go to some expense and to accept perhaps somewhat large risks in certain cases, but the gains are proportionately great, and it is on these lines that their competitors are working.

"The United Kingdom still supplies about 26 per cent. of the total imports, as against about 15 per cent. from Germany, 12 per cent. from the United States, and 10 per cent. from France. There is no reason why she should not continue to remain the principal supplier of this country. A falling off in the importation of a certain article may very often be merely an indication that it is necessary for the supplying firm to send out a responsible man to talk over matters with its agent and perhaps with some of the buyers."

The British Consul at Pernambuco writes that in spite of the advice that is annually given in Consular reports, inquiries are constantly received from manufacturers and merchants in the United Kingdom as to the best means of obtaining an opening for their goods in Brazil. Little can be done by correspondence, and then only in the Portuguese language, and not in Spanish. Catalogues, lists, &c., should also be in Portuguese, and prices quoted in milreis at, say, 1s. 4d.; weights should be given in kilogrammes. Large exporting houses in London, Manchester and Birmingham, &c., have well-established agencies in each Brazilian port, and the bulk of the British exports to Brazil are distributed by this means. Travellers who know the country and language well also make their regular visits, often representing two or three different lines of goods. Manufacturers of goods that are retailed in small quan-

tities should either furnish samples to a traveller who has already a good connection in Brazil, or should come to some arrangement with one of the exporting houses in the United Kingdom. Direct business between the manufacturers at home and the shopkeeper in Brazil means long credits, unsatisfactory business generally, and bad debts. A traveller who does not know the language and people is, as a rule, equally unsatisfactory. German imports have cut into British trade very seriously during the last few years. German travellers are very capable, carry a full range of attractive samples and pay great attention to details. German manufacturers also stndy the requirements of the market, and give much attention to the question of new and original patterns, which is an important element of success when looking for orders in Brazil.

The British Vice-Consul at Cuyaba gives some interesting details which throw a light on the difficulties to be met with in trade with certain parts of Brazil. He writes :—

"Goods are usually sold here on draft terms at six months from date of invoice. It is evident that when goods take from 10 to 14 months (a common occurrence) to arrive in Cuyaba, a merchant is called npon to pay his drafts long in advance of his receiving his goods. I have instances of merchants who have large sums of their capital locked up in this manner, representing drafts paid to foreign houses and no news whatever of their goods. Firms in this State are strongly disinclined to pay their drafts before the arrival of their goods. In this they are helped by our German competitors, who send their representatives to the district to study the difficulties and arrange their terms of credit accordingly. It is quite common for foreign houses, with the exception of British and American, to allow as much as three months' credit from the date of arrival of goods in the port of Cuyaba. During the year just closed, 25 German travellers visited the State, and three British, one of whom did not arrive as far as Cuyaba, making a total of two who actually visited the capital. There are at the present time three Germans representing German houses permanently stationed at Cuyaba, and one British. In Corumba there are four Germans permanently stationed and no British. I would impress upon British firms the importance of sending out men to this zone who are prepared for all difficulties. It is no use a man arriving at Corumba for instance, and, because up to that point he has had to put up with food and accommodation that is somewhat below what he would get on a British liner, feeling that he is not justified in continuing the worst part of the journey. I speak now of the dry season, when one has very often to spend days on a barge with little food and no accommodation whatever. I personally have spent four days on the hot roof of a barge, which was my only bed during this time, without either rug, pillow or mattress."

BUSINESS NOTES.

Dissolutions and Liquidations.—Imeson, Finch and Co., Ltd., Bridge Road, Stockton-on-Tees, tramway engineers (in voluntary liquidation).—A meeting of creditors was held at Stockton-on-Tees on November 15th, creditors amounting to £2,915 ont of a total liability of £3,468 being present or represented. Mr. J. W. Brown, of Messrs. Hanson, Brown & Co., Ltd., Middlesbrough, presided. A statement of affairs was submitted by the liquidator, Mr. T. R. G. Rowland, and the deficiency explained. After a full discussion of the present position, it was unanimously resolved that the following gentlemen be appointed to confer with the liquidator as an Advisory Committee for the purpose of ascertaining the present market values of the assets with a view to a sale to the best advantage :—Mr. Joseph Robinson, of Messrs. Geo. Scott and Sons, Ltd., Stockton ; Mr. Isaac Robson, of Messrs. I. Robson and Co., Ltd., Stockton ; Mr. J. P. Wilson, of Messrs. Wilsons, Pease & Co., Ltd., Middlesbro'. It was resolved, *nem. con.*, that the voluntary winding-up as resolved at the shareholders' meeting be approved, and that it was not necessary to apply to the Court for the appointment of a Committee of Inspection. The statement of the liquidator showed a surplus of £847 as regards secured creditors, a deficit of £878 as regards unsecured creditors, and a total deficit as regards shareholders and unsecured creditors of £3,885. The following are the principal unsecured creditors :—

Bainbridge Ltd., A., ...	£16	Imperial Brake Block Co., Ltd.	£24
Brown & Sons, J., ...	66	Manc. Armature Repair Co. ..	122
Brit. Insu. & Helsby Cables, Ltd.	25	Phosphor Bronze Co., Ltd. ..	26
Carr Bros., Ltd.	52	Robson & Co., Ltd., I., ...	20
Clegg & Howgate, Ltd.	62	Scott & Sons, Ltd., George, ..	17
Dyer & Young	38	Smith & Co., Frederick, ...	69
Dennis & Co., W. F., ...	27	Shropshire Iron Co., Ltd. ..	55
Foster, Brotherton & Co. ..	20	Standard Underground Cable	
Heaton & Dugard, Ltd.	20	Co., Pittsburg, U.S.A. ..	44
Hanson, Brown & Co., Ltd. ..	202	Worsley & Co., Peterborough ..	50

Creditors must send particulars of their debts, &c., to the liquidator, Mr. T. R. G. Rowland, Victoria Buildings, Stockton-on-Tees, by December 23rd.

Power Accessories, Ltd.—Creditors are asked to send particnlars of their debts, &c., to the liqnidator, Mr. S. P. Hutton, Rolt Street, Deptford, S.E., by December 6th.

Ashton & Shepstone, lighting, heating and electric light and power contractors, 183/185, Above Bar, Southampton.—Messrs. H. M. Ashton and M. A. Shepstone have dissolved partnership. Debts will be attended to by Mr. Ashton, who will continne the business as "H. M. Ashton."

Slater, Batty & Co., mechanical, electrical and automobile engineers, Bridge Street and Market Square, Hitchin.—Messrs. C. A. Slater and D. E. Batty have dissolved partnership, from June, 1911. Mr. Slater attends to debts, &c., and continues the business under the old style.

Hughes & Whiteley, electrical engineers, 2, Back Clement Street, Llandudno.—Messrs. W. Hughes and A. Whiteley have dissolved partnership as from December 18th, 1910.

Midland Camera Co., Ltd.—A meeting of creditors was called for November 20th by Mr. G. H. Fookes, the liquidator, who announces that by arrangement with the debenture-holders, he will be enabled to pay creditors in full as soon as the list of debts and claims is finally settled.

Turbine Corporation, Ltd.—A meeting will be held on December 22nd at 64, Gresham Street, E.C.. to hear an account of the winding up from the liquidator, Mr. Percy Mason.

Messrs. Brooks & White, electrical and mechanical engineers, 10, Maclise Road, West Kensington, London.—Messrs. W. P. Brooks and A. D. White have dissolved partnership. Mr. Brooks attends to debts, &c., and continues the business under the old style at the same address.

For Sale.—Messrs. Wheatley Kirk, Price & Co. are offering for sale by tender (until November 30th) the premises, plant, machinery, stock, stores, and work in progress, also goodwill, patents, &c., of the Beck Flame Lamp, Ltd., of Hayes, Middlesex, by order of the Receiver for the debenture-holders.

Book Notices.—The British Fire Prevention Committee has decided to publish early next year an important illustrated tabular summary of the results of its official fire tests with 60 fire-resisting doors, covering an experimental period of 12 years. The summary will be published at £2 2s. net. Later a similar summary dealing with 15 different types of fire-resisting partitions will be published at 10s. 6d. net. These publications will be additional to the usual reports and well-known "Red Books" of the Committee. New subscribers to the Committee's publications enrolled at this period (November and December, 1911) whereby their subscription ranks until the end of 1912, will have the benefit of a number of publications of exceptional importance, as well as the useful publications issued by the Committee in the ordinary course. The subscription to the publications (£2 2s. per annum) allows for use of the Committee's inquiry office as well as of obtaining back issues of the 150 "Red Books" already issued at special figures, and the summarised results of 28 fire tests with fire-resisting floors, otherwise only obtainable at £1 1s. net. Inquiries should be addressed to the Assistant Secretary of the British Fire Prevention Committee, 8, Waterloo Place, London, S.W.

"*Journal* of the American Society of Mechanical Engineers." November, 1911. Baltimore, Ind.: The Society. Price 35 c.

"*Bulletin* of the Association des Ingénieurs Electriciens." August, 1911. Liége : The Association. Price 5 fr.

"*Bulletin* Scientifique de l'Association des Elèvcs dcs Ecolcs Speciales." June-October, 1911. Liége : *Imprimerie Moderne.* Price 75 c.

"The Problem of Increasing the Load Factor." By G. Sartori. (Report submitted to the Turin International Congress.) Trieste : From the author.

"*Journal* of the Franklin Institute." Vol. CLXXII, No 5. November, 1911. Philadelphia : The Institute. Price 50 c.

"*Transactions* of the Illuminating Engineering Society." Vol. VI, No. 7. October, 1911. Easton, Pa. : The Society. Price 75 c.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 2. November, 1911. New York : The Institute. Price $1.

"The Physical Review." Vol. XXXIII, No. 4. October, 1911. Lancaster, Pa. : The *Review* offices.

"Boiler Draught." By H. Keay Pratt. 1911. London : Constable & Co., Ltd. Price 4s. net.

Electro-Chemistry in Switzerland.—The report for 1910-11 of the Elektrizitätswerk Lonza states that the understanding which had been sought to be reached among the manufacturers of carbide and ferro-silicon was concluded during the year, although it necessitated a limitation in thc production which involved sacrifices on the part of thc company. On thc other hand, prices were raised to a suitable level. The more favourable situation of the market was not experienced during the ycar, as a considerable quantity of old orders taken at low prices remained on the books and had to be cleared. After placing £29,000 to the depreciation fund, as against £26,000 in 1909-10, the balance permits of the debit balance of £48,000 brought forward from last year being reduced to £40,000. This is the third ycar the company has been unable to pay a dividend on the share capital of £480,000 whilst the loan debt amounts to £360,000.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New pamphlet (El1,512), giving full illustrated particulars regarding the Angold photographic arc lamps, embodying the latest developments. Tabulated reference numbers, voltages, currents and sizes of carbons, are included for medium and high power type lamps, double arc open type process lamps, and information is also published regarding automatic, suspension and adjustable travelling gear, and spare parts of the above lamps. Large numbers of these lamps have been sold to process and photo-engravers, cinematograph film makers, printers and photographers, and they have recently been nsed by lace-makers in taking blue prints of lace for travellers' use.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot.—Postcard announcing reduced prices of the "B.I." metal-filament lamps.

Messrs. Richard Wade, Sons & Co., Ltd., Hull.—Sheet of illustrations showing timber for different purposes treated by the "Rüping" process of creosoting. Rüpenised telegraph poles (Norwegian and Russian), sleepers, fencing, and other examples appear among them, the object being to show the remarkable penetration of the Rüping process as compared with the old method.

Messrs. Samuel Gratrix, Junr. & Bro., Ltd., Quay Street, Manchester.—New catalogue (No. 174) (84 pages art paper) containing particulars and prices with illustrations of a variety of electrical accessories and appliances for lighting, heating and power. The manufactures listed include tantalum, Onewatt and Osram lamps, candle fittings, switches, ceilings roses, cut-outs, ironclad switches and fuses, ball fittings, shade removers, glass and silk shades, Holophane and other reflectors, hand lamps, "Tubolite," electric cooking and heating apparatus, fans, wires and cables, outside light fittings, arc lamps, motors and dynamos, car-lighting sets, and many other things.

Messrs. Gimson & Co. (Leicester), Ltd., engine works, Vulcan Road, Leicester.—Twenty-four-page pamphlet containing illustrated particulars and prices of their pumps and pumping machinery for deep wells, bore holes, public water supply and drainage, breweries and other industrial purposes. The pictures include views of electric motor and worm reduction gear used for driving pumps for Buenos Ayres railway, and at the Savoy Hotel, London.

Messrs. Berry, Skinner & Co., 78, Upper Thames Street, London, E.C.—Two new lists. No. 11,011 gives illustrations and brief particulars of foolproof motor starting panels, made up of their "Masta" type fused switches and rheostat on angle-iron framework. Prices are fully tabulated for open, semi- and totally-enclosed types series panels, and for starters for same. Ammeters or wattmeters can be fitted as required. List No. 2,101 particularises and prices a similar type of panel, with the exception that the switch is of the firm's "Micaloc" pattern, totally enclosed, but without fuses; these are supplied for installations where fuses are not always necessary.

The Hoffmann Manufacturing Co., Ltd., Chelmsford.—Circular No. 750, just issued, which is produced in excellent style, with choice half-tone illustrations, deals with the "Hoffmann" ball bearings applied to wood-working machinery. Copies can be obtained on application.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—12-page pamphlet (No. 118), well illustrated, regarding aluminium for motor and carriage building. Corrected copy of leaflet No. 119, relating to aluminium in the service of electric traction, in which it is shown that there are 8,000 aluminium coils in service not 850 as stated in the earlier list.

Messrs. Samuel Hartford & Co., Ltd., 67, Lord Street, Liverpool.—8-page price list tabulating particulars of Association and non-Association qualities vulcanised electric light wires and cables made by them. Copies can be obtained on application.

The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, London, E.—Bound catalogue, now being issued for 1911-12, containing illustrations and information arranged in a very clear and attractive style regarding the Hart storage batteries. In addition to a short general index there is also a thumb index to sections. Erecting and working instructions are followed by tabulated particulars (capacity, charge and discharge rates, dimensions, weights and prices) of various lighting type batteries, motor-car and launch cells, traction cells, central station batteries, ignition batteries, motor-car lighting cells, portable batteries, and information concerning switchboards, cell-testing voltmeters, cell inspection lamps and sundries.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Weekly mailing card, No. 169, giving particulars of a new pattern lantern (in aluminium, polished copper, or oxidised copper) for outside and shop window lighting.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—New catalogue of more than 50 pages, containing up-to-date descriptive particulars, with prices and numerous illustrations of the "Kalkos" conduit system. Increasing demand has led to substantial reductions being made in prices of many of the standard fittings. Some photographic views appear of large buildings in which the "Kalkos" system is employed, including the new premises of the Institution of Electrical Engineers.

British Trade with Central America.—It is announced in the *Times* that the President of the Board of Trade, on the advice of the Advisory Committee on Commercial Intelligence, has appointed Mr. G. T. Milne to conduct a Special Mission of Inquiry into the conditions and prospects of British trade with the Central American Republics, Colombia and Venezuela.

Publicity Literature.—We have received from the Electric Supply Publicity Committee a batch of further leaflets, &c. One of these is a small black-and-white print of a cooking poster, which is issued lithographed in colours (25 in. × 40 in.). Another poster, lithographed in five colours, and made in two sizes (25 in. × 40 in. and 60 in. × 80 in.), represents a statue of Liberty holding an electric torch aloft in one hand, and carrying a luminous electric radiator with the other; this makes an effective appeal on behalf of both electric lighting and heating, which are "cheaper than ever." The electric vacuum cleaner, the public interest in which is so greatly increased now, has a leaflet to itself, "How to Save Housework," and how to use one Lloyd George servant stamp less. A small "cooking" mail card, a leaflet intended for shopkeepers, telling them how convenient it is, by the aid of a time-switch, to keep their shop windows lighted for hours after closing time, a four-page circular outlining the good points of electricity compared with gas, for lighting a home, are also issued. Specimens can be obtained on application to the Committee, at Moorgate Court, London, E.C.

Trade Announcements.—Messrs. Lord & Shand, Plymouth and Newquay, have opened a branch at Guildhall Square, Launceston, Cornwall.

With reference to a notice appearing under this heading last week, Messrs. Ship Carbons, Ltd., write stating that with regard to "Monowatt" metal-filament and carbon lamps, they desire to make it clear that they do not represent the "Watt" Electric Incandescent Lamp Works for lamps of less than 16 volts, used for battery lamps, &c. With further reference to the same notice, The London Commercial Electrical Stores, 65 and 67, Knightrider Street, E.C., inform us that they continue to hold the sole agency in the United Kingdom for "Watt" Vienna metal and carbon-filament lamps for batteries and accumulators, which they hold well-assorted stocks in London.

Mr. J. G. Wilson, of Manchester, and 70, Wood Street, Liverpool, has been appointed representative for Lancashire for Messrs. Hart Wittusen & Co., 27, Shoe Lane, London, E.C., for their electric glassware.

Bankruptcy Proceedings.—W. R. N. Gard, electrician, West Ealing (Orchard Electrical Works, Canterbury).—First meeting November 27th at 14, Bedford Row, W.C.; public examination November 28th at Brentford.

The Tube Trade.—Wrought-iron tube makers in South Staffordshire and the Midlands last week reported a remarkable state of prosperity. The *Standard* said that orders were pouring in from all sources, and immediate extensions of works were being contemplated to overtake the demand. The explanation of this sudden activity was believed to be the expectation entertained by buyers that success would still attend the makers' efforts to form an All-England Association. On 14th inst. some makers declared that they were losing £2 per ton on certain classes of tubes, and tempting offers were made to consumers for contracts extending over the whole of 1912.

Lamp Works in Belgium.—New works for the manufacture of incandescent lamps are being established at Sainte Josseten-Noode by La Société Métal et Lumière.

LIGHTING and POWER NOTES.

Abingdon.—As the outcome of a public desire for the E.L., the T.C. has decided to go into the matter and report, and a Committee formed for this purpose has been given power to expend £50.

Ashtead.—The Council has accepted the tender of the Leatherhead Electric Supply Co. for additional public lamps at £3 10s. each, and £2 16s. each per annum for lighting.

Atherton.—The U.D.C. has decided to erect a sub-station near Four Lane Ends, to allow of a supply of electricity to that district.

Barnsley.—The T.C. has received the sanction of the L.G.B. for a loan of £12,500 for extensions at the electricity works.

Birstall.—The Council is applying in the next Parliamentary session for the enlarging and transfer of its lighting order. It is proposed to transfer this order to the Electrical Distribution of Yorkshire, Ltd.

Bolivia.—A new hydroelectric power plant was inaugurated at Achachicala, near La Paz, on July 19th. This provides for the supply of 3,000 H.P., or 4,500 H.P. when needed, in the form of three-phase current at 6,000 volts delivered to Callapampa, where it is in part transformed to 500 volts D.C. for electric railways, and partly transmitted underground to the city for transforming to 120 volts for the general supply. After passing through the hydro-electric plant, the water is filtered for domestic supply in the city. The work has been carried out by the Bolivian Rubber and General Enterprise Co., Ltd., with offices in London, at a cost exceeding £360,000; its value may be gathered from the fact that coal has cost as much as £12 per ton in La Paz.

Bootle.—The White Star Co. has leased extensive premises in Rimrose Road, Bootle, and will convert the place into a large laundry, fitted up with the most modern type of machinery electrically-driven, the power being supplied by the Corporation.

Bo'ness.—The National Electric Construction Co., contractors under Bo'ness T.C. for the lighting of the burgh, has published a notice of its intention to promote a Bill to confirm agreements entered into with consumers under the hire-wire system. Most of the premises in the burgh using the electric light have fittings supplied by the company, for which they pay a rental. A recent decision has raised the question of the legality of these agreements, and the object of the Bill is to legalise charges for rental for the use of the electric lines and fittings and for current. Twenty other lighting authorities are said to be parties to the promotion of the Bill.

Brighton.—With reference to the Bill to be promoted by the I.M.E.A., seeking powers for local authorities to provide and fix electric wiring and fittings upon consumers' premises, the engineer has recommended the T.C. not to support the Bill in its present form, as he is of opinion that the actual wiring and supplying of fittings on consumers' premises is work which would be better left to private enterprise, and should not be undertaken by municipal authorities. The Lighting Committee, however, has resolved that, subject to a sufficient number of Corporations agreeing to contribute towards the cost of promoting the Bill, the Brighton T.C. will contribute.

Bucklow.—The R.D.C. has approved of the proposed extension of the E.L. lighting area by the Altrincham T.C.

Bury.—At a meeting of the Electricity Committee held on the 17th inst., it was decided to fix at the new electricity works, a tablet recording the fact that the site of the works was formerly the site of Chamber Hall, the birthplace of Sir Robert Peel. The tablet will also bear the names of the members of the Committee and information as to the date of the opening of the new works, which has been fixed for the 30th inst.

Cheddar.—Steps are being taken by a syndicate formed by Mr. J. J. Bellamy, of Weston-super-Mare, to provide a supply of electricity for the town. The charges will be 6d. per unit for lighting, and from 2d. to 3d. per unit for power.

Chesterfield.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for a loan of £7,000 for additions to the plant at the electricity works.

Continental Notes.—France.—La Compagnie Générale Française et Continentale d'Eclairage has secured a concession for the supply of electrical energy for lighting and power purposes in the town of Alencon (Orne).

Hungary.—The Commercial Bank, of Buda-Pesth, is interested in a scheme to put down a plant to utilise the water-power of the River Drau, near Perlack, in the generation of electrical energy for lighting and power purposes.

Fife.—A complete electrical installation has been established by the Townhill (Dunfermline) Collieries Co., at No. 7 pit, Townhill; everything will be driven electrically, winding, haulage, pumping, &c., and it will, therefore, be one of the few smokeless pits in Scotland. The output will be raised from 220 to 440 tons per day.

Glasgow.—The Clyde Valley Electrical Power Co. purposes extending its cables to the north-west of Glasgow, and has asked the T.C. for permission to lay the cables through part of the municipal area. The Electricity Committee has raised no objection, and the Corporation has given the necessary sanction provided (1) that the company undertakes not to supply any energy within the city area, and (2) that the permission now granted is not used as an argument for getting authority to lay down additional cables or supply electrical energy within the city boundaries.

A contribution of £50 has been voted by the T.C. towards the guaranteed fund of £3,000 in connection with the promotion of a private Bill in Parliament, under the auspices of the I.M.E.A., for the amendment of the Acts relating to electric lighting.

Grays.—The U.D.C. has decided to improve the public lighting by replacing 81 50-c.p. tantalum lamps with single 50-c.p. tungsten lamps, and 100-c.p. tantalum lamps with single tungsten lamps of similar candle-power. The alteration will save £148 per annum.

Great Harwood.—A further meeting of the U.D.C. is being held to discuss the electricity scheme.

The Council has given formal notice of its intended application to the B. of T. for an order authorising it to supply electricity within the urban district.

Greenock.—At its meeting on November 21st, the T.C. agreed to give notice to the Scottish Office authorities and others interested of its intention of borrowing a further sum of £20,000 for the erection of additional plant, &c., at the electricity works. In answer to a question as to when borrowing was to cease, Mr. J. W. Bailey explained that the extensions now required had all been sanctioned by the T.C., which was under certain contracts for electricity and must meet its obligations. It was explained that in addition to contracts already arranged the electricity department continued to receive numerous new applications for light and power, among the latest being one from Messrs. Dunlop, Bremner & Co., shipbuilders and engineers. In connection with this application, the burgh electrical engineer reported that in order to provide a H.T. supply from the Dellingburn works to the firm's premises, an expenditure of £3,700 would be necessary, and that to make the proposition remunerative it would be necessary for the firm to guarantee an annual payment of not less than £750 for 10 years. In the event of the firm agreeing to the T.C.'s terms there is a probability of the question of the supplying of the whole of the Port Glasgow area—on the boundary of which the firm's yards are situated—being reopened.

Harold Wood.—The Romford R.D.C. has consented to mains being laid in the parish by the Electrical and Engineering Supplies Co., Ltd., subject to the company erecting a power station within 18 months.

Hastings.—Mr. Hooper, of the L.G.B., held an inquiry a few days since into the application of the Council for a loan sanction for proposed expenditure of £621 for an extension of mains to the West Hill district. Mr. C. E. Botley, engineer of the Hastings Gas Co., opposed the application as a ratepayer on financial grounds. In support of the application, it was urged that the proposed extension would be profitable, as 11 new consumers had been obtained, and in addition, 16 public gas lamps would be converted for electric lighting. The charge made to the Public Lighting Committee by the Electricity Committee was £3 5s. 8d. per lamp, although it was shown that the actual cost was only £1 14s. 3d. per lamp. Mr. Botley submitted that the undertaking was being carried on in a reckless manner, and that the alleged profit only existed on paper. The town clerk pointed out that if they were not allowed to borrow money to extend mains, they could not hope to get new consumers, and it was only by obtaining an increased number of customers that the undertaking could be made to pay. In the course of the inquiry it was stated that the present outstanding debt in respect of the Corporation electricity undertaking was £94,219.

Hereford.—The T.C. has received from the L.G.B. sanction to loans of £850 for mechanical stokers; £1,000 for services; and £500 for mains.

Johnstone.—Following a public meeting to discuss the question of electric power for the town, the Council has received a deputation from the Clyde Valley Co. which explained that the company was considering coming to Johnstone. The deputation also pointed out that through its subsidiary company, the Strathclyde Co., it had the power of lighting Johnstone and supplying any person there under its own Act of Parliament. The company states that it will be prepared shortly to submit a tender indicating the rate at which it can supply current in the event of a definite quantity being arranged.

London.—Marylebone.—The Electric Supply Committee has had under consideration a report from the general manager, suggesting that current for cooking be offered to any subscriber who was on the telephone system, at a rebate of 25 per cent. on the present price of 1d. per unit during April to September, inclusive, also recommending that the same rebate, but for all the year round, should be given for non-peak cooking to businesses (also being "telephone" consumers) having large installations, where a large amount of day cooking is done. The object was to encourage a big summer and non-peak cooking load at a time when the additional output cost little more than ½d. per unit. The Committee has decided to concur with these suggestions and to allow the rebates to be made as from January 1st, 1912.

Islington.—The Lighting Committee reports to the effect that it is of opinion that powers should be given it to undertake the outside lighting of business premises in the borough at a fixed sum per annum by agreement, and stating that an arrangement of this kind would be to the advantage of consumers and result in the further use of electricity for lighting purposes. It has accordingly submitted a recommendation to the effect that it be authorised to enter into such agreements, and that a sum not exceeding £250 be set aside to carry out the suggestion.

Tottenham.—The Education Committee has instructed its architect to report as to the advisability of installing electric light or gas at new schools, together with the comparative cost of the two systems.

L.C.C.—The adjourned report respecting loans for electricity undertakings and the special position created by the London Electric Supply Act, 1908, were dealt with by the Council on Tuesday. Sir George Goldie moved the acceptance of the report. Taking a broad view of the present situation, and having regard to the developments of electricity supply in recent years, the Finance Committee considered that it would seem to be preferable, so far as the financial aspect of the question was concerned, for Borough Councils, where possible, as opportunity offered, to link up their undertakings for mutual support as well as for economy, instead of extending a number of comparatively small and, in some cases unprofitable concerns, which might, on economical grounds, some day have to be scrapped. It might be that such extensions necessary to fulfil the statutory requirements in regard to the supply of electrical energy could be made by a few only of the Borough Councils, who, having regard to the situation or other circumstances, were able to develop their plant and stations in a more economical manner than others. It was conceivable also that, in particular cases, it might be financially advantageous to make arrangements with a company for the supply of energy in bulk. The Committee had suggested to the Highways Committee that it should consider whether it would not be desirable for it to recommend the Council to formulate, as far as circumstances would permit, a comprehensive policy as to the action which the Council should take in view of the London Electric Supply Act, 1908. Although unable to make any proposals that afternoon, Sir George Goldie suggested that the Highways Committee might very well refer to the General Purposes Committee the question of appointing a special committee to consider the whole question of electricity supply in and around London, with particular reference to the provisions of the London Electric Supply Act, 1908. Sir John Benn said he was prepared to second a resolution to that effect if it were to be put to the vote. The report was passed.

Fulham.—The Council has decided to take up a loan of £9,280 from the L.C.C., made up as follows:—£6,280 for generating plant and foundations; £1,000 for house services; and £2,000 for meters. About 20 modern and up-to-date transformers are to be substituted for the older type of transformers at present installed at the various sub-stations in the borough.

Lowestoft.—The Electric Lighting Committee has received a report as to the Electrical Exhibition at Olympia, and a

recommendation that a certain fitting for street lamps shown there would be very suitable for replacing some of the older forms of street lamps in the town. It is hoped that the Committee will see its way to allow a small exhibition to be held in Lowestoft during the early part of 1912, when cooking, heating and motor power would be shown to the public, as it was this load they required to make the undertaking still more successful.

Menai Bridge.—The scheme for the electric lighting of the town, which has been before the Urban District Council, is now in a likely position to be carried out, Mr. Parry, one of the promoters, having informed the Council that he is in a position to commence the work of putting down the plant. The preliminary negotiations had taken longer than he had anticipated, and for that reason the party co-operating with him feared the installation would not be finished quite at the time arranged. In view of all the circumstances, the Council acceded to Mr. Parry's request for a three months' extension of the period for the completion of the work. It seems that Mr. J. W. Williams, of Pwllfanog, had approached the Urban Council on behalf of a new party of promoters, asking what would be the Council's attitude in case they sought a provisional order. They were prepared to compensate Mr. Parry, provided he was reasonable. It was agreed that, in view of Mr. Parry's letter and the decision the Council had come to with him, it could not deal with Mr. Williams.

Nuneaton.—The T.C. has decided to support the Bill of the M.E.A. seeking powers for municipal authorities to undertake wiring work and the supply of fittings, &c., and has guaranteed £3 3s. towards the cost.

Redditch.—A L.G.B. inquiry will be held on November 24th into the application of the U.D.C. for a loan of £5,800 for E.L. purposes. With the installation of new turbines, the cost of production is expected to fall to ¾d. per unit.

Sandown.—The U.D.C. has decided to accept the offer of the Isle of Wight Electric Light Co. for street lighting for a term of three years, at a total cost of £601 15s.

Shrewsbury.—At a recent meeting of the T.C. it was stated that though there had been improvements in the high-efficiency lamps, giving the consumer a better light with less cost, the Committee still held its own in the matter of output. About £2,400 a year was being transferred to the sinking fund, and the electricity undertaking was in a sound financial condition.

Skegness.—The U.D.C. has decided to consider at a special meeting the question of applying for a prov. order for electricity supply.

Swinton and Pendlebury.—At a meeting of the D.C. held last week a letter was read from the Lancashire Electric Power Co., intimating that the directors were prepared to meet the Electricity Committee to discuss points arising out of the agreements for supply of electricity in bulk and management.

Wheatley.—The Doncaster T.C. has decided to apply to the B. of T. for a prov. order to enable the Council to supply electricity to Wheatley.

West Yorkshire.—The Electrical Distribution of Yorkshire, Ltd., is applying for the following prov. orders at the ensuing Parliamentary session: Darton and district (including Darton and Cawthorne), Rothwell and district (including Rothwell and Oulton with Woodlesford), Goole district (including Goole, Rawcliffe, Airmyn and Hook), Hoyland Nether district (including Hoyland Nether, Worsboro' and Wombwell), Wath and Ardsley.

Witham.—Steps are being taken to erect an electricity works in the town.

TRAMWAY and RAILWAY NOTES.

Ashton.—On Tuesday arbitration proceedings were commenced in private with regard to the dispute which has existed for many months between the employés of the Ashton Corporation Tramways, the Stalybridge, Mossley and Dukinfield Joint Board, and the Oldham, Ashton, Hyde and Denton Electric Tramways Co. Both sides have accepted the services of Mr. Ernest Moon, K.C., as arbitrator appointed by the B. of T. Mr. W. F. Chambers, solicitor, Denton, conducted the case for the authorities, and Ald. G. T. Jackson, the secretary of the Tramway and Vehicle Workers' Union, appeared on behalf of the men. The points for arbitration were that the hours should be 9½ per day with time and a quarter for overtime, each day to count by itself; a minimum wage for conductors of 22s. 6d. per week, rising to 27s. 6d.; for drivers a minimum of 28s. 6d., rising to 32s. 6d. per week; car-shed men's wages to be raised by ½d. per hour, annual holidays to be increased from three to six days with payment, and relief for meals of not less than 20 minutes per day to be granted to each shift of men. The proceedings were expected to last over two days.

Belfast.—At the fortnightly meeting of the Tramways Committee, a suggestion was made to have glass screens put up in front of the cars for the protection of motormen; it was pointed out that this matter had been before the Committee, and its opinion was that it would be highly dangerous, not only to the undertaking, but to the motormen themselves, to have glass screens erected.

Bradford.—The profits on the working of the City tramways for the half-year ended September 30th, the figures of which were submitted this week, constitute a record for the department. The statement shows a net profit for the period of £35,867, compared with £23,991 for the corresponding six months of last year, an increase of £11,870. The actual traffic receipts were £144,350, as against £131,885. On the expenditure side of the statement is shown a total increase of £2,500, whilst under the new arrangement between the electricity and tramways departments, whereby energy is supplied at a reduction of ½d. per unit, there is a decrease in cost of power of £2,609 on an expenditure for this purpose of £21,506, or 1·7d. per car-mile, as against £24,116, or 2·0d. per car-mile last year.

Brighton.—On Thursday last week the T.C. passed a resolution, by 41 votes to 1, in favour of obtaining power to run a railless trolley service in Brighton, Hove, Portslade, Southwick and Shoreham.

Conway.—A proposal is under consideration for the construction of a light railway along Conway Valley, to run on the opposite side of the river to the existing railway. The estimated cost of the scheme is £75,000.

Continental Notes.—Turkey.—It was recently reported that the Turkish Ministry of Public Works had concluded an agreement with the Berlin firm of Lenz & Co., for the construction of an electric railway in Constantinople, which is to involve an expenditure of about £4,000,000. A Constantinople correspondent has now forwarded to a Frankfort newspaper some details in relation to the concession, which is for a period of 75 years. The railway is to begin in the centre of Stamboul, and then proceeds to the High Porte, and thence to the Golden Horn. Crossing this arm of the sea by means of a new bridge, the railway will rise over Galata to Pera, and will be carried on the heights along the Bosphorus for about 20 miles to the Black Sea. The holder of the concession undertakes to construct and work the railway at his own expense, the plans being subject to the approval of the Ministry of Public Works. Work has to be commenced within three months of the sanction of the plans, and the railway is to be completed to Sari-Yer in three years, and to the terminus in eight years. A Turkish company is to be formed by the concessionaire one year after the ratification of the agreement, and one-half of the shares is to be placed at the disposal of Turkish subjects. The right of expropriation for the construction of the railway is granted. If the Constantinople city authorities should resolve on the formation of streets along the route of the railway, the concessionaire agrees to construct them for the account of the city, and to charge the costs and 4 per cent. interest on the profit share of the city in the working results. The line from Galata to Aranut is to be of double track at the beginning, but the question of a second track for the remainder of the railway is left open, although the land for the purpose is to be acquired at once. All the materials necessary for the construction of the railway, including the rolling stock, will be admitted free of duty, and the fares will be subject to the approval of the Government and the city authorities. As far as the gross receipts are concerned, the correspondent states that the working expenses and cost of maintenance, together with the annual charge of 5 per cent. for redemption and interest on cost of construction, are to be deducted first. If the annual receipts do not cover the working expenses, the concessionaire has no right of claiming compensation, although he is entitled to carry the deficiency to a special account, and charge it with 4 per cent. interest. If, however, the gross receipts are higher than the charges in question, the difference is to be regarded as net profits, and to be devoted to the extinction of the deficiency account. The balance then remaining is to be divided with the city authorities, who are to receive 20 per cent. if the annual net profits amount to £400 per kilometre, 35 per cent. if they range from £400 to £800, and 50 per cent. if they exceed £800 per kilometre. If the deficiency in the working receipts has not been extinguished when the concession expires, the concessionaire has no claim to compensation. On the lapse of the period of the concession, the city authorities acquire all the rights of the concessionaire in the railway, power stations and accessories. The latter is under the obligation to hand over the railway to the Government in good condition and free from any debt. If this obligation is not, or is only partly, fulfilled, the Government has the right to collect the railway receipts five years before the expiration of the concession, and employ them for the maintenance of the line. The Government reserves the right to acquire the whole or any portion of the rolling stock and the "stocks" in the stations on the basis of an estimate prepared by experts, and the purchase price is to be paid six months after the transfer. The Government has also the right of acquiring the undertaking at any time from the fifteenth year after the opening of the whole of the railway. It is further provided that the workmen and officials are to be Turkish subjects, although foreigners may be conditionally employed for technical work in so far as suitable Ottoman subjects cannot be obtained.

France.—La Compagnie des Chemins de Fer Départementaux de la Haute-Vienne has secured the concession for the construction and working of 350 km. of electric railways in the Department of Haute-Vienne. The lines will be on the monophase system.

An electrical motor dust cart has just made its appearance in the streets of Paris. It is being experimentally tried by the sanitary department of the municipality, and if it is successful, vehicles of

the new type will displace the insanitary horse-drawn dust carts hitherto employed.

Dewsbury.—The Corporation has given notice of its intended application to the B. of T. for an order authorising the construction and working of a double line of tramway in Halifax Road, Willans Road, Moorlands Road, Boothroyd Lane and Staincliffe Road.

Falkirk.—The Falkirk and District Tramway Co. proposes to apply to Parliament for an extension of time for carrying through the extension of the electric tramway system to Grangemouth. In 1906 the company obtained powers to connect Grangemouth, amongst other places, with its system of tramways, and five years was allowed to give effect to the powers obtained. Up till now the Grangemouth extension is the only portion of the original scheme which has not been proceeded with. Under its new order the company asks for another three years—the maximum time allowed—to complete the scheme. As a line to Grangemouth would be remunerative, it is believed the extension will not be long delayed.

Glasgow.—At its last meeting, the T.C. dealt with the Committee's report on tramway facilities for the blind published in last week's Review. The convener pointed out that the Committee was willing to recommend that the blind should travel free on the cars by passes, and it was anxious that the distribution of these passes should be undertaken by a committee of the blind themselves. The only question now to be settled was that of conditions, which would be reported to the Corporation for approval. The passes would be applicable over the whole tramway system.

The recent strike of tramway employés of the T.C., and other strikes in Glasgow, were responsible for the consideration of a proposal by that body at its last meeting. The proposal asked for the appointment of a committee to report what steps should be taken to prevent or discourage strikes, and to confer with other authorities as to the alteration in the existing law which might be considered necessary for the better protection of all public services and property under municipal control.

There is every prospect of the T.C. putting the confirmation on the proposal to double the length of the present ½d. stage on its tramway system. The matter was opened up from the practical point of view by the success which attended the "two-stage" experiment—*i.e.*, a species of return ticket, by which two double ½d. stages were given for 1½d. The T.C. some time ago remitted the question of increasing the ½d. stage to the Committee for consideration and report, the Lord Provost giving the assurance that that course was practically only a matter of form. The Finance Sub-Committee and the Tramways Committee have reported favourably, and the expectation is that—the T.C. agreeing—the new system will come into operation next month.

Hartlepool.—The Corporation proposes to expend £56,000 on the tramway, this includes the purchase of several routes from the present company, and also the laying of two miles of extra track, and the purchase of six new cars, &c.

Leith.—A provisional order is being applied for to construct electric railways between the coal shipping docks at Leith and the leading collieries in East and Mid Lothian. A company has been formed of colliery owners and others, and a sum for preliminary expenses of £10,000, is subscribed. There will be four lines. One from Leith to Prestonpans, a distance of about seven miles, other two lines branching off, and a fourth line leading from Leith Docks to Gorebridge, in Midlothian, the longest of the four railways. Many collieries will be connected up in this way direct with Leith, where the coal shipments last year totalled about 1¾ million tons. This project, if carried out, will be the first of its kind in Scotland.

London.—Metropolitan Asylums Board.—It is proposed that an agreement should be entered into with the Tudor Accumulator Co. for the maintenance of the battery of the new 30-cwt. electric vehicle at Queen Mary's Hospital. Two agreements had previously been entered into with this company (who were the makers of the batteries), one for the maintenance of the battery of the small 5-cwt. vehicle purchased at the opening, which was worn out and no longer in use, and the other for the 25-cwt. car battery. The first agreement provided for an annual payment of £10 (to cover any number of vehicles up to six), and ¾d. per mile run. For the 25-cwt. car, 1¼d. per mile run was charged, and for the new vehicle the charge would be 1½d. per mile.

Lewisham.—Intimation has been received from the L.C.C. that it proposes at an early date to proceed with the construction of tramways from London Road to Park Road, Forest Hill, and from Forest Hill to Rushey Green.

London Electric Railway Proposals.—A scheme has been prepared by the District Railway, under which powers are to be sought to double the line between East Putney and Wimbledon Park, thus enabling the District Co. to use its own track instead of, as at present, having the joint use of the L. & S.W. Co.'s line between the points mentioned. This scheme will give a greatly increased electric railway service between Wimbledon and the City.

The Central London Railway has decided to seek powers to extend its line, in connection with the Shepherd's Bush-Ealing (G.W.) line which is under construction. The proposal is for a loop line running from Goldhawk Road through Turnham Green, under Kew Bridge, and round by Isleworth and Hounslow, to the Ealing line. The Bank to Liverpool Street extension of this company should be opened next June, and the Ealing line six months later.

The Metropolitan Railway also has a project, for which Parliamentary powers are to be sought, to provide a branch from its main line at Rickmansworth to the Cassiobury Park side of Watford, in connection with which the electrification of the line will be extended from Harrow to Watford. A simultaneous widening of the line between Wembley and Finchley Road will enable a frequent service of non-stop trains to be run. The same company proposes to link up its Hammersmith and City line with the Central London extension mentioned previously.

The Great Eastern Railway Co. is asking for Parliamentary powers in connection with the East London Railway electrification, the capital for which may be found by the leasing companies.

Last week we noted the fact that a definite proposition for electrifying the North London Ry. had at last been made. Later information shows that the scheme is part of a comprehensive proposal by the L. & N.-W. Railway, which in 1907 commenced a scheme for widening its main line from Kilburn to Watford, with a connecting tube between the former station and Euston, where a low-level station was to be constructed. We understand that the tube portion of the scheme has now been abandoned, and the new scheme comprises the construction of two extra lines between Watford and Chalk Farm, and the electrification of two of the four lines between Chalk Farm and Broad Street, thus giving direct communication between Watford and the City. Such portion of the electrically-worked traffic as passes to Euston will be worked over the existing lines. At the same time the Bakerloo tube is to be extended to Queen's Park on the North-Western line, and in this way Watford will be linked up with Paddington, Marylebone, Piccadilly, Waterloo, &c., and all the railways which connect with this tube, over which through trains will be run.

The North London electrification includes the section from Willesden to Kew and Richmond, a portion of which route is already in use by the District Co.'s electrical trains; also the Earl's Court-Willesden line, which the North-Western Co. operates by means of steam trains. As regards the North London line, it is instructive to note that the passenger receipts have steadily declined from £311,400 in 1902 to £198,000 in 1910, owing to the increasing tube and tramway competition. The scheme avoids congestion at Euston, and incidentally gives to Watford a prospective electric service to three points in the metropolis.

Morley.—The T.C. has applied to the B. of T. for an extension of time to December 31st, 1912, for the completion of the works authorised by the Light Railway Order, 1901.

Newcastle-on-Tyne.—According to our Tyneside correspondent, the officials of the Corporation tramways have been experimenting with a new form of brake for cars which the engineer (Mr. Ernest Hatton) has invented. The purpose of the brake is to prevent a tramcar from running away in the event of the usual two brakes failing. The brake takes the form of a slipper or skid the entire length of the car, and is held in position from the truck. This slipper is fitted with a crescent-shaped toe. In the case of an undue speed getting on to the car the brake can easily be operated by either the motorman or conductor. As the brake is put in use the slipper falls to the ground, and drums, which are fixed to the inside of the wheels, and which revolve at the same time, come into play on the rising toe of the brake. By this means the running wheels are lifted sufficiently off the ground to leave the rails, and the way is almost immediately taken off the car. The principle has worked exceedingly well in experiment, and tests are being continued.

Newcastle-under-Lyme.—The R.D.C. has decided to support the North Staffordshire Railway Co. in its application to the Light Railway Commissioners, for powers to construct a light railway from Trentham to Newcastle.

Ramsbottom.—At a special meeting of the U.D.C. on the 16th inst., it was unanimously decided that a Bill be promoted in Parliament to authorise the erection of overhead equipment and other works for the installation of a system of railless traction. The Council proposes to install the system between Holcombe Brook and Edenfield Church, a distance of 3½ miles, at a cost of about £10,000.

At the special meeting of the U.D.C. Mr. Shore, who presided, stated that it was proposed to run a half-hourly service daily, from 5.30 a.m. to 11 p.m., from Holcombe Brook to Edenfield Church and from Ramsbottom market place to the Railway Station, and they would have three cars to start with. The cost would be approximately £10,000, compared with £28,000 for a rail system. He expressed confidence that the scheme would pay. The Council had been able to come to a satisfactory arrangement with regard to current, and it was proposed to erect a car-shed.

United States.—The cable plant of the United Railroads of San Francisco is now operated by electricity. Operating conditions demand that the plant shall run continuously for 20·25 hours per day, all the year through, and that a constant cable speed of 9·5 m.p.h. shall be maintained. The power installation consists of a G.E. 600-h.p., 400 r.p.m., 400-volt induction motor, with master controller and contactors, and a set of 12 cast-iron grid rheostats, the motor being mounted on a sliding base for adjustment of the transmission chain. Power is brought to the building at 11,000 volts, passing through a set of air-blast, step-down transformers, which reduce the pressure to 440 volts.—*Elec. Rev. and W. Electrician.*

Stockport.—The Corporation has given notice of its intention to apply to Parliament in the ensuing session for leave to bring in a Bill to empower it to provide railless trolley or other vehicles to run through Offerton to Marple. The Hazel Grove and Marple Councils are supporting the application.

TELEGRAPH and TELEPHONE NOTES.

An Experimental Wireless Plant.—New plant of modern design has been installed in the electrical engineering laboratories at the Liverpool University, and the department of electrical engineering has recently been equipped, through the munificence of Sir Wm. P. Hartley, with a complete installation of apparatus for the purpose of wireless telegraphy. An aerial post, having a total height of 150 ft., is being erected above the University building by members of the engineering department, under Prof. Marchant, and in connection therewith is a complete set of receiving and transmitting apparatus, by means of which direct communication with the Eiffel Tower and the North of Germany will be established. The installation is a full-scale one, and will be used for the instruction of students and for research and experimental work.

Automatic Call Meter.—It is reported from Wales that Mr. S. D. Williams has invented an automatic meter for telephone calls, which makes no record of ineffective calls, and is said to be proof against mistakes, fraud and fools.

Constantinople. — In the *Journal* of the British Chamber of Commerce of Turkey for September some particulars are given of the future telephone system, which will consist of 10,000 lines, to be ultimately increased to 18,000. The rates charged will be based on the measured-rate system, with a minimum of £T5.50 for 550 calls, for business offices; a flat rate of £T8.00 will be charged to dwelling houses, with an extra charge of one piastre (2d.) per call from one zone to another. It is expected that the installation will be completed in 20 months, at a cost of £200,000 or more.

Sweden.—Several well-known business men have petitioned the Government for a concession to build a wireless telegraph station, on the Marconi system, near Stockholm, with a radius of 1,200 miles, which will provide a regular connection between Sweden and several European and other countries and with ships on the high seas. The connection with Great Britain would be direct, and with most other countries *via* Great Britain. A company will be formed, with a share capital of £100,000. The station will be ready in a year.—*Daily Telegraph.*

Wireless Telegraphy.—Last week, for the first time, the post at Fez succeeded in communicating with the Eiffel Tower.

The wireless telegraph installation by Lloyd's at Port Said has now been completed, and from December 1st telegrams can be dispatched to any ships within the radius of the apparatus from any telegraph office in Egypt.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

January 3rd, 1912.—Sixty-nine switchboards, magneto, non-multiple, for the P.M.G.'s Department. See "Official Notices" to-day.

Melbourne.—December 19th. Deputy P.M.G. 2,750 rolled steel beams for use as telegraph and telephone poles (Sched. 579), 8,320 protectors and 16,640 fuses for main distributing frame (Sched. 619). Specifications, &c., High Commissioner in London, 72, Victoria Street, S.W., and at Board of Trade Commercial Intelligence Department.

South Australia.—January 3rd. One wire-testing machine, for the P.M.G.'s Department. See "Official Notices" to-day.

N.S.W. Government Railways.—December 4th. Two return boosters. January 8th, 1912.—Four 1,000-kw. rotary converter units. January 22nd, 1912.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th, 1912. A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

Belgium.—December 5th. The Secrétariat Général de l'Administration des Hospices, of Brussels (Boulevard Botanique, Hopital St. Jean), is inviting tenders for the supply and installation of two electrically-operated lifts in the St. Pierre Hospital, Brussels.

December 7th.—The municipal authorities of Lambermont (Verviers) are inviting tenders for the electric lighting of the town.

Blackpool.—November 29th. One 1,500-kw. steam turbo-alternator, one barometric jet condenser, and one 800-kw mixed-pressure steam turbo-generator, for the Corporation. See "Official Notices" November 10th.

Clayton-le-Moors.—December 2nd. Repair and maintenance of fire brigade alarm system for a year, for the U.D.C. Hon. Superintendent of the Fire Station, off Pickup Street.

Dewsbury.—November 30th. 3-h.p. electric motor for driving a kneading machine. Further particulars from the Master of the Workhouse.

Darlington. — December 4th. 500-kw. d.c. dynamo coupled to a reciprocating steam engine, for the Corporation. See "Official Notices" November 17th.

Edinburgh.—Edinburgh and District Tramways Co., Ltd., invite tenders for electric light supplies, &c. C. H. Shepherd, manager.

France.—March 12th. Tenders are invited for the installation and working of an electric ship-towing service between Etrum and Janville on the Upper Scheldt along the St. Quentin and Oise Canals. Particulars, Service Spécial de la Navigation entre la Belgique et Paris, in Compiègne, Rue de l'Aigle 5.

Germany.—December 5th. The Prussian State Railway authorities at Paderborn are inviting tenders for the supply of three electrically-operated travelling cranes.

London.—Fulham.—The B.C. is to spend £1,000 upon 20 modern transformers for sub-stations, to replace the older type at present installed.

Neath.—November 25th. Small steam coal for a year, for the electricity generating station of the R.D.C. G. H. Thomson, electrical engineer, 12, Green Street, Neath.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Norwich.—November 27th. Two water-tube boilers, for the Corporation Electricity Department. See "Official Notices" November 17th.

Norway.—January 31st, 1912. The Norwegian military authorities in Christiania are inviting tenders for the supply of 100 sets of field telephone apparatus.

Rotherham.—November 30th. Tramway uniforms, for the T.C. W. J. Board, Town Clerk.

Salford.—November 27th. Two 1,000-kw. direct-current turbo-generators, for the Corporation. See "Official Notices" November 3rd.

Electrical equipment of the Infirmary, for the B.G. Lacey, Sillar & Leigh, engineers.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Bangkok.—March 15th, 1912. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. Correspondence and inquiries to Mr. F. B. Shaw, engineer-in-charge, Municipal Electric Power Station, Local Sanitary Department, Bangkok. Tenders must include a sum in respect of import duties, calculated at 3 per cent. on the value c.i.f. Bangkok of all plant and materials. A copy of the specifications, &c., may be seen by British contractors at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Spain.—December 6th. Tenders are being invited by the municipal authorities of Pedro Bernardo (province of Avila), for the concession for the electric lighting of the town during a period of 20 years.

Tenders have just been invited by the municipal authorities of Amusco (province of Palencia) for the concession for the electric lighting of the town during the period of 10 years.

Trimdon Grange (Co. Durham).—December 9th. Electric fittings for a year, for Walter Scott, Ltd., Trimdon Grange Colliery; the Storekeeper.

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. For further particulars, see this column for October 27th.

Warrington.—November 28th. Low-tension cable, for the Corporation Electricity Department. See "Official Notices" November 17th.

West Ham.—December 4th. Electric light installation at the Gainsborough Road Schools, for the Corporation. See "Official Notices" November 10th.

CLOSED.

Atherton.—The D.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for about 880 yards of concentric high-tension paper-insulated lead-sheathed cable, also that of Messrs. Hanchett, Barrett & Co., for two transformers.

Australia.—According to the *Australian Mining Standard*, the following contracts have been placed by the Government Departments mentioned :—

Queensland.—Postmaster-General :
3,520 yards of lead-covered cable, at £360 per mile.—W. T. Henley's Telegraph Works Co., Ltd.
1,070 conduits at 3s. 8d. each, and 864 conduits at 2s. 8d. each.—James Campbell & Sons, Ltd.
70 miles tinned copper wire, No. 20 s.w.g., at £2 19s. 6d. per mile.—Armorduct Manufacturing Co.
90 miles twisted pair wire, at £22 per mile; 80 miles twisted pair wire, tinned annealed copper, at £17 7s. 6d. per mile; 20 miles tinned copper wire, at £8 4s. 6d. per mile.—W. T. Henley's Telegraph Works Co., Ltd.
1,700 wall telephones, at £2 11s. 6d.; 250 table telephones, at £2 18s. 3d. each; 200 wall magneto telephone sets, at £2 16s. each.—James Paton & Co.

South Australia.—Postmaster-General :
100 cast-iron covers and frames for manholes, at £1 15s. each.—R. Kennedy and Sons.
1,500 conduits at 4s. 4d. each and 11,800 at 2s. 10d. each, and 9,000 pipes at 10d. each.—G. R. Marks.

Tasmania.—Postmaster-General :
5 miles of wire at £14 13s. per mile, and 30 miles at £7 1s. per mile.—Armorduct Manufacturing Co., Ltd.
5 miles of wire at £22 5s. per mile, 5 miles at £12 15s. per mile, and 5 miles at £24 10s. per mile.—W. T. Henley's Telegraph Works Co., Ltd.
2,000 insulators at 3d., and 10,000 at 5d. each.—Dalgety & Co., Ltd.
1,000 insulators at 5d. each.—Western Electric Co. (Australia), Ltd.

Victoria.—Postmaster-General :
21,120 glazed earthenware conduits, £2,298.—Mills & Co.
55 tons of hard-drawn copper wire, £3,765.—Gibbs, Bright & Co.
5 miles of telegraph cable, lead-covered, paper-insulated, 50 lb. per mile, £1,180.—Callender's Cable and Construction Co.
Department of Public Works (State Shipbuilding Yard) :
Electrical generating plant. £5,074.—Gardner, Waern & Co.
Three-ton electric crane, £1,479.—Babcock & Wilcox.
One motor-generator and accumulators, at the Central Telegraph Office, Melbourne. £450.—T. K. Steanes.
Supply of wire. £3,494 15s.—W. T. Henley's Telegraph Works Co., Ltd.
Automatic switchboard, £14,293.—Automatic Telephones (Australasia), Ltd.

Belgium.—Ten concerns—seven German, two Belgian nd one Austrian—last week submitted tenders to the municipal uthorities of St. Gilles-lez-Bruxelles for the supply of 5,000 metres f electric armoured cable, the lowest being that of Messrs. Felten nd Guilleaume, of Mulheim-am-Rhine.

Condensing Plant Contracts.—Amongst the orders ecently received for steam condensing plant by the Mirrlees Watson o., Ltd., are the following :—

Surface Condensing Plants.
One set for Messrs. Bolckow Vaughan's Steel Works, Southbank. (This makes the tenth set supplied.)
One condenser for Wesselton Mine, De Beers Consolidated Mines, Ltd., Kimberley.
Two sets for Carron Iron Works per the British Thomson-Houston Co., Ltd.
Two sets for Elliott's Metal Co.
Plant for Messrs. Ransomes & Rapier, Ltd.
Plant for Bradford Colliery, per British Thomson-Houston Co., Ltd.
Plant for Wigan Coal and Iron Co., per Messrs. Fraser & Chalmers, Ltd.

Jet Condensing Plants.
Plant for Nobel's Explosives Co., Ltd., Stevenston, per Messrs. Jas. Howden and Co., Glasgow. (Repeat order.)
Plant for Empress Mills, Nagpur, per Messrs. D. Adamson & Co., Dukinfield.
One Mirrlees-Leblanc plant for Mr. Edouard Bataille, Paris.
One Mirrlees-Edwards air pump for London Electric Supply Corporation, Deptford.

Dundee.—Messrs. G. H. Nicoll & Co. have secured the ectrical contract in connection with a new school at Broughty rry.

G.W. Railway.—The G.W. Railway Co. have again cepted the tender of Messrs. Jones Bros. (West Bromwich), Ltd., r refined Trinidad bitumen for the next 12 months.

Hereford.—The T.C. has accepted the tender of Messrs. m. Cory & Son for 500 tons of Welsh small coal for the electricity orks, at 10s. 6d. per ton.

Horsham.—The U.D.C. has decided to accept the tender a Manchester firm for cables, at £295, in preference to one for viss cable at £265. The next lowest tender for foreign cable was 315, and those for English-made cable ranged from £354 to £390.

London.—L.C.C.—The Highways Committee received e following tenders for static transformers and switchgear for e new sub-station to be erected at Vauxhall :—

Static Transformers.

British Westinghouse Elec. and Manf. Co., Ltd.	(recommended)	£2,772
British Electric Transformer Co., Ltd.		2,803
General Electric Co., Ltd.		2,875
British Thomson-Houston Co., Ltd.		3,065
Dick, Kerr & Co., Ltd.		3,129
W. E. Burnand & Co.		3,388

High and Low-Tension Switchgear.

Switchgear & Cowans, Ltd.	(recommended)	5,080
Johnson & Phillips, Ltd.		6,194
A. Reyrolle & Co., Ltd.		6,399
General Electric Co., Ltd.		6,498
Spagnoletti, Ltd.		6,821
Electric and Ordnance Accessories Co., Ltd.		6,951
Electric Construction Co., Ltd.		7,408
Siemens Bros. Dynamo Works, Ltd.		7,450
Ferranti, Ltd.		8,079

BATTERSEA.—The B.C. has accepted an offer from Messrs. Whipp d Bourne to supply four circuit-breakers, at a cost of £34.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

Admiralty, Contract Department.
Incandescent lamps.—Edison & Swan Co., Ltd.; General Electric Co., Ltd.

War Office.
Magnetic compasses.—James J. Hicks; Short & Mason, Ltd.
Works services: installation of electric light at Guadeloupe and Martinique Barracks, Bordon.—J. B. Saunders & Co., Ltd.
Ditto, at St. Lucia Barracks, Bordon.—G. E. Taylor & Co.
Overhead conductors, supports, feeders, &c., for electric light, Bordon Camp.—J. B. Saunders & Co., Ltd.

India Office, Store Department.
Apparatus.—Elliott Bros.
Backs, &c.—Bullers, Ltd.
Batteries, &c.—Tudor Accumulator Co.
Cable.—Siemens Bros. & Co.
Fans.—Veritys, Ltd.
Generating sets.—Laurence, Scott & Co.
Insulators.—Bullers, Ltd.
Telephone sets, transmitters, &c.—Peel-Conner Telephone Works, Ltd.

General Post Office.
Fire-alarm apparatus.—A. C. Brown.
Protective apparatus, distributing fuseboards.—Johnson & Phillips, Ltd.
Heat coils, &c.—British L. M. Ericsson Manfg. Co., Ltd.
Protectors, &c.—British L. M. Ericsson Manfg. Co., Ltd.; International Electric Co.
Telephone bells.—British L. M. Ericsson Manfg. Co., Ltd.; W. Maxwell and Co.; Spagnoletti, Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.
Generators.—Siemens Bros. & Co., Ltd.
Plugs.—British L. M. Ericsson Manfg. Co., Ltd.
Switchboards.—British Insulated and Helsby Cables, Ltd.; British L. M. Ericsson Manfg. Co., Ltd.; Western Electric Co., Ltd.
Telephones.—British L. M. Ericsson Manfg. Co., Ltd.
Repair of telephones.—National Telephone Co., Ltd.
Transmitters.—Peel-Conner Telephone Works, Ltd.
Paper-core cable.—Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Morse telegraph paper.—Waterlow & Sons, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co.) and Smiths, Ltd.
E.L., I.R., vulcanised wire and cable.—British Insulated and Helsby Cables, Ltd.
Flameproof wire.—C. MacIntosh & Co., Ltd.
Electric lighting, Belfast Head P.O.—Craig & Paton.
Local telephone exchange equipment, North Shields Head P.O.—British Insulated and Helsby Cables, Ltd.

Keighley.—The Electricity Committee has accepted the tender of Messrs. Robson & Co., Sheffield, for a coal elevator, screw conveyor and haulage plant, at £376.

Largs.—The T.C. has accepted the offer by Messrs. Heenan & Froude to erect a two-feed refuse destructor at a cost of £2,897.

London.—Hammersmith.—The Council is purchasing from the British Electric Transformer Co., Ltd., two 250-kw. and two 75-kw. transformers, built as show transformers for Olympia Exhibition, for £330, plus eight existing old transformers of 194 kw. (estimated at £58 as scrap), which, in consequence of the change-over from arc to incandescent lighting in the main streets, are unsuitable for the ordinary supply circuits.

Lowestoft.—The T.C. has accepted the following tenders for supplies to the Tramways Department :—

Noble & Hoare.—Varnish, at schedule prices.
Stern, Sonneborn & Co., Ltd.—Car grease, 13s. 6d. per cwt.
Hadfield's.—24 rolled-steel tires, £1 18s. 9d. each.

The E.L. Committee has accepted the following tenders :—

P. Moir, Crane & Co., Ltd.—Cylinder oil, 1s. 10½d. per gallon.
Vacuum Oil Co.—Crank-chamber oil and dynamo oil, 1s. 4d. per gallon.

New Zealand.—Auckland.—City Council :—

Underground cables, £10,730; overhead cables, £546.—Noyes Bros. (Sydney), Ltd.
Feeder pillar-boxes, £280.—National Electrical and Engineering Co., Ltd.

Gisborne.—Borough Council :—

Electrical plant, switchboards and motor pumps.—British General Electric Co., Ltd.

Sandown.—The Council has accepted the tender of the Isle of Wight Electric Light Co. for public lighting for three years, at £601 15s. per annum.

Smethwick.—The T.C. has accepted the following tenders for the equipment of the depôt in Rolfe Street :—

Sisson & Co., Ltd.—Steam dynamo (120 kw. at 250 volts), complete with Sisson patent engine, rheostat, separator, &c., £797.
British Thomson-Houston Co., Ltd.—Three-panel switchboard, £104; D.C. 8-15-h.p. 250-volt motor, £39 18s.; D.C. 4-3-h.p. 250-volt motor, £15.
Mr. H. W. Ludlow, Smethwick.—Wiring, £343; fittings and lamps fixed, £203.

Carbide in Australia.—A company entitled the Carbide Manufacturing Syndicate, Ltd., is being formed in Sydney for the purpose of manufacturing calcium carbide. It is intended to erect two electric furnaces of the intermittent type, one only being used and the other kept as a stand-by. Tenders have been called for the power plant, which will consist of a 175-B.H.P. suction gas engine and producer plant, and single-phase electric generator.—*Australian M. and E. Review.*

FORTHCOMING EVENTS.

Physical Society.—Friday, November 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Maximum Value of the Electric Stress between Two Unequal Spherical Electrodes," by Dr. A. Russell; "The Magnetic Transition Point of Cementite," by Messrs. S. W. J. Smith, W. White and S. G. Barker, and other papers.

Institution of Electrical Engineers (Scottish Local Section).—Friday, November 24th. At 8 p.m. At 207, Bath Street, Glasgow. Special meeting to discuss the revision of the articles of association.

Institution of Electrical Engineers (Newcastle Local Section).—Friday, November 24th. At 7.30 p.m. At the Armstrong College, Newcastle. Special meeting *re* proposed new articles of association.

Monday, November 27th.—At 7.30 p.m. At the Armstrong College. Paper on "The Principles of Radio-Telegraphy," by Mr. Sorensen.

Manchester Association of Engineers.—Friday, November 24th. At 7.30 p.m. At the Grand Hotel, Manchester. Paper on "Coal-Cutting Machinery," by Mr. W. Bolton Shaw.

Labour Co-Partnership Association.—Saturday, November 25th. At 3 p.m. At New Masonic Buildings, High Street, Oxford. Paper on "Labour Unrest and Labour Co-Partnership," by Mr. Aneurin Williams.

Institution of Civil Engineers.—Tuesday, November 28th. At 8 p.m. Paper on "Electric Lighting of Railway Trains: the Brake-Vehicle Method," by Mr. R. T. Smith.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 28th. At 7.30 p.m. At the University, Manchester. Paper on "Automatic Reversible Boosters," by Mr. R. Rankin.

Institution of Electrical Engineers (London Students' Section).—Wednesday, November 29th. At 7.45 p.m. At the Institution. Paper on "Some New Zealand Electric Plants," by Mr. A. E. E. Cheal.

Northampton Institute Engineering Society.—Friday, December 1st. At 5.45 p.m. At the Institute. Open debate on "The Prospects of the Technical *v.* Practical Man."

Association of Engineers-in-Charge.—Saturday, December 2nd. Social. Dance.

Society of Engineers (Inc.).—Monday, December 4th. At 7.30 p.m. At the Institution of Electrical Engineers. Paper on "The Design of Tall Chimneys," by Mr. H. Adams.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following orders are issued:—

Monday, November 27th.—"A" Company. Work same as last week.

Tuesday, November 28th.—"B" Company. Work same as last week.

Wednesday, November 29th.—Gymnastic classes, 7 to 10 p.m.

Thursday, November 30th.—"C" Company. Lecture by Major J. H. S. Phillips, 7 to 8 p.m. Technical work, 8 to 10 p.m.

Friday, December 1st.—"D" Company. Same as for "C" Company.

Saturday, December 2nd.—"D" Company. Mobilisation week-end run at Coal House Fort, Gravesend. Train leaves Fenchurch Street Station, L.T. & S. Railway, at 3.10 p.m. Dress:—Service dress, putties, great-coat, belt and haversacks will be worn.

Saturday and Sunday, December 9th and 10th.—"A" and "B" Companies. Mobilisation week-end run at Dover. Train leaves Victoria Station, L.C. & D. Railway, at 1.30 p.m. Dress:—Same as for "D" Company above.

(Signed) J. H. S. Phillips, Major,
For Officer commanding London Electrical Engineers.

NOTES.

The Tilling-Stevens Petrol-Electric 'Bus.—On Monday last we were present at a demonstration of the Tilling-Stevens petrol-electric 'bus in Kingsway, which was followed by a largely attended luncheon at the Holborn Restaurant, when the chair was taken by Richard Tilling, Esq., chairman of the well-known 'bus company which bears his name. As to the vehicle itself, we cannot add much to the illustrated description given in our issue of June 23rd, 1911, pp. 986 and 1003, and the favourable comment which an extended trial of this vehicle enabled us to give.

The London 'bus problem is mainly a financial one, and the fact that the petrol-electric vehicle above mentioned has been adopted by Messrs. Tilling—who are placing at least 150 of them on the London streets during the next 12 months—in preference to the modern petrol gear-driven type of 'bus sponsored by the London General Omnibus Co., is probably more convincing testimony to its efficiency than any amount of argument can be. We are aware that the working costs of the now well-known "B" type 'bus of the L.G.O. Co. are on a most economical basis at the present time, but we believe that the Tilling-Stevens vehicle will, in view of the experienced gained so far, show even better results than are understood to stand to the credit of the first-mentioned 'bus.

In proposing the toast of the motor-'bus industry, at the luncheon, Mr. Richard Tilling reviewed the history of the London omnibus, and claimed, contrary to the commonly accepted idea, that the taxation per passenger was heavier in the case of the motor-omnibus than the tramway. His company had decided to build a large number of Tilling-Stevens petrol-electric vehicles, and in order to meet these requirements and numerous other inquiries, premises covering 34 acres in the Midlands had been acquired, and Messrs. W. A. Stevens & Co. were removing their establishment from Maidstone to the new works. Mr. Daniel Duff (L.G.O. Co.), in replying, emphasised the necessity for uniformity in 'bus design; there were 10 or 12 different types of vehicle in use by his company, and something like 16,000 spare parts had to be handled.

Various toasts followed, amongst the speakers being Mr. W. A. Stevens, Prof. W. C. Unwin (President of the Institution of Civil Engineers), Mr. Louis Brennan, Col. Crompton, and Mr. W. M. Mordey. Mr. P. H. Frost Smith, chief engineer to Messrs. Tillings, gave some interesting figures connected with omnibus working. A few years ago when various types of motor-'bus were employed the average cost worked out at 10½d. per mile run, while the earnings averaged only some 11d. per mile run. The most recent petrol-electric vehicle of Messrs. Tilling operated for under 7d. per mile, exclusive of depreciation, and a fleet of these vehicles should not cost more than 7½d. per mile, with all charges included. The great saving was in maintenance, which amounted on the average to 3·3d. per mile with the older type 'bus, but only came to 1·25d. per mile with the latest type. Such 'buses could safely be depreciated over a period of 10 years. He emphasised particularly the proved reliability of the petrol-electric vehicle, which owing to the ease of inspection and repair, eliminated the night work in the sheds, which was a necessity with the ordinary petrol gear-driven 'bus.

Readers who have followed our earlier articles on the Tilling-Stevens 'bus will have gathered that it represents a great practical advance in passenger road vehicle construction, and the fact of it pending commercial development on an extensive scale augurs well for the future of petrol-electric traction.

The London Electrical Engineers' Club.—The members of this Club held their first annual dinner at the Café Monico on Saturday evening last. This organisation is the Sports Club recruited amongst the members of the Electrical Engineers' Corps of the Territorial Force, and this function replaced the annual dinner hitherto held under the auspices of the Corps. After a reception by the officer in command of the Corps (Lieut.-Col. Leaf), dinner was served for about 200 members of the Club and their friends. In addition to the officers, Col. R. E. Crompton, C.B., who has recently been appointed honorary colonel of the Corps, Col. L. C. Jackson, C.M.G., R.E., Lieut.-General Sir Alfred Keogh, K.C.B., LL.D., and Prof. Dalby, of the Central Technical College, were present.

After the usual loyal toasts, Col. Jackson proposed the toast of "The Corps," and remarked on the need there was in our home defence as well as in our regular forces for the use of brains. He felt that the value of a corps such as the Electrical Engineers consisted in their willingness to contribute their special knowledge to the common good. He was aware of their record through the Boer War, and felt sure that should the need arise, what had been done once would be done again. Lieut.-Col. Leaf, in reply, pointed with satisfaction to the fact that the War Office had at last found a definite place in the Territorial Force scheme for the corps. For a long time they had been under the fear that eventually they would be disbanded and absorbed into other units. It had now been definitely arranged that they were to be responsible for the searchlights at five important ports, and there was little doubt but that eventually their duties and responsibilities would increase. He was also glad to be able to say that their old friend and late commander, Col. Crompton, had been appointed Hon. Colonel of the corps, succeeding in that position the late Lord Kelvin.—Col. Crompton said how glad he was to accept the post, and it kept in being a tie which had always given him a great deal of pleasure.

The distribution of the various challenge shields and prizes gained in the various sports competitions of the year then took place, "C" Company (Capt. Edgcumbe) winning by far the largest number. The toast of "The Visitors" was proposed by Capt. Rich (the hon. sec. of the club), and responded to by Lieut.-General Sir Alfred Keogh, K.C.B., and Prof. Dalby, and a very pleasant evening was then brought to a close. We are glad to hear such good accounts of the progress of the corps; at present it is of full strength, but there are, no doubt, many electrical engineers who would like to join. Full particulars can always be obtained on application at the headquarters of the corps, 46, Regency Street, Westminster.

Foreign Languages, or Esperanto?—Referring to Mr. J. F. C. Snell's advice to the I.E.E. Students at Manchester, to learn French and if possible Spanish, Mr. Max. J. E. Tilney writes suggesting that if, instead of these, Esperanto is studied, much wider scope is given, and a much more easily assimilated language is available. The Esperanto Engineers' Association, with headquarters at Lille, has now been established for some time, and affords the opportunity for interchange of ideas with engineers who, besides Esperanto, speak only such languages as Russian and Hungarian, which are not easily assimilated by the ordinary Briton. Mr. Tilney gives instances within his own knowledge of persons who have been able to converse with strangers speaking foreign languages, with the aid of Esperanto, and mentions that the State of California, which is starting an advertising tour on the European Continent, has orgauised an Esperanto Commission to deliver lectures on California in most of the large cities on the Continent with gratifying results. Esperanto has been added to the regular teaching in the schools in many of the American States and in many European countries, while in South America, which was probably the part of the world Mr. Snell had chiefly in mind, the language is daily becoming more widely used, and Mr. Tilney has himself utilised it in correspondence with a firm in Venezuela.

Electric Portable Lamps in Mines.—At the first annual dinner of the Scottish branch of the National Association of Colliery Managers, held in Edinburgh on Saturday evening, Mr. Wm. Walker, Chief Inspector of Mines for Scotland, referred to the question of the early introduction of electric portable lamps into mines. During the past year alone, he said, they had had in Scotland no fewer than 12 fatalities caused by the ignition of gas, 11 of which occurred in naked-light pits. During the same period 94 burning accidents had occurred, and in every instance it was an open-light pit which was affected. In the present controversy as between safety and open lamps, the claims of the electric portable lamp—a most practical proposition—were being entirely overlooked. He knew of one mine where 2,000 of these electric lamps were in daily use, and he looked forward not only to an improvement in these lamps, but to a more general use of them in the near future.

Labour Union Intimidation.—We are asked to state that, as a practical step towards protecting employers and their willing workpeople against molestation and intimidation by labour union pickets during disputes and strikes, the Liberty and Property Defence League has organised a system of counter-picketing, and can supply at short notice adequate numbers of trained men, who have served in the naval, military and police forces, for the purpose of resisting the tyranny of the unions. The League is prepared to send fully-experienced ex-police officers to provincial centres to locally organise special police protection, and by prompt action make the freedom of labour safe and the rights of employers secure. Employers and others who desire to avail themselves of the services of the League in this respect are requested to communicate with the Secretary, 25, Victoria Street, London, S.W.

Parliamentary.—Rapid Transit.—Mr. W. Thorne asked the President of the Board of Trade whether he had received the report upon the Adkins Lewis system of rapid continuous transit; and whether the Government would consider the advisability of constructing such a system through the east end of London with a view to providing a remedy for the ever-increasing overcrowding of trains. Mr. Buxton replied that the Board of Trade are acquainted with the principle of the system referred to, which requires all passengers to enter and leave the cars whilst in motion. No railway constructed on this system is in actual working in any country, and considerable practical experience would be necessary before sanction could be given for the opening of a line of this description for the public conveyance of passengers.

Income-Tax and Depreciation.—Mr. Snowden calls attention to the resolution passed by the Associated Chambers of Commerce, pointing out several hardships and inequalities of the present income laws as to allowances for depreciation on buildings, machinery and wasting assets, and asks if a Committee will be set up to inquire into the whole question of a revision of the Acts which regulate the income-tax. Mr. McKinnon Wood says that the points raised are under consideration, but he is unable as yet to say whether the time has come to set up another Committee to inquire into them.

In the House of Lords on Monday the Telegraph (Construction) Bill passed through Committee and was reported: the Pacific Cable Bill also passed through Committee unamended and was reported.

Electro-Hydraulic Steering Gear.—While running her trials on the Firth of Clyde, and on her way round to the Thames, special tests were made of the installation of alternative or auxiliary steering gear of the electro-hydraulic type devised by Dr. H. S. Hele-Shaw and Mr. F. Leigh Martineau, and made by Messrs. John Hastie & Co., Greenock, with which the steam steering gear is supplemented, on board the new Orient liner *Orama*. Either type is capable of steering the ship at full speed, and the two are worked from the bridge through the same steering wheel and telemotor, either being used as desired. In the trials it was found that the gear could be easily shipped without slowing down the main engines or interfering with the vessel in any way. The power required to steer the vessel on a course was only a little over 2 H.P. This represents a great saving in a vessel of the size of the *Orama*. The absence of the lost motion between the steering wheel on the bridge and the rudder was exceedingly marked, and it was found that a very much smaller amount of motion of the steering wheel was required. Two gears of the new type have been supplied to the Austrian Lloyd for use on their new steamers *Wein* and *Helouan*, and Messrs. Hastie have three sets in hand for vessels to be propelled by Diesel engines. A first or demonstration installation has been in use on board the steam yacht *Albion* for about 18 months.

Electrical Trades Union.—On November 14th the London (West) branch held the second of its series of winter lectures. The lecturer on this occasion was Mr Forster, of the Anti-Socialist Union, taking for his subject "Socialism and Trade Unions," which provided an animated discussion adverse to the lecturer. There was a large attendance, and 17 new members were added to the ranks. Applications regarding membership should be sent to Mr. W. J. Webb, 98, Coomer Road, Fulham, S.W.

"Northampton" Past Students.—A reunion of this Association will be held on Saturday, December 2nd, at the Food Reform Restaurant, Holborn. The function will take the form of a whist drive and social, and in the interests of a successful gathering, it is hoped that every "Northampton" man will endeavour to be present. Tickets (ladies' and gentlemen's) of Mr. J. C. Rennie, 28, Oxford Road, Putney, S.W.

Automatic Telephony.—On Wednesday last a demonstration of the automatic telephone system was given by the British Insulated and Helsby Cables, Ltd., who have acquired the patent rights of the Strowger system for this country and the British Colonies. We understand that the company has taken this step only after the most mature deliberation and painstaking investigation, and that, in the opinion of the general manager, Mr. Dane Sinclair (who, as our readers will remember, was formerly engineer-in-chief to the National Telephone Co., Ltd.), the system in question is now capable of meeting all possible demands upon it. Mr. A. Brooker, electrical engineer to the company, shares this view, and the directors have determined to embark upon the manufacture of the apparatus on the largest scale, in the confident anticipation that the system will come into general use, to the supersession of the manual system. The experimental automatic exchanges which have been installed by the Post Office at Epsom and in their own building, are of the Strowger type, and we are informed that the Post Office authorities have expressed their definite intention to adopt automatic telephony. This, if confirmed, must be regarded as an extremely important statement, fundamentally affecting the whole future of the British telephone service.

The system is owned by the Automatic Electric Co. in America, and has proved highly successful in operation; already more than 300,000 telephones are in use in connection with it in the United States and Canada, and in Chicago alone 30,000 have been installed, in competition with the Bell Co.'s service. We recently published a lengthy abstract of a paper read by Mr. W. Aitken before the Institution of Electrical Engineers (Electrical Review, June 23rd and 30th, 1911), in which the system was fully described; we need not, therefore, go into details here regarding the mechanism. Suffice it to say that the operator at the exchange is totally eliminated; one subscriber calls another by an extremely simple operation, and either connection is effected within a few seconds, or the "engaged" signal is given to the calling subscriber, thus putting an end to that waste of time which is so characteristic of any manually-operated system, and is the bugbear of the telephone engineer. Only in the case of trunk calls are the services of an operator required.

It is claimed that the reduction in the cost of the service is so great, and the saving of time on the junction lines so considerable, that the adoption of the automatic system renders possible an unlimited service at a low cost, instead of the "measured rate" which is indispensable to the successful commercial operation of the manual system on a large scale. It is round this question of working and maintenance cost that the battle between the automatic and manual systems has raged; we are assured that though the original cost of the automatic equipment is necessarily greater than that of the manual, the running costs are far lower. Absolute secrecy is also a feature of the automatic, and the system can be worked in conjunction with private branch exchanges, manual exchanges, extension telephones, "coin in the slot" telephones, &c.

This new venture of the British Insulated and Helsby Cables, Ltd., is certainly of exceptional interest, and we wish it all success.

The Individual Drive of Textile Machinery.—In connection with our article in last week's issue on the above subject, Messrs. Wright & Wood, Ltd., of Halifax, write to say that about a year ago they put down 60 15-H.P. three-phase motors for driving a doubling mill in Yorkshire, and that this is as far as they know the only English mill designed entirely for individual driving from the commencement, and which depends solely for its power on an outside source (the Yorkshire Electric Power Co.).

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At a meeting of the East of Scotland branch held in Dunfermline, a paper was read by Mr. C. Augustus Carlow, Fife Coal Co., on "The Lessons to be Learned from the Electrical Mining Accidents in Scotland in 1910." The author said that of the total number of fatal accidents during the year, namely, 209, the five due to electricity gave a percentage of only 2·4. The five fatalities—two being in connection with cables, and three occasioned by switchgear—occurred with medium-pressure three-phase current. High-pressure could do nothing worse, and he believed that high-pressure would ultimately be regarded as the safer in situations where its use was permitted.

At a meeting of the West of Scotland branch at Glasgow, on 17th inst., the Branch President, Mr. A. Anderson, Motherwell, inaugurated a discussion on the subject of examinations, with special reference to those promoted by the Association. He stated that service certificates would not be issued after June of next year. An animated discussion followed.

Institution of Electrical Engineers (Scottish Local Section).—At the opening meeting of the current session, held in Glasgow on November 14th. Mr. F. A. Newington, chief engineer of Edinburgh Corporation Electricity Department, delivered his inaugural address as chairman. He said that two exhaust steam turbines, each driving a D.C. generator of 1,200 KW., had been installed at Edinburgh, and had increased the output by 77 per cent. for the same steam consumption; they showed an average saving of 22 per cent. in the coal bill and 54 per cent. for water, oil, stores, &c. He thought that if lamp makers would concentrate on the improvement of lamps from 30 C.P. upwards, they would be performing a more useful service than by trying to produce lamps of low candle-power. The maximum demand system was weak, in that it did not indicate when the maximum demand was taken. Mr. Lackie had devised a very simple system for heating and cooking supplies in domestic premises. From previous records he was able to tell the average consumption for lighting, and energy consumed beyond that was charged at 1d. This obviated the installa-

tion of a separate meter or separate heating circuits. Mr. Newington urged that the hiring powers enjoyed by gas concerns should be extended to electricity supply undertakings. Speaking of the low profits earned by British manufacturers of electrical machinery and apparatus, he pointed out that such plant could now be bought at one-fourth of what it cost 15 years ago. Dealing with labour troubles, Mr. Newington argued that the present fiscal system handicapped British manufacturers. If capital could not be profitably invested in the home market, it would inevitably go where it would have a better return. With regard to recent unrest and the need for generating stations to be guarded by military, the speaker recalled that "The Conspiracy and Protection of Property Act," of 1875, made it a penal offence for any person employed in gas or water undertakings to break a contract of service, should such breach of contract interfere with the supply of gas or water. It was the duty of the Institution to get this Act amended to cover electricity.

Physical Society of London.—At the meeting on November 10th, 1911, Prof. Silvanus P. Thompson and Prof. E. G. Coker exhibited two reflecting polariscopes for the study of optical stress in materials. Various experiments on surface tension were exhibited by Mr. C. R. Darling. A paper on "The Effects of Holes and Semicircular Notches on the Distribution of Stress in Tension Members," was read by Prof. Coker. Prof. Silvanus P. Thompson exhibited a large harmonograph for inscribing on a moving ribbon of paper the harmonio movements produced by compounding together mechanically the oscillations of two heavy pendulums. He also described his apparatus (shown in operation in the laboratory) for demonstrating the physiological effect of an alternating magnetic field, and demonstrated several experiments in acoustics.

Northampton Institute Engineering Society.—On Friday, November 17th, Mr. A. H. Perret read a paper before the above society on "The Design of Electric Power Stations." The object of this paper was to suggest certain rearrangements of plant in order to economise space. The author first dealt with some of the modern additions to power house equipment, going somewhat fully into the question of aluminium *v.* copper for the conductors in the station itself. After dealing with these additions to plant, the paper proceeded to describe various power stations in different parts of the world. From these certain deductions and suggestions were made for the design of power stations. The paper concluded with a discussion on the use of ice-making machinery for improving the load factor on the plant, and the author suggested the application of this principle to electrochemical and electrometallurgical processes. The paper was followed by an interesting discussion.

Institution of Electrical Engineers (Yorkshire Local Section).—A meeting was held on Monday evening, at which Mr. R. Hammond and Mr. J. E. Kingsbury were present as representing the Council, to discuss the new Articles of Association. It was decided to ask the Council to defer the question for a period of 12 months.

Dublin Local Section.—A meeting was held on November 14th to discuss the new Articles, and 60 per cent. of the Corporate Members in the Section signed a list of opinions adverse to the proposals.

Newcastle and Glasgow Local Sections.—Special meetings are to be held to-day to discuss the new Articles.

Birmingham Local Section.—A special meeting was held on Wednesday to discuss the new Articles with Members of the Council. An unofficial meeting had been held on October 31st, at which resolutions on the subject were passed.

Institution of Electrical Engineers (Scottish Students).—A paper on "Electric Clocks" was recently read to the members of the Scottish Students' Local Section by Prof. Magnus Maclean, of the Glasgow Technical College.

Northampton Polytechnic Institute.—The annual prize distribution, by Sir Wm. H. White, takes place on December 8th, at 7.30 p.m.

Appointment Vacant.—Showroom assistant, for the Birmingham Electric Supply Department (£100). See our advertisement pages to-day.

A Union Defeated.—We are pleased to offer our congratulations to Messrs. W. T. Henley's Telegraph Works Co., Ltd., on having completely frustrated the efforts of Trade Union agitators who, some weeks ago, brought about a strike at the Gravesend works, with the object of securing recognition for the Union. As a result of the company's firm determination, coupled no doubt with the men's appreciation of their past treatment by their employers, the struggle is now at an end, the Union scheme having failed, and Henley's have taken back all but 50 of their former employés.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Last Saturday week, at the Connaught Room, Great Queen Street, Kingsway, the staff of the headquarters of the West Ham Corporation electricity department at 84, Romford Road, foregathered to feast, and present a testimonial to, Mr. W. MacKenzie, late mechanical superintendent of the generating station, Canning Town, on his leaving the West Ham Corporation's employ for that of the Charing Cross and Strand Electric Supply Co., with which undertaking he has taken up the duties of station superintendent at their principal generating station in Marshgate Lane, Stratford. The gathering was presided over by Mr. H. H. Couzens, engineer and manager of the West Ham Corporation electric supply, supported by Mr. W. A. Gilbert, mains superintendent; Mr. F. Farndon, sales manager; Mr. W. F. Edgerton, assistant sales manager; Mr. J. Allan, Mr. MacKenzie's successor (who before going to West Ham was mechanical superintendent at the Glasgow Corporation's Dundas Road generating station), Mr. Seddon, Mr. Bendix and other heads of departments of Romford Road and Canning Town. At the close of the dinner, the chairman presented the goodwill and parting offerings of those present, which took the form of a silver cigarette case, match box and sovereign purse, to Mr. MacKenzie, as slight marks of regard, and wished him success in the sphere of larger responsibility into which he had recently entered. Mr. MacKenzie responded, and in the course of his speech he thanked Mr. Couzens for the many kind bits of advice and guidance which he had received from him during the tenure of his position at Canning Town, and concluded by asking those present to extend to his successor, Mr. J. Allan, all the guidance and assistance that had been given to him whilst in West Ham. Mr. Allan, in a brief speech, acknowledged the kind welcome accorded to him. After appropriate music and harmony (Messrs. J. Smith, H. B. Johnson and F. J. Delves being amongst the contributors), the gathering terminated. Mr. H. B. Johnson carried out the arrangements connected with the function.

According to an Australian exchange, Mr. F. McPhail, works engineer of the electric light department of the Sydney City Council, recently resigned, and a successor was to be appointed at £300 per annum.

Tramway Officials.—Mr. F. J. Ayliffe, the manager of the tramways system in Taunton, has severed his connection with the Taunton company, and he left England on 17th inst. for Melbourne, Australia. Before going to Taunton, Mr. Ayliffe was employed by the Bristol Tram and Carriage Co., Ltd. He was first employed in Taunton as foreman, a position which he held for seven years, ultimately succeeding Mr. Smith as manager. Mr. Ayliffe and his family were the recipients of many valuable presents.

General.—Mr. Fred. E. Hinton, who for the last 3½ years has held the post of superintendent of the Electric and Ordnance Accessories Co., Ltd., at Cheston Road, Aston Manor, Birmingham, and who is leaving to take up a position at the London office of the company's principals, Messrs. Vickers, Ltd., was the guest of the evening at a smoking concert, which was largely attended by the heads of departments, general staff, foremen and outside engineers of that company, and held at the Imperial Hotel, Birmingham, on 13th inst. Mr. J. D. Morrison, secretary and commercial manager, was in the chair, and presented Mr. Hinton with a gold albert, which had been subscribed for by those present. The chairman was supported by Mr. Jacobsen (head of fan department), and Mr. Willmott (assistant works manager). The musical programme was contributed to by the following members of the staff:—Messrs. Bowen, Watt, Garrett, Partridge, Sparrow, Rooke, MacNamara, Downie and Taylor.

The Marquess of Tweeddale, who is prominently associated with a number of the submarine cable companies, is ill with bronchitis

The *Times* states that Prof. Andrew McWilliam, A.R.S.M., M.Met., Professor of Metallurgy in the University of Sheffield, has been appointed by the Government of India to the newly-created post of Metallurgical and Analytical Inspector of Steel in India. We recently published a British Association report by Mr. McWilliam on "The Present Position of Electric Steel Melting."

Mr. J. G. Lorrain, chartered patent agent, has removed from Norfolk House, Norfolk Street, W.C., to Staple Inn Buildings, High Holborn, W.C.

Mr. W. Walter Hughes, after 12 years with the British Westinghouse Electric and Manufacturing Co., Ltd., has terminated his connection with the company, and he will in future devote himself entirely to private practice as an electrical, mechanical and mining engineer, specialising in mining equipments, with headquarters at 5, Dowgate Hill, Cannon Street, London, E.C., and branch offices at Cardiff and Swansea. The style of the business will be Wm. Walter Hughes and Associates. Mr. Hughes occupied the position of assistant sales manager to the Westinghouse Co. in Manchester, and more recently was manager of their plant department. He also occupied the position of the company's manager for South Wales for eight years, and had great experience in connection with the application of electrical power in the coalfields there. Prior to his connection with the Westinghouse Co. he was engineer to Messrs. Crompton & Co., Ltd., and later their manager in Cardiff. Mr. Hughes enters upon his new enterprise with the best wishes of many friends.

Mr. J. Horsnell May has voluntarily resigned his position as chief engineer to the Electrical Power Storage Co., Ltd. Mr. May has been in the service of the company for nearly 19 years in the successive positions of laboratory superintendent and chief chemist, as works superintendent, and finally as chief engineer. Letters should be addressed to 21, Donovan Avenue, Muswell Hill, N.

The J. L. Manufacturing Co., Ltd., having amalgamated with Submersible Motors, Ltd., Mr. T. L. Reed-Cooper, managing director of the J. L. Co., has been appointed managing director of the amalgamated concern, which at an early date will alter its name to Submersible and J. L. Motors, Ltd.

Mr. Philip Monson, who has been for 35 years lighting engineer to the Borough Council of Kensington, has, on medical advice, asked to retire.

Mr. Wm. C. Jeary has left the General Electric Co., Ltd. (vacuum cleaner department), and is now appointed general manager of Magic Appliances, Ltd. (Magic suction cleaner), 6, Farringdon Avenue, E.C. Telephone, "Holborn 6525."

Obituary.—Sir Cuthbert Quilter, Bart.—We regret to record the death of Sir Cuthbert Quilter, which occurred on Saturday last at Bawdsy Manor, Woodbridge, at the age of 71 years. For between 40 and 50 years Sir Cuthbert had been prominently connected with financial affairs in the city and on the Stock Exchange. He was one of the founders of the National Telephone Co., in which he is said to have had a large interest, and he had been connected with the pioneering telephone companies which preceded the National. He remained a director of the National Co. to the last. The deceased baronet was also for some years a director of the Edison & Swan United Electric Light Co., Ltd.

Many of our readers will desire to join with us in expressing sympathy with Mr. Francis Teague, the city electrical engineer of Bath, whose wife passed away recently. Mrs. Teague had had a prolonged illness, from which she recovered somewhat in June last.

NEW COMPANIES REGISTERED.

Romolite, Ltd. (118,626).—This company was registered on November 16th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical machinery, &c., and to acquire and turn to account any invention relating to the production, treatment, storage, application, distribution, manufacture and use of metallic substances, filaments, electricity and any apparatus therefor. The subscribers are:—J. L. Elliot, Capel House, New Broad Street, E.C., mining engineer, 10 shares; A. Bonnin, 22, Royal Avenue, Chelsea, S.W., barrister, 1 share. Private company. The number of directors is not to be less than two or more than seven; the first are J. L. Elliot and A. Bonnin; qualification, one share; remuneration as fixed by the company. Registered office, Capel House, New Broad Street, E.C.

Coverwell, Ltd. (118,596).—This company was registered on November 15th, with a capital of £500 in £1 shares, to carry on the business of manufacturers of the non-conducting material known as "Coverwell." The subscribers (with one share each) are:—F. E. Bristowe, 11, Tothill Street, Westminster, S.W., managing director; V. Parker, 49, Denmark Villas, Hove, director. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered office, 20, Tothill Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical and Engineering Supplies Co., Ltd. (99,423).—Return dated September 12th, filed October 16th, 1911. Capital £1,000, in 950 preferred ordinary shares of £1 each, and 1,000 deferred shares of 1s. each. 610 preferred ordinary and 1,000 deferred shares taken up. £1 per share called up on the preferred ordinary, and 1s. on the deferred. £660 paid. Mortgages and charges: Nil.

Dick, Kerr & Co., Ltd. (63,407).—Return dated October 12th, filed October 17th, 1911. Capital £650,000, in £1 shares (350,000 preference). 305,000 preference and 260,000 ordinary shares taken up. £265,000 paid on 265,000 preference, £300,000 considered as paid on 260,000 ordinary and 40,000 preference. Mortgages and charges: £252,630.

Thos. W. Ward, Ltd. (81,020).—Return dated October 5th, filed October 23rd, 1911. Capital £350,000 in £1 shares (150,000 preference and 200,000 ordinary); 143,884 preference and 183,848 ordinary shares taken up; £147,732 paid on 143,884 preference and 3,848 ordinary; £180,000 considered as paid on 180,000 ordinary. Mortgages and charges: £93,852 13s. 2d.

Nalder Bros. & Thompson, Ltd. (62,214).—Return dated November 8th, filed November 15th, 1911. Capital £22,500 in £1 shares (10,000 preference); 8,236 preference and 11,125 ordinary shares taken up; £9,361 paid on 8,256 preference and 1,125 ordinary; £10,000 considered as paid on 10,000 ordinary. Mortgages and charges: Nil.

United Lighting and Maintenance Co., Ltd. (111,517).—Particulars of £500 debentures, created November 10th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Munster Electric Lighting Co., Ltd. (100,269).—Charges created by Receiver:—Four mortgages, dated October 23rd, 1911, to secure £250, £250, £250 and £50 respectively, charged on company's plant, machinery and electrical equipment and undertaking at Fethard and Callan, Ireland. Holders: J. Hunter, J.P., 20, Fairfield Crescent, Liverpool; R. H. Bindloss, 26, North John Street, Liverpool; J. W. Jones, 70, Victoria Street, Liverpool; and A. Henderson, 24, North John Street, Liverpool.

Foster Engineering Co., Ltd. (94,371).—Return dated July 10th, filed October 18th, 1911; capital, £45,000 in £1 shares: 41,350 shares taken up: £1 per share called up on 16,850 and 15s. per share on 11,500; £25,475 paid, £13,000 considered as paid on 13,000 shares. Mortgages and charges: £7,250.

Imperial Tramways Co., Ltd. (118,981).—Return dated March 9th, filed October 2nd, 1911, capital £400,000 in £10 shares (20,000 preference); all shares taken up; £10 per share called up on 10,000 ordinary; £100,000 paid; £300,000 considered as paid on 10,000 preference and 20,000 ordinary. Mortgages and charges: £330,000.

Cleveland and Durham Electric Power, Ltd. (89,539).—Return dated October 10th, filed October 16th, 1911. Capital £700,000 in £1 shares (350,000 preference); 333,705 preference and 157,640 ordinary shares taken up; £1 per share called up on 331,935 preference and 79,068 ordinary; £111,003 paid; £80,302 (except £6 5s. paid in cash) considered as paid on 1,770 preference and 78,532 ordinary. Mortgages and charges: £312,000.

Anglo-Argentine Tramways Co., Ltd. (25,363).—Acknowledgment of indebtedness dated October 26th, 1911, to secure £1,500,000 (supplemental to trust deed dated June 15th, 1910, securing £1,500,000 5 per cent. debenture stock), and ranking *pari passu* with said stock, power being reserved to the company to issue further debenture stock up to £6,000,000 (including the two said amounts of stock), charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior charges. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Beck Flame Lamp, Ltd. (in liquidation) (92,387).—Mortgage dated November 6th, 1911, to secure £500, charged on certain patents; leasehold messuage and premises at Hayes, Middlesex, and the company's undertaking and other assets, including uncalled capital. Holder: C. W. B. Bridson, Upmeads, Burcott Road, Purley.

English Electrical Co., Ltd. (112,639).—Issue on November 7th, 1911, of £1,000 debentures, part of a series of which particulars have already been filed.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Return dated September 27th, 1911, filed same date. Capital, £50,000 in £5 shares. All shares taken up. £50,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Eastern Telegraph Co., Ltd.

Sir J. Wolfe Barry occupied the chair at the seventy-ninth ordinary general meeting of the company, held at Electra House, E.C., on November 15th. In moving the adoption of the report (see Electrical Review, p. 792), he said that the gross revenue for the half-year amounted to £672,300, against, for the corresponding half-year of 1910, £664,500, or an increase of £7,800. Messages and other receipts had not varied to any great extent, there being a small increase of about £500. The amount received for interest and dividends on investments, &c., showed an increase of £7,300. The total gross revenue for the half-year was the highest they had received for many years; in fact, it had only once been exceeded, and then very slightly. The total expenses for the half-year amounted to £291,300, against, for the half-year to June, 1910, £283,800, or an increase of £7,500. The principal item of increased expenditure was that relating to working expenses at stations, which was £13,800 more than for the corresponding half-year of 1910, and was chiefly due to an increase of £8,700 in salaries and wages, caused by automatic promotions and a slight augmentation in the number of staff, and to a readjustment of the method of payment for overtime and Sunday duty performed by the station staff at home and abroad, by which they materially benefited. Maintenance of instruments had also increased by £3,300, which was mainly due to the supply of new and improved apparatus which would still further increase the carrying capacity of their cables and give greater accuracy. Other items included in this abstract showed minor increases, while others showed reductions, the total increase under the abstract being £13,800. Against this increase there was a reduction of £5,000 in the expenses of negotiations, there having been some special expenses on this account in the half-year to June, 1910, while the expenses attending maintenance of cables were also less this half-year by £1,700. The net result of the half-year's working was practically the same as that for the half-year to June, 1910, there being a difference of only £289 in the net profit when comparing the two half-years, and the result shown might, he thought, be considered satisfactory. When he last addressed them he mentioned that the time was approaching for strengthening their cable system in the Mediterranean and elsewhere, and in furtherance of this object, the board had decided to lay an additional cable between Gibraltar and Egypt, touching at Malta. The cost of this additional cable, about £400,000, would be charged against the general reserve fund, as had been done under similar circumstances in the past. There was a sum of £24,492 charged in respect of a bonus paid to the staff. The directors of the Associated Companies, acting together, decided to celebrate the Coronation of his Majesty King George V by granting a bonus of one month's pay to every permanent employé of the staff ashore and on board ship who had been in the service of the companies, and in receipt of either salary or wages, for at least one year prior to May 31st, 1911. Apart from the special occasion of the Coronation, the directors were much pleased to be able to confer this benefit on the staff, to mark their appreciation of the loyal services which the employés had always rendered to the Associated Companies. In dealing with all questions affecting the welfare of the staff, the directors had always given the fullest consideration to any reasonable representations which the staff might desire to place before them, and when they were satisfied that such appeals were justified by the circumstances of the case, the matter was dealt with in as liberal a spirit as was consistent with the proper interests of the stockholders. This policy had engendered that good feeling which he was glad to say had always existed between the staff and the directors. In granting the additional benefit of the bonus, they felt confident that their action in allowing the staff to share to some extent in the prosperity of the company would receive the hearty approval of the stockholders. After providing for this and for the usual interim dividends, they had been able to make a contribution of £150,000 to the general reserve fund, and to carry forward £49,000. The general and other reserve funds now amounted to £2,452,000, after setting aside £250,000 as a provision on account of investment fluctuations. They had not added any further sum this half-year to the amount already provided, the figure of £250,000 being considered ample having regard to the estimated

reduction in the market value of their reserve fund investments as at June 30th, 1911. When addressing the stockholders a year ago, he referred to a proposal submitted by the British Postmaster-General to the various cable companies interested for the introduction of a reduced rate for deferred telegrams in plain language, and he explained that the Associated Companies had agreed to the proposal in principle, leaving the necessary details to be worked out. Since then the proposal had taken definite shape, and had been considered by the various Governments concerned, and it was expected that the British Postmaster-General would soon be in a position to make an official announcement on the subject. The Eastern Extension and Great Northern Telegraph Companies undertook, about six months ago, to make an advance, at 5 per cent. interest, to the Imperial Chinese Telegraph Administration, to be devoted towards the improvement and development of the telegraph and telephone services in China. As this company was a party to the traffic agreements between the Imperial Chinese Telegraph Administration and the Eastern Extension and Great Northern Telegraph Companies, they had taken their proportionate share in the transaction, and the total amount of this company's share was £125,000. The repayment of this advance was secured by the moneys due by the three companies to the Imperial Chinese Telegraph Administration, and payable from time to time under the existing agreements, The Chinese Imperial Edict authorising the signing of the agreement was officially communicated to, and approved by, the Ministers of Great Britan, Russia and Denmark.

Sir J. Denison Pender seconded the motion.

Mr. C. D. Stacey, speaking as one who had been in the service of the company for 12 years abroad, asked whether means could not be devised which would give each member of the staff down to the humblest able seaman or doorkeeper, a more individual interest in the welfare of the company at all times. They were happily largely free from the general and remarkably spreading unrest which pervaded the ranks of wage-earners throughout the world—an unrest which, in the opinion of competent judges, could only be met by some system of co-partnership. Profit-sharing was good, but it could never have the far-reaching effect of even a modest system of gradual co-partnership in leading every member of the staff to be zealously solicitous of economical working, and of everything which related to the common interest. The amount which would be involved by establishing such a system in their company would not be large. If it were started on a 5 per cent. basis, increasing 1 per cent. per annum to 7 per cent., the initial charge according to the schedules in the report would be about £14,000, or less than one-fifth of 1 per cent. on the capital of the company. It was not for him to suggest methods, but he trusted that the board would entertain the idea and work out a scheme.

The Chairman said that if any development of the idea of co-partnership was seen to be applicable to the working of telegraph companies, he was sure the board would give it consideration ; but, at the same time, he would like to point out that the Associated Companies had gone a very long way at present towards interesting the staff in the success of the company, and no better example could be furnished than what he had told them about giving the whole staff a bonus.

The report was then adopted.

Provincial Tramways Co., Ltd.

The meeting of this company was held on Friday last, at the offices, Moorgate Station Chambers, E.C., Mr. Andrew Beattie, J.P., in the chair.

The Chairman, in proposing the adoption of the report, said that the past year had been one of the best that the company had had in its 39 years' history. The best year was in 1907, but there were exceptional circumstances that year which did not recur in the 12 months they were now dealing with. The very fine summer to some extent helped their receipts. He believed that the company was one of the oldest, if not the oldest, tramway concerns in the country, and although it had had a chequered career, its history had always been one of progress. When he joined the board, about 20 years ago, the net profits were a little over £16,000 ; during the past year they were £36,458. At that time they held tramways in Portsmouth, Cardiff, Plymouth and Grimsby. They sold the two former tramways in 1901 and 1902 respectively, and their annual income was brought down to about £18,000. However, they used the money which they received for the purchase of those lines in the electrification of their other tramways, and they had now got back to the highest earning powers that the company had ever had. They had debentures on which they paid 5 per cent., 6 per cent. preference shares, and this year they were able to pay 7½ per cent. on the ordinary shares. Those results had only been obtained by good management and economy ; and they were all the more creditable when they took into account the very great increase in local rates. In one town they were paying 100 per cent. more in rates than they were some years ago, and that was symptomatic of what was going on all over the country. The assessment of tramway undertakings by local authorities had almost reached the breaking point, and he hoped the authorities throughout the country would bear that in mind, and not kill the goose that laid the golden eggs. During the past year they had obtained an extension of their tramways at Cleethorpes from 1920 to 1930, and as years went on they expected to reap considerable advantage from that extension. They had made an application to the Light Railway Commissioners for an order to extend their lines from Gosport to Lee, on the Solent, and he hoped that when they met next year he would be able to tell them that their application had been granted. They had been paying £1,000 a year for many years to insure against third-party risks, and the board had been looking into the question to see whether it would not be wise for them to set aside a sum each year for that purpose and become their own insurers. For the past three years the cost to the insurance company had only been about £300 a year, while they had paid £1,000 a year, and it was, therefore, worth considering whether it would not pay them better to act as their own insurers.

Mr. S. Hern, in seconding the motion, said that last year, taking advantage of the increase in revenue, the board had set aside £10,000 to reserve and depreciation.

The report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

County of London Electric Supply Co., Ltd.—Further issue of £50,000 4½ per cent. second debenture stock.

The Committee has ordered the undermentioned securities to be quoted in the Official List :—

Cascade Water, Power and Light Co., Ltd.—$285,500 first mortgage 4½ per cent. 33-year sinking fund gold coupon bonds of $500 each, Nos. 22 to 507 and 516 to 600.

Chiswick Electricity Supply Corporation, Ltd.—£80,000 4½ per cent. first mortgage debenture stock.

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 8,011 to 8,110 and 8,198 to 8,297.

Notting Hill Electric Lighting Co., Ltd.—11,402 6 per cent. non-cumulative preference shares of £10 each fully paid, Nos. 2,999 to 14,400, in lieu partly of the 10,852 ordinary shares now quoted.

Bullers, Ltd.—The directors' report for the year ended July 31st last, as printed in the *Financial News*, states that the volume of trade mentioned in the previous report has been maintained, but competition is still very keen. The order books are now very full and prospects are brighter. Large extensions have been completed at the Hanley works, and probably further extensions will have to be made. The accounts show a profit of £9.629, plus £453 brought forward, making £10,083. The interest on the preference shares, £7,500, has been paid, leaving a balance of £2,583. The directors propose to place £2,000 of this to reserve account, making it £48,000, and to carry forward £583.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—A special general meeting of shareholders will be held at Toronto on December 8th, for the purpose of considering and confirming a by-law passed by the directors, to increase the capital stock from $40,000,000 to $50,000,000 by the issue of 100,000 additional shares of $100 each. It is announced that the development and growth of the company's business calls for this increase. Amongst other things the company has purchased the Jacarepagua tramway lines, which are being equipped by the company for electrical operation. It has also acquired the Interurban Telephone Co. which at present is operating in the city of Nictheroy, the capital of the State of Rio de Janeiro, and has direct communication with the company's telephone system in Rio de Janeiro by means of a submarine cable across the Bay. In Rio das Lages power station work is under way for the installation of two additional generators of 16,000 H.P. each, but this will not suffice to meet power requirements within a few years. Important other works have been begun.

British Columbia Electric Railway Co., Ltd.—The directors' annual report was issued yesterday. It shows an increase of 43 per cent. in gross receipts and 34 per cent. in net earnings. Since June the gross earnings have been increasing 45 per cent. and the net earnings 17 per cent. The dividend on the deferred ordinary stock is 8 per cent. for the year.

British Electric Traction Co., Ltd.—On Wednesday an extraordinary general meeting was held, at which the alterations in the Articles and the amended scheme of the directors were confirmed.

Manaos Tramways and Lighting Co., Ltd.—The directors' report for the year ended April 30th, as quoted in the *Times*, says that active construction work by the contractors was completed in June, 1910, but the reconstruction of the lighting system and other improvements carried out by the company's own staff continued for some months after that time, so that the construction works somewhat interfered with satisfactory operation, and delayed final organisation for nearly the whole of the fiscal year. All works originally contemplated are now completed, and better results are being shown. The result of the company's operation for the year was a profit of £30,431, as compared with £18,978 for the preceding year. After providing for London expenses, &c., and debenture interest, there remains £12,446, with £1,583 brought forward, making £14,029. The directors recommend that £10,520 be transferred to accident, contingencies and general reserve, and that £3,509 be carried forward.

United Wire Works, Ltd.—The directors' report for the year ended September 30th, after setting aside £1,500 for depreciation, shows £7,079 available, out of which a dividend of 3 per cent. on the ordinary shares is recommended, carrying forward £621.

R. Hornsby & Sons, Ltd.—After paying the preference dividend (6 per cent. per annum) the directors recommend a dividend on the ordinary and new shares, at the rate of 6¼ per cent. per annum for the year ended September 30th, placing £25,000 to reserve, and carrying forward £3,851.

West India and Panama Telegraph Co., Ltd.

Mr. W. B. Kingsford (chairman) presided at Winchester House, E.C., on Wednesday, November 15th, over the meeting of this company, and in moving the adoption of the report (see Electrical Review, page 792), he said that they had had, as he predicted at their last meeting, a satisfactory half year. On the expenditure side there was an increase of £694. Some of this increased expenditure represented the cost of renewing instruments and maintaining landlines, which two items in the nature of things were always somewhat fluctuating. One item of increased expenditure was incurred by the visit which they instructed Mr. Morell, their general superintendent in the West Indies, to make to their stations. Leaving out Demerara, where he had been a little while before, Mr. Morell made a pretty complete tour of inspection, which occupied a considerable time, and his interviews with Government officials, with many of their leading customers, and last, but not least, with the different members of their staff, coupled with much useful information and various good suggestions with which he furnished them, had proved of great benefit to the company. The total of the items which went to make up the cost of repairs to their cables, was £832 less than for the corresponding year. The traffic receipts were £3,729 in excess of those for the corresponding period. The total figures showed that, including interest on investments and the amount brought forward, they had an available balance of £24,719, which the directors recommended should be dealt with as proposed in the report. Having regard to the great importance to them of maintaining their cables, which were 22 in number, in a state of thorough efficiency, they had wished for a long while to increase their reserve fund, but unfortunately they could not do that whilst the preference dividend continued in arrears. A year ago, when these arrears were cleared off, and they were also able for the first time for 10 years to pay a dividend to the ordinary shareholders, they at once placed £1,000 to reserve. That day, as they had a larger sum at their disposal, they thought it a right and prudent policy to strengthen the reserve fund with something more substantial. After placing £3,500 to the reserve fund, they would carry forward £2,825. They would have noted that the price of sugar of late had considerably increased, and this naturally was having a beneficial effect upon the sugar-growing colonies. This fact, together with the continued good progress made by the oil industry of Trinidad, was duly reflected in their traffic receipts. It was a matter of common knowledge that of late years most securities had been falling in value almost continually, and notably so in some instances in those very securities which had always been counted most stable. As a matter of course, the heavy fall in values had affected them like other people, but he was sure it would give them great satisfaction to know that the total depreciation on their investments in the reserve fund amounted to no more than £3,400, or, to be very precise, £4 3s. 8d. per cent. of their original cost. The traffic receipts for the current half-year down to the end of October, which was their latest return, compared favourably with those for the corresponding period a year ago.

Mr. H. Holmes seconded the motion.

Mr. J. Melvin supported the board in the policy of strengthening the reserve, for in such a company as theirs the first thing to do was to make the house strong. He suggested that as the price of copper was normal at the present time, the directors might make provision for what they would require in the coming year. With regard to the company's investments, he agreed that the list was a splendid one, but seeing that the company had debentures of £80,000, he suggested that it might be well to reduce these, even by selling some of the investments.

The Chairman said they only used copper in their cables, and as a matter of fact, they had ordered some fresh cable. The debentures matured in 1916, and the board considered, taking everything into account, that it was not desirable to take steps at present to pay them off.

The motion was then carried, and a vote of thanks was accorded to the board and staff.

Western Telegraph Co., Ltd.

The meeting of this company was held at Electra House, Finsbury Pavement, E.C., on Wednesday, November 15th. Sir Wolfe-Barry, who presided, said that the message revenue for the half-year ended June 30th last showed an increase of nearly £10,000 over that of the corresponding period of 1910. In making comparisons of the message receipts it must be borne in mind that the tariff with the River Plate and West Coast of America was reduced on June 1st, 1910, by 75 centimes per word, and on March 30th last by a similar amount for telegrams from Brazil. It was also to be remembered that the German cable from the Canaries to Pernambuco had been in operation since March 29th last. The improvement, in spite of the above circumstances, was not due to any exceptional circumstances, but apparently was in consequence of the steady increase in trade and commerce in South America. With regard to the current half-year to date there was a small decrease in revenue, due almost entirely to a slightly lower exchange value of the Brazilian milreis. During the half-year under review there were increased amounts derived from interest on deposits, rents and transfer fees to the extent of £830, but interest on investments was lower by about £8,000, leaving a net increase in revenue from all sources of about £2,500. The reduction in the interest on investments was consequent, as he stated at the last meeting, upon the sale of reserve fund investments during the year 1910 to meet payments for new cables, &c. Although at present their message revenue was being maintained at a satisfactory figure, in spite of the recent large reductions in tariff, it was accompanied by increased working expenses consequent upon the extra traffic carried and the enhanced cost of living in the countries where their stations were situated. These in London were more by £255, at the stations abroad by £10,714, principally under the item of salaries and wages in respect of the new station at Buenos Ayres, an increased number in the staff at other places, and overtime. Maintenance of cables accounted for an increased net expenditure of £7,056, making a total increase of expenses of £18,025. With respect to the increase, he would point out that the cable steamer *Norseman* was in commission for the whole six months, against four in 1910. The *Cormorant* cost more for repairs and docking. Some of their cables between Lisbon and Madeira and St. Vincent were interrupted on five occasions, necessitating the charter of other cable steamers. More cable was used in repairs, and there was a larger depreciation and insurance of cable in stock. Against these increased expenses they were relieved of the cost of the *Cambria*, chartered last year to relieve the *Norseman*. The increases under Abstracts A, B and C, amounted to £18,025, reduced by a smaller expenditure on sundry other items, amounting to £1,609, leaving on balance a net excess of expenses of £16,416. After providing £16,373 for debenture stock interest, and £7,930 for income-tax, there remained a balance of £215,898, plus £30,276 brought forward from December last, making a total of £246,175, out of which sum a bonus had been paid to the staff to commemorate the Coronation of King George V, amounting to £8,613. A quarterly interim dividend, amounting to £31,189, had been paid, £140,000 transferred to the general reserve fund, and £10,000 to the land and buildings depreciation fund. The directors now recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per year, both free of income-tax, which together would amount to £51,982, leaving a balance of £4,390 to be carried forward. The shareholders would perhaps have learned from newspaper reports published recently that a decision had been given in the Brazilian Federal Court in the suit brought by the company for the annulment of the Government decree authorising the laying of submarine cables along the coast of Brazil, which they considered would, if carried out, infringe the rights and privileges which they granted to the company. The judge dismissed the case, considering that the decree was at present a mere authorisation, and on the ground that it contained the express reservation of the rights of third parties, who, in the words of the judgment, "cannot be and are none other than the Western Telegraph Co." The judge also stated that it was open to the company to take further proceedings in the defence of the rights secured by its contract in the event of these being ignored or violated by the carrying out of the decree.

Sir J. Denison Pender seconded the motion.

Replying to Mr. Fuller as to the note in the balance sheet relating to the company having guaranteed certain stock of the West Coast of America Telegraph Co. and the Pacific and European Telegraph Co., the Chairman said they were not likely to be called on to pay any guarantee.

The motion was carried.

Prospectus.—*The Constantinople Telephone Co.*—The subscription list was to close yesterday in an issue of 60,000 ordinary shares of £5 each (£300,000). The objects of the company are already well known to our readers. The concession was granted by the Imperial Ottoman Government for the construction and operation of a general telephone system in Constantinople and its suburbs, as the result of prolonged negotiations conducted by Mr. Herbert Laws Webb. The period of the concession is 30 years, and if the system is not by then bought over by the Government, the period is to be extended by 10 years. The tariff is to be exclusively measured rate, with the exception that there is to be a flat rate for private residences. The Government is to receive a royalty of 15 per cent. on the gross telephone revenue. A plant of 10,000 lines will be installed, capable of extension to a much larger figure. £27,500 is payable to the Telephone Development Co., Ltd., for the expenses of preliminary negotiations and for obtaining the concession. The articles give power to pay 5 per cent. interest on the paid-up capital during the period of construction. The directors of the company are: Stanley J. Goddard, general superintendent of the National Telephone Co., Ltd.; Leon Pissard, Constantinople; D. Sinclair, general manager, B.I. and Helsby Cables, Ltd.; D. Smith, United River Plate Telephone Co., Ltd.; E. Thurnauer, French Thomson-Houston Co., Paris; H. Laws Webb; and F. R. Welles, vice-president of the Western Electric Co., Paris. The consulting engineers are Messrs. Frank Gill and W. W. Cook, engineer-in-chief and assistant engineer-in-chief respectively of the National Telephone Co., Ltd. The head office is Adalet Han, Galata, Constantinople.

Buenos Ayres Lacroze Tramways Co., Ltd.—The directors' report for the year ended June 30th states that the gross receipts were $4,681,319 and operating expenses $2,842,952, leaving net receipts of $1,838,367. After deducting from the net earnings the amounts paid for amortisation and interest on debentures, there remains a net balance of $1,482,944, which (says a financial contemporary) the directors propose to distribute as follows: Five per cent. to the reserve fund, $73,989; 5 per cent. to the directors, $73,989; ½ per cent. to the syndic, $7,398; to fund providing for accidents, $13,000; to special fund for renovations, $306,567; to the shareholders, $911,100; to next year, $96,898. Thus the shareholders will receive $911,100, gainst $750,000 distributed last year.

MARKET QUOTATIONS.

Wednesday, November 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulpbide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£11 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£25 10	£1 10 inc.
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Cblorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Cblorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 10 £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅛d.	¼d. inc.
c ,, Tube (brazed)	,,	9⅜d.	¼d. inc.
c ,, ,, (solid drawn)	,,	7⅜d.	¼d. inc.
c ,, Wire, basis	,,	7½d.	⅜d. inc.
c Copper Tubes (brazed)	,,	9⅝d.	⅜d. inc.
c ,, ,, (solid drawn)	,,	9½d.	⅜d. inc.
g ,, Bars (best selected)	per ton	£73	£1 inc.
g ,, Sheet	,,	£73	£1 inc.
g ,, Rod	,,	£73	£1 inc.
e ,, (Electrolytic) Bars	,,	£60 10	£2 inc.
e ,, ,, Sheets	,,	£76	£1 10 inc.
e ,, ,, Rods	,,	£64	£2 inc.
e ,, ,, H.C. Wire	per lb.	8d.	¼d. inc.
f Ebonite Rod	,,	5/3	..
f ,, Sbeet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percba, fine	,,	5/- to 7/-	..
h India-rubber, Para fine	,,	4/3	1/1 dec.
j Iron Pig (Cleveland warrants)	per ton	47/10½	1/4 inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£16 5 to £16 7 6	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Pbospbor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½.	..
p ,, ,, rolled strip & sbeet	,,	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8⅜d.	¼d. inc.
r Steel Magnet, in bars	per ton	£65	..
g Tin, Block (Englisb)	,,	£196 to £197	£2 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/3	1d. inc.
p Wbite Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£30 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The Britisb Aluminium Co., Ltd.
c Tbos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smitb & Co.
f India-Rubber, Gutta-Percba and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Asbby, Ltd.
l Richard Johnson & Nepbew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Mattbey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE tone throughout the Stock Exchange has become rather more nervous, for which the hint that money rates may stiffen before Christmas is in the main responsible. Moreover, the various meetings of railwaymen on Sunday last were not of a nature to help the railway market, by whose fluctuations a number of other departments are indirectly affected.

After many days—not to say years—the North London Railway is about to be electrified, the North-Western Railway making the announcement at the end of last week. Thus there will be confirmed the anticipations so long current, and a most important link added to the network of electric lines running out to the suburbs. Included in the comprehensive scheme is an extension of the Bakerloo portion of the London Electric Railways. The prophetic eye may well see in these arrangements a possible gigantic combination of suburban transport companies, but this, of course, lies wholly in the future, and its accomplishment could only take place in the teeth of violent opposition from various interested sources.

Metropolitans rose ¼, but Districts fell ½, the former rise being associated with the idea that the Metropolitan line has still plenty of scope for increasing its traffics. District 4½ per cent. Preference rose 2 points, and the 3½ per cent. Guaranteed put on 1. The former stock received its full dividend for the last half-year, and will, no doubt, do so in respect of the coming six months; if maintained, this means a yield of 5 per cent. on the money, and, in view of the energetic management of the District Company, it is considered in the market that the 4½ per cent. First Preference may already be regarded as likely to get its full dividend in the future. The present price carries the dividend due next February. Electric Railway stocks are steady but quiet. Underground Electric 6 per cent. bonds are rather easier.

There has been no fresh development in British Electric Traction issues, the prices of which remain dull. London United Tramways Preference again lost ½, and Metropolitan Electric Preference fell ⅜. On the other hand, Potteries Ordinary are a shade higher. The market for English Electricity Supply shares is firmer than it has been for a long while past, and fresh buyers are coming forward daily. The dealers who for some time have found it profitable enough to go short of shares are a little surprised at the turn which events have taken, and they are not eager to sell except at higher prices. The features this week are the rises of 5s. in Brompton Ordinary and 7s. 6d. in Westminsters—the last-named shares being in scant supply. Several other improvements, however, have taken place, City Ordinary and Preference putting on ⅛ and ¼ respectively, while Charing Cross rose ⅛ and Brompton Preference gained a similar fraction. Amongst the provincials, Bournemouth and Poole Second Preference came in for demand on the good yield obtainable on the shares, and at 10¾, the enhanced price, there are very few shares about. In the Prior Charge stocks there is no particular change, but St. James' Debenture, at 87, is a point higher on the week.

In the Foreign List, business is decidedly active amongst most of the Traction, Light and Power descriptions. Northern Light and Power bonds have recovered 6 after their steep fall, very little inquiry being sufficient to put the price up thus substantially. Rio Trams continue to crumble, the price again falling 1½ on account of the new issue of shares, of which we were able to give a hint last week. The company's bonds, however, are steady, the First at 102¼, being ¼ better. In the Mexican group fluctuations are mostly on the dull side, but this does not argue absence of business, for, as a matter of fact, the jobbers in this section find their hands full of orders every day. Shawinigan Capital stock fell 2 and Sao Paulo Trams lost their two-point rise of last week. Winnipeg Debenture came to market on account of the high price at which this 4½ per cent. bond stands as compared with other securities of similar character, and the quotation is 2 down. Calcutta Preference recovered half their previous drop, and now stand at 5½. Melbourne 5 per cent. First Debenture at 98 is slightly higher, and River Plate 5 per cent. Debenture hardened to 103. The premium on the new Anglo-Argentine Tramways First Preference keeps very steady at 1¼ for cash. The new Mexican Light and Power Second Debenture is quoted at 1 discount to par, *i.e.*, the issue price. The company's Common shares have drooped, while Monterey bonds have gained a trifle.

Telegraph stocks and shares are quietly steady, with the exception of Amazons, which show a fall of 10s. A seller of a few shares came along, and found the market rather a tender one. Anglo-American issues are again unchanged. Eastern Ordinary rose a point, bringing the higher price to a level at which the yield is exactly 5 per cent. on the money. Westerns are ⅛ higher, and the good tendency of the market in general is reflected in a 5s. rise which has taken Globe Ordinary to 11. Other Trust issues are practically unaltered, a fall of 1 in Mackay Common being balanced by a rise of equal amount in the Preferred.

National Telephone Deferred stock has been pretty extensively sold on its big rise of 7 points last week, with the consequence that half of it has been lost. Some announcement as to what proprietors may expect in the way of distribution, may possibly be made next month. Following the relapse in the Deferred, the company's Third Preference shares lost 1/16. New York Telephone bonds are harder. No premium was quoted on the new Constantinople Telephone shares in advance of the allotment, the market not having been started in them. Some people think that the issue appeared at a somewhat unfortunate time, in view of the war between Turkey and Italy, which, although it has, of course, no direct influence upon a telephone company in Constantinople, yet exercises a sentimental effect upon the mind of the investor. The company has a strong Board, and seems to offer good prospects.

In the Manufacturing group, Telegraph Constructions, after their steady rise, have this week fallen 30s., but other manufacturing shares are good. Crompton Debentures at 63½ are 3½ points harder. Callender's Preference shares rose 1/16, and Aron Ordinary are better to the same extent. Edison & Swan partly-paid shares have followed up their jump of last week with a further gain of 1/16. Electric Construction Preference, on the other hand, at 1¾ are ⅛ down. The excellent results achieved by the Castner-Kellner Company, upon which we have already commented, caused a further rise, and the shares now stand at 3¾. A slight fall in Babcock Ordinary restores the quotation to what it was a fortnight ago.

The subscription-lists of the South American Light and Power Debentures closed within two or three hours of their opening last week, and a keen demand sprang up for the scrip at 2 premium before the allotment letters came out.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7⅜ — 8⅜	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8⅜ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 11	+ ⅛	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅝ — 8⅝	+ ⅛	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	+ ⅛	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5†	3⅜ — 4	+ ⅛	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12⅜ — 12⅞	+ ⅛	5 8 9
Do. 6 % Cum. Pref.	10	6	6	12 — 13	+ ¼	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅜ — 9⅛	..	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knigbtsbridge, Ord	5	9	8†	6⅝ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	8	2	..	1¼ — 2	— 1/16	8 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	+1	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98⅔	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill	10	8	6†	..	..	..
Oxford	5	7½	6†	6⅝ — 6⅞	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	..	5 17 8
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	+1	3 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2⅜ — 3½	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
Soutb Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	— 1/16	6 3 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	¼ — ⅜	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88⅞	..	5 1 8
Westminster, Ord.	5	10	10†	7⅞ — 8⅜	+ ⅜	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	7†	6½ — 7 xd	..	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5¼	+ ⅛	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96⅝ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	115 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	13/16 — 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Eleo. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 9 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/4 — 25/32	+ 3/32	Nil
Do. 6 % Pref.	1	6	6	15/16 — 31/32	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	97 — 99	+ ½	5 1 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	90 — 92	—1	4 7 0
Do. 7 % Cum. Pref.	$100	7	7	108 —110	..	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	..	5 2 7
Monterey Rly. Ligbt & Power, 5 % 1st Mort. Deb.	100	5	5	91 — 93	+1	5 7 6
Montreal, Lt., H. and Power	$100	7	8	185 —190	..	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	40 — 42	+6	11 18 2
River Plate, Ord.	Stock	10	..	223 —233	..	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	102 —104	+ ½	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	122 —124	—2	3 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	..	4½	4½	103 —105 xd	+ ½	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11¼d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ — 108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	..	7⅛ — 7¾	— ½	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	144 —145	..	5 10 4
Do. Collat. Trust	$1000	4	4	94½ — 96½	..	4 2 11
Anglo-American Telegraph	Stock	3⅜	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110½ — 111½	..	5 7 7
Do. Def.	Do.	30/-	..	25⅞ — 26⅜	..	5 13 8
Anglo-Portnguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6⅞ — 7⅛	..	4 18 8
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87 — 89	..	4 9 11
Cuba Telegraph	10	6	6†	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8½ — 8¾	— ⅛	5 14 8
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	7¾ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	137 —140	+1	5 0 0
Do. 8½ % Pref. Stock	Do.	3½	3½	83⅛ — 85⅛	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½	..	3 18 1
Eastern Extension	10	7	5†	13¼ — 13⅜	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ — 102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ — 100½	..	3 19 7
Globe Telegrapb and Trust	10	5⅞	6	10⅜ — 11½	+ ¼	5 6 8
Do. 6 % Pref.	10	6	6	12⅛ — 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	32½ — 33½	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	—1	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	74 — 77	+1	5 3 11
Marconi's Wireless Telegraph	1	5	..	2⅜ — 2½	..	..
Do. 7 % Cum. Partic. Pref.	1	16	..	1⅝ — 2⅜	..	..
Monte Video Telephone, Ord.	1	6	6	1/16 — 1⅛	..	5 12 11
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ — 105½	..	5 13 9
Do. Def.	Do.	6	6†	121½ — 123½	—3½	4 17 2
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10¼	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5½	— 1/16	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	8 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100⅛ — 101½	+ ⅛	4 8 8
Oriental Telep. and Elec.	1	8	..	1⅞ — 1⅞	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	+ 1/32	4 18 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacifio and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	+ ½	8 18 5
Rentcr's	8	5	5†	8⅞ — 9⅜	..	4 5 3
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telcphone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of Amcrica	2½	2½	2½	1 15/16 — 1 15/16	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Snb. Tel.	100	4	4	98½ — 100½	..	3 19 7
West India and Panama Teleg.	10	1½	..	2⅜ — 8	..	4 8 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10⅞	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegrapb, Ltd.	10	7	6†	13⅜ — 14½	+ ⅛	4 18 3
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	105½ — 108½	..	3 18 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99 —102	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/32	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1 1/8	..	Nil
Do. 6 % Pref.	10	1½	1½	3 7/8 — 4 1/8	..	3 8 7
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	..	5 9 9
Central London Railway, Ord.	100	8	8†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	—1	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1 3/4†	30½ — 31½	..	4 14 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1½	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/8 — 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	73 — 78	—1	5 14 8
Isle of Tbanet Trams, 5 % Pref.	5	2½	..	2 1/2 — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	.	2 7/8 — 3 3/8	— 1/8	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Metropolitan Railway Consol.	100	1 3/8	2†	42 3/8 — 43 1/4	+ 1/4	3 3
Do. Surplus Lands	100	2 3/8	3†	65 — 67	..	4 2
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 17
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1
Metropolitan District Ord.	100	Nil	..	29 3/8 — 30 1/2	— 1/2	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1
Do. 4 % Prior Lien	100	4	4	100 —102	+1	3 18
Do. 4½ % First Pref.	100	3½	4 3/4†	88 — 90	+2	3 12
Do. 3½ % Gtd.	100	3½	3½	74 — 76	+1	4 12
Metropolitan Elec. Trams, Ord.	1	5½	5†	3 7/32 — 3 9/32	..	5 12
Do. Def.	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	3 7/32 — 3 9/32	— 1/32	5 3
Do. 4½ % Deb.	100	4½	4½	100½—102½	..	4 7 1
Do. 5 % Deb.	100	5	5	100½—102½	+ ½	4 17
Potteries, Ord.	1	2	..	5/16 — 7/16	+ 1/32	..
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 19
Do. 4½ % Deb.	100	4½	4½	87½ — 90½ xd	..	4 17
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 5/8	..	6 17
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 1
Underground Elec. Railways	10	..	..	1 7/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8
Do. 6 % Income	100	1	1½†	63 — 65	—1	1 10
Do. Power House Debs.	100	4	4	100 —102	..	3 18
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2 1/8 — 2 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 1

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 1/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4 3/4 — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	100½—102½	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	104 —107	+1	4 13 6
Bombay Eleo. S. & Trams, Pref.	10	6	6	10 3/4 — 11 1/4	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½—100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	7 1/2 — 8	+ ¼	5 0 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Eleo. Rly., Def.	100	8	..	143 —147	..	5 8 10
Do. Pref. Ord.	100	6	6	124 —128	..	4 13 9
Do. 5 % Pref.	100	5	5	109½—112½	..	4 8 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 3/8 — 6 1/8	— 1/8	4 18 2
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	7/16 — 9/16	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 3/8 — 5 5/8 xd	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Eleo. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Eleo. Rly., 5 % Bonds	$1000	5	5	101½—104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Eleo. Trms, Prf.	1	6	6	3/8 — 1	..	6 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼	..	4 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16
Do. 5 % Deb.	100	5	5	96 —100	..	5 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	..	5 1
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 94	..	5 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 —101	+1	4 19
Mexico Trams Com.	$100	7	7†	123 —125	—2	5 12
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19
Do. 6 % Bonds	100	6	6	103 —105	..	5 14
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7 1/8	..	6 18
Do. 6 % Pref.	5	6	6	5 3/4 — 5 7/8	..	5 4
Do. 5 % 1st Deb.	100	5	5	99¼—101½	..	4 18
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	1 3/8 — 1 7/8	..	2 7
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 3/8	..	5 9
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9
Rio de Janeiro Trams	$100	4½	5†	115 —116	—1½	4 6
Do. 1st Mort. 5 % Bonds	..	5	5	101 3/8—102 3/8	+ ¼	4 17
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	185 —189	—2	5 5
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 18
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95¼ — 97½	..	5 2
Un. Elec. Trams Monte Video	5	6	7	5 3/4 — 6	..	5 0
Do. 6 % Pref.	5	6	6	5 — 5 1/4	..	5 9
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18
Winnipeg Eleo. Rly., 4½ % Deb.	100	4½	4½	104 —106	—2	4 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 3/4	+ 1/16	Nil
Do. 6 % Pref.	1	9	6	3 3/32 — 3 7/32	..	7 2 2
Babcock & Wilcox	1	26	24†	5 3/4 — 6	— 1/16	4 6 8
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/4 — 7 1/4	..	6 17 11
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/2	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/2	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	+ 1/16	4 15 3
Do. Deb	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/16 — 3 3/16	+ 1/16	5 5 3
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	8	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	60 — 67	+3½	7 9 3
Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 12
Do. Deb.	100	4½	4½	95 — 98	..	4 11
Edison & Swan, A, £3 paid	5	Nil	..	3/8 — 7/16	+ 1/16	Nil
Do. fully paid	5	Nil	..	1 7/8 — 2 1/8	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5
Electric Construction	2	Nil	2½†	1/4 — 3/8	..	6 13
Do. Pref.	2	7	7	1½ — 2	— 1/8	7 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8¼	..	8 5
Do. Deb.	100	5	5	94 — 96	..	5 4
General Electric, Pref.	10	5	5	9 — 9½	..	5 5
Do. Deb.	100	4	4	86 — 91	..	4 7
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18
Do. Pref.	5	4½	4½	4 1/8 — 5 1/16	..	4 5
Do. Deb.	100	4½	4½	106½—108½	..	4 2
India-Rubber, G. & T.	10	10	..	12½ — 14½	..	6 17
Do. Pref.	10	5	5	9 3/4 — 10 3/4	..	4 16
Telegraph Construction	12	20	10†	35 — 37	—1½	6 7
Do. Deb.	100	4	4	100 —102	..	3 18
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all sbares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1911.

After the somewhat meagre business of September, the October returns of electrical export trade are surprisingly good. For the month the total value of the exports amounted to £464,191, this being a higher value than has so far been recorded this year, and very satisfactory in that neglecting the telegraphic section there remains the substantial amount of £394,000, representing general business. Increased values appear generally in all sections of the exports; machinery accounted for over £170,000, while cable exports reached over £90,000 in value.

By a fnrther sub-division of the returns, accurate values of both the exports and imports of electric glow lamps are shown; the former approached £14,000 in value, while the latter figures at £28,526.

The imports totalled £221,289, a somewhat higher figure than in the preceding month; machinery imports amounted to over £87,000 in value, while telegraphic and telephonic material (Germany and Belgium sending the bulk of this) reached a total of £58,000.

Of our customers during the month, India, Argentina, Japan, our Australian Colonies and Spain (due to a comparatively large telegraphic purchase) deserve mention, improved business is, however, apparent in many directions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,232	1,440	177	224	27	1,235	8,696	2,368	130	...	1,378	413	17,320
Germany and German W. Africa	1,702	342	75	...	667	10	2,918	53	...	...	25	47	5,839
Netherlands, Java and Dutch Indies ...	582	1,119	150	60	...	...	436	645	39	...	6	8	3,045
Belgium	412	336	19	14	305	80	1,450	18	30	...	1,585	11	4,260
France	1,108	13	1,690	15	61	146	2,516	3,690	2	...	224	42	9,507
Portugal	37	51	19	92	...	...	575	240	61	...	...	...	1,075
Spain and Canary Isles	818	54	365	10	12	196	1,984	148	1	5	2	30,862	34,457
Switzerland, Italy and Austria-Hungary ...	590	28	1,397	...	38	15	1,859	876	51	13	21	...	4,888
Greece, Bulgaria, Roumania and Turkey ...	22	33	68	29	24	3	236	26	21	...	4	75	541
Channel Isles, Gibraltar and Malta... ...	23	42	40	35	...	5	557	950	27	...	151	156	1,986
U.S.A., Philippines and Cuba	72	...	34	288	...	161	1,032	...	...	1,034	...	320	2,941
Canada and Newfoundland	831	6,297	1,543	1,817	40	2,549	7,437	140	218	52	499	84	21,507
British West Indies and British Guiana ...	38	39	58	24	...	594	552	...	25	...	29	12	1,371
Mexico and Central America	144	115	49	90	...	...	276	250	8	...	...	...	932
Peru, Uruguay and Paraguay	104	351	249	120	44	60	483	148	31	...	4	669	2,263
Chile	937	145	321	888	134	153	2,612	526	50	80	320	31	6,197
Brazil	551	896	817	690	87	650	7,210	678	344	...	4,028	13,919	29,870
Argentina	2,758	4,472	993	2,853	403	381	20,132	359	4,734	40	4,818	1,991	43,934
Colombia, Venezuela, Ecuador and Bolivia	36	230	216	...	...	4	407	4	22	...	...	340	1,259
Egypt and Persia	1,530	1,556	334	14	18	47	4,041	378	416	...	311	2,072	10,717
British West Africa	365	35	62	117	...	...	156	32	2	...	205	50	1,024
Rhodesia, O.R.C. and Transvaal	2,088	181	287	1,254	207	75	3,619	45	44	...	25	229	8,054
Cape of Good Hope	1,575	1,325	443	767	130	96	3,548	...	1,408	52	55	935	10,334
Natal	1,598	9,519	181	167	60	47	762	335	241	55	349	75	13,389
Zanzibar, Brit. E. Africa, Mauritius & Aden	199	127	89	135	17	227	416	...	22	...	56	255	1,543
Azores, Madeira and Portuguese Africa ...	262	237	224	59	...	165	86	2,250	52	...	21	181	3,537
French African Colonies and Madagascar ...	...	80	25	...	...	...	528	...	...	...	...	148	781
China and Siam	730	2,116	337	979	144	216	2,259	65	42	...	35	...	6,923
Japan and Korea	1,207	6,360	250	...	...	650	20,952	1,443	242	...	3,229	8,320	42,653
India	5,590	12,983	4,228	342	456	2,295	17,737	3,480	5,020	39	1,515	1,018	54,703
Ceylon	192	90	126	61	...	7	686	44	288	...	332	69	1,895
Straits Settlements and Fed. Malay States	468	349	193	57	...	13	968	36	312	...	132	180	2,708
Hong Kong	16	32	13	...	...	130	455	11	74	20	...	32	783
West Australia	382	168	67	346	...	45	1,185	...	152	29	240	52	2,666
South Australia	428	7,435	309	179	...	711	200	31	405	...	95	...	9,793
Victoria	2,823	18,033	583	399	207	79	3,503	10	218	141	4,848	52	30,896
New South Wales	2,284	12,412	1,100	1,047	193	372	11,286	371	1,062	...	668	4,069	34,864
Queensland	206	416	59	...	78	293	5,002	...	71	...	5,293	948	12,366
Tasmania	15	...	...	23	...	100	621	...	...	...	25	...	784
New Zealand and Fiji Islands	1,322	2,007	532	582	...	154	11,899	515	1,019	67	49	2,440	20,586
Total, £	35,277	91,464	17,722	13,777	3,352	11,965	151,277	20,165	16,884	1,627	30,577	70,105	464,191

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	482	...	6	55	...	...	3,955	34	599	...	8,200	13,331
Germany	2,425	6,555	1,747	23,143	6,399	2,104	56,813	805	2,324	6,640	34,851	143,806
Holland	6	...	...	1,070	611	...	186	10	...	44	13	1,940
Belgium	287	2,292	7	53	...	266	1,582	37	610	429	11,623	17,186
France	60	152	1,059	657	461	446	1,048	200	968	3,359	715	9,125
Switzerland	204	162	16	54	48	64	9,062	...	...	...	32	9,642
Italy	21	561	...	...	...	...	...	...	...	...	2,496	3,078
Austria-Hungary	...	520	...	623	...	91	1,112	...	19	219	12	2,596
United States	3,837	67	10	2,871	383	...	5,648	6,736	125	114	278	20,069
Total, £	7,322	10,309	2,845	28,526	7,902	2,971	79,406	7,822	4,645	10,805	58,220	220,773

Additional imports: Spain, carbons, £420; Canada, goods, £96.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,705	2,661	...	1,898	277	...	4,662	...	280	407	830

Total Exports: £464,191. Total Re-Exports: £21,720. Total Imports: £221,289.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, donbtless, consisting of similar materials to those appearing in adjacent columns Imports are credited to the conntry whence consigned, which is not necessarily the country of origin.

A GENERATOR FOR HIGH-FREQUENCY WIRELESS TELEGRAPH CURRENTS.

By S. M. POWELL.

Alternating currents of frequencies lying between 30,000 and 100,000 cycles per second are required in the operation of wireless telegraph circuits, and it is—for long-distance work—essential to obtain *very considerable amounts of power* at this high frequency, and from a *steady source* (the latter stipulation being most important in wireless telephony).

The output which can be obtained from spark and arc sources of high-frequency alternating current is limited in amount, and the steadiness of these sources is imperfect at large outputs. Endeavours have therefore been made during recent years to generate suitable current in dynamo-electric machines, thus avoiding the use of spark and arc sources, and enabling more power to be supplied to the aerial simply by increasing the output of the prime mover.

High-frequency alternators may easily be built, but it is extremely difficult to obtain a large kw. output from such machines. A single example will demonstrate this difficulty and explain its exact nature.

Assuming a peripheral rotor velocity of 80 m./sec.—a value seldom exceeded—the pole pitch T of a 30,000-cycle alternator is :—

$$T = \frac{80{,}000}{2 \times 30{,}000} = 1{\cdot}33 \text{ mm.}$$

$$\text{Now } T = (A + B + 2C) \text{ (see fig. 1),}$$

and at high voltages the thickness of insulation (2 C) soon approaches the full available width (T), leaving a totally insufficient peripheral thickness for copper (A) and iron (B).

Even supposing the above peripheral velocity to be doubled, the output of the machine could not be proportionately increased, for at small slot pitches, the permissible slot depth is limited, both by mechanical stresses and by

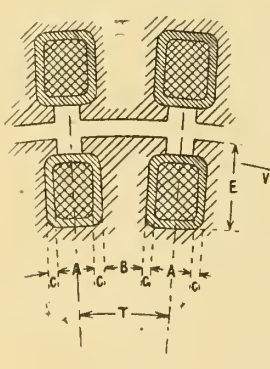


Fig. 1.

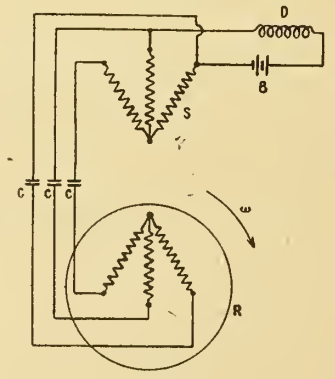


Fig. 2.

magnetic flux density. In the field system, the higher flux density would merely require higher excitation and saturation of the iron, but in the armature it would entail greatly increased hysteresis and eddy-current losses—particularly at the enormous frequencies proposed. Again, small poles necessitate short air gaps, which are highly undesirable from a mechanical point of view.

Prof. Arnold,* however, has devised an arrangement by which high frequency and large output may be simultaneously secured ; his machine, moreover, has proved very satisfactory in practice. Its theory may be explained as follows :—

Referring to fig. 2, R represents the rotor, and S the stator of a machine built like an induction motor. The rotor slip-rings are electrically connected to the stator terminals. Into S or R, or both simultaneously, direct current is fed from the battery B, which is protected from alternating current by the choking coil D. Suppose the rotor to be rotated at ω radians per second (reduced to a two-pole basis), then currents of frequency f are set up in R (f being the frequency corresponding to ω). Now, R and S are connected through condensers C, C, C, which prevent the passage of direct current from B to R, but allow t alternating current generated in R to flow into S, where sets up a rotary field. The connections between R and must be so arranged that the rotary field in S turns *opposite* to the rotor R, and hence has a velocity of 2ω relative to t latter. Currents of frequency $2f$ are then induced in and flowing through the stator, set up in turn curren of $3f$ frequency, and so on. Theoretically, infinitely hi frequencies could thus be derived.

The arrangement of fig. 3, however, represents the actu practical form of the apparatus in its essential feature Stator and rotor have now single-phase windings ; the rot is short-circuited on itself and the stator is short-circuite *for alternating current only*, by the large condenser C. connecting S with a direct-current source and rotating R, current of frequency f is set up in the latter. Calling R t "primary," and imagining the alternating field set up

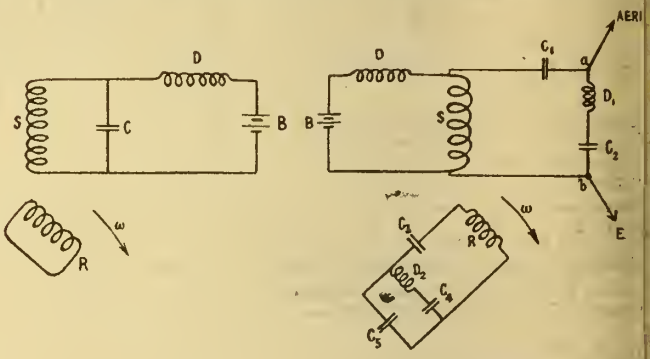


Fig. 3.

Fig. 4.

the rotor current to be resolved into two parts, rotating opposite directions and with angular velocity ω relative the rotor—one of these components clearly stands still space, and forms the rotor reaction on the D.C. excited stat field ; the second component revolves in space with angul velocity 2ω and induces currents of frequency $2f$ in t stator winding. This current, again, may be resolved in a "reaction" and "action" component ; the latter induc currents of frequency $3f$ in the rotor, and thus aga infinite frequencies may ultimately (theoretically) generated.

In the latter arrangement, inductive coupling is employ to enable the to and fro transference of energy between t primary and secondary necessary to raise the frequenc whereas in fig. 2 the transference is obtained by actu electrical coupling. It is characteristic of the arrang ment of fig. 3 that rotor and stator are alternately t "primary."

At first sight, it might be thought that only high harmonics could be produced by this means, *i.e.*, relative small oscillations such as are obtained (as "by-products" in all alternating-current machines by the non-sinusoid form of the field flux and the armature windings, and suc as are created in single-phase generators by the interactio of field and armature.* Clearly, however, this is not t case, *if* care be taken that all the lower frequencies flow closed short-circuits, only the utilised frequency being drive through the resistance of the antenna and other workin circuits ; in fact, by "resonant short-circuiting" (see below we obtain frequency *sorting* without *wasting* the unsuitab frequencies. The machine then constitutes a permutato changing lower to higher frequencies with very considerab efficiency. The power output increases to a known lim with rising frequency, for, at each increase of frequenc more of the mechanical energy in the system is converted t electrical oscillations. Without a short-circuit for th "dead" frequencies, the high-frequency currents woul become ever weaker, and it would be impossible to obtai large amounts of energy in the signalling circuits.

The fact that the increase of frequency is effected in single machine, brings with it the advantage that th "action" component of frequency $(n \cdot f)$ is nearly wipe out by the "reaction" component of frequency $(n + 1) \cdot f$ Only the last field, created by the highest frequency (an

* *Elektrotechnische Zeitung*, January 19th, 1911

* Arnold, *Wechselstromtechnik*, IV, pp. 25 *et seq.*

†As with the currents, so with the fields, there is really on the complex *resultant* in each case.

erefore the "useful" field) exists in full strength, and erefore it alone creates the full iron loss due to this hypo-etical component. (See footnote.) This cancellation of e low-frequency fields is the more complete, the freer from mping the various circuits.

The stator and rotor windings may be likened to stationary d rotating mirrors; between them electrical energy is reflected" to and fro just as light rays would be in the alogy cited. The reflection occurs at increasing frequency, d is the more complete, the less the energy absorbed by the nirror" or, here, the freer the various oscillating circuits om damping. (It is suggested that, by this analogy, the w machine should be called a "reflection generator.")

Where alternating current is concerned, a "complete ort-circuit" does not mean a simple wire coupling, but a ort-circuit through a condenser, which permits the flow of ernating current through itself and automatically com-nsates (if properly chosen) the inductance of the machine ndings. How this compensation is obtained may be thered from fig. 4, which closely represents the actual ctical arrangement of the generator.

Suppose, for example, that the quadruple frequency $4f$ is be employed. The stator S is supplied with direct current rough the choking coil D. The rotor current of quency f then flows *viâ* R, C_3, D_2, C_4, R. The condenser is so chosen and connected that it counterbalances the uctance of R; and D_2, C_4 are exactly in resonance at the quency f. The induced stator currents of $2f$ frequency v *via* C_1 (which is proportioned to the inductance of D_1, C_2; C_2 and D_1 are syntonic with frequency $2f$. The or currents of frequency $3f$ flow *via* the condenser C_5 ned to this frequency). The currents of frequency $4f$ e to be usefully employed (by hypothesis), and may be olly led off from the points *a b* (fig. 4). Since D_1, C_2 is of tune for the frequency $4f$, only an extremely small rent of quadruple frequency will flow *via* this short-cuit to the aerial; D_1, C_2 are, however, sharply tuned to frequency $2f$, so that practically no P.D. of $2f$ frequency sts between *a* and *b*. It should be noted that the addition C_5 does not disturb the resonance of the rotor circuit to frequency f, nor the connection of the aerial the syntony he stator circuit. It is because C_1, C_3 are tuned to the chine windings that the circuits remain in resonance, te whether D_1, C_2 and D_2, C_4 are short-circuited or open.

The first machine, to be built on this plan has been rating since April, 1910, in the Lorenz radio station at erswalde. The output of the machine is about 12½ KW. en supplying a 10,000-metre wave, and at the shorter e length of 5,000 metres, 8 or 10 KW. output may still obtained. It appears that machines of 60-80 KW., or n greater output, can be built on this system to supply quencies as high as that corresponding to 3,000 metres e length. The efficiency of the machine (on a 10,000-wave) is about 80 per cent., and a special advantage is , by simple variations, a large number of frequencies may obtained. The finer gradations of wave length are ined by special tuning apparatus as usual.

The Lorenz Co. (Berlin) have been very largely onsible for the successful development of this inte-ing and valuable machine, and the German patents rning its manufacture are in their name.

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insbury Technical College O.S.A.—The sixth annual er of this Association will be held at the Trocadero Restaurant, ndilly Circus, on Saturday, December 9th, at 7 for 7.30 p.m. Reginald Wallis-Jones, the president, will take the chair. The er is being held on a Saturday in order to enable provincial bers to attend. Particulars can be obtained from Mr. H. F. ht, 64, Amhurst Park, Stamford Hill, one of the secretaries. annual dance is to take place at the Caxton Hall, Westminster, aturday, February 3rd, 1912, a smoking concert following in h. Mr. H. W. Gregory (1, Atherton Road, Forest Gate, E.), the rical honorary secretary, announces the formation of a dining amongst the members. The club dinners take place once a h and they are strictly limited to members.

onus to Tramway Employés.—In recognition of the ty of their employés, the Bristol Tramways and Carriage Co., distributed to every employé in all departments of the service veek an addition of half-a-week's pay at full rate.

BRAZIL: ITS PRESENT CONDITIONS AND THE POSSIBILITIES FOR FUTURE COMMERCIAL RELATIONS WITH GREAT BRITAIN.

By C. E. BEST and H. L. PARROTT.

(*Continued from page* 805.)

Mineral Wealth of Brazil.—There are but few people who are aware of the enormous wealth of various minerals which Brazil holds within her bosom. Yet it is a country comparatively easy to travel in. Mining concessions are not difficult to obtain from either Federal or State Governments, while property can be purchased from private owners at very low prices.

It was the early Portuguese settlers who first established for Brazil the reputation as a country of vast latent mineral riches. When we consider the tremendous difficulties with which these early pioneers had to contend, we may well admire their dogged courage and indomitable endurance in overcoming every barrier between them and their ambition. In those days —the sixteenth and seventeenth centuries—it is true that there were the dangers of unexplored tropical forests, infested with ferocious animals, as well as the indigenous natives, whose barbarian cruelty and vindictive nature might justly cause the boldest to hesitate.

The first signs of the presence of gold were manifested by the natives themselves, who adorned their persons with gorgeous ornaments of gold.

After the early dealings between the Portuguese and the more docile Indians, the settlers demanded that the natives should take them to the locality where gold was to be found. The natives at first, however, refused, "whereupon one of the Portuguese poured out some spirit (which the natives assumed was water) from his flask and set fire to it, saying that he and his comrades would set fire to all the rivers in their country if they did not show them where gold was to be found!"

Even so, the hardship which these early settlers endured can only be imagined. In some respects it would appear that a comparison of their endeavours with those of many of the present generation might make us appear somewhat timid and half-hearted.

In those days they could have had no certainty that they would strike wealth and success. They had no maps prepared for them with full and graphic accounts of the whole country and its conditions.

We know of many excellent and well-established firms in England who are apparently anxious to develop their export trade and open up agencies abroad. But before they embark upon such a "hazardous enterprise" (!) they want others to give them a practical guarantee of success. So while they remain quietly at home waiting for the "indisputable" facts to convince them, there are many from other countries who go boldly there and establish themselves—and naturally take success in both hands.

When our friends at home realise this, they calmly say, "Well, now it is too late; there can be no chance now, as others are already established there, and have obtained the best business."

Last year one of the writers visited some alluvial gold mines which are now being opened up and worked by a British company. It will give an idea of the distance from the coast, to state that after two days' journey by rail it took 23 days' riding on horseback to reach the seat of mines.

Our friend, the chief engineer, is an Australian miner, who, during a visit in South America, met an Englishman who owns some property containing alluvial gold in the locality. The mining engineer first undertook the journey to this property in order to make a report on the mine. Although satisfied with it, he took the opportunity to prospect round about, when he came across unmistakable signs of old placer workings of the Portuguese settlers (Antigos). After spending nearly 12 months exploring that part of the country, he acquired options on private properties to extent of some 70,000 acres, as well as Government concessions to extent of 80,000 acres. Thereupon our friend returned to Sao Paulo,

and, although scarcely known in Brazil, he found no difficulty in raising sufficient capital from among the English colony there to purchase efficient plant, pay for transport, and commence operations.

There are several small rivers running through the company's property, all flowing into one of the main tributaries south of the Amazon. In all the rivers gold is to be found, usually in a sufficient quantity to pay a handsome profit over and above all working expenses. In the main river, some six miles distant from the centre of present operations, there is a big fall, there being some 25-30 ft. difference in the level within a stretch of ¼ mile of the river. As its rocky bed is visible in several places, it presents but little difficulty to control its waters and generate electric power. The engineer calculates that there is sufficient latent power to drive 20 different plants for hydraulicing the alluvial gold. The company have already obtained the concession from the State Government permitting them to utilise this natural force. These are actual facts, and we are glad to inform our readers that British enterprise was to the fore in this case.

There are many other excellent propositions which only await men with the spirit of pioneering and enterprise.

In commercial undertakings firms must liberate themselves from all rigid and conservative *régime*, and adapt themselves more to present demands. British engineering firms might acquire many valuable concessions and contracts for public works if they were more enterprising, and did not wait for projects to be brought to them.

It is undoubtedly essential that they have one or two representatives residing or travelling in the country, Then they would be continually informed of the progress there, and as to improvements which are always being projected and considered in Congress.

A representative should be a man of culture and ability, with a good knowledge of the Portuguese, and even the French language, in order that he may mix with the Brazilians and get acquainted socially with the more important and influential men. This will necessitate the payment of salaries which stay-at-home English firms might think exorbitant, at the least £500 to £800 per annum, with freedom to incur further expenses which may be considered necessary.

In this respect we may remark that several German firms have representatives travelling in Brazil to whom they pay a salary of £65 per month, plus all expenses, both hotel and travelling. And this is simply to acquire ordinary trade! Naturally they are proving very successful, and paying handsome profits on the comparatively small outlay.

Attitude of Britishers in Brazil.—There are several obstacles which the Britisher prepares for himself when he goes to Brazil.

First, it seems impossible for him to realise that *he* is the *foreigner* while in the country, and that the Brazilian is at home there. Then, as a rule, he does not attempt to interest himself in the people or their native customs, but rather prefers to make odious comparisons between them and those of his own country.

He fails to reflect that it is one's own natural surroundings that develop one's tastes and habits, and for the Brazilian his are quite as good, if not better, than those of the "foreigner."

Again, the Britisher is very prone to be seclusive and conservative in his social life. He seems to consider that it is "infra dig." to associate with Brazilians.

We have no qualms in stating that the well-educated Brazilian can give many of our countrymen points in social decorum. Besides this they are generally far better read and better informed men as to the great events of the world's history, and they take a much more liberal view of international affairs than most Englishmen.

It is, therefore, a great mistake not to cultivate more intimate social relations with the Brazilians, for this would greatly facilitate business developments.

The average Englishman who regards himself and his country as beyond reproach and all comparison with others, may well keep his own counsel on the matter. He can never make friends abroad by expressing such opinions. The Brazilian has a very sensitive nature, and is justly proud of his country and the achievements of his countrymen, and is usually satisfied with his own opinion.

So if we wish to obtain any privileges in his country i behoves us to hide our pride with businesslike courtesy an diplomacy. When a Britisher can recognise these facts an be prepared to live up to them, he may then look with hope ful eyes toward Brazil for business success.

The Journey to Brazil.—To those of our readers wh have not yet visited Brazil, it may be interesting to give brief account of the journey from England, and the necessar equipment for a short tour. First, the traveller mus acquaint himself with a sufficient knowledge of the Portu guese language to make himself understood in ordinary con versation. A knowledge of French will also be very usefu

As is well known, England stands well to the fore in a shipping, and this applies to the passenger service on th South American route. The Royal Mail Steam Packet Co have done much to merit the appreciation of Britishers fo the rapid progress they have made during the last six year Until 1906 the best of their boats was only of some 6,00 tons, and even so, it had already done good service. How ever, encouraged by the great progress of the Argentin and the increasing number of passengers always travellin between South America and Europe, they began to construc a new fleet of A1 steamers, of the *Amazon*, *Avon* an *Asturias* type. The effect of these splendid steamers wa very marked, and the better classes and more wealth families soon began to regard it as an essential part of the education to visit Europe occasionally.

But Great Britain has not had the field all to hersel The French, Germans and Italians also have brough excellent lines of steamers to the route, and owing to th cosmopolitan nature of the population in South Americ all lines are well patronised, though it is a recognised fa that the English line is most highly appreciated.

The Royal Mail Co.'s boats leave Southampton ever Friday for Brazil and the River Plate.

The first-class passenger return fare to Rio de Janeiro £53, and to Santos £54 10s. To Permanbuco the fare proportionately less—£50.

The passenger may break his journey at any port, an continue by a following steamer if he wishes.

The Pacific Steam Navigation Co.'s boats leave Liverpo every other Thursday, as a rule, and their fares are th same as those of the Royal Mail Company. As a matt of fact, the latter have lately acquired the Pacific Lin which we think will prove a benefit to all concerned.

The trip to Rio de Janeiro takes 18 days, and we ventu to say that it is one of the most enjoyable sea journe that can be taken.

The boats call at various ports on the way out, includin Lisbon, Madeira, and St. Vincent. At most of these plac it is possible for the passenger to go ashore and see the pla and people of the country for himself.

At all seasons of the year warm weather will be encountere during the journey, as well as in Brazil itself. So it is we to prepare an outfit suitable to the conditions of place an season. Ordinary thin summer suiting will generally be mo suitable, with thin under-clothing, woollen or otherwis according to the taste of the person wearing same, althoug we favour wool.

Apart from this, from three to six white linen or dri suits are practically essential, while a panama hat is a boo during the hot weather. Hard and soft felt hats, as well a ordinary straw, are all in general fashion.

We would here recommend the purchase of everythin necessary for one's outfit being made in England, as pric in Brazil range from 50 per cent. to 200 per cent. high than here.

We will assume that the reader intends disembarking Rio, this being the capital of the Republic, and the large city, with a population of about a million inhabitants. It probable that fellow passengers will be met on board who a directly or indirectly interested in Brazil, and, apart fro information, they may be able to give introductions to con mercial houses in the cities. Even if not, there should be difficulty in finding a number of British firms, banks, &c., as well as the Consul, who are always willing to give pr liminary directions to a Britisher on his arrival.

There are now some very good hotels, although their tari is rather high. It may be better for the traveller to wa and decide which he will patronise when he gets there. B

according to his requirements and taste, he can arrange for hotel accommodation from 12s. 6d. up to 20s. per day.

As regards food, naturally there are a number of purely national dishes peculiar to Brazil, but a Britisher may rely upon obtaining food quite as good as and of similar kind to that which is to be found in most large European cities.

All hotels keep a good stock of French, German and Italian wines.

In most of the large towns in Brazil there is a good service of tramcars, generally with electric traction, though still mule-drawn in many places.

On arrival in Rio, the traveller will readily see the renowned "Central" Avenue. It was upon this grand thoroughfare that the chief efforts of the municipality were centred when the city was remodelled, six years ago. This is a wonderful example of Brazilian enterprise, and it seems absolutely incredible that this magnificent avenue could have been built in the short space of 18 months. It is interesting to note the different types of architecture in the palatial edifices that line each side of the street, which well illustrate the original and independent tastes of the Brazilian.

The new municipal theatre, situated in the Avenue, immediately attracts one's attention. It is said that, in its magnificent appearance and its spacious dimensions, with a seating capacity for some 20,000 persons, it vies with the Paris Opera House, while the arrangement of the electric illumination, both in the body of the theatre and on the stage, is the last word in lighting effects.

The most conspicuous of the new buildings on the Central Avenue is the Monroe Palace, in which were held the sessions of the Pan-American Congress in 1906. Its artistic design attracts universal admiration, and reflects great credit on the architect.

One other great feature of beauty in Rio is the new esplanade, called the "Avenida Beira-Mar." Much of this has been built on ground reclaimed from the sea along the Bay of Botofogo.

This is not the place to enlarge on the exceptional wealth of natural beauty around Rio, but we recommend the traveller to utilise his leisure and see for himself.

In future articles we shall give sketches of some of the chief towns along the coast of Brazil, and describe their geographical positions and extent of commerce, pointing out many of the improvements relating to electricity which must necessarily take place shortly.

(To be continued.)

LOANS FOR ELECTRICITY SUPPLY AND OTHER PURPOSES.

The L.C.C. and the Local Authorities in London.

The Finance Committee of the L.C.C. has just submitted to the Council a very interesting report as to the powers and duties of the Council in respect of sanctioning loans and lending money to local authorities, with special reference to loans for electricity purposes.

The Council is the sanctioning authority for most of the loans raised by the Metropolitan Borough Councils, subject, since 1900, to the right of Borough Councils to appeal, under the London Government Act, 1899, to the Local Government Board against refusal of sanction or against conditions imposed by the Council in granting the sanction.

The Local Government Board, however, is the sanctioning authority in respect of loans for certain purposes under special Acts of Parliament. The power of a Metropolitan Borough Council to borrow must be derived from some statutory enactment enabling it to borrow to defray any particular expenditure, and the sanction of the Council, or the L.G.B., as the case may be, is a condition precedent to the Borough Council being able to put into force its borrowing powers conferred by Statute.

The preliminary questions, therefore, in the case of every application for a loan are whether the Borough Council has statutory authority to incur the expenditure in question and to borrow to defray the same. If the Borough Council does not possess the necessary powers, the Council does not, of course, issue a sanction; but if it is armed with the required authority, the questions whether or not the Council shall sanction, and the amount of the sanction, become matters within the discretion of the Council, and it is entitled to give or refuse the sanction, subject to the right of appeal which we have mentioned.

Before the L.C.C. Finance Committee recommends sanction to a loan it requires to be satisfied—

1. That the financial position of the borough warrants the proposed increase of indebtedness.
2. That the amount is not in excess of the reasonable cost of the work.
3. That the work is necessary, and is such as to justify the cost being spread over a period of years.
4. That the loan will be repaid during the life of the work, so as to preclude the possibility of future ratepayers being saddled with the cost of exhausted works.

And in connection therewith the following are some of the principal points considered:—

1. The outstanding indebtedness of the Borough Council.
2. The assessable annual value of the borough.
3. The total of the local and county debt chargeable on the rates of the borough, and the percentage which this debt bears to assessable value, and the amount of this percentage which is in respect of unremunerative debt.
4. The amount of the local rates in the £.

The Council's security for loans advanced is in all cases a mortgage of the local rates. With regard to loans advanced for revenue-producing undertakings, the revenue is charged by the local authority with the service of the loan, so that in such cases the revenue of the undertaking constitutes, in fact, the primary security with the local rates behind it, although in law the security for the loan is the rates only.

Attention is drawn to the fact that owing to the unrivalled facilities of the central financial authority (the L.C.C.) for raising and advancing moneys, local authorities could only raise money for themselves at a higher cost, that they would have to incur the expense of floating such loans, and the risks attendant upon the management of the sinking funds, which under present conditions are borne by the Council, whilst the prospects of their success in this direction are problematical, even in the case of the largest local authorities. Moreover, a very considerable proportion of their loan requirements are for periods not exceeding 20 years, and are therefore appropriately met by mortgage loans rather than by the issue of stock.

The London Electricity Supply Act, 1908, has created a special position with regard to loans for electricity undertakings, and one of the elementary requirements of the Council is that the loan shall be repaid within the life of the works for which it is required. For buildings for electricity supply purposes the maximum period is 50 years, which is supposed to be within the estimated "life."

Up to 1906 most of the loans for electric lighting purposes were sanctioned for an all-round term of 42 years (although this period exceeds the probable life of some of the items for which such loans were required), subject to the condition imposed by the Treasury that if any renewals were necessary during the 42 years' term the cost of such renewals should constitute a maintenance charge, and should not be made the subject of a fresh loan. Different periods, not exceeding the life of the works, are now allowed for various items comprised in loans for electricity purposes, the period for plant and machinery being 20 years. The Council, as opportunities occur, endeavours to induce Borough Councils which have raised loans for 42 years to reduce the outstanding periods of repayment of such loans.

It will be remembered that the Select Committee on the Repayment of Loans by Local Authorities, which reported in 1902, stated that it considered it to be the duty of a department in deciding the question of the period for repayment, as apart from the question whether any loan should be permitted, to consider more closely the durability than the desirability of the works or purposes for which the loan was required, and to use very considerable caution in fixing the period.

During the year 1910-11 the total amount borrowed by the Borough Councils from the L.C.C., or the central financial authority, was £335,436, and £77,343 was raised elsewhere under the Council's sanction; but these sums do not necessarily represent the total borrowings of the Councils. Of this £77,343, £51,054 was taken up from the Borough Councils' bankers, the loans being mostly subject to repayment at six months' notice; but they were loans made under the Council's sanction, and complying with the sanction as to periodical repayment by instalments. This method of borrowing is not regarded by the Finance Committee as altogether satisfactory, as in the event of a period of financial stress occurring the banks would probably exercise their options to call in the loans, and borrowers would then be compelled to raise money elsewhere to discharge their obligations to the banks. Further, from the point of view of economy, it is undesirable to give local authorities cause to look to other means of raising money, such as the issue of local stocks, short-term mortgages and debentures, or taking money on deposit.

The following table shows the loans sanctioned by the Council in the case of Metropolitan Borough Councils for the 10 years ended March 31st, 1911, for electricity undertakings (including meters and street lighting with electricity) and the electric wiring of consumers' premises, and providing electrical apparatus. The table does not include, of course, any loans sanctioned by Act of Parliament in respect of which the Council's sanction to the borrowing was not requisite, or loans sanctioned by the Treasury or the Local Government Board:—

1901-2	£577,998	1907-8	£275,518
1902-3	545,727	1908-9	184,905
1903-4	241,007	1909-10	129,580
1904-5	732,629	1910-11	183,325
1905-6	320,299		
1906-7	255,104	Total	...£3,446,092

From this it will be seen that there has been a large decrease during the last few years, which observation applies to loans under all heads.

The net expenditure (charged to capital) on the electricity undertakings of Metropolitan Borough Councils up to March 31st, 1909, is as under :—

For Land	£229,990
Buildings (including furniture and fittings)	712,678
Plant and machinery...	1,653,658
Mains and services	1,939,934
Meters and indicators	175,008
Other items	1,399,552
Total	£6,110,820

It is necessary to explain that the large amount opposite "other items" includes £1,379,546 for purchase of goodwill, viz. :—St. Marylebone, £1,344,437 estimated cost of purchase of goodwill of undertaking ; Woolwich, £35,109 cost of goodwill ; total, £1,379,546.

The loans sanctioned by the Council from March 31st, 1909, to September 30th, 1911, in respect of the electricity undertakings of the Metropolitan Borough Councils amount to £432,994, which may for all practical purposes be apportioned as under :—

*Site and buildings...	£41,705	
Plant (all plant at generating station, including accumulators, switchboards, &c.)	118,496	Generation £160,201
Site and buildings for sub-stations ...	13,354	
Mains	174,325	
Plant (all plant at sub-station, viz., converting plant, transformers and switchgear)	25,067	Distribution £272,793
House services	41,028	
Meters	19,019	
Total		£432,994

* It should be added that £13,450 of this sum was for the freehold of the Woolwich Borough Council's generating station "and adjoining property."

During the period covered by these loans, the general employment of metallic-filament lamps has had the effect of reducing the consumption of electricity, which has arrested the extension of electricity plant in some cases.

The fact is borne in mind that the London Electric Supply Act of 1908 transfers to the Council the powers of purchase previously vested in the several Borough Councils so far as regards the undertakings of most of the London Electricity Supply Companies, and, in addition, empowers the Council to purchase the undertakings, or parts of them, in the county, of those bulk supply companies which were not purchasable by a local authority. The powers of purchase may be exercised in 1931, or at subsequent periods of ten years. There remain just 20 years between now and the earliest date by which the Council could purchase the company's undertakings, and this period corresponds with the loan term allowed for generating plant. Consequently any loans sanctioned for such plant after 1911 will be in respect of plant estimated to last until after the Council is empowered to purchase the companies' undertakings, and if the option to purchase is exercised, the Council will then be the authority for supplying electricity in London side by side with the Borough Councils. The Committee taking a broad view of the present situation, and having regard to the developments of electricity supply in recent years, seems to think it preferable, so far as the financial aspect of the question is concerned, for Borough Councils where possible, as opportunity offers, to link up their undertakings for mutual support as well as for economy.

The Council has not up to the present expressed itself in favour of any definite policy to govern its actions as the sanctioning authority for loans for electricity purposes, having regard to the future development of electricity supply in London, and the possibility of the Council becoming the principal authority for the supply of electricity in or after 1931.

The duty of advising the Council as to the exercise of its powers under the London Electric Supply Act, 1908, rests with the Highways Committee, and it has been suggested to that Committee that they should consider whether it would not be desirable for them to recommend the Council to formulate a comprehensive policy as to the action which the Council should take in view of the 1908 Act. It is not suggested that at this stage the question of the exercise of power of purchase in 1931 should be considered, the immediate matter for deliberation being the development of all the various electricity supply undertakings in London.

The Committee is of opinion that, generally speaking, the relationship between the Council and the Metropolitan Borough Councils in regard to the sanctioning of loans is satisfactory, and that the action of the Council secures a wise and salutary supervision over the loan operations of the Councils in question.

Government Contracts (Fair Wages).—In the House of Commons Mr. Hodge asked the Home Secretary whether his attention had been called to an alleged violation of the Fair Wages clause by Messrs. Duncan Watson & Co., contractors for electrical work at Wormwood Scrubbs and Pentonville prisons, and whether he proposed to take any action in the matter. Mr. McKenna replied that he received a complaint of the nature indicated, and he had asked to be furnished with facts to substantiate it. When he received these he would make further inquiry, but he might say that the firm in question was not now doing, and had not for some weeks past done, any work for the prisons

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION (INC.).

A MEETING of the Council was held at the Association's offices, 36, Kingsway, W.C., on 9th inst., at which the following firms were elected members :—The British Thomson-Houston Co., Ltd. ; the British Electric Transformer Co., Ltd. ; Messrs. Browett, Lindley and Co., Ltd. ; Messrs. Dick, Kerr & Co., Ltd. Messrs. Feld Bros. and Co,, Ltd., were elected Associates. We are informed that since the date of the Council meeting the secretary has received applications for membership by several important firms.

The secretary reported that the following gentlemen had assented to their election as Vice-Presidents of the Association :—S. Z. de Ferranti ; J. McDonald Henderson, M.P. ; Hugo Hirst, managing director, General Electric Co., Ltd. ; John Kerr, chairman of directors, Dick, Kerr & Co., Ltd. ; N. Kilvert, chairman, Lancashire Dynamo Motor Co., Ltd. ; C. A. Parr, managing director, British Westinghouse Co., Ltd. ; O. H. Smith, director, British Thomson-Houston Co., Ltd. ; W. T. Stubbs, director, Electromotors, Ltd., President Manchester Chamber of Commerce ; G. A. Touche, M.P. ; Lord Vaux of Harrowden ; Douglas Vickers, director, Vickers, Ltd.

The following gentlemen were elected Vice-Presidents of the Association :—Sir Wm. Mather, Sir Andrew Noble, Sir C. A. Parsons, Mr. Alex. Siemens, Colonel Crompton and Lord Furness.

Reports from various Sub-Committees were considered and adopted, including that of the Sub-Committee on the Coal Mines Bill, under the recommendation of which the following letter was despatched to every Member of Parliament :—

COAL MINES BILL.

(As Amended by Standing Committee B.)

Clause 59, Section (2).

SIR,—I am directed by my Council to submit to you their views, with regard to Sec. (2) of Clause 59 of the above Bill, for which they respectfully claim your most serious consideration, having regard to the fact that this Association includes on its roll of members practically every important electrical manufacturing firm in the country, thus representing about £15,000,000 (fifteen million pounds) of invested capital, which gives employment to about 100,000 workmen.

My Council beg, first, to draw your attention to the Report of the recent Departmental Committee ("Electricity in Mines" [Cd. 5,498]) composed of the experts—R. A. S. Redmayne, Esq., Chief Inspector of Mines ; C. H. Merz, Esq., and R. Nelson, Esq., Electrical Inspector of Mines. These gentlemen found, *inter alia*, that—

"Electricity is to-day applied in one part of the country or another to every operation requiring mechanical power in and about a colliery ;"

"The feeling against the use of electricity in mines was largely based upon a vague fear due to lack of knowledge . . . . ;"

"Experience has shown that the proper use of electricity cannot be regarded as inherently unsafe . . . . ;"

"The number of fatal accidents due to the use of electricity in mines in one year has never reached a figure greater than 1·54 per cent. of the total number of fatal accidents in mines."

In view of these findings, and of the submissions hereunder, my Council find it difficult to understand how this Bill comes to contain a section calculated to have the most detrimental effect not only upon the whole electrical, but also upon the mining industry, by providing (Clause 59, Sec. (2)) : that should inflammable gas in air currents of mines exceed ½ per cent., the use of electricity shall be at once discontinued. My Council respectfully submit, as follows :—

1. That the safety of workers is already amply covered by Sec. (1) of Clause 59, which prohibits the use of electricity where, in the Inspector's opinion, such use would be dangerous to life.

2. That it is well-known that ½ per cent. of inflammable gas cannot be detected by the ordinary safety lamp in use in mines.

3. That this percentage of gas is not dangerous, as the Bill itself admits in Clause 66, Secs. (1) and (2), which provide that a place shall be deemed to be dangerous if the percentage of gas is found to be 2½ per cent. or upwards.

4. That, further, under the same Clause, Sec. (2) a mine may be worked with naked lights provided the percentage of gas does not exceed one and a quarter—which apparently goes to show that His Majesty's advisers regard a naked light as less dangerous than heavily-insulated electrical apparatus.

5. And, lastly, that the passing into law of Sec. (2) would manifestly be tantamount to a public condemnation, on the authority of the Legislature, of the general use of electricity as an exceptionally dangerous source of energy, heat and light.

My Council, therefore, respectfully claim your most serious consideration of the foregoing statement in the full confidence that, when the Bill comes up for its third reading, you will find yourself in a position strenuously to oppose, on all grounds of reason and justice, the placing of Sec. (2) of Clause 59, on the Statute Book.

D. N. DUNLOP, *Secretary.*

November 6th, 1911.

The report of the Sub-Committee on the model general conditions proposed by the Institution of Electrical Engineers recommending the transmission to the Institution of amendments was provisionally agreed by the Association.

In order to provide for the more prompt dispatch of ordinary and pressing business than was customary at the monthly meetings of Council, an Executive and Finance Committee of five members was elected. One of the immediate duties of this Committee will be to prepare for the annual general meeting (January) at which a new Council will be elected.

Applications for support from certain bodies desirous of projecting electrical exhibitions were considered, and the secretary was instructed to inform the applicants that the Council was unable to depart from the standing rule.

It will be of interest to those not yet working in the sectional groups to know that most of the important business of the Association (excepting matters of policy and questions affecting it as a whole) is conducted by these groups, which are at present as follows :—

A.—Arc lamps and carbons.
B.—Accessories (light, power and other electrical).
C.—Accumulators.
D.—Conduits and conduit fittings.
E.—Dynamos and motors.
F.—Fittings (including heating and cooking apparatus)
G.—Instruments.
H.—Meters.
J.—Incandescent lamps.
K.—Switchgear and controllers.
L.—Transformers
M.—Telephone, telegraphic and signalling apparatus, and primary batteries.
N.—Wires and cables.
O.—Engines (reciprocating, turbines, gas and oil engines).

Arrangements are in progress for the early meeting of each of the groups.

We are asked to state that the new offices of the Association at 36, Kingsway, W.C., afford good facilities, particularly for country members and their friends, for meeting and conducting correspondence. By the courtesy of the managers of the whole electrical and technical Press (with one exception) all the weekly papers are to be found on the table of the reading room.

Each member of the Association is requested to send to the secretary at an early date a bound set of his complete catalogues for reference by visitors from abroad.

In view of the fact that Mr. Hawes resigned the position secretary as from the 9th inst., and that Mr. Dunlop assumed full responsibility as on that date, members are asked to bear in mind that all correspondence should be addressed to the latter at 36 Kingsway, W.C.

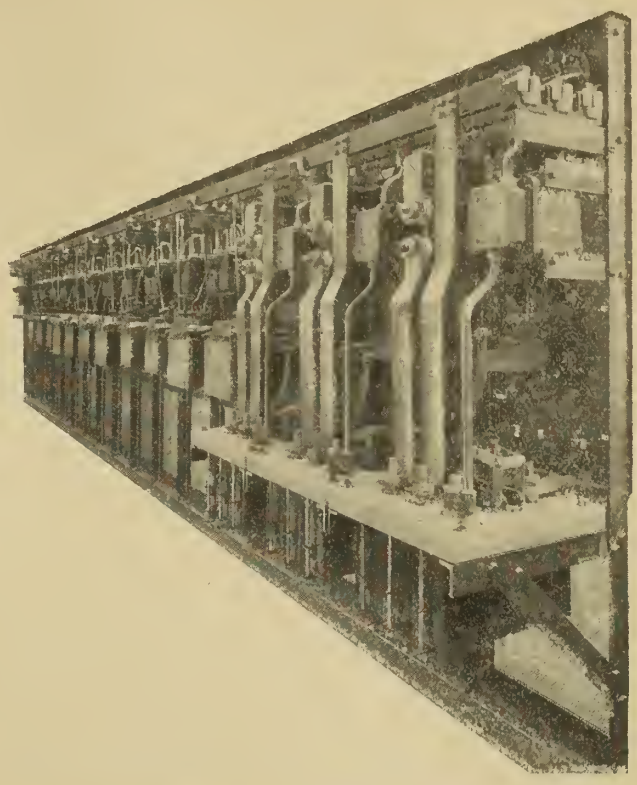


Fig. 3.—Back of Switchboard

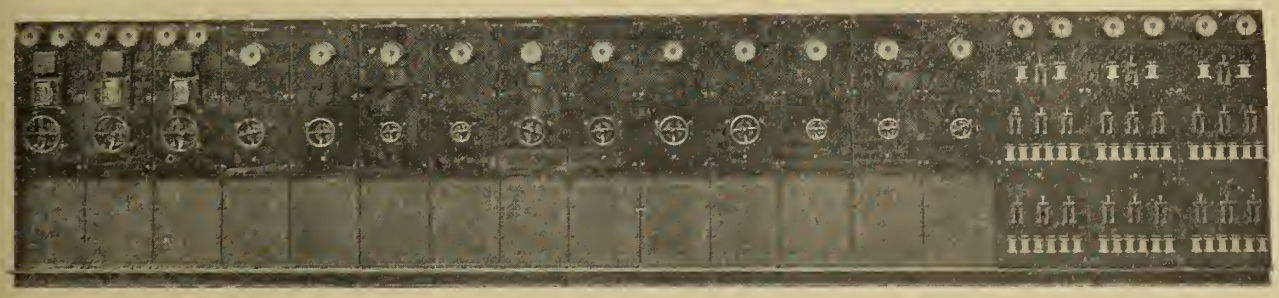


Fig. 2.—Front of Ferranti Switchboard in Textile Mill.

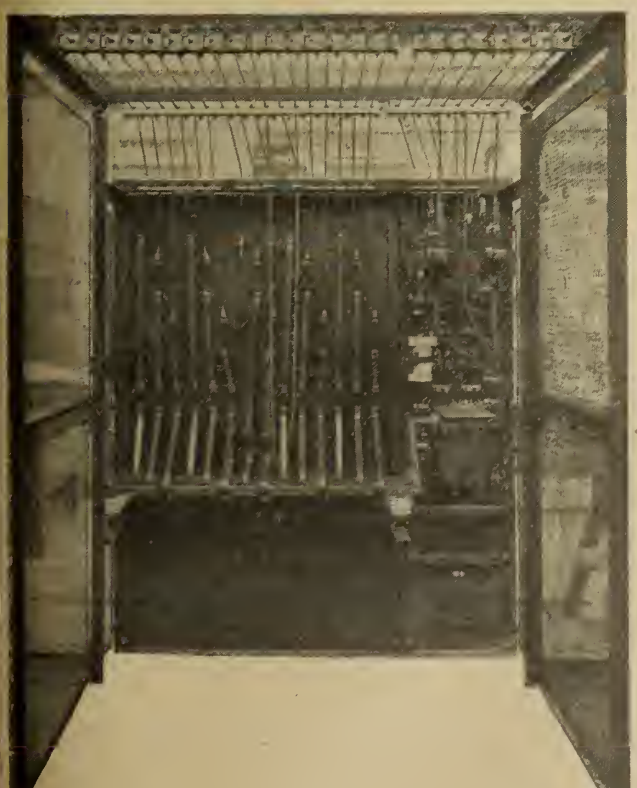


Fig. 1.—Bare Copper Connections between Cables and Switchboard

SWITCHBOARDS FOR TEXTILE MILLS.

The steady advance of electrical power in textile mills is well marked by the large number of boards supplied by Messrs. Ferranti, Ltd., to mills in Lancashire and Yorkshire. These boards bear a strong family likeness to each other, and are all for low-tension three-phase systems, of 40 or 50 cycles frequency.

A striking feature is their extreme simplicity. The even nature of the demand for power of a textile mill renders superfluous any protective device beyond overload instantaneous trip-coils on the switches. In one exceptional case, where all the power is taken from a supply company, and three transformers in parallel supply current to the board, overload and no-volt switches have been introduced.

The generator or transformer panels, in addition to the main oil switch and its accessories, usually contain only an integrating or indicating wattmeter and a voltmeter. The feeder panels are generally fitted with indicating wattmeters only. Lighting circuits are dealt with from a separate panel (situated at the end of the board), which is fitted with knife switches and fuses, enabling the distributing circuits to be connected between phases, or between each phase and the neutral, as the case may be.

Distribution of the power load is generally over a restricted network, and in consequence of this and the low voltage of supply, the generator and transformer panels have frequently to deal with very heavy currents, in some cases up to 5,000 amperes per phase. The construction of the switchgear is, therefore, very massive, and all the connections are heavy and liberally designed. They are kept as simple as possible, and care is exercised to give ample clearances between phases and all live parts and earthed metal.

The bus-bars and connections have frequently been made of aluminium to obtain increased contact surfaces, and this practice

has proved highly satisfactory, inasmuch as it has the twofold advantage of decreasing both weight and cost.

On account of the size of the cables, special arrangements have to be provided for neatly leading-up and adequately supporting them. In many cases the cables have not been taken to the board itself, but have been ended on the wall at the back, and bare copper rods or bars have then been taken overhead from the wall to the back of the board. An illustration of this arrangement is given in fig. 1, p 885.

Many of the mills appear to consider it unnecessary to provide a stand-by set, and only one generator panel is provided for on the board. Where a stand-by set is provided for, it generally takes the form of a transformer supplied from the mains of a local power company.

The panels are usually entirely of slate, or of slate with sheet-iron sub-bases. Marble panels do not appear to have found favour in this connection.

Our illustrations, figs. 2 and 3, show the front and back views of a switchboard supplied to a mill in the Stalybridge district.

THE TURIN EXHIBITION.

[BY OUR SPECIAL COMMISSIONER.]

The preceding article* was concerned with the British engineering exhibits. While it dealt with salient features, it did not, of course, exhaust them—among the omissions was that of a good collection of steamship models, fairly representative of what our big shipbuilding firms can do. Obviously one must leave to those journals concerned with other branches of industry, such subjects as photography, ceramics, textiles, furniture or printing.

In dealing with the exhibits of other countries, precedence must be given to the various Italian exhibits, which, as a whole, are indeed a revelation of the development of modern Italy. One has this exemplified again in the pavilion given to the province of Turin, which may be said to be the area of greatest technical industrial activity in the country.

As has been noted elsewhere in the pages of the Electrical Review, the inspiration of the electrical development of modern Italy has had its source in Switzerland, France and Germany. Names of big Continental firms familar enough to us in this country for their competition with our own firms in the British, Colonial and South American market are well to the front at Turin, exhibiting mostly through their Italian branches. For instance, the Tecnomasio Italiano Brown, Boveri, of Milan, showed a 3,500-h.p., 3,800-volt, 42-cycle turbo-alternator, running at the low speed of 504 r.p.m., together with a two-motor single-phase equipment for the Parma tramways. They also exhibited the most striking extra-high-tension switch in the Exhibition in the shape of a 100,000-volt 200-ampere switch with six breaks under oil, all in series. (The life history of the contacts and the oil in such a switch would be very instructive if it were made public in the form of an original communication to the *Proceedings* of the I.E.E. Some day or other such matters will be common knowledge. In its acquisition other than contact fingers will be burned.)

Messrs. A. and C. Fantini & Co., of Bergano, showed some decidedly good 65,000-volt switchgear. There was also a good example of a modern desk panel remote control switchboard, with push-button control of the operating solenoids. This type of control suffers somewhat in comparison with standard British and American practice of a knife-blade switch.

Among other large Italian generators was a 4,200-k.v.a., three-phase, 50-cycle, 6,400-volt turbo-alternator, with its direct-coupled exciter, by Franco Tosi, of Legnano. This firm also showed a 600-720-h.p. Diesel engine directly coupled to a Brown-Boveri alternator. The neat finish of the latter was very pleasing. Copper strip wound on edge is now common enough in British practice for field magnets, but one wonders when our firms will go further and finish off their work with the even, polished surface characteristic of the best Continental firms. One does not urge polish and appearance at the expense of sound construction, but a well-built machine is as worthy of pleasing finish as is a good book of a tree calf cover.

For the generating plant supplying light and power to the Exhibition in general the Societa Nazionale dele' Officine di Savagliano supplied a good seven-panel switchboard, up to date in all its details. Steam was raised in Babcock-type boilers supplied by Franco Tosi. The familiar Underfeed stoker was in operation here, as also a Babcock bucket conveyor.

Pelton wheels were well to the front; perhaps the best exhibits in the Italian section were those of Alberto, Riva and Co., of Milan, and of A. Calzoni, of Bologna.

The exhibit of the Italian Westinghouse Co. was a little disappointing, consisting almost entirely of light material.

Italian practice in electrical instruments had nothing very novel, but Messrs. Olivetti & Co., of Milan, made a good display of switchboard instruments, and current and potential transformers.

Messrs. Richard Ginovi, of Milan, showed some porcelain insulators for 100,000 volts working pressure and subject to 200,000 volts test pressure.

British inspiration is to be seen in the Vickers-Terni display of guns, armour plates and miscellaneous forgings, and also in the Ansaldo-Armstrong guns, and electric steering gear for a 7,000-h.p. turbine-driven destroyer. This also served to indicate the apparently extensive use of electricity in the Italian Navy. The 105-volt 1,400-ampere d.c. motors running at 450 r.p.m., for the steering gear were of a specially solid type. Generally, the Italian exhibits of models of merchant and warships were excellent, as also the display of automobiles and machine tools.

The type of three-phase overhead construction on the Italian State Railways was shown. The insulation is cut rather on the fine side, compared with British practice. Their more favourable climatic conditions are doubtless the reason.

Among Italian electro-metallurgical exhibits was the display of the Societa Metallurgica Italiano, who showed electrolytic copper, some excellently finished small brass articles, and copper and phosphor-bronze wire. The Italian metallurgical section was very good, some fine specimens of castings, forgings and riveted steelwork attracting special attention. This section was, however, weak in its descriptive matter and lack of attendants.

Among the Swiss exhibits, the Oerlikon, and Brown, Boveri displays were pre-eminent, while the Diesel engines shown by the Westinghouse Co., indicated the enormous popularity of this type of prime-mover on the Continent. Among the (in this country) less widely-known Swiss firms must be mentioned the Societa de Elettricita Alioth, of Munchenstein, who showed both e.h.t. switchgear and a number of single-phase traction motors. The most interesting of these was a 180-h.p., 3,500-volt, 15-cycle motor.

The German display was, of course, good, and varied. It suffered in comparison with the British display by its relative dispersion of the exhibits. The German Pavilion contained representations of the general industries, and was well situated.

General engineering exhibits were scattered in blocks in the various sections, while the electric railway exhibits were again in the railway pavilion. (Electric locomotives, German and others, will be described separately.)

The diversity of the German general exhibits was both interesting and suggestive. The sub-sectionalisation was inferior in attractiveness and organisation to that in the British Pavilion. The section devoted to the State activities in the protection of labour was particularly good in regard to consumptive sanatoria, a subject in which we are now imitating German policy after she has had several years' experience. Your Commissioner remembers visiting one such about 10 years ago, and being favourably impressed with the fact that workmen contributing to these had their minds rendered easy while they were under treatment by reason of the fact that their families were in receipt of adequate monetary assistance during the time of their separation from the general community.

* Electrical Review, Vol. 69, p. 688.

Passing from this section one noticed excellent examples of photographic and lithographic work. It was rather a shock to pass from paintings, lace and embroidery, to another section devoted to shells and the components of explosives. Cut glass and earthenware scarcely did credit to German potentialities in this respect.

Scientific and electromedical apparatus of neat design and good finish was the feature of an exhibition by Gebrüder Ruhstrat, of Göttingen, while E Laylold's Nachfolgen, of Cologne, exhibited mathematical instruments, Röntgen ray apparatus, spectroscopes, &c.

More war munitions were next encountered, the most interesting being a device for determining the velocity of a bullet or large projectile, together with the pressure due to the firing of the charge. The marine section was good, Schichau, of Danzig, showing numerous models of steamers, dredgers, hopper barges and war vessels. The German display of furniture was also good, but heavy in tone.

The United States pavilion was on the north bank of the river. The facade was distinctly imposing, but the building was very shallow. It contained numerous excellent photographs. The stands generally were unattended.

Interesting models and maps of the Panama Canal were shown. Other than photographically, the American engineering industries were practically absent. The Carborundum Co. had a stand (*all* exhibits thereon were described in English). The Jones & Laughlin Steel Co., of Pittsburg, showed steel spikes, wire, chains, bars and some tinned plates, *not* of exhibition finish. The Aluminium Co. of America showed aluminium in wire, sheet and ingot form. Another firm showed stoneware ducts. Quite apart from the fact that the glazing might be better, one would have expected it to be obvious to the manufacturers concerned that freight charges on bulky, breakable articles of this character would quite prevent a successful trade therein in Italy.

The French exhibits, on the other hand, were numerous, varied and well displayed. Not once had your commissioner a minute's difficulty in getting information or catalogues.

The Société pour Le Travail Electrique des Métaux showed a complete transformer sub-station, and also a set of accumulators for use on submarines ; a very good working model of the automatic block signalling system, as used on the P.L.M. Railway, was showd by the Maison Müller, of Paris.

Messrs. Vedovelli Priestley & Co., of Paris, showed oil-break switchgear, porcelain and glass insulators, and gave displays of a short section of a line under 100,000-volt working pressure. Glass insulators were shown by Messrs. Charbonneaux et Cie, of Reims.

Another French display of high-tension accessories was that of La Canalizata Electrique, of Ste. Maurice. It comprised 10,000-volt three-phase oil-immersed fuses, 15,000-volt joint-boxes, 10,000-volt isolating switches, and 50,000-volt trifurcating boxes.

One special feature in the French metallurgical section was the models of electric furnaces and numerous samples of electric furnace products. There were models of a 5-ton Chaplet furnace, and also of Girod and Heroult furnaces.

Messrs. Marrel Frères showed some good heavy steel work, while the French aluminium producing concerns combined to put forward a collective display.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TURKEY.—As the result of the imposition by the Turkish Government of a special extra duty of 100 per cent. *ad valorem* on all Italian goods imported, certificates of origin will be required for all goods entering Turkey, on and after November 1st, from any European country, all Mediterranean ports, and Morocco and Egypt. Goods unaccompanied by such certificates will be regarded as of Italian origin until proof to the contrary is afforded.

The certificates, which may be endorsed on invoices, must state the country of production or manufacture of the goods. They must be legalised by the "Commercial Tribunal" (Chamber of Commerce) or municipal or police authority at the place of residence of the shipper, or by the Customs authorities at the port of shipment, but need not be legalised by Ottoman Consuls. If the certificates are not endorsed on invoices, they must be drawn up on the official forms of the authorities named. Certificates must be presented at the Customs House of importation with the original invoices and the Customs declarations.

AUSTRALIA.—The Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods. The rates quoted are those leviable under the Preferential Tariff applicable to British goods.

Asbestos wood (ebony or plain) in sheets 3 ft. × 4 ft.	
Used for mounting electrical instruments ...	15 %
Shunt coils, imported separately for arc lamps ...	Free
Watkin switch	20 %
Telephone distributing frames ; relay or condenser racks ; meter racks ; coil racks, of metal ...	25 %
Cinematographs...	25 %
Electric carpet sweepers	25 %
Motor horns, Klaxon, electric...	30 %
Magnet wire, copper, black enamelled (used in connection with wireless telegraph instruments)...	Free

Electricity in Australia: Agricultural and Industrial Needs.—There has recently been considerable talk of extensive electrification work in the vicinity of Melbourne for railway, tramway and power purposes, and there is little doubt that in the near future something important will be effected in this direction. The *Melbourne Age* recently pointed out how magnificent such work may be from an agricultural point of view :—"The wheat lands of Victoria are not very rich in nitrates, and that is largely why their average yield per acre is so far below the yield of the American wheat lands, where nitrates are more abundant. These wheat lands are also somewhat deficient in phosphoric acid. Victorian farmers have already begun to fertilise in a small way, but so far they have confined their efforts to making good the phosphoric deficiency. That, however, is only half the battle, and the least important half. Nitrates are the most acutely essential factor in successful wheat production, and if farmers had available a good cheap nitrogenous manure they could assure themselves wheat crops of a richness beyond their present dreams. The question is, How can they get such a fertiliser?"

"Superphosphates are fairly cheap, but it is very different with nitrates, the price of which is virtually prohibitive. It is no exaggeration to say that if it were possible for Victorian farmers to obtain good nitrates at about the present price of superphosphates, the wheat production of this State would very soon be trebled in volume and in value. This can be done, and with the greatest ease, by means of the electrification of the Melbourne train and tramway service. Railway and tramway electrification will require the installation of a great State-owned electric power plant in or near Melbourne. This enterprise will necessarily entail the acquisition by the State of the requisite power, and provide an ideal opportunity to establish an electro-chemical industry in the farmers' interest. The atmosphere is the great main source of nitrogen, and the only means of fixation to render it serviceable for agricultural purposes is electric power. Wherever electric power is cheaply available nitrates can be manufactured at a minimum of cost."

In Victoria nitrates could be made in large quantities at a particularly low cost, because the work could be carried on at periods of light load. "Experts calculate that the electric power station which will be required in Melbourne for the trams and trains will have enough electric power to spare in periods of light load to produce a sufficiency of nitrate fertilisers (including nitrolim) and of calcium carbide (for acetylene gas) and carborundum (to take the place of emery) to supply the needs of all Australia. It is estimated, moreover, that the nitro fertilisers and the calcium carbide can be produced so cheaply that the Government will be able to put them on the market at the price of £6 and £7 per ton respectively, and still make a substantial profit. What this means to the rural population generally will be appreciated at a glance. The current retail price of nitrate of soda is £13 10s. per ton, and of sulphate of ammonia £15 per ton. These are the two most used nitrogenous fertilisers. If supplied at £6 per ton to our farmers, the very poorest would be able to manure their lands in a scientific way and double, treble and even quadruple the present fruits of their industry." Calcium carbide supplied at £7 per ton would reduce at one blow the farmer's lighting bill by more than 50 per cent., and give the Victorian agricultural producer one of the best and cheapest lights in the world.

It is further pointed out that when the Australian Government begins to deal with electrification it should build a power plant capable of benefiting the country as well as the city, and the station should be constructed also with a view to the possibility of steel and iron smelting at a later date.

China.—The German Consul at Hong Kong states, with regard to the outlet for electrical goods there, that electric fans are mainly supplied by the English General Electric Co., while German makers fail to find an entrance owing to high prices Lighting apparatus in general is chiefly supplied from England and Germany, tantalum and Osram lamps being most in demand. In 1910 of the aggregate imports of 463,000,000 Haikwan taels, electrical material figured for 1,387,000 taels, an increase of 23,000 taels on the imports of the previous year.—*Elektrotechnische Zeitschrift.*

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,584. "Electric light fittings." W. J. Hollick. November 6th.

24,595. "Incandescent electric lamp." W. F. Melhuish. November 6th.

24,601. "Electric clock." D. Burns and F. G. Couch. November 6th.

24,666. "Insulated wire or cable for electrical purposes." A. J. Faulding. November 6th.

24,668. "Electrically-operated portable vacuum cleaners and the like." W. Schmahl and Magio Appliances, Ltd. November 6th. (Complete.)

24,674. "Devices and appliances for the purpose of mechanically or electrically operating and manipulating tram and other permanent way points, switches, signals and the like from cars while in motion." W. G. Boonzaier. November 6th.

24,685. "Means for providing electric light for cycles, motor-cycles, motor-cars and like vehicles." F. von Madaler and R. H. Morten. November 6th. (Complete.)

24,697. "Means for use in automatically controlling the timing in magneto-ignition apparatus." H. Diehl. (Convention date, November 26th, 1910, Germany.) November 6th. (Complete.)

24,724 "Electric and other internally heated flat irons and the like." J. E. Pownall. November 7th.

24,730. "Supports or carriers for the globes surrounding incandescent gas lamps, electric lamps and the like." R. Hughes. November 7th.

24 743. "Electro-deposition of metals and their alloys." C. A. Owen and R. Fletcher. November 7th.

24,744. "Buffer machines used in connection with electrical circuits." Siemens Schuckertwerke G.m.b.H. (Convention date, November 8th, 1910, Germany.) November 7th. (Complete.)

24,745. "Controlling apparatus for electrical lifts." A. W. Penrose and Co., Ltd., and F. Barlow. (Addition to No. 1,335, 1911.) November 7th. (Complete.)

24,760. "Electrical precipitation of precious metals from solutions containing same." H. Peabson. November 7th.

24,761. "Magneto-electric machines for combined ignition and illumination purposes for motor road vehicles." F. R. Simms and Simms Magneto Co., Ltd. November 7th.

24,776. "Magnetic clutches." A. T. Collier. November 7th.

24,778. "Electrically-operated motor vehicles." Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. November 7th.

24,779. "Electric regenerative control apparatus and systems." Crompton and Co, Ltd., J. C. Macfarlane and H. Burge. November 7th.

24,787. "Miners' electric safety lamps." O. Oldham. November 7th.

24,807. "Circuit connection for private telephone installations connected to telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) November 7th. (Complete.)

24,823. "Means for increasing the power-factor and overload capacity of alternating-current asynchronous machines." G. Kapp. November 7th.

24,838. "Miners' safety lamps." W. L. Avery. November 8th.

24,847. "Electric heaters." A. S. Blackman and S. R. Windle. November 8th.

24,933. "Electrically-heated devices particularly applicable to soldering irons and the like." Evershed & Vignoles, Ltd., S. Evershed and W. Clark. November 8th. (Complete.)

24,935. "Electrical machine for taking a graphical record of the notes played on a piano or organ." E. T. Illing. November 9th.

24,941. "Sparking plugs." A. E. Fletcher. November 9th.

24,942. "Electrical overhead gear strainer and like insulators." British Insulated & Helsby Cables, Ltd., and J. W. Astley. November 9th.

24,970. "Means for use in automatically regulating the timing in magneto-ignition apparatus." H. Diehl. (Convention date, November 9th, 1910, Germany.) November 9th. (Complete.)

24,977. "Alternating current electromagnets." R. H. Barbour. November 9th.

25,044. "Circuit arrangements for alternating current galvanometers." H. Abraham and J. Carpentier. (Convention date, November 12th, 1910, France.) November 10th. (Complete.)

25,050. "Electric switches." F. L. Anderson. November 10th.

25,086. "Electrical measuring instruments." G. North. November 10th.

25,087. "Electrical measuring instruments." G. North. November 10th.

25,091. "Apparatus for heating water or other liquid by means of electricity." Soc. Anon Fabrifk Van Instrumenten en Electrische Apparaten Inventa. (Convention date, July 20th, 1911, Belgium.) November 10th. (Complete.)

25,108. "Means for heating liquids by electricity." C. J. Montgomery. November 11th.

25,109. "Dynamo-electric machinery." Lancashire Dynamo and Motor Co., Ltd., and H. C. S ddeley. November 11th.

25,138. "Lighting and regulating of electric arc lamps." Harle et Cie. (Convention date, November 12th, 1910, France.) November 11th. (Complete.)

25,157. "Perforating apparatus for telegraphic apparatus." E. Belin. (Divided application on 9,556/1911, April 19th.) November 11th. (Complete.)

25,158. "Automatic resistance regulators for telegraph lines and the like." E. Belin. (Divided application on 9,556/1911, April 19th.) November 11th. (Complete.)

25,161. "Means for use in automatically regulating the timing in magneto ignition apparatus." H. Diehl. (Convention date, November 23rd, 1910, Germany.) November 11th. (Complete.)

25,164. "Incandescent electric lamps or the like." C. E. S. McCann, S. R. Skellorn and S. Cooper. November 11th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. and J. Whitcher. 17,177. July 19th.

Electric Switch Contact Devices for Lowering Gears for Arc Lamps. O. R. W. Williams and J. Stevenson. 24,294. October 20th. (Patent of Addition not granted.)

Determination of Low Voltages in Electric Circuits. Cambridge Scientific Instrument Co. and W. S. Peake. 24,457. October 21st.

Electric Striking and Chiming Mechanism. 1. H. Parsons and A. E. J. Ball 24,533. October 22nd.

Regulating Switches for Electrical Currents. C. W. Bailey. 24,858. October 26th.

Regulating Devices for Electrically-Actuated Air and like Fluid Compressors. Westinghouse Brake Co. (Westinghouse Air-Brake Co.) 24,912. October 27th.

Regulation of Dynamo-Electric Machines. Soc. Anon. "Phi" 25,026. October 27th. (August 6th, 1910.)

Electric Switches. Spagnoletti, Ltd., and V. E. Joyce. 25,076. October 28th.

Connector for Electric Cables. H. R. Doel and A. E. Clarke. 26,124. November 10th.

Party-Line Telephone System. E. Bowman. 26,440. November 14th.

Fastener for Lids of Train-Lighting Accumulators. W. N. Cochrane. 26,696. November 17th.

Electric Vapour Lamps. R. Ritzmann, M. Wolfke and F. Lissy. 27,163. November 22nd.

Electric Signs. P. C. Watmough. 27,981. December 1st.

Electric Connections and Focussing Arrangement for Electric Motor Lamps. C. H. Worsnop. 28,457. December 7th.

1911.

Contact Pins for Interrupters for Electric Circuits. Firm of Robert Bosch. 72. January 2nd. (February 11th, 1910.)

Sparking Plug. Officine di Villar Perosa Agnelli & Co. 1,562. January 20th. (June 2 th, 1910.)

Systems for Transmitting Signals Electrically through Conductors. F. Fisher. 2,686. February 2nd. (February 3rd, 1910.)

Magnetic Compasses. E. H. Clift. 3,404. February 10th. (Cognate application, No. 13,203 of 1911.)

Automatic Telephone System Selectors. F. R. McBerty. 3,452. February 10th. (February 10th, 1910.)

Electric Lampholders. W. Leonard. 3,746. February 14th.

Method of Starting and Regulating the Speed of Alternating-Current Motors. A. Heyland. 4,627. February 23rd. (February 24th, 1910.)

Insulating Material. British Thomson-Houston Co. (General Electric Co.) 5,165. March 1st.

Electric Conductors. Ges. für Elektrotechnische Industrie. 5,569. March 6th. (June 28th, 1910.)

Push-Button Electric Switches. Hartmann & Braun Akt.-Ges. 6,147. March 11th. (April 12th, 1910.)

X-Ray Tube. S. Tousey. 7,067. March 21st.

Electricity Meters according to the Ferraris Principle. M. Strelow. 8,032. March 30th. (March 30th, 1910. Addition to No. 21,240 of 1910.)

Electro-magnetically Operated Collectors for Electric Railways. H. W. Sheehy. 11,740. May 15th.

Electric Arc Lamps. Siemens Bros. Dynamo Works. (Siemens & Schuckertwerke Ges.) 14,127. June 14th.

Electrically-Heated Vessel. H. Mieth. 14,222. June 15th.

Device for Operating or Controlling Electric Switches and the like from a Distance. J. L. Odgers. 14,704. June 21st.

Experimental Apparatus for Intuitive Electric Instruction. G. Bache. 14,999. June 27th.

Apparatus for the Sterilisation of Milk, Beer, Water or other Liquids by Means of the Ultra-Violet Rays. W. R. Walkey. 16,110. June 12th.

Electromagnetically Operated Switches. C. B. Larzelere. 17,142. July 21st. (August 2nd, 1910.)

Current Transformer for High Voltages. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 17,408. July 27th.

Electrical Contact Devices for use with Moving Conductors. O. S. Schairer. 17,481. August 6th. (August 6th, 1910.)

Dynamo-Electric Generators. G. Inrig and Gavan Inrig, Ltd. 20,904. September 21st. (Divided application on No. 28,754 of 1910. May 2nd.)

Electrical Switches. A. Stephenson. 463. January 7th.

Electric Lighting System. E. M. Fitz. 2,727. February 2nd.

Electrically-Operated Signs and the like. A. D. Hecht and J. S. Dowdell. 4,821. February 27th. (Cognate application, No. 18,265 of 1911.)

Carbon-Holder for Distributors of Electrical Ignition Machines. A. G. Bloxam. (Firm of Robert Bosch.) 8,224. October 1st.

Electric Furnaces. W. E. Lake. (J. E. Florence.) 8,998. April 11th.

Electric Incandescent Lamp. O. Schaller. 9,719. April 21st. (April 21st, 1910.)

Reflectors for Incandescent Electric Lamps. E. Booth and N. R. Booth. 9,806. April 22nd.

Electric Capacitative Inductive Couplings. J. Schiessler. 13,962. October 12th. (Divided application on No. 24,696 of 1910, October 24th.)

Electrical Terminals. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 16,514. July 18th.

High-Tension Distributors for Electrical Ignition Systems for Internal-Combustion Engines. F. H. Royce and Rolls-Royce, Ltd. 17,204. July 27th.

Terminal Clips for Electric Wires. J. H. Kaeser. 18,575. August 14th.

Device for Short-Circuiting the Current of Magneto-Electric Ignition Apparatus. Firm of Robert Bosch. 19,233. August 28th. (May 15th, 1911.)

Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. and J. Whitcher. 21,662. October 2nd. (Divided application on No. 17,177 of 1910, July 19th.)

British Trade Failings in Turkey.—"The key-note of recent British Consular reports is, that owing to obsolete methods, our trade is not holding its own against the aggressive activity of our commercial rivals. The great failing of the British manufacturer would seem to be the lack of adaptability to the needs of his customer—and the sooner this is remedied the better. The necessity for direct representation, and more particularly the advantage of sending regular commercial travellers to this part of the world, cannot be too urgently impressed upon British firms, if they are to compete with our rivals in supplying the increasing demands of the country in every branch of trade."—*Journal of the British Chamber of Commerce in Turkey.*

A Dutch Tramway Contract.—It is reported from Mastricht that the A.E.G. has accepted the conditions imposed by the Dutch Government in regard to the construction of a tramway from Mastricht to Vaals. This is considered to represent the completion of the transaction.

THE
ELECTRICAL REVIEW.

VOL. LXIX. DECEMBER 1, 1911. No. 1,775.

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE MINERS' MINIMUM WAGE.

THE Miners' Federation of Great Britain duly held their adjourned meeting on the 14th ult., but, we are glad to say, did not carry out their foolish threat to call a national strike to enforce the impossible demands of ignorant and ill-advised miners, and, in fact, there now seems every reason to think—though the situation is still more or less critical—that the wiser counsels of the more reasonable section of the men's leaders will prevail over those imbued with the belief that, as coal cannot be dispensed with, the miners have only to refuse to work to obtain any terms they care to impose. At any rate, there is now no possibility of a strike at Christmastide, as the next meeting of the Miners' Federation does not take place until December 20th.

Previously to the last meeting, the owners again met the miners' representatives, when the latter proposed a minimum wage of 7s. per day, but the owners definitely stated that they could not agree to it. On the other hand, they (the owners) approached the matter in a very conciliatory spirit, and a provisional agreement was made between the parties fixing the wages of boys and day-wage men: the owners further offered to continue the negotiations with regard to the "abnormal place" question, with the object of giving each district an opportunity of devising means to regulate the additions to be made to the tonnage rate of a miner working in an abnormal place where the conditions are such that he cannot honestly earn a fair day's wage. Beyond this the owners cannot possibly go, and many think that to go so far is unwise—even in face of the threat of a national strike. In fact, many people intimately connected with the coal trade think that a strike would not be altogether an evil, as it would tend to clear the air and teach the miners a lesson which would settle matters for at least some time to come. As things are, the more militant section may look upon this concession as fear, on the part of the owners, of a strike, and the introduction of machinery for regulating the wages in abnormal places as the thin edge of the wedge towards the greater demand of a minimum wage all round. It is sincerely to be hoped, however, that the owners will remain firm against the latter demand, and will also carefully guard the proposed new machinery against any possible interpretation of its being applied to any working place other than the purely "abnormal." The real difficulty lies in the determination of what is an "abnormal" place, as it has been proved over and over again that one man will be able to earn good wages whereas another in the same place cannot do so, and the latter because of this will complain that it is "abnormal." The difficulty will thus readily be appreciated even by those who know nothing of coal mining. Who is to decide the question? A committee of miners' representatives, consisting for the

most part of inefficient workmen?—Be it noted, the good workman, capable of earning good wages, is as a rule satisfied with his lot, and even has very little sympathy with his grumbling, dissatisfied mates; but unfortunately such men take very little interest in the doings of the union, or we should undoubtedly hear less of complaints and threats to strike. But to return to our question; if, as is probable, a committee or board of inspection be formed, and on the men's side there are poor workmen filled with the idea of an 8s. daily wage minimum, it is most likely they will decide in every case that the place in question is "abnormal," and as there will also be certain fees paid by the union to the men making the inspection, one can easily foresee a most harassing time for the colliery manager and his owner, as undoubtedly as fast as one place is agreed upon as "abnormal" another will arise, and an "inspection" job will always be very much preferred to that of doing a day's work at the "face."

The fact is that during the past few years the owners have been much too generous, and have granted far too many concessions; and this, together with the ill-effect produced by the spouting of Socialist malcontents with an eye to a soft job in the union, has so filled the miner with a sense of his own importance, that he thinks he holds the key to lock or unlock—as he thinks fit—the door of the world's industry. He overlooks the fact that he is merely a labourer—a more or less skilled one we admit, but only of a second or third-rate class—and as such can only demand the wages of such class, for immediately wages go up in the coal trade, as they did, for instance, about 1901, men leave other occupations, especially sailors, farm hands, and such like, for work in the pits. It is true that a man must serve a sort of apprenticeship for a period of two years before he can become a fully-fledged coal hewer—the autocrat of the pit, as someone facetiously but aptly termed him—but this does not deter them. Considering the number of hours worked, the miner is one of the highest paid workmen in the country, but as all piece-work shows, whether in an engineering shop or at a coal-face, there is a great difference in men, and where one cannot earn a living another will do well.

As regards the profits from coal mining, it is an admitted fact that these only yield about 5 per cent., yet the leaders of the men—Mr. Straker, for instance, of the Northumberland Miners—are inflating the workers with ideas of huge profits being made by coal owners. In a recent speech, Mr. Straker said that coal hewers had not the necessaries of life, while owners were becoming millionaires, yet as we write we have before us a report of the annual meeting of the Horden Collieries, Ltd., where Sir Hugh Bell told the shareholders that the company had been registered for 11 years and 8 months, during 5½ of which years they did nothing but *spend* money, and now all they had to offer was a mere 1 per cent. This is not an old colliery, but one of the largest and newest in the county, replete with every modern improvement. But how many collieries are paying no dividend at all, and how many more are struggling on, though losing money, in the hope of better times coming? One colliery lost £20,000 in three months after the introduction of the Eight Hours Act, and had to be closed down. Mr. Straker, however, carefully avoids any reference to these cases, though he must be aware of them; instead, he would like to know the individual profits of coa owners, which information naturally is withheld, but he ha no more right to assume because of this that owne are pocketing huge profits than we have to take the 10 and 15s. per day to coal hewers as fair examples of th wages of miners. We know that some coal owners are doin well, as we know that some coal hewers are earning excep tionally good wages, but no industry can be regulated a regards wages by taking the lowest wages and highest profi of individuals as Mr. Straker wishes to do.

To sum up the position as it stands at present, we hav the men in Northumberland and Durham—the latter count at present taking a ballot vote against the three-shift syste —and South Wales clamouring for a national strike, whi the men in the other federated areas, excepting perha Derbyshire, are more or less contented, while the owne are doing everything possible to meet the demands in ord to avoid a national calamity. A meeting of owners an men's representatives is again to take place on December 6t and a further meeting of the Miners' Federation o December 20th, and on these two meetings depends the issu Whether it will be war or peace none can say, but as we hav already said, many would welcome the former as probab being the evil which would produce most good. Meantim we repeat our warning to all depending upon a coal supp to watch and be prepared as far as they possibly can.

London Railway Electrification.

From time to time it has been our wo to criticise the laggard attitude of th more important English railways in th matter of railway electrification, and on only need look over the astonishing crop of electric railwa proposals for London, which made its appearance so sudden last week, to realise what scope there is for local electr railway working.

The various proposals touch the North, East and West the metropolis—on the South side, apparently, no furth development beyond the work already carried out by th Brighton Co. is to be looked for yet, as the South-Weste Co. are absorbed in the work of reconstructing Waterlo Station to the exclusion of other matters, and the Soutl Eastern and Chatham Co., judging by official utterances, a determined to live up to their reputation for chronic indiffe ence to traffic working, which results from crowded termin stations and lines.

Of the new proposals put forward, that of the North Western Co., for the electrical working of its own lin between Euston and Watford, and the leased lines of th North London Co., between Broad Street and Kew Bridg Station—through which, of course, the District Co.'s electr trains now run to Richmond—is a most comprehensive on embracing some 40 miles of route. Possibly the mos interesting feature of the above scheme, the cost of whic it is understood will fall on the North-Western Co. shoulders, is a proposal to construct a short connecting tub line between Queen's Park and the Paddington terminus o the Bakerloo tube railway, and to run tube trains from th South London terminus of that line to Watford. Apparentl no constructional difficulties are anticipated in connectio with the joint rolling stock; at any rate, the North Western Co. has taken up a very different attitude to tha which resulted in the expensively large tube of the Grea Northern and City Co. and its full-size rolling stock bein adopted.

The scheme marks the first real attempt of the North Western Co. to cater adequately for the suburban passenge and it avoids the costly tube railway from Kilburn to a

underground station at Euston, originally included in the company's 1907 proposals.

Curiously enough, the announcement of the North-Western's Watford scheme was immediately followed by one on the part of the Metropolitan Co., which proposes to build a branch line to that place, and to extend its electrically worked services there also.

Yet another proposal, that of the Central London Co., which is already engaged on extensions which will link up Liverpool Street with Ealing through its tube line, is to build a loop line through Chiswick, Kew, Hounslow, &c., to the new Ealing line; and this does not exhaust the list, for the East London electrification will shortly be under way, and the District Co. is busily engaged in doubling tracks wherever possible with a view to still further augmenting the wonderfully frequent services which it now gives.

We have refrained from mentioning the Brighton Co.'s further electrical projects, which are understood to be of a comprehensive character, and the ultimate destiny of the Tilbury line, in the event of the Midland Co. taking over that concern, is probably bound up with electrification.

While it is, of course, somewhat idle to speculate on the prospects of these various projects at the present stage, it is useless for the most ardent steam traction enthusiast to deny their far-reaching character or the inference which may be drawn from them. The lessons of the District, Metropolitan, South London and other electrified lines are at last bearing fruit, but it is astonishing that, in the case of existing railways, it should be necessary for the latter to be on the verge of collapse before the owners can be brought to see the expediency of spending money on a good thing. Obstacles there are always in the way of financial railway proposals, but it is difficult to understand why productive expenditure on electrification meets with such determined opposition on the part of the older railway companies, that it may generally be said that they only adopt electrical working under compulsion.

It is this aspect of the matter which strikes one most forcibly—nothing less than disastrous competition on the part of tramways, 'buses, or other electrically worked lines, will, as a rule, influence the English railway director, although there is another aspect of electrification, even more important than its ability to meet competition, and that is, the opportunity which it gives of relieving the ever-increasing congestion of existing terminal approaches and stations, even with a more frequent service of trains than may be accommodated under steam working.

To realise how important the question of terminal accommodation may be in London, one only needs, for instance, to use habitually the London Bridge stations of the Brighton and South-Eastern Companies; at a moderate estimate, nine-tenths of the steam trains entering these stations are some minutes late under normal conditions, and the merest hint of other than normal conditions renders their working chaotic in the extreme.

We are entirely in agreement with a writer in one of the financial papers, who says that "Electrification within a radius of, say, 25 miles from a great London terminus represents . . . . the only means whereby it is possible both to reduce terminal congestion at a minimum outlay and to make that outlay productive of new business." The North-Western Co.'s scheme is important in that the company appears to have fully realised the fact.

The question of terminal congestion due to suburban traffic appears to be the crux of the whole situation; practically all the great railways, except those which have elected to extend their London terminal accommodation at enormous expense, must shortly face the situation, and meanwhile the suburban passenger must presumably put up with the callous disregard which, in too many instances, has been his portion for years, and which, it is not too much to say, has driven him to the electric tramways for suburban journeys of up to 5 miles or so.

The tramways are within easy reach of the majority, the services are frequent and involve little waiting about; they are also cheap, and in the end do offer a quicker means of transit for a short journey, than many of the infrequent, unpunctual, crawling, stopping trains which some companies appear to regard as "an excellent suburban service."

The Burdens of the German Manufacturer.

A REPORT presented to one of the principal German Associations of Engineers (the Machine Makers), and referred to in an engineering contemporary, dwells upon the increasing difficulties which the German engineering industry has to face, and shows pretty clearly that on the other side of the North Sea the stress of competition is at least no less keenly felt than here. Employment was in July reduced by 4 per cent. as compared with the previous two years, which were, however, exceptionally busy ones.

The actual dividends earned by the various engineering concerns reported upon must be considered very good, the average earnings for textile machinery being 13 per cent. in 1910, agricultural machinery 9·5 per cent., locomotives 9·4 per cent., and for general machinery 5·1 per cent.

Complaint is made of the long credits that have to be given, especially in the foreign trade, and of the manner in which such credits are extended by the customer on various pretexts, which results in a large part of the manufacturers' profit going to pay interest on bank overdrafts.

The main difference in this country is that the banks here are not nearly so ready to assist the manufacturer as the German banks are, which gives the Germans a very great advantage in the getting and carrying-out of orders.

A British Consular report from Leipzig bears out the above account and draws attention to the efforts, sustained, systematic, and highly effective, adopted by our German rivals in South America, Russia, and in practically all the British colonies and dependencies.

The old story is repeated. Longer credit is given and closer attention is paid to the requirements of the customer. Immense importance is attached to the foreign trade; and no pains are spared to gain and keep a good position in each importing country, whether by Government officials, association of traders, or individual firms.

Nevertheless the increased cost of living, the rise in wages and other growing burdens of manufacturing, are beginning to tell; and competition is being daily felt to be more severe. We venture to add, on our own account, that the handicap against the German on account of his import duties is probably well balanced by the much higher rates we have to pay for transport over much shorter distances, and the general official and political apathy with which all matters connected with the prosperity of industry are treated in this country. Individually we may be a nation of shop-keepers, and fairly successful ones; but collectively the nation seems to take less interest in its trade than would be required to make a success of a shrimp barrow.

Electrical Accidents in Mines.

In the discussion which took place on Friday in the House on the "Coal Mines Bill," the use of electricity in the pit naturally gave the scaremongers their opportunity. Mr. W. E. Harvey said the men received with alarm the introduction of electricity into the mines. The expert opinion was that the West Stanley Pit disaster was due to electricity, and the men were looking to the Government to give them every protection in the matter.

It is when one reads such stuff as this, that one wishes every Member of the Cabinet and every Member of Parliament could be supplied with a copy of our leader of last week, and of the many previous articles on the same topic, published in our pages.

Incidentally, too, the discussion leads to the hope that some day a reformed House of Commons may contain a fair percentage of engineers, now that so much of a technical nature occupies the attention of Parliament; for when we see hon. members like Mr. Keir Hardie openly advocating a return to the naked lights of bygone days, on the ground that the use of safety lamps is only an excuse for not taking other and more efficient means to prevent explosions, we rub our eyes to be sure we are not dreaming. Mr. Keir Hardie's pleasantries in the House may add to the gaiety of nations, but not to the safety of the miner. As we write, the daily papers report another pit explosion, with fatal results, in Staffordshire—*not due*, it appears, to the introduction of electricity.

KJELLBERG ELECTRIC WELDING SYSTEM.

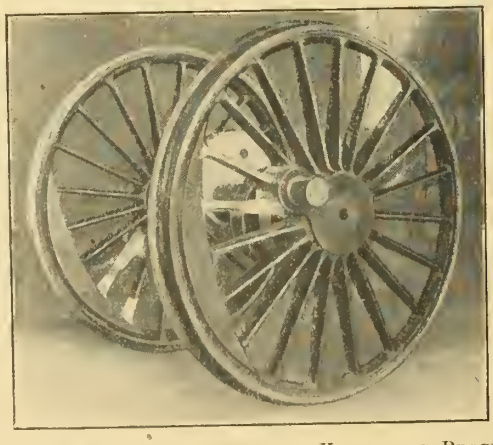
As mentioned briefly in a recent issue, the Kjellberg Syndicate, Ltd., has for some time been introducing the electric welding process, patented by Mr. Kjellberg into this country. The process originated in Sweden, where the parent company has been in existence for five years, and



Swedish Firebox welded throughout by the Kjellberg Process.

as in all seven companies are working the process, in various countries, it is obviously a proved one for practical purposes.

The essential feature of the Kjellberg process is the use of a metal electrode covered by a special sheath constituting a second-class conductor, which apparently acts as a guide for the molten metal passing from the rod to the weld, and at the same time enables the composition of the welding material to be suitably varied to meet the conditions of the work. Thus a weld can be obtained of any desired strength or ductility, while the great drawback of carbon welding, *i.e.*, the absorption of carbon particles in the molten metal, is entirely avoided. But the Kjellberg process has an outstanding advantage over all others, in that the welding can be done



Loco. Wheels repaired by the Kjellberg Process.

overhead equally as well as downwards, and this opens up a sphere of usefulness in boiler repair work,, as cracks or defects in the crown of a furnace can be welded *in situ* from the interior of the furnace.

Generally speaking, the process requires 120 amperes at 110 volts pressure; in practice a 200-ampere supply should be available, together with suitable resistances to reduce the pressure according to the conditions. Practically constant voltage is a necessity, but a 3 per cent. variation is allowable.

The syndicate has carried out a great variety of welding at its temporary works and in different parts of the country; we illustrate one of a number of (Swedish) vertical fire-boxes with water tubes which were welded throughout by this process, also a special piece of welding for the Swedish State Railways, over a score of driving wheels of this kind having fractured in use and been finally and successfully welded by the Kjellberg process, after gas welding had proved unavailing. In this country work has been carried out for the Coventry Ordnance Works, Messrs. Cammell Laird & Co., the Darlington Forge Co., the General Steam Navigation Co., the London Electric Supply Corporation, &c.

A valuable feature of the process is its adaptability for adding metal, thickening up corroded boiler plates *in situ*, worn journals and shafting (which can be subsequently turned up), worn rail flanges, &c.; in fact, the process seems to be well worth the attention of the tramway engineer who is still struggling with the problem of overcoming the premature wear of the rail joint as compared with the remainder of the rail. The facility with which the composition of the weld can be adjusted to requirements would appear to be specially advantageous in the above case.

Not the least interesting work carried out was the experimental welding of cast-iron and wrought-iron tips to a cast-iron propeller for the General Steam Navigation Co.; for marine work generally the process has had a wide application, many fractured stern frames of large size having been welded to the satisfaction of the marine inspection societies.

As to the cost of the process, it is many times cheaper than gas welding, and even cheaper than fire welding, while it is, of course, far more convenient and capable of turning out a clean and satisfactory job.

So far as hammer and chisel work over one of these welds could demonstrate the metallic continuity of the joint, we were, on the occasion of a visit of inspection, very favourably impressed.

The simplicity of the apparatus employed, and the apparently reliable character of the results obtained, are greatly in favour of the Kjellberg process.

IRONMONGERS AND THE SALE OF ELECTRIC LAMPS.

By H. E. GOODY.

For a long time there has been simmering in the minds of wiring contractors a sentiment of unfair treatment, on the one hand by the public, and on the other by the big wholesale firms and manufacturers.

The custom of giving the wiring work to a local contractor, and then going to the city and buying the fittings at the manufacturers' showrooms, is such a usual one as to excite no comment; and hitherto the contractor has had some little hope of profit, because he knew that he would probably be asked to supply lamps, not only at the time of installation, but also in future years for renewal purposes.

At the ruling suburban prices it is quite impossible to make a living by wiring alone, and, as I have said, the contractor has not depended on it for profit, nor has he looked to the sale of fittings for recompense. The wholesale houses have long since deprived him of that by selling direct to private customers. The supply of lamps was the rock of his financial salvation, and constituted the only department of his business which had escaped the encroachments of the wholesaler and the discount hunting of his customers.

And now the contractor is in danger of losing even this source of income. Ironmongery has enlarged its scope, and the incandescent electric lamp, the complexity and technical mystery of whose manufacturing processes should have saved it from this final disgrace, has become part of a stock-in-trade which includes putty and French nails. But it is not on a point of dignity that the case against the sale of lamps by ironmongers rests.

Supply pressures vary with the locality, so that in the case of electric lamps there are two inconstant factors—voltage and candle-power. In spite of the extended use of electricity amongst all classes of the community, there is a wonderful amount of ignorance in the matter of lamp ratings.

Nine ordinary consumers out of ten do not make any intelligible distinction between voltage and candle-power, and the question of lamp ratings is still further complicated for them by the use of transformers. Therefore it comes to this, that the average consumer, when he goes into a shop to buy an electric lamp, does not know a bit what he wants, but is compelled to leave himself entirely in the hands of the salesman, and trust to getting something that will neither glow redly like a Bastian heating element, nor give, like magnesium wire, a brilliant glare as a prelude to imminent dissolution and darkness.

To make sure that he is supplying a suitable article, it is necessary for the salesman to cross-examine his customer as to the conditions of his (the customer's) electrical supply. To ascertain the supply pressure, he will probably have to ask the customer for his address; and even then there remains the question of transformers, and to find out whether there is one installed or not the salesman may have to ask how much was paid for the last lamps purchased, and guess from that, or else give a detailed and graphic description of a transformer, so that the customer can say whether he has seen such a piece of apparatus in his house.

Of course, if a man brings his broken lamp to the shop the matter is a perfectly simple one; but that is not often done, and the task of finding out what sort of lamp is required usually devolves upon the salesman.

Thus, the chief argument against the supply of lamps by ironmongers and other electrically ignorant tradesmen is that, in the nature of things, they cannot be safely trusted to sell in any given case the right sort and size of lamp. The ironmonger sells a thousand things of common everyday use about which no inquiry of a technical nature is even remotely necessary; and it is not likely that the assistant who has just been doling out tin-tacks or dresser hooks in an entirely confident manner, free from all qualms or questionings, and who has probably never seen an electric lamp out of its wrapper, will be a trustworthy salesman of the last commodity.

The sale of electric lamps, and the giving of advice in connection therewith, are still matters of a somewhat technical nature, and they will remain so until such time as supply pressures shall be standardised, and the use of transformers rendered superfluous. When that time arrives it will not matter who sells lamps, so long as someone sells them, for all possibility of danger will have been eliminated.

Apart from the main argument as to the unfitness of ironmongers to supply lamps, there is the further question: Is it fair to the wiring contractor? Wiring contractors are a much abused class, but after all they are the class chiefly to be looked to for the popularisation of electricity, and if their business is going to be made quite unprofitable by wholesale methods and public indifference, they may revolt as a body and devote themselves to gas-fitting. I say this in all seriousness. It is difficult to exaggerate the influence of the wiring contractor, and unless it is made worth his while to stick to his trade, he may use his influence in recommending some other illuminant which it pays him better to install.

The lamp manufacturers are to blame. Several firms which recently embarked on immense advertising schemes, have made a point of getting ironmongers and house decorators to take up the sale of their lamps. They give them the same trade discount as they give the wiring contractor, and in their lamp lists and pamphlets they use the terrible phrase "to be obtained of all ironmongers." The fact of the matter is these firms have treated the wiring contractors very badly from the beginning. One firm at least will supply anyone who cares to journey to them with lamps at trade discount; and as if this were not sufficient, they have lowered the discount to such a point that, what with the inevitable breakages, it hardly pays the contractor to stock these lamps. As a consequence, contractors, whenever possible, supply lamps of a less well-known make on which they can make a larger profit.

The delinquent manufacturers are now attempting to force the hands of the contractors. They say "we will make the name of our lamp a household word by means of extensive advertising, so that continual inquiries therefor will compel you to stock it whether you like our terms or not; and furthermore, in case you think we are dependent on you for the distribution of our products, we will supply the public through the media of ironmongers, oil and colour shops, and house decorators."

I am no prophet, and for me the final issue of these belligerent preparations is wrapped in obscurity; but it does not seem likely that even the biggest lamp manufacturer will be able to ride roughshod over all the electrical trade interests (excluding, of course, his own).

I would not for a moment abuse or discourage any business method which tended to the popularisation of electricity; but the particular method criticised in the preceding paragraphs is certainly not calculated to do anything of the sort. It simply means taking the supply of a certain commodity from the hands of a class of men who are competent to surround it with intelligent safeguards, and putting it in the hands of men who, however well-meaning, have not the necessary knowledge or ability.

Lamp manufacturers would, I think, be well advised to refuse to supply any trader with lamps at trade discount, unless the said trader is himself, or has in his employ, a person of electrical training and experience.

A NOVEL COUNTRY HOUSE INSTALLATION

By FRANCIS H. DAVIES, A.M.I.E.E.

In the ordinary course, one country-house installation is very like another, and whatever form of motive power be employed, there is generally little of a distinctive nature about the generating machinery or any part of the plant. There are, however, exceptions, and the subject of this article may be deemed a noteworthy one, since power for lighting, heating and cooking is derived from a motor-car engine without in any way interfering with the regular use of the car.

The installation, which is situated some few miles out of London, has now run successfully for close on two years, and having thus passed the experimental stage, some details of the equipment may be of value.

Fig. 1 shows the arrangement of the generating plant, which consists of a 5½-KW. British Westinghouse dynamo driven by the car engine at 1,650 R.P.M. The car itself is a 20—28-H.P. four-cylinder Darracq, the engine of which



Fig. 1—Car-Engine Driving Dynamo.

runs at 750 R.P.M., and drives the dynamo by means of a 13-in. special split pulley fixed to the shaft on the engine side of the clutch. The length of the drive is 6 ft., and a 3-in. Gandy belt, fitted with Jackson fasteners, is used.

It will be seen that the dynamo is mounted on wooden blocks, the whole being held together by two straps and four bolts. The belt is kept tight and the length of the drive fixed by means of a screw jack bearing on a block of wood placed against the car frame, as shown. There is just sufficient clearance on both sides for the belt, which runs without any trouble. It will be obvious that the ca

cannot be placed in exactly the same position every time it is required to use the dynamo, and hence the latter is not fixed to the ground in any way, but depends for stability entirely upon its own weight and the jack. The success of the arrangement is probably due to its simplicity, which, however, is the result of a considerable number of experiments with other drives. It could no doubt be applied to numerous classes of cars, but it is unlikely that every make and size would afford the necessary clearance for the belt and special pulley, and those two points will usually be found to constitute the chief difficulty. To keep the engine as cool as possible it is run with the bonnet off, and the tires are pumped hard in order to give rigidity. Paraffin at 4½d. a gallon is used in the engine without any alterations to the carburetter, it being found necessary only to heat the induction pipe by a blow lamp at the commencement of the run. At the normal load of 4 KW. the engine consumes 1 gallon of oil in 1½ hours, and the fuel cost thus works out at the low figure of ·75d. per unit.

As a considerable amount of energy is used for cooking, &c., a comparatively large battery of 200 ampere-hours' capacity has been installed. It is of the Tudor type, and part is housed, as shown in fig. 2, in a simple wooden erection, which readily takes to pieces in order to give free access to the cells. The remaining part of the battery is in an adjacent shed, which contains among other tools a lathe driven by a ½-H.P. motor. As there is ample margin in the generating and battery plant, it is proposed to extend the use of power to water pumping and lawn mowing, thus enhancing the usefulness of the car and its engine to an extent undreamed of by the average motorist.

An interesting point about the installation, which is the outcome of increased use of the cooking apparatus, is the provision of a two-voltage supply. The orignal installation was run at 50 volts, but this is now only employed for lighting, and the cooking apparatus is operated at 70 volts off the whole battery. Three bare overhead wires, some 35 ft. long, transmit current to the house, where the supply is tapped off at 50 volts or 70 volts, as may be required.

The cooking installation, by reason of its completeness and the fact that practically all culinary operations are performed with it, is of particular interest. Further, very careful records have been kept, and it is hence possible to give authoritative data of consumption, &c., in everyday practical use. The whole of the apparatus is of the Economic type of Messrs. F. A. Wilkinson & Partners, Ltd., Harpenden, and the range and oven is illustrated in fig. 3. In addition, there is installed one 700-watt toaster, one 600-watt rapid heater, one 1,000-watt combined stove and radiator, one 1,000-watt lamp substitute radiator, and one

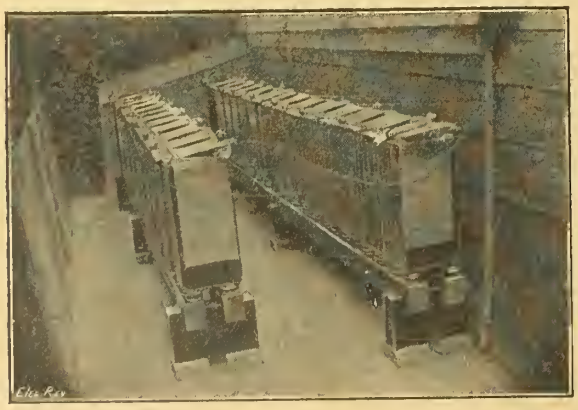


FIG. 2.—BATTERY INSTALLATION.

700-watt heater on the Tubead system. The oven has four heats, and is equipped on the top with grilling and boiling attachments, each of which has two heats. There is also the usual lamp indicator board, on which are placed the switches, as it has been found by experience that this is the only satisfactory course. Ordinary household utensils are employed, the construction and design of the apparatus rendering flat-bottomed or special utensils unnecessary. The range on the top of the oven is so designed that boiling operations can be carried out simultaneously with grillin and toasting beneath, and a metal slide is provided to defle the heat when one operation only is carried on at a time.

A great deal of data as to cost, &c., are available, but tl following have been selected as typical of the resul ordinarily attained :—

7½ lb. of beef, potatoes, cauliflower, rice, rice puddin Consumption 3·9 units.

1½ lb. of lamb, 2 lb. fish, potatoes, asparagus, custa pudding, fish sauce. Consumption 3·8 units.

Four chops grilled simultaneously with the boiling of cabbage and potatoes. Consumption 1·9 units.

Large slices of toast are made at the rate of one slice i two minutes with a consumption of 600 watts per hou

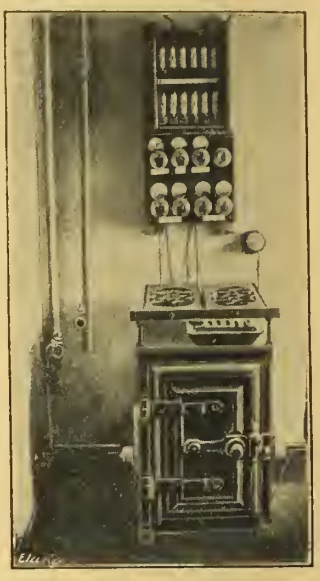


FIG. 3.—ELECTRICAL COOKING RANGE.

Three pints of cold water are boiled on the rapid heater an ordinary tin kettle in 23 minutes with a consumption 600 watts per hour.

As the cooking circuit is metered, the above figures a accurate. For this purpose a Siemens watt-hour meter installed, and the lighting circuit is provided with an amper hour meter.

The total cost of the installation, excluding the car b including wiring for some 25 lighting points, amounted £98, a very moderate figure, largely contributed to by simple system of surface wiring. Armoured flexible has be used throughout, and installed in such a manner that in t event of a change of residence it could be taken out and us over again with a minimum of expense. This considerati had, indeed, an important bearing upon the whole design the installation, which, in fact, might be moved with facili in a few journeys of the car, and with a minimum of cost making good.

Tripoli.—Just before the war broke out the municip authorities were in correspondence with the Minister of Publ Works in Constantinople for permission to invite public tenders f the construction of such necessary utilities as water supply a sewerage schemes, electric lighting, and tramway plants and public telephone service. After the war is over——

Syria.—An American Consul reports that the Municip Government of Aleppo has had plans and specifications prepar for the construction and operation of an electric tramway for th city, covering all of the main thoroughfares; also for an electr lighting system to take the place of the present antiquat petroleum lamps. "It is desired to grant the concession for t two projects to the same concern, and at the same time in order ensure better success and more economical service. It appears pr bable that the power may be conducted by cable from the Daph Falls, or from the Orontes River, both near the city of Antioch, distance of some 60 miles from Aleppo. Inasmuch as there are means of locomotion in Aleppo, estimated to have a population 200,000 to 250,000, except by carriage, which must be driven ov exceedingly rough stone streets, and as there are no lightin systems such as electricity or gas, there is little doubt that the tw propositions, taken jointly, would provide a lucrative profit to t concessionaires."

TWO-WATTMETER METHOD OF MEASURING POWER IN THREE-PHASE CIRCUITS.

By D. H. OGLEY, B.Eng., Royal Technical Institute, Salford.

This method of power measurement is apt to confuse many, for whereas the two meters are connected in a precisely similar manner, their readings in general vary. A little consideration will, however, make the reason for this clear.

Suppose that it is required to measure the power supplied to a three-phase induction motor, the stator of which is star connected.

The thick, or current, coil of each wattmeter is connected in series with one of the supply mains and one of the terminals of the machine, while their volt coils are connected between the same mains and the third line, as shown.

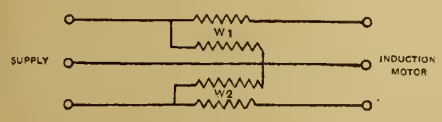


Fig. 1.

In this case of a three-phase star-connected circuit, the E.M.F.'s acting differ in phase by 120°. Let O M, O N, O P (fig. 2) represent the maximum values of the P.D.'s between the ends of the stator circuit and the neutral point.

Then M N will represent, in relative phase and magnitude, the P.D. between the points M and N or between two stator terminals. Similarly M P and N P will represent the P.D.'s between the points M and P, and N and P, or between the other terminals.

M N, M P, N P, thus represent in relative phase and magnitude the line voltages.

Let V represent the maximum value of the P.D. between any line and the neutral point. Thus V is represented by M, O N or O P.

Then M N, M P or N P $= V\sqrt{3}$.

Since the motor circuit is an inductive one, the current lags behind the E.M.F.

Let $o\,m$, $o\,n$, $o\,p$ represent the current lagging by an angle θ.

Now from fig. 1 the current through the main coil of wattmeter W_1 is represented by $o\,m$, while the P.D. across the terminals of the pressure coil is represented by M N.

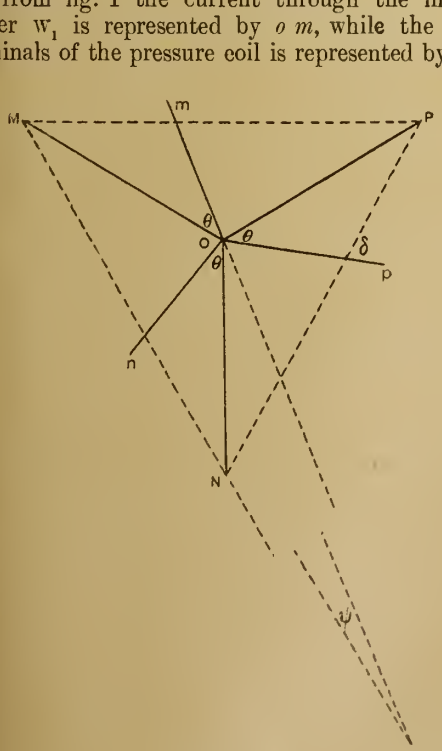


Fig. 2.

The angle ψ of phase difference is obviously $\theta - 30$.

The angle δ—the angle of phase difference between $o\,p$ and N P—representing current and pressure values for W_2, is $\theta + 30$.

Let W_1 be the reading of the first wattmeter,
" W_2 " " " second wattmeter,
" I represent the maximum value of the current.

Then $W_1 = \frac{\sqrt{3}}{2}\,V\,I\cos(\theta - 30)$,

$$W_2 = \frac{\sqrt{3}}{2}\,V\,I\cos(\theta + 30).$$

These values will vary, of course, with the value of θ.

Thus for $\theta = 30$,

$$W_1 = \frac{\sqrt{3}}{2}\,V\,I,$$

$$W_2 = \frac{\sqrt{3}}{2}\,V\,I\cos 60 = \frac{\sqrt{3}}{2}\,V\,I\,\frac{1}{2} = \frac{\sqrt{3}}{4}\,V\,I.$$

It is thus clearly indicated that the readings on the two wattmeters will vary, until as θ gradually increases and at length becomes equal to 60°, W_2 reads zero. If θ becomes greater than 60°, as it probably will do if the motor is running light, then W_2 reads in the reverse direction. This may necessitate the reversal of the shunt-coil in the case of some wattmeters, and the two readings will have to be subtracted to give the total power.

For any case :—

$$W_1 + W_2 = \frac{\sqrt{3}}{2}\,V\,I\,\{\cos(\theta - 30) + \cos(\theta + 30)\},$$

$$= \frac{\sqrt{3}}{2}\,V\,I\,\sqrt{3}\cos\theta,$$

$$= \frac{3}{2}\,V\,I\cos\theta,$$

which is clearly the total power in the circuit.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Reliable Rectifier Wanted.

Your correspondent " J. R." seems inclined to invert the natural order of things, which conserves the type but is prodigal of the individual, for he appears to be willing to reprobate the species without having had experience with the unit.

Being interested in the " Batten " rectifier, I, upon reading his letter, at once offered my services with the view of getting him out of his difficulty with his instrument, only to find that he had not one. Considered in this light, his mention of the name of " Batten " was not cricket.

In the event of my experience in the matter of rectifiers being considered at all interesting, I should like to be permitted to give a little history of the invention. In 1900, a medical friend had the alternating current led into his house, and as he had already made use of the suave assistance of Demoiselle Elektra in his practice, he hailed the advent of an unlimited supply with delight, which rapidly ebbed as limitations of its usefulness from a chemical and electrotherapeutical point of view unfolded themselves. My assistance was invoked, and we set to work together to straighten out some of the kinks. Small synchronous motor commutators, in air, in spirit, and in paraffin were tried, worked and abandoned. Electrolytic rectifiers were found to need enormous mass and superficial area of plates or liquid, and even then only worked passably well when the cells were water-jacketed to keep the temperature somewhere near normal. Then electrolysis at joints gave us trouble. A limited experience with vacuum rectifiers promised little and performed less. Being a telegraph man, I knew very well that a speed of vibration of 100 per second offered no difficulties to a small properly pivoted polarised armature moving between two rigid stops, and upon these lines a new form of relay was designed and formed the basis of the " Batten " rectifier. This I have found little difficulty in adapting to any normal requirements, but for reasons best

known to themselves, the supply companies are generally most unreliable in their statements with regard to frequency, and this is a vital point, not on account of the vibrating armature, but the efficiency of the transformer, which forms an essential part of the apparatus. A modification of the instrument, breaking the circuit in mercury at a point in the phase when the voltage was highest, enabled us to work an X-ray tube spark coil direct off the secondary of the transformer. As far as I know, the few rectifiers of this type that have been constructed upon the original lines have given every satisfaction when intelligently used, and in more than one case of motor engineers they have done good work in charging spark coil accumulators on business lines, and have paid for their small first cost many times over. Our troubles have been commercial rather than technical or experimental, the apparatus having proved itself thoroughly reliable if given a chance to prove its merit.

Geo. Sutton.

Dulwich, *November 23rd*, 1911.

Operators in Electric Theatres.

I have read with interest the article on electric theatres in your issue of November 17th. I have come in contact with several operators and know that they experience considerable difficulty in obtaining efficient theoretical tuition in their particular branch of the profession. Their salary debars them from participating in private coaching, while the technical classes are of no use to them, because their presence is required every evening at the theatre. Perhaps special day technical classes at the various large centres would overcome the difficulty.

Bearing out your correspondent's remarks, at a local theatre, at which we were informed the arc was hissing and flickering badly, a visit revealed the fact that the pressure (D.C.) across the arc was 90 volts, the current at the same time being over 90 amperes. The arc and carbons seemed to consist of a single ball of fire, the whole of the carbons running red hot. The temperature inside the operating box was unbearable to an outsider, yet the operator seemed proud of the fact that he could produce such an effect.

The condenser requires replacing about every month, the forces set up due to the violent expansion and contraction of the metal case eventually fracturing it; while, at the same time, a special shutter has to be provided to shield the film when stationary, otherwise it inevitably catches fire.

Daniel H. Ogley,

Royal Technical Institute, Salford.

November 22nd, 1911.

Electricity in Mines.

You are rather hard upon the colliery electrician. There are probably good men who, through no fault of their own, cannot keep the electrical appliances below ground in good order. Take a main road underground, with power cables, lighting cables and signal cables running along it. This is a very bad road, the road constantly lifting, the bars breaking, and falls of roof very often taking place. Datallers are working at it every night, timbering and removing the dirt. The cables are dropped on the floor and covered with wood while this work is going on (at least they are supposed to be, but very often they are left uncovered, and it is not a difficult matter to tell the treatment they have had). When they have finished they will tie all the cables together, and sling them on to a piece of iron or a nail; in fact, they think that they will do anyway: "it's only a cable" being an expression that is often made use of.

This work is going on night after night, week after week. How can anyone keep cables in good order that are being knocked about like this? The electrician knows how bad the cables are; he reports to the management that the road is not fit for cables. He is told that there is no other way, and they are bound to have the current on, and he must keep them in as good a condition as possible. Consequently, they are being worked in an unfit condition. This is one of many cases where the electrician is not to blame.

You also mention the responsibility of the collier manager being shared with a certificated engineer. Th President of the Association of Mining Electrical Enginee stated in his Presidential address that the electrician mu always be subject to the engineer. I do not know who h means by that. If the colliery manager is meant, it is a we can expect at present; but if enginewright is meant, can hardly be expected to raise the status of an electricia when he has to be subject to a carpenter or a blacksmith, a these are very often the men who are appointed to the po of enginewright. I want more responsibility to be attache to the electrician; he would then have a say as to h apparatus and his men. It would be bound to improve th use of electricity in mines.

Interested.

The Cash Value of Electrical Knowledge.

The following is an advertisement from yesterday's *Manchester Guardian*:—

> Wanted, in Mains Department of Electricity Supply Station, near Manchester, Man to install, maintain and repair motors, and make himself generally useful in the department; one able to fix and read meters; wage to commence, £1 per week of 50 hours, with prospect of increase for satisfactory man. Address, &c.

There is not much to say about this—it speaks for itse —except to express the pious hope that the "prospect" wi not be too dazzling for the satisfactory prospector's eyesigh If this advertisement emanates from a public body, it is public disgrace; if from a private company, the latt deserves the disaster it is courting in employing skilled labo at this figure.

John S. Leese.

Manchester, *November 22nd*, 1911.

P.S.—The Institution of Electrical Engineers would, I su gest, be more profitably employed in the investigation of suc cases as the above than in chopping and changing its intern rules and regulations, with which pastime it appears to i exclusively engaged at the present time.—J. S. L.

THE SUBTRACTIVE PRODUCTION OF ARTIFICIAL DAYLIGHT.

Messrs. Ives and Luckiesh have recently described a series experiments on the subtractive production of artificial daylight, t results of which are of the greatest importance in cases where tr colour values must be realised, even at the cost of extravaga production.

Gas flames and electric glow lamps have a deficiency of blue and excess of red rays as compared with daylight, and in fig. 1 (curve T) a shown the relative intensities of various colours in average daylig and in the light from a tungsten lamp when giving approximate the same illumination. To correct the colour of the tungsten ligh the redundant rays may be absorbed by a colour screen, the tran mission of which should be the reciprocal of the relative brightne of the illuminant and daylight at every point of the spectru

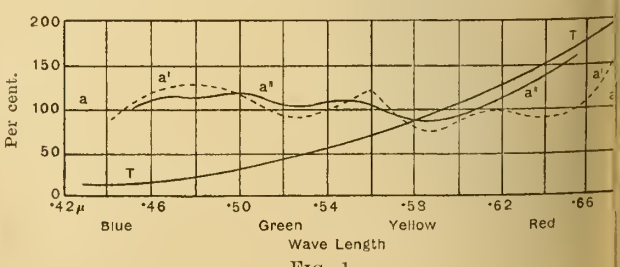


Fig. 1.

The transmission curve of such an ideal medium is as shown at fig. 2; curve *b* shows the actual brightness of tungsten lamp radi tions, and *c* shows the same after absorption by the screen *a*. Th candle-power of the filtered light is about 15 per cent. that of th original light, *i.e.*, the "daylight" efficiency of tungsten lamps about 10 watts per m. spher. C.P.

It is, of course, impossible to obtain an absorbing medium exact conforming to the ideal curve *a*, fig. 2, particularly in view of th variable nature of daylight itself. So long, however, as th artificial daylight merely differs from *a*, fig. 1, by a reasonab

amount progressing smoothly towards the red or blue end of the spectrum, we are merely matching a different quality of daylight.

The human eye can adapt its colour scale to suit any reasonable approximation to daylight, and a light having a "humpy" spectrum can yield quite a good impression of daylight, but, some colours being partially or wholly absent, will not give true colour matching of monochromatic colours. Actually, however, most colours dealt with in everyday work are very complex mixtures, so that it has been found quite possible to get satisfactory results from a screen yielding a more or less "humpy" spectrum on the emergent side.

Coloured glass is preferable to dyed films or liquid filters as a colour screen material, owing to its greater permanence, more practical nature and distributed absorption characteristic (dyes have a sharp, local absorption).

Cobalt-blue glass transmits blue rays, an isolated yellow-green band and deep red; placed over a tungsten lamp, it yields a purple light. Signal-green glass reduces the red rays transmitted by cobalt-blue, but, used alone, yields too green a light. A good combination of the two may be found by trial with a pair of carefully ground wedges, the outstanding yellow-green transmitted by the combination being absorbed by a screen of gelatine

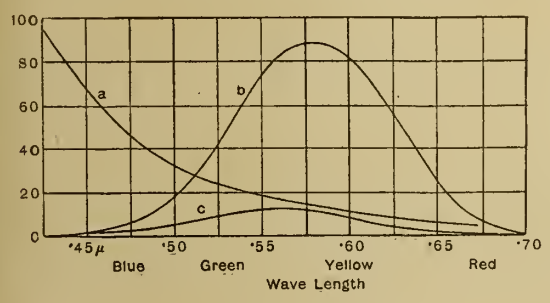


Fig. 2.

dyed with rozazeine. The spectrum of the light transmitted by this combination shows "humps" in the red, green, and blue (see also fig. 1 in which a' refers to the first screen derived by careful trial and error, and a'' refers to a screen built up from ordinary market grades of glass).

For testing purposes, a box containing frosted-tip tungsten lamps was fitted with a double bottom—one of a colour screen built as above, and the other of frosted glass for diffusing purposes. On the testing surface below the box, the illumination obtained was 30 ft.-candles; testing the window illumination by a colorimeter shows:—Red, 100; green, 85·4; blue, 75·8. (Daylight 100; 100; 100.)

It is fortunate that two standard market glasses form such an excellent combination, giving quite good enough results for most practical purposes. A skilled glass worker could doubtless find a better pair of glasses or even a single tint answering the desired purpose, and it is especially desirable that the dyed screen be replaced by a more permanent material.

On a colour sensation basis, the artificial daylight obtained by the above means is a closer approximation to average daylight than any other known artificial illumination. True, its efficiency of production is only 1/10 to 1/12 c.p. per watt, but the first cost of the apparatus required is very low, and the component parts are very easily and cheaply renewable, while the high energy cost is fully justified in most cases where the special light is really desirable.—*Electrical World*

LEGAL.

Electricity Supply Inspection at St. Pancras.

At the Clerkenwell Police Court on November 22nd, before Mr. Bros, the hearing was resumed (adjourned from November 2nd) of an application by Mr. Stanley Syer (of Macdonald, Syer & Co., Ltd., electrical engineers, of Gray's Inn Road), as a consumer of electricity supplied by the St. Pancras Borough Council, for the appointment of an inspector under the local Electric Lighting Act.

At the previous hearing, Mr. R. Tweedy Smith, solicitor, appeared for the applicant, and Mr. Barrington Ward as counsel for the Borough Council, appeared to resist the application. Applicant disapproved of the type of fuse insisted on by the Council, but found that he could appeal to no one to decide the question, as the Borough Council electricity undertaking was not under the inspection, for this purpose, of the London County Council. The local Act provided than an aggrieved consumer must ask the Stipendiary of the district to appoint an inspector. It was then stated that the Council had, in the interim, received a letter withdrawing the appointment, and stating that it was proposed to proceed "in another way." Mr. Smith said that a test case was proceeding in the High Court. A second application was also made at the same time by Edward Evans, of Fitzroy Square, on public grounds, of possible danger to users.

At the resumed hearing, Mr. Ward said that he would not resist the appointment of an inspector to deal with the two cases in question, but was of opinion that it would be inadvisable to appoint an inspector generally to deal with all cases that might arise on the question of expense. He suggested the appointment of Mr. C. A. Baker, M.I.E.E., principal assistant in the electrical department of the London County Council, as a suitable person.

Mr. Smith, however, for the applicants, pressed for an inspector authorised to deal with all complaints received, and not only the two in question. The Electrical Contractors' Association had already, he understood, a number of cases of complaints, and he asked for the appointment of a permanent inspector. St. Pancras, and also Chelsea Borough Councils, he said, had slightly different powers in dealing with electricity supply from other London Borough Councils, having been the first two Councils to take up the matter. Unless a permanent inspector were appointed every dissatisfied consumer would have to make a separate application to his Worship in each case. As to the question of costs, there had been no difficulties arise in other London areas, as the Act provided that the fees should be paid in advance, and the undertakers (in this case the Borough Council) were only responsible in the case of their work being proved faulty.

Mr. Harding, who appeared for the L.C.C., said that if his Worship decided to appoint anyone in the present service of the L.C.C. as inspector, he would ask him to say that the inspectorship would cease if the person specified at any time left the service of the L.C.C.

After some further argument on the interpretation of the Act, the magistrate said that he was willing to appoint Mr. Baker as an inspector to deal with complaints generally. This appointment would date from January 1st, 1912, and would be for 12 months. The question of remuneration was left over for the time.

Both parties agreeing to this, the appointment was accordingly made.

A Dumbarton Tramway Case.

Owing to the rowdy conduct of some boys on the top of a heavily laden workmen's car one morning recently, the tramway officials ran the car off the direct route in the direction of the depôt, with the object of bringing the car to the nearest point to the police office.

Great inconvenience was caused to the workmen as they were forced to walk about half a mile on foot, and as they were refused the return of their fares, a test case was brought before Sheriff Blair, at the Dumbarton Small Debt Court.

The Sheriff refused to decide the question of breach of contract, and considered that the company were quite entitled to run the car either to the depôt or anywhere else if destruction of their property was threatened.

He thought, however, that peaceful passengers should have had their fares returned, and accordingly granted decree for ½d., with 7s. 1d. expenses.

Crompton & Co., Ltd., *v.* W. B. Haigh & Co., Ltd.

In the Lord Mayor's Court, on Friday, before Assistant Judge Jackson and a jury, a claim was made by plaintiffs, of Chelmsford, against defendants, who are manufacturers of wood-working machinery, of Oldham, to recover the price of an electric motor supplied. The plaintiffs' claim was admitted, subject to a counterclaim by defendants for damages.

Mr. Gwyer, for the plaintiffs, said that the question the jury had to consider was whether the defendants were entitled to their cross claim against the plaintiffs, they having admitted the plaintiffs' claim. In September, 1910, the defendants, who did a large business in supplying the Government home departments and also foreign Governments with wood-working machinery, had an inquiry from the Government of Italy with reference to a circular saw mill, which they required to be erected at their works at Florence. An electric motor was required to drive the saw, and the defendants, who did not manufacture electric motors, asked the plaintiffs for an estimate for the supply and erection of a number of different varieties of electric motors. This was with a view to enabling the defendants to see what sort of motor they could get, and the time for delivery, because they contemplated tendering to the Italian Government. Fortunately, the whole of the transactions that passed between the plaintiffs and defendants were in writing. The defendants had in the course of the correspondence informed the plaintiffs that the electric motor required was for the purpose of being supplied to a foreign Government. A quotation was received from the plaintiffs. The defendants, in consequence of the information received as to the delivery and price of the electric motor, sent a tender to the Italian Government. The defendants' tender was accepted, and the plaintiffs were given instructions to proceed with the work of delivering a certain electric motor to be supplied by February 20th, but the motor was delivered on April 6th. In consequence of the delay on the plaintiffs' part, the defendants, it was contended, were liable, or would become liable under a penalty clause in their contract with the Italian Government, for 1 per cent. of the amount of the contract of £121, for every 15 days' delay. There was a delay of 37 days, and the defendants claimed £3 under this head. They also claimed £13 10s. for expenses and labour incurred in having to pull down and re-erect the saw bench, owing to the plaintiffs' delay.

It was contended by Mr. Morle, who appeared for the defendants, that the plaintiffs knew, or ought to have known, from the letters passing between the parties, before the order was given, that it was in connection with machinery to be supplied under a Government contract, and that the delay would incur a penalty. Evidence was given in support of the defendants' counterclaim.

For the plaintiffs, it was submitted there was no case for them to answer. The plaintiffs had no knowledge of the contract which the defendants had with the Italian Government, and even assuming there was a breach by the plaintiffs, then the damages, as had been proved, were hopelessly remote and could not be recovered by the defendants.

The Assistant Judge said he would not take the case from the jury.

Counsel for the plaintiffs said he could not usefully call evidence, because the facts were admitted.

Evidence, however, was given by Mr. Sidney Robert Smith, assistant secretary of the plaintiffs' company at Chelmsford, who said the plaintiffs had no knowledge of the defendants' contract apart from the letters which had passed.

For the plaintiffs, it was contended that they had not broken the contract. They were late in delivery, but this was occasioned, as they were informed, by an unfortunate series of accidents to one of the end covers of the electric motor. If there was a technical breach the defendants had proved no damage.

The jury found a verdict for the plaintiffs on the claim and counterclaim, and judgment was entered accordingly.

Fyfe, Wilson & Co. *v.* Wakelin Bros., Ltd.

Before Mr. Justice Coleridge in the King's Bench Division, on November 22nd, plaintiffs of Glasgow, sued defendants of London, for the balance of an account for Kelvin petrol-electric generating sets. The defendants alleged that the machines would not do the work for which they were sold, and that by reason of defects they frequently broke down. They counterclaimed £220 for loss of profit and expenses. The plaintiffs denied the allegations in the counterclaim.

According to the report of the case in the *Glasgow Herald*, Mr. Willis, for the plaintiffs, said the only contest in the case would be on the counterclaim, as the plaintiffs had already recovered the price of two of the machines supplied. The defendants, who were the plaintiffs' selling agents in London, alleged that the machines were not in accordance with the contract, but he would call a large body of expert evidence to show that they were. The first item of the plaintiffs' claim was in respect of a demonstration set supplied to the defendants, which was to remain the property of the plaintiffs unless defendants purchased it. When Mr. Fyfe in February of this year called at defendants' place to see it, however, he was told he could not do so, and that it was the property of the defendants, although they had not paid for it.

A large number of expert witnesses gave evidence as to the effectiveness of the dynamo and engine supplied by the plaintiffs.

At the close of the evidence for plaintiffs, his Lordship intimated that he was against the defendants on the counterclaim in respect of loss of profits on the sale of six sets of machines.

In opening the defendants' case, Mr. Lynch admitted that his clients sold the demonstration set supplied by the plaintiffs in July last, and had not paid for it, but he claimed that as the machine was sold in place of one which had been found to be defective, the plaintiffs had no right to sue for the purchase price. The machine was guaranteed to give 75 amperes, but it would only produce 60 amperes.

The hearing was adjourned.

Anglo-American Telegraph Co., Ltd.

On Tuesday, November 28th, in the Chancery Division, Mr. Justice Joyce gave his sanction to the extension of the objects contained in the memorandum of association of the Anglo-American Telegraph Co., Ltd., so as to include the sale of the undertaking of the company. The petition was unopposed.

Mr. Younger, K.C., said when the matter was before the Court on a former occasion, his Lordship was not satisfied that the Court had power to sanction such an arrangement. He (counsel) now produced a decision of Mr. Justice Parker, which was supported by other decisions showing that the Court had power.

In this case the transaction his Lordship was asked to authorise, was of a very far-reaching nature, and the matter arose in this way. The Anglo-American Telegraph Co., Ltd., whose petition was before the Court, was incorporated in 1866, and acted as the pioneer of cable business in the Atlantic. At first it was in absolute command of the field, but shortly afterwards very active competition was commenced. Between that time and 1882 it was found necessary to enter into certain pooling agreements between the companies, and in 1882 an arrangement was entered into between the Direct Co., the Anglo-American Co., the French Co., which had a special cable between France and America, and the company which afterwards became the Western Union. A pool was thus constituted in all the cable business of America and Canada upon terms. In the ordinary course of events this arrangement would come to an end in the year 1920. The Western Union possessed the land-line in America, which was necessary in order to enable the messages to be conveniently transmitted. In 1911 the Western Union came to the conclusion that the working of the cable business should all be in one control, and with this object in view they approached the other companies mentioned. These negotiations were proceeding when the Western Union were advised that under the Sherman Anti-Trust Law they exposed themselves to a prosecution, because they were parties to a trust. On February 10th, 1911, the Western Union gave notice to terminate their connection with the other companies under the pooling agreement of 1882, on the ground that they were no longer bound by that agreement under American law. The Anglo-American Co. took the best advice available in America and in England, and they were advised that the view taken by the Western Union was the correct view. They then had to consider what was the next best arrangement to be made. The Direct Co., who were also parties to the pooling agreement, took the same view, and on August 7th, 1911, two agreements were entered into—one between the Western Union and the Anglo-American Co. and the other between the Western Union and the Direct Co. These agreements were to last for 99 years, and the shareholders were to receive £262,500 a year, which would provide a very substantial dividend, exceeding what they had been receiving in the past years. To carry out this agreement between the Anglo-American Co. and the Western Union it was essential that the objects of the memorandum should be extended. The petition did not ask for the Court's approval of the terms of the agreement, but asked his Lordship to say that the company had power to enter into such an agreement. The necessary resolutions had been unanimously passed by all classes of shareholders, and there were no creditors concerned. Everybody interested in this matter had been overwhelmed with responsibility, and the present scheme was the best in the interests of all parties.

His Lordship made the order asked for in the petition.

Meyer *v.* Sachsenwerk Licht, &c., Co.

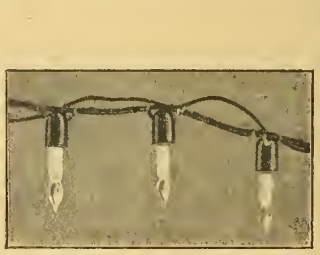
A common jury, sitting with Mr. Justice Lawrence in the King's Bench Division on November 27th, awarded £47 damages to the plaintiff in this action in respect of a claim for wrongful dismissal.

The plaintiff, Mr. Ernest Meyer, was employed from 1902 to 1907 by the Electric Motor-Dynamo Co., whose operations consisted mainly of supplying electric motors to factories and workshops, his remuneration being in the form of a weekly salary and commission. According to the terms of the agreement, the service was terminable on three months' notice terminating at the date of the year upon which the appointment was made. In 1907 the business was taken over by the defendant company, a German company, whose business in this country was carried on by agents at Finsbury Street, E.C., and the plaintiff's services were transferred to them. In 1910 he received notice of the intention of the agents to put an end to his agreement, but before the term expired he was dismissed in consequence, according to counsel for the defence, of his having extended a week's leave of absence in Germany, to 16 days, and his neglect to obey the lawful orders of his employers. An effort had been made, said plaintiff's counsel, to prevent the action being brought in England, but the matter had gone before a judge in chambers, who had decided against the defendants. The evidence as to the cause of the dismissal was of a conflicting character, but in the result the jury found for the plaintiff, giving him £47 in lieu of salary, but refusing to allow a claim for commission which might possibly have been earned during the period.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Christmas Decorations.

The Electrical and Engineering Supplies Co., Ltd., of 36 and 37, Upper Thames Street, London, E.C., have just issued a pamphlet regarding their decorative electrical outfits, particularly suitable for Christmas trees and shop-window displays. The





Figs. 1 & 2.—Decorative Lamps.

accompanying figures show suspended lamp and candle lamp sections. All live parts are totally enclosed, and for ordinary window dressing or in the foliage of Christmas trees the devices should be used with excellent effect and safety. Copies of the price list will be sent on application.

New Abbey Flame Lamp.

We are now able to give some further particulars of the new single-enclosed flame arc lamp recently brought out by the Abbey Electric Co., of 17, Victoria Street, London, S.W., and exhibited by them at the recent Electrical Exhibition at Olympia for the first time.

The alternating lamp burns for 50 hours on one pair of carbons, and the cost of carbon consumption has been reduced to the extremely low figure of ·06d. per hour, or about 15 hours for 1d.

The lamp has one pair of carbons arranged vertically, and is fitted with a special device for cooling the gases given off, thus

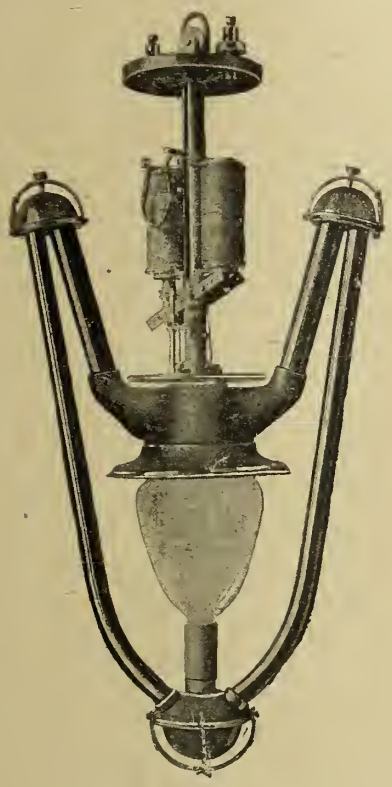


Fig. 3.—Mechanism of the Abbey Flame Lamp.

always keeping the globe clean from deposit below the arc. The method of cleaning and trimming the lamp is very simple, the tubes, which can be seen in the accompanying illustration, having three openings, two at the top and one at the bottom of the lamp, so as to allow of a small brush being passed through, to take away all the deposit which has collected there. The dome or cap for fastening up the aperture at the ends of the tube is kept



Fig. 4.—The Abbey Flame Lamp.

in place by a small thumb-screw and bow-shaped spring, the dome itself being permanently attached to the latter by a short flexible chain.

The globe is removed for trimming by simply pressing down the short brass tube, shown in the illustration, connecting the bottom of the globe with the tubes. This short brass tube has a spiral phosphor-bronze spring inside which keeps the globe in position and allows at the same time for the expansion of the glass when heated. The carbons are, of course, inserted in the same way as in an ordinary enclosed lamp, the mechanism consisting simply of the usual shunt and series differential solenoid control with clutch feed.

The carbons used are short, and of a very substantial type, there being enough of the top carbon left after a run of 50 hours to make two trims for the bottom ; thus every particle of carbon is used up, except that held in the bottom carbon-holder, which is about ¾ in. long. The whole of the lamp, tubes and framework and all the castings are made of either brass or copper, and are entirely insulated from both terminals.

The light given by these lamps is of a whitish yellow, though a pure white carbon is supplied for special cases, which has a very good efficiency for use with any sort of colour work. The maximum candle-power is given at an angle of from 10 to 15° below the horizontal, resulting in an even distribution of light over a large area.

The arc voltage is from 40 to 45 volts, and the current from 8 to 10 amperes according to requirements, thus giving a lamp which takes only from 350 to 450 watts.

These lamps will burn on alternating current either in single-parallel on 50 volts, or two in series on 100 volts, four in series on 200 volts : in the latter case, a very neat substitutional resistance and automatic cut-out is fitted inside the lamp case. The object of the makers in bringing out this lamp has been to give the burning hours of a magazine, with a simple mechanism, at a low initial cost, together with a very low price for maintenance.

Drawn-Wire Mazda Lamps.

The accompanying illustration shows a device employed for testing the strength of Mazda drawn-wire tungsten lamps at the Electrical Testing Laboratories, New York. The arm upon which the lamp is mounted is brought to a constant position by each revolution of a small cam, and is allowed to drop freely upon a spiral cam, with which the drop can be varied from 0·01 in. to 4 in., with a constant increment of 0·01 in. per revolution. The fall at

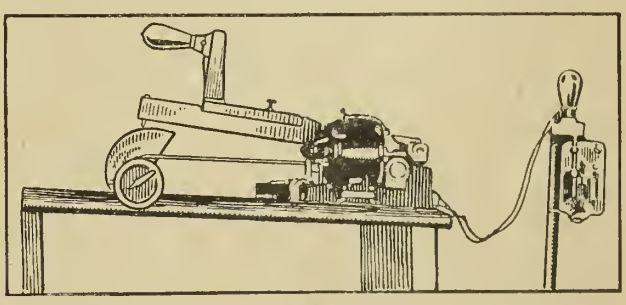


Fig. 5.—Mazda Lamp Testing Device.

which the filament breaks is indicated upon a dial by a pointer attached to the large cam. The result of a series of tests, described at a recent meeting of the Illuminating Engineering Society, comparing the old pressed-filament type with the drawn-wire lamp, was as follows :—

	25-watt lamp.	*60-watt lamp.*
Old pressed filament, distance lamp was dropped	0·06 in.	1·15 in.
Mazda drawn-wire filament, distance lamp was dropped	3·75 in.	A 4-in. fall failed to break filament.

A carbon lamp remained intact at the maximum fall.

Experience with Mazda drawn-wire lamps shows that the superiority of the drawn wire over the pressed filament is not confined to the early stages of the lamp's life, but that the drawn-wire filament is many times stronger than the old pressed filament at any time during its entire life.

The British Thomson-Houston Co., Ltd., have received a letter from the electrical engineer of a colliery stating that he tested the Mazda lamps by mounting them on a vibrating pit-head frame, and was highly satisfied with the result. Other reports state that of a consignment to Johannesburg of 1,200 lamps, not more than 1 per cent. were broken, and in another instance, where a batch arrived in a badly smashed-up case, only one lamp was broken.

Annual Dinner.—On November 18th, at Southall, Submersible & J-L Motors, Ltd., held their first Annual Dinner since the amalgamation of the two companies. Mr. B. T. Rumble (chairman of directors) presided, and Mr. T. L. Reed-Cooper (managing director) was in the vice-chair. After a few remarks from the chairman, Mr. C. F. Collins, representing the works, toasted the company. In responding, the Vice-Chairman outlined the successes of the "J-L" motors and dynamos, and referred to the trade done in them all over the world, especially in the Colonies. At home they had been fitted successfully to the largest lift contract on this side of the water. Government contracts were now in hand. Mr. C. K. Hickman (secretary) proposed the employés, and Mr. Whitehorn (designer) responded. A concert followed.

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BUSINESS NOTES.

Glover's Almanac.—The editor of this well-known and highly-appreciated almanac is at present inviting contributions of interest to electrical men for the 1912-1913 issue, which will be ready for circulation by June next. An advertisement stating fuller information appears in our pages to-day.

Water Purification Apparatus.—The Paterson Engineering Co., Ltd., of London, have received the following orders for their Paterson apparatus for electricity works :—

Aberdeen Corporation.—Standard type oil eliminator, with quartz filter of 5,000 gallons hourly capacity, capable of being readily extended to 10,000 gallons at a later date.

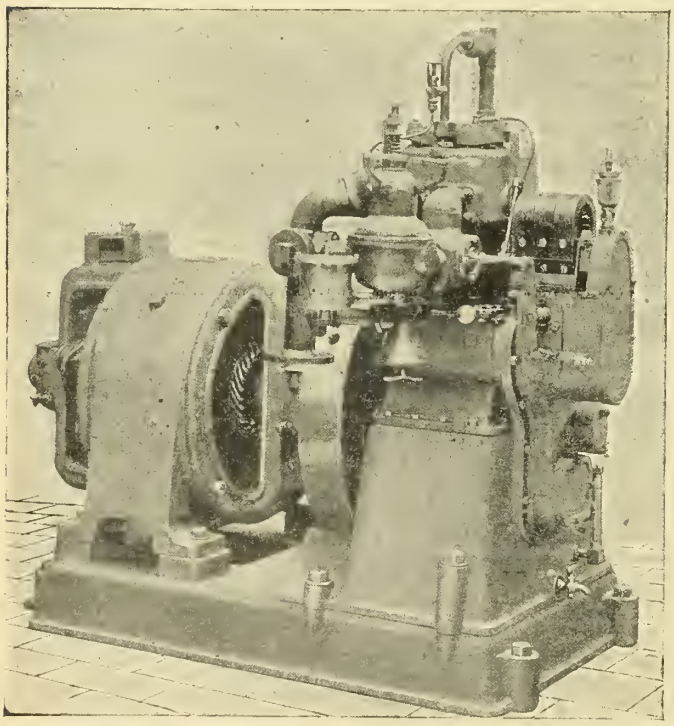
Kettering Corporation.—Oil eliminator, with quartz filter of 2,500 gallons hourly capacity, through Messrs. Aiton & Co. Consulting engineers, Messrs. Kennedy & Jenkin.

Barnes Electricity Works.—One oil eliminator and exhaust heater of 3,600 gallons hourly capacity.

Radcliffe Electricity Works, Lancs.—A cold process water-softener of 2,500 gallons hourly capacity. The water contains an exceptional amount of matter in suspension. This machine is fitted with the firm's quartz sand filter.

Lancashire Electric Power Co.—Two pressure quartz filters of 3,000 gallons hourly capacity, for purification of heavily contaminated water.

The Royal Train in India.—We understand that a special train has been built for the sole use of the King and Queen during all their journeys in India. In one of the cars there is an electric lighting plant, from which the whole of the cars composing the train will be lighted. The set consists of a 4·8-kw. 25-32-volt generator direct-coupled and mounted on a combination base to a paraffin engine. The marble switchboard panel for controlling this set consists of a combination generator and accumulator panel, which is equipped with the necessary instruments, rheostats, cut-outs, switches, and charging and discharging switch. The switchboard and the generator set were supplied by the British Thomson-Houston Co., Ltd., to Messrs. Turner, Hoare and Co., of Bombay.



B.T.-H. Paraffin Engine Set for the Royal Train.

British Electrical Success in New Zealand.—British Electrical manufacturers and traders have command of the electrical market (motors, lamp-ware, appliances, &c.) in New Zealand, and recognising the importance of this trade, American Vice-Consul-General Baker, who is on special service in New Zealand, has reported home concerning what he finds to be the reasons why British control is so marked. As, we believe, our firms will be interested in his views—which, by the way, are those furnished to him by the principal of a leading firm of electrical engineers there in response to questions—we print them :—

"As a rule, I find that for the same money better value is obtained in Great Britain, and the public taste seems to favour the British article when prices are the same ; but when going further into the merits and demerits of the manufactures of the two countries, the following three reasons make me prefer the British market when the home costs are the same :—

"1. The preferential Customs tariff at present in force treats American goods as being of foreign manufacture, and as a result the duty on them is 50 per cent. higher. As most electrical appliances bear a duty of 20 per cent. *ad valorem* on the invoice value (plus 10 per cent.), the American article costs 11 per cent. more for duty alone. This is a most important factor in quoting prices fine, and gives the British article a big lift.

"2. It has been my experience that before American houses will give a paying trade discount, arrangements have to be made to either send cash with order or take up a demand draft. The terms offered by competing British firms are much more liberal ; 60 and 90 days' sight are frequently given, and the receiver of the goods has a chance to turn them over before payment is actually made. On the American basis of business this is impossible.

"3. The time taken by American suppliers to effect delivery of an order is usually longer than that of British or even some European firms ; and the home charges are usually much heavier in America than in the British Isles.

"Complaints have been made to me by firms that have taken up American agencies that their principals sell direct to firms competing with their agents, granting the same discounts and terms to the outsider as would be given to the agent. Considering that the latter has, as a rule, to bear the cost of advertising, &c., it seems only just that he should be properly protected ; and full inquiries might be made by home firms before accepting direct orders. These are very frequently sent per medium of a home buying agent. I maintain that if an agent is expected to show a good return, all direct orders received from his district should be treated as though they had come through the ordinary channels. Unfortunately many firms, both British and American, do not see this matter in the same light, and as a result direct ordering is carried on to such an extent that some agencies are not worth having. I feel sure that in the long run it would pay home suppliers better by far if more attention were directed toward establishing properly protected agencies and less time devoted to the outside buyer."

Vice-Consul Baker tells his countrymen that as American manufacturers must contend with a preferential surtax of 50 per cent. of the duty on electrical appliances of other than British make, the only way they can succeed there is by offering goods of more attractive pattern and cheaper than the British goods, so as to offset the preferential surtax, and by being equally liberal in credit arrangements.

Turkey.—The American Chamber of Commerce recently founded a section at Salonika, Turkey. It already has one at Constantinople, but Salonika merchants will not accept sub-agencies of general agencies established in Constantinople.

Private Meetings.—Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, London, E.C.—In this matter, particulars of which appeared in a recent issue, the following are creditors :—

Deutsche Beck Bogenlamper (Ges.)	£51	Quitman Carl	£22
Annan Dexter & Co.	52	Automatic Standard Screw Co.	236
Middlesex Printing Co.	22	Gaspar & Co.	28
Uxbridge and District E.L. Co.	38	Highton & Son	64
Venner Time Switches, Ltd.	81	Pridey & Hale	20
Buchanan & Carwen	17	Hartjen, W., & Co.	16
Kelvin & James White	32	Vaughton Bros.	32
Heaton & Dugard	40	Allison Bros.	22
Lindley, C., & Co.	54	Harper, J., & Co.	36
London Electric Wire Co.	191	Shoolbred & Connell	61
Delta Metal Co.	60	Still, W., & Sons	32
Vons Co.	16	Haydn Harrison	98
Blume, C. H.	46	Corbett, S. D.	77
Jones, Price & Co.	16	Grant & Blake	32
Dalton & Morgan	28	Hatch, Geo.	18
Davis & Timmins	50	Argus Printing Co.	32
London Electric Firm	42	*Electrical Times*	32
		Price, E. C.	16

Bankruptcy Proceedings.—W. R. N. Gard, electrician, 65, Kingsley Avenue, West Ealing, late Orchard Electrical Works, Orchard Street, Canterbury. The following are among the creditors :—

Brock, A.	£50	MacQuaide, H. C.	£24
Braulik, G.	41	Court, Bros.	21
Service Co., Ltd.	27		

The first meeting of creditors was held on Monday, at the offices of the Official Receiver, 14, Bedford Row, W.C. The debtor's statement of accounts showed liabilities to unsecured creditors, £285, and the only asset disclosed is a surplus of £7 in respect of an organ held by a secured creditor to secure £8. Debtor attributes his failure to "want of capital and bad trade." It appears that he commenced business in June, 1903, at the Orchard Electrical Works, Canterbury, in partnership with another person. In November, 1905, the stock was sold, the book debts collected, and the debts paid in full, and the debtor then continued the business up to the end of October, 1906, when he came to London. He admits knowledge of his insolvency since July, 1906. At the date of the Receiving Order, two creditors had obtained judgment against the debtor. The furniture at the debtor's residence was stated to belong to his father-in-law, who lives with him. An order for summary administration having been made, the matter remains in the hands of the Official Receiver.

Arthur Parker, electrical engineer, of Yorkshire Street, Burnley.—On a creditor's petition a receiving order has been made at Burnley County Court. First meeting, December 7th, at Preston ; public examination, December 8th, at Burnley.

Charles Wallis, electrical engineer, Great Grimsby.—December 9th is the last day for receipt of proofs for dividend by Mr. J. F. Wintringham, St. Mary's Chambers, Great Grimsby.

For Sale.—As will be seen from another page of this issue, Messrs. Rhyrolle & Co., Ltd., of Hebburn-on-Tyne, are offering for sale, either as it stands or in parts, their D.C. switchboard which controlled the generators and supply to the

British section of the Turin Exhibition, and was awarded the Grand Prix.

Messrs. P. Huddleston & Co. will, on Thursday, December 7th, sell by auction at 16, Long Millgate, Manchester, a large quantity of electrical apparatus, fittings, and office effects. See our advertisement pages to-day.

Dissolutions and Liquidations. — Cowper - Coles Engineering Co., Ltd.—A meeting of creditors is called for December 5th, at the offices of W. B. Peat & Co., 11, Ironmonger Lane, E.C.

Solium Electrical Co., Ltd.—A meeting is called for January 12th, at 23, King Street, Nottingham, to hear an account of the winding-up from the liquidator, Mr. E. Harlow.

Australian Electrical Co., Ltd.—A meeting will be held on January 3rd, at 20, Copthall Avenue, London, E.C., to hear an account of the winding-up from the liquidator, Mr. E. Pears.

Miners' Safety Lamp and Accessories Co., Ltd.—A meeting is called by the liquidator, Mr. T. L. Judd, for December 30th, at 57, Gracechurch Street, E.C.

Torquay Tramways Construction Syndicate, Ltd.—This company is winding-up voluntarily, with Mr. L. B. Schlesinger and Mr. W. B. Cownie as liquidators. A meeting of creditors is called for December 6th, at 3, Laurence Pountney Hill, E.C.

J. E. Elliott & Co., electrical engineers, 12, Broad Street, Oxford.—Messrs. H. J. Bradley, H. S. Kingerlee, J. E. Elliott and J. D. Elliott have dissolved partnership. Messrs. J. E. and J. D. Elliott will attend to debts, &c.

A Sydney Exhibition.—The New South Wales Legislative Assembly is conferring with the other State Governments regarding the holding of an international exhibition at Sydney, at a cost of £100,000, the object being to bring the potentialities of Australia under the notice of the world.

Book Notices.—"Engineering Standards Committee: Report No. 55.—Experiments on Hard-Drawn Copper and Bronze Wire." London: Crosby Lockwood. Price 10s. 6d. net.—The General Post Office and the National Telephone Co., the two largest users of telegraph and telephone wire in the country, having provided certain funds for the purpose, experiments have been carried out for the Engineering Standards Committee by the National Physical Laboratory, with a view of obtaining some independent data with regard to the breaking stress of hard-drawn wire of small diameter, used for telegraph and telephone purposes. The experiments described have covered a wide ground and include investigation into the variation of mechanical properties of these wires due to difference of make, variation in diameter, length and temperature, as well as variation in strength due to the kinking of the wire, which apparently has a more considerable influence on the strength of the wire than has hitherto been appreciated. This class of wire should be wound on coils of larger diameter than is usually the case in order to minimise this defect.

"The Principles and Practice of Electric Wiring." By A. Bursil. 1911. London: Longmans, Green & Co. Price 3s. net.

"Revolving Vectors." By George W. Patterson. 1911. London: Macmillan & Co. Price 4s. 6d. net.

"Journal of the Western Society of Engineers." Vol. XVI, No. 7. September, 1911. Chicago: The Society. Price 50 cents.

Cooking by Electricity.—Olympia Award.—Visitors to the Olympia Electrical Exhibition will learn with interest that the first prize in the Olympia competition for kitchen equipment was won with a "Tricity" outfit by Mrs. Miller, of Chislehurst. Mr. Grogan was also awarded a prize for his "Tricity" essay.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Price list of "Plania" flame carbons for various purposes; also a leaflet of D.C. motors in stock.

Messrs. C. Whittaker & Co., Ltd., Union Foundry, Haslingden.—Several illustrated lists relating to their manufactures. One describes the improved "Sun" type of propeller fan, with a table of speeds, volumes, and powers of standard sizes, and gives sections showing positions of pulleys, and states prices. The second ("B"), describes centrifugal fans in sheet-steel cases, also giving a table of diameters, speeds, B.H.P.s, &c. Lists "C" and "E," particularise Tattersall's "thin stream" heaters or coolers; List "D" contains a full description of the Tattersall multiple effect condenser or cooler, which is a combination of surface condensing by air with evaporative cooling; this is claimed to be a highly efficient and convenient system of condensing steam entirely by air in place of water.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—This is a 20-page catalogue of alternating-current motors. It is got up in superior style with excellent half-tone views on art paper of slip-ring and squirrel-cage motors, including totally enclosed slip-ring motors for colliery work showing inspection cover open and closed. A general description of the motors is followed by tabulated powers, speeds, and prices of two and three-phase squirrel-cage and slip-ring motors, also single-phase squirrel-cage and slip-ring rotors of several types. Other tabular matter details efficiencies and power factors, dimensions, and approximate weights and shipping particulars.

The Korfund Co., 47, Victoria Street, Westminster, London, S.W.—Twelve-page pamphlet giving a good deal of illustrated information regarding "Korfund" patent impregnated cork resilient plates for insulating the foundations of stationary machines, &c., minimising or absorbing vibration or noise arising therefrom. The Korfund Co. has taken over the business of the Genest-Stoessel Insulating Co. for the supply of these plates.

The Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—New circular (AE 52) containing a brief description of their metallic-filament lamp fitting for indirect lighting for use in workshops and factories, large offices, schools, drawing offices, &c. Prices and details are tabulated.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Two folders in the form of "Sirocco" centrifugal fans. In opening one the cover of the fan is removed, while the other contains a series of small half-tone views showing the fans employed in various classes of work.

Trade Announcements. — Messrs. Submersible Motors, Ltd., of 23, St. Swithin's Lane, E.C., have taken over the works and business of the J. L. Manufacturing Co., Ltd., of Johnson Street, Southall, Middlesex, as from August 11th, 1911, and all liabilities since incurred, and book debts, will be met by them. It is intended to shortly alter the name to "Submersible & J. L. Motors, Ltd." as stated in our last issue. The manufacture of the laminated field "J. L." motors and dynamos will be continued, and the plant used in their production is being extended, and the manufacture of "Macdonald" submersible motors is also to be transferred to Southall.

The Polystat Electric Co. have removed from 5, Kelvin Avenue, to 226, Marsland Road, Sale, near Manchester.

Mr. Horace Sloman, electrical engineer, will in future carry on business at 56, Leigh Road, Westcliff-on-Sea.

The British Central Electrical Co., of Hatton Garden, have added a new telephone line, and their numbers are now "City 9498" and "Central 1218."

The Britannia Rubber and Kamptulicon Co., Ltd., are removing to more central premises, and on and after December 1st next their address will be 7, Newgate Street, E.C.

Mr. John D. MacKenzie, 217, West George Street, Glasgow, has been appointed sole Scottish agent for Messrs. Sykes & Sugden, Ltd., Huddersfield, manufacturers of service fuses, joint boxes, feeder pillars, &c.

Mr. H. R. Witting will, from December 8th, transfer his offices to more extensive premises at 41, Berners Street, London, W.

Osram v. Motor-'Bus.—We have received a further testimony to the strength of the Osram filament. In this case it was very strikingly demonstrated, for in a recent collision between a motor-'bus and a lamp standard in the West End of London, the lantern was completely buckled, and in a picture that is before us it appears making its obeisance in most abject manner—it is considerably more than half-seas-over. Nevertheless, the Osram lamp itself, with that stolid indifference to surroundings that has so often characterised other members of the same family, remained intact, and lit up instantly in response to the switching on of the current.

Fire.—A correspondent says that valuable machinery, electrical power fittings, laboratory apparatus, &c., were destroyed by fire last week at Musselburgh Wire Works (Messrs. W. N. Brunton and Son).

Chile.—An American Consul draws attention to the good openings in mining and industrial pursuits in Chile that are worthy of investigation. The Government is anxious to develop the natural resources, and capital can be profitably invested. A decree has been issued by the Minister of Public Works reserving sufficient water power to generate electricity in the event of the present plans for electrifying the Government railways being carried out.

All-German.—An American Consul in Germany states that Der Alldeutscher Verband (The All-German Union) has issued a circular, copies of which have been transmitted to all principal business men, calling upon the German people in general, and the business men in particular, to favour home interests wherever possible. In German business houses and factories only Germans should be employed; commercial correspondence with foreign countries should be in all instances in German; German products should be given German names; and German retailers should always recommend the articles of home production carried by them before calling attention to those of foreign make.

LIGHTING and POWER NOTES.

Abingdon.—While the T.C. has given notice of its intention to apply for a provisional order to supply electric power and light, no scheme will be taken up until the reports of the special committee and of the expert consulted have been laid before the Council. The Council has retained the services of Messrs. Lacey & Sillar, consulting engineers.]

Aldeburgh.—A B. of T. inquiry was held on November 22nd relative to objections to proposed works to be established by the Electric Supply Co., Ltd. Mr. Christie, of Messrs. Christie Bros., of Chelmsford, said that the proposed plant would not cause any noise or vibration to the annoyance of residents. The nearest house was 60 or 70 yds. from the site of the generating station, and the exhaust would be absolutely silent at 20 or 30 yds. away. He also fully met other objections put forward.

Australia.—The North Sydney Electric Lighting Bill has again been discussed by the Council; an opinion was given that the Council could not legally farm out the electricity supply. It was estimated that the cost of the undertaking would be £75,000, and this sum, it was stated, was beyond the power of the Council.

The Railway Department contemplates spending £20,000 on additional electrical plant in connection with the Melbourne goods yards and sheds.

Axbridge.—The R.D.C. has consented to the application of the Winscombe E.L. Co. for powers to supply current to the parishes of Banwell, Sandford, Churchill, Cross, Axbridge and Cheddar.

Aylesbury.—The U.D.C. has decided to go into the electric light question with a view to a prov. order being applied for. A private person has offered to give a site for the generating station, and to defray the expenses of obtaining the order.

Biddulph.—A special meeting of the U.D.C. has decided by 10 votes to 2 to apply for a prov. order authorising a supply of electricity within the district. According to a draft agreement before the meeting, Messrs. Heath will supply electricity at the rate of 1½d. per unit, less discount according to quantity, for a certain number of years, and if not terminated then, to be subject to notice on either side.

Blackpool.—As a result of experiments with the "Metroflam" arc lamp, it has been decided to put up another 10 of these lamps on the widened promenade.

Brazil.—The *Financial News* says that cable advice received in London from Rio de Janeiro, states that the petition presented by Messrs. Guinle to Congress for a concession for the distribution of electricity in the City of Rio de Janeiro has been rejected by a large majority.

Brighton.—By a large majority the T.C., on November 23rd, rejected the recommendation (referred to in the Electrical Review last week) to support the Bill of the I.M.E.A. seeking powers to enable local authorities to provide and fix wiring and fittings in consumers' premises. It will be remembered that the engineer advised that such work was best left to private enterprise.

Burnham (Somerset).—The U.D.C. has definitely decided to apply to the B. of T. for a prov. order for E.L.

Buxton.—The U.D.C. has decided to ascertain whether the B. of T. will amend the E.L. Order giving the Council power to hire out stoves, &c.

An Electrical Exhibition has been arranged to be held from December 4th to 9th; 12 firms have promised to send exhibits.

Canada.—Sir Max Aitken is organising a merger of the various sources of power on the Upper St. Lawrence River, the capital involved being £20,000,000. Some existing concerns will be taken over by the new company, which will develop sufficient power to supply the needs of Eastern Ontario and Western Quebec for some years.

Carnarvon.—The T.C. is still in a state of uncertainty as to whether to light the principal streets of the town by electricity or not, though the matter has been under consideration for more than 12 months. At a special meeting of the Council in September, it was agreed to adopt a scheme of electric lighting for some parts of of the town, the annual cost to the ratepayers not to exceed £100. A member of the Council has since given notice to move that the resolution be rescinded, and the proposal will be discussed at the next meeting of the Council. Much interest is being taken in the matter by the ratepayers.

Crewe.—An inquiry has been held by the L.G.B., relative to the application of the Corporation for sanction to borrow £3,602 for electricity purposes. Of the amount named; £1,000 is required for an additional boiler and fittings; £550 for a new main in Wistaston Road to the Webb Orphanage and Cottage Hospital; £825 for a main to supply the new postal sorting office and new training college; £375 for mains extensions in High Street and Market Street; and £500 for general extensions to mains (public lighting, house services, &c.). It was stated that the postal authorities and the County Council had agreed to pay for current at the same rates as in Crewe.

Croydon.—The L.G.B. has sanctioned an expenditure of £9,500 for extension of mains. The application for power to borrow £500 for transformers having been withdrawn at the public inquiry (on the suggestion of the Inspector), such expense is in future to be taken from revenue. For dealing satisfactorily with the increasing output of the undertaking, the Committee obtained the consent of the B.C. on Monday last, to taking £5,150 from the reserve and renewals fund for 2,000-volt and 5,000-volt switchboards, and the necessary alterations for fixing same. The vice-chairman said the fund stood at £38,000, so that this expense would still leave the undertaking in a strong financial position. The borough electrical engineer (Mr. A. C. Cramb) reported that between October 12th and November 16th there were 114 new applications for current, equivalent to 3,715 8-c.p. lamps.

Darlington.—On Tuesday, Mr. R. H. Bicknell held a L.G.B. inquiry into an application of the T.C. for £3,200 for the provision of additional generating plant at the Houghton Road electricity works.

Dundee.—The Electricity Committee has agreed, on the recommendation of Mr. Harry Richardson, the engineer, to support the Bill promoted by the I.M.E.A., in which further powers are sought for public electrical undertakings. Mr. Richardson explained that the cost of the Bill would be apportioned according to the revenues of the several corporations benefiting by it, and that Dundee's share would not at the most exceed £120. Mr. Richardson described as incongruous the position of the electricity department compared with the gas undertaking, which had unlimited powers, even power to manufacture gas appliances. The convener—Mr. J. M. Nairn—said that the work done by local contractors during the last four years amounted to £13,000, while £36,000 worth of work had been done by firms outside the city. When the matter had been brought up before, the local contractors had made made a great song about the business they would lose, but it could be shown that at present they were not doing a third of the business of the city. The Committee was unanimous in its decision.

Durham.—An electrical installation has been put in at Twizell Colliery, Beamish, Durham, belonging to Messrs. James Joicey & Co., to drive the fan, a pump, the haulage and the screens, by Messrs. Siemens Bros. Dynamo Works, Ltd. Three-phase current is supplied by the Durham and Cleveland Electric Supply Co. The western group of collieries owned by Messrs. Joicey, of which Twizell forms one, produces about 9,000 tons of coal per day, and Twizell is the first to be electrified.

East Barnet Valley.—At the last meeting of the U.D.C., it was decided, in accordance with Sec. 6 of the North Metropolitan Electric Power Supply Act, 1909, that consent should be given to the North Metropolitan Electric Power Supply Co. to supply energy within the East Barnet District, upon the understanding that the company submitted for consideration by the Council, and got its approval of, a definite area of the district to be supplied with electricity within a period of two years. It was further decided that under no circumstances would the company be allowed to place a kiosk on the public highway.

Falkirk.—At a meeting of the T.C. a report was submitted as to the present and prospective load at the electricity station and as to the necessity of further extending the works. The engineer was asked to report on the matter. It was agreed to adopt the Metroflam lamp for lighting at Camelon.

Great Harwood.—The question of gas lighting cropped up at the meeting of the Council on November 22nd, when Mr. J. E. Allsopp called attention to what he described as the miserable gas illumination. It looked as if the town was being lighted up with farthing candles. The chairman also criticised the gas lighting, and said he was pestered with complaints from people. But he was inclined to think matters were not so bad in Acerington itself as at Great Harwood, or they would have heard about it

Helsby.—The P.C. has decided to substitute an electric motor for a gas engine at the waterworks, for driving the pumps.

Hoyland (near Barnsley).—For some time the Council has had under consideration the question of the introduction of electricity into the district. The matter was brought to the forefront by an application from the Electrical Distribution of Yorkshire, Ltd., asking for permission to come into the township, and for the support of the U.D.C. in its application for the necessary prov. order. The question has again been considered, and at a specially convened meeting it was decided that the Council itself should apply for an order to supply electricity in the township.

Hornsey.—At the last meeting of the B.C., it was decided to appoint a lady canvasser for the electricity department, at a salary of £1 per week, with an additional payment of 10s. for each consumer obtained. Replying to various statements made in the discussion which ensued, Councillor Moritz said that a canvasser was a serious necessity. Frequently they had received applications for an extension of cable, which would be unremunerative unless two or more additional consumers could be secured, and it was usual to canvass the road, and according to the experience of business men, that could be done better by a woman than by a man. As an experiment the Committee desired to see whether they could not get better results from a lady canvasser than could be obtained in the case of a man.

Launceston.—The Launceston and District Supply Co. proposes applying for a provisional order to authorise it to supply electricity for public and private purposes within the borough.

Linlithgow.—At a meeting of the T.C., a communication was read from a firm of Edinburgh agents transmitting a proof of the draft of the Linlithgow and District Electric Lighting Order, under which it is proposed to introduce electric lighting to an area to include the burghs of Linlithgow, Bathgate and Armadale, and the parishes of Linlithgow, Bo'ness and Carriden, Bathgate and Torphichen, in the county, except the parts of Bo'ness and Carriden,

which are situated within the municipal boundary of Bo'ness. Without expressing any definite pronouncement on the scheme, the T.C. instructed the Town Clerk to ask why the promoters of the order only proposed to carry their distributing plant along the High Street, for a distance of little more than one-fourth of a mile.

India.—The *Times of India* of November 4th states that the Mysore Durbar has sanctioned a large scheme for the extension of the River Cauvery hydro-electric and irrigation works, and the execution of the first stage of the scheme was to be begun immediately. The full project, estimated to cost about £1,687,000, includes, besides hydraulic works, extensions and improvements of the Cauvery power works to provide additional power to the extent of 5,000 H.P.

Llandudno.—The electrical engineer has been requested to furnish plans and particulars of the proposed additional promenade lighting, so that application may be made without delay to the L.G.B. for sanction to the required loan.

London.—The Workhouse and Infirmary Management and Visiting Committee of the City of London Guardians has decided to carry out by direct labour the installation of electric light in the chapel and dining hall, at a cost of £25, owing to the incandescent gas lighting not being satisfactory. By doing this, the Committee states a saving of 2s. 7½d. per quarter on each burner, during the winter months, would be effected.

HAMMERSMITH.—Application is to be made to the L.C.C. to advance the snm of £10,000 as the first instalment of the loan of £23,775 sanctioned by it for electricity purposes.

Mansfield.—The T.C. has applied to the L.G.B. for loans of £500 for meters and £3,500 for works in connection with the supply of current to Mansfield Woodhouse, where the terms to consumers will be a flat rate of 4½d. per unit.

New Malden.—The U.D.C. has decided to have the mnnicipal offices, fire station and mortuary lighted by electricity, at an estimated cost of £150.

Manchester.—The Electricity Committee has accepted the tender of Messrs. J. Howden & Co., for a 4,500-KW. exhaust turbine with Siemens alternator, and barometric condensing plant by Messrs. Mirrlees Watson. The turbine set will be run from exhaust steam supplied from five Yates & Thom reciprocating sets.

A deputation which had been on the Continent to inspect turbo-alternators, was much impressed with the possibilities of using in the future large power internal combustion engines.

Newton (Lancs.).—The U.D.C. has decided to make application to the B. of T. for a provisional order to supply electrical energy. It was stated that the provision of electricity by an outside authority would in time seriously compete with the gas undertaking, and it was thought the Council should see if there was a demand sufficient to warrant the local authority embarking upon a scheme. At the present time the Council was in communication with probable large consumers, and hoped to supply the works with current at a low cost.

North Berwick.—The T.C. has agreed to an extension by six months of the period allowed for forming a company in connection with the introduction of electric lighting into North Berwick. It is anticipated that negotiations will be completed within the next three or four months.

Portsmouth.—The Finance Committee of the T.C. has decided to offer no objection to the proposal of the Electricity Committee to apply for powers to wire houses and charge the owners on the hire-purchase system or a rental, on the same lines as the gas company.

Rawtenstall.—It has been resolved to withdraw the application to borrow £2,000 for the lighting of the streets by electricity, but it has been decided to light Bacup Road from Queen's Square to Waterfoot by electricity, as well as Band Street from the central fire station to the railway station, the cost of the reduced scheme to be provided out of current revenue. Central lighting will be adopted, the lamps being suspended in the middle of the road.

Redditch.—On November 24th a L.G.B. inquiry was held into the application of the U.D.C. for a loan of £5,850 for electricity purposes. There was no opposition.

Sheffield.—A L.G.B. inquiry is to be held on December 7th into the application of the T.C. for a loan of £61,099 for extensions at the Neepsend generating station.

Slough.—There has been a remarkable growth in the demand for electricity in the districts of Slough and Windsor. At Gotha Works, Slough, Messrs. Peters & Co. have installed electric motors of over 200 H.P. to replace a steam plant, and all the premises are being lit by electricity. At Windsor the sewage works are fitted with a pumping installation ; electric motors have been installed in the Royal Gardens, Frogmore, to assist the hot-water circulation in the many glass houses, and the buildings are being lighted by the same means, while at the Royal Mews, upwards of 500 electric lamps are being fitted. Several of the larger local institutions are also adopting electricity.

South Africa.—Mr. Bellad Ellis has lately been appointed electrical engineer to the Municipality of Queenstown (Cape Colony) where an electric light plant is just about to be put down. The plant is to consist of two 100-H.P. Diesel engines direct-coupled to 70-KW. D.C. generators for 220-440 volts. The distribntion will be on the three-wire system, with underground feeders and overhead lines erected on steel poles, approximately 520 in number. The street lighting will be carried out with 200-C.P. metal lamps for the main street, 16 in number, and 50-C.P. metal lamps for the side streets, 200 in number. Power is to be available during the 24 hours, and at times of light load a Tudor battery of 258 cells will meet the demand as well as on the peak of the load. A balancer and battery booster are also to be included in the plant. Already 100 consumers have agreed to take a supply, which it is hoped will be available by July, 1912.

EAST LONDON.—Mr. E. J. Evans has just carried out the electric light installation of the Vaudette Theatre, of this town ; it consists of four flame arc lamps of approximately 2,000 C.P. outside, and interior lighting of the theatre and stage up to 7,640 C.P. in small lamps, also a motor-generator for the bioscope arc lamp, and two large electric ventilating fans. The same firm are about to install two 2,000-lb. Waygood electric lifts in the large wool store of Messrs. Mosenthal & Co.

South Wales.—Provisional orders for electric light for the districts of Llantwit-Fardre, Llantrisant, Bedwas and Machen Upper are being applied for by the South Wales Electrical Power Distribution Co.

Swinton (near Manchester).—The application of the Swinton and Pendlebury U.D.C., for sanction to borrow £4,000 for electricity purposes, has been the subject of an inquiry by the L.G.B. The amount was made up as follows :—£2,198 expenditure in excess of loan ; £1,600 for mains and services ; £100 for meters ; and £102 for contingencies, but this amount was subsequently reduced by £677—£600 in respect of mains and £77 for contingencies—leaving the net amount applied for as £3,323. No opposition was raised at the inquiry.

Tasmania.—It is reported that the Complex Ores Co. has deposited £1,000 in favour of the Hobart Council, in accordance with its contract to supply electricity by December, 1912. The company is developing power at Great Lake, and intends to produce carbide, and establish metallurgical works.

Tingael.—Efforts are being made to secure a supply of electricity for this parish, and a private company has sought the assent of the Camelford R.D.C., which has referred the matter to the Parish Council.

U.S.A.—The first of three 20,000-KW. turbo-alternators which are being installed at the Waterside Station No. 1 of the New York Edison Co., was officially started up on November 3rd. These sets consist of six-stage Curtis vertical turbines coupled to four-pole, there-phase, 25-cycle, 6,600-volt alternators, and operate on 175-lb. pressure steam, superheated 100°. The machines are 17 ft. 6 in. diameter and stand 37 ft. high above the base. It is interesting to note that the floor area taken by one of these sets is 297 sq. ft., while the area taken up by one of the 3,500-KW. engine units which have been displaced was 918 sq. ft. The steam consumption guaranteed is at 10,000-KW. load, 15 lb. per KW.-hour, at 15,000 KW., 14·4 lb., and at 20,000 KW., 15 lb. per KW.-hour. It will be remembered that we described a Chicago station a few weeks back, in which similar size units are being installed.

Uruguay.—A Government Bill has been introduced for the nationalisation of electricity supply throughout the country. It is proposed to redeem existing concessions by an issue of 5 per cent. bonds, amounting to a million sterling.

West Ham.—Mr. H. H. Couzens, electrical engineer, reports that it is absolutely essential in order to have a proper reserve that further boiler plant should be installed. He had accordingly approached Messrs. Babcock & Wilcox (whose tender was recently accepted for two boilers, each evaporating 37,500 lb., with economisers and other auxiliaries, at £9,790), to see whether they could anticipate delivery. They were unable to promise less than three months delivery for one boiler, but offered two alternatives :—(1) one boiler with economisers and auxiliaries evaporating 25,000 lb. per hour at £3,500 ; and (2) two boilers to evaporate 36,000 lb. per hour at £4,700, with a guarantee that both offers should be complete, ready for steaming, by December 28th, provided the order was placed immediately. As an alternative, he had approached Messrs. Clarke, Chapman & Co., who had offered a boiler of 26,500 lb. evaporation, with economisers and auxiliaries, at £3,540, to be delivered at the end of the second week in January. The engineer recommended that the tender of Messrs. Babcock and Wilcox for the two boilers should be accepted at £4,700. The engineer further reported that in addition to the amount of Messrs. Babcock & Wilcox's tender, there were certain motors to be provided for driving auxiliary plant, &c., and recommended that application be made to the L.G.B. for the borrowing of £5,500. These recommendations were agreed to by the Electric Lighting and Tramways Committee. Sanction has been received from the L.G.B. to the borrowing of £3,100 for extensions of mains in the Stratford district.

Worcester.—The T.C. has decided to apply to the L.G.B. for a loan of £1,675, in connection with the electrical pumping plant at the waterworks. An additional main, to cost £1,400, will be necessary.

Worsley.—It is understood that the D.C. here contemplates lighting with electricity certain portions of its township and has communicated with the Lancashire Electric Power Co.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Tramways Committee, on Monday, agreed to alter the car trucks by lengthening the wheel base from 6 ft. to 7 ft., in order to strengthen and steady the cars and reduce rocking to a minimum. The work will be undertaken gradually in the Corporation's own workshops, by men employed by the department, during the next two years. A letter was received from the B. of T. agreeing to the "speeding up" of the cars to the maximum rate proposed.

Argentina.—The directors of the Compania Anglo-Argentina de Electricidad, following the programme laid down of steadily extending the sphere of influence of the company, have acquired all the shares of the Compania Luz y Tranvias del Norte, in the city of Salta, and also the use of water power of the rivers Toro and Corralito, in the same province. Construction work on the tramway is well in hand, and the first section will be opened in a few months.—*Review of the River Plate.*

Australia.—Two accountants, appointed by the Victorian Government to investigate the accounts of the Railways Department, have reported that the suburban lines are operating at a profit, which last year, according to their basis of reckoning, amounted to £33,000. The Commissioners considered that these lines were run at a considerable loss.

Baildon (Yorks.).—A proposal to ask the Bradford City Council to state on what terms it would be prepared to extend the tramway from Baildon Bridge to the Bay Horse Hotel, at Baildon, led to a long and lively discussion at a meeting of the Baildon D.C. last week. The resolution in favour of approaching Bradford was, however, eventually carried.

Blackpool.—The T.C. on November 23rd decided to invite tenders for repaving the tramway track from Queen's Square to the Gynn. Application is to be made to the L.G.B. for sanction to borrow £4,200 to cover the cost of the six new cars just ordered, which are to be ready for Easter, and also the cost of proposed extensions at the Blundell Street depot for the accommodation of machinery for carrying out repairs on the premises.

Bradford.—The manager of the city tramways, Mr. C. J. Spencer, has been instructed to prepare a comprehensive report on halfpenny fares, workmen's return fares, tramway tickets and passes

Continental Notes.—Austria.—The Imperial Railway Department has been engaged for a considerable time past in studying the question of electrifying various sections of the railway network. The Salzkammergut section from Attnang to Steinach will take precedence for treatment, and it is stated that the firm of Stern & Haferl are about tendering to the Department for the supply of current from the Gosau station. The inquiries of the Railway Department have shown that electric driving will not cost more than the existing motive power. The particular section which the Railway Department has had under consideration has an extent of 140 km., and it has been decided to employ electric locomotives for the main line traffic, but motor carriages will be employed in other localities.

An electric railway 23·5 km. in length, to cost 2,300,000 kronen, is to be built starting from Baden and running to Klausen Leopoldsdorf, in Lower Austria, the concession has already received official sanction. Suburban electric railways are also projected at Grosswardein and Grad, in the Estergom district, while the T.C. of Tata have ordered the preliminary studies for the introduction of electric tramways to be undertaken.—*Der Elektrotechniker.*

Germany.—As a result of the successful adoption of electric traction on the Dessau-Bitterfeld line, on the A.E.G. alternating-current system, the Prussian State Railway authorities have decided to similarly "electrify" the Madgeburg-Leipzig-Halle (106 miles) and the Lauhan-Konigszeit lines (150 miles).

Croydon.—The tramway manager (Mr. T. B. Goodyer) had been instructed to accelerate the speed of the cars, and report any practical difficulties found in that direction.

Dundee.—The Corporation Tramways Sub-Committee has accepted the offer of the Railless Electric Traction Co. for two vehicles at £700 each. They are to be run on the Clepington Road between Maryfield and Strathmartine Road. The town clerk, at a meeting of the Tramway Committee, reported the receipt of letters from the North British and Caledonian Railway Companies setting forth that it appeared from notices in the Press that the T.C. was to initiate a trackless car system in Clepington Road without having obtained the necessary powers from Parliament. The companies objected, and if the announcement made was correct, they would be glad to hear that the proposal was to be abandoned, otherwise they had no alternative but to take action in the matter. The town clerk, in reply, pointed out that the letters must have been written in ignorance of Sec. 50 of the Dundee Corporation Order of 1907, which gave the Council power to adopt that system of traction. The consent of the B. of T. had been obtained He (the town clerk) was afraid the companies could not now object, and the Corporation had no intention of abandoning the new system. The Committee approved of the town clerk's reply.

Glasgow.—Confirmation of the proposal to double the present ½d. stage for the same fare, has not yet received the final sanction of the T.C. The parent Committee has not, but without disapproving of the proposed experiment—which will extend for three months—remitted the question back for further information. The matter must again come before the Committee this week, and will not be decided by the Corporation—which is already committed to the principle—until December 7th.

Lanarkshire.—The County Council of Lanark has published a draft of the proposed provisional order under which it seeks to lay down, and work electrically, several tramway routes within its jurisdiction. The first route, which extends six miles, commences with a junction with the tramways belonging to the Corporation of Glasgow, near Uddingston, and passing thence to Holytown *via* Thorniewood, Bellshill, &c. The second tramway, which will be two miles long, commences with a junction with the Lanarkshire Tramways Co.'s line in Main Street, Uddingston, linking up the first line on the road from Glasgow and Bellshill and the thoroughfare from Glasgow to Holytown. The third tramway will commence with a junction with tramway No. 1 in Main Street, Mossend, and proceed *via* the Calder and other roads by Milnwood and terminate at New Stevenston.

Lancaster.—At the yearly meeting of the Lancaster and District Tramways Co., Ltd., the report showed a profit, after paying interest on loans, of £589. The income had increased, and expenditure decreased. The chairman said they could not expect a much better return with the present horse traction system, which cost 1s. 1d. per mile, and the directors would seriously consider, in the immediate future, the question of electrical or petrol traction.

Liverpool.—The Tramways Committee, on November 24th, discussed are solution calling for the immediate reinstatement to the same grade, and at the same rate of pay of the tramway men who came out during the August labour troubles. The general manager reported that the number of men still out was 67, all but 15 of whom were in some kind of temporary employment. During the debate that ensued, it was generally agreed that the men would eventually be reinstated. The resolution only received seven supporters, and was defeated by a large majority.

London.—Hammersmith.—A letter has been received from the B. of T. to the effect that it had appointed Mr. W. Worby Beaumont, of the Outer Temple, as referee to settle the difference between the Borough Council and the London United Tramways, Ltd., with respect to the condition and repair of the track and rails of certain tramways belonging to the company.

Tynemouth.—At a meeting of the T.C. on November 22nd, a report from the Council in committee was approved for the construction by the Tynemouth Electric Traction Co., Ltd., of a railless trolley system from the Town Hall, North Shields, to Preston Village. The company had been approached by a deputation, who made a request for the system, and the company agreed, on condition that the Corporation consented to the consolidation of the dates of purchase for the existing tramways and light railways in its area, so that the right of purchase should be the same all round—that is, 21 years from the granting of the order for the railless trolley system. The company also asked for a flat rate of 1d. per unit for all current used, and laid down other conditions as to route, but in the event of the electric 'buses taking 10d. per 'bus-mile during a 12 months' trial, the company undertook to construct a circular route which was proposed. The Council, in its proposals, agreed as to the consolidation of the dates as to rights of purchase, but suggested that the charges for power for the existing tramways should remain as at present, and the company be charged 1d. per unit for the railless system, and that the company should construct a complete circular route. It is understood that these modified terms are under consideration by the company.

TELEGRAPH and TELEPHONE NOTES.

Imperial Cables.—An interesting lecture upon "The Atlantic Cable Position and its Moral" was given by Mr. Charles Bright, F.R.S.E., M.I.C.E., at the London Chamber of Commerce, on Wednesday afternoon last, Lord Desborough, K.C.V.O., in the chair. The lecturer noted the various suggestions he made in a lecture delivered before the Chamber in 1902, when he addressed it in connection with the all-British Pacific cable. Since then the *personnel* of the various Government departments concerned has undergone frequent change, but little real progress has been made. The principal reforms have been the diversion of part of the landline in America from the State of Maine to Canada, and the decision to charge reduced rates for deferred messages.

On the other hand, the general position has undergone a distinct change for the worse. The absorption of the Western Union Telegraph Co. by the American Telephone and Telegraph Co., and the subsequent action taken with regard to landlines in America, placed the English-owned cables in a very difficult position. They have extricated themselves on favourable terms to their shareholders by an arrangement which practically places the control of the cable in American hands, and this arrangement only awaits the sanction of the Imperial Government with reference to the transfer of the landing licence to become operative.

The trans-Atlantic link in the scheme for All-British cables to all parts of the Empire thus passes under foreign control. The

lecturer showed that this was a serious menace to Imperial interests, and urged the provision of duplicate cables, laid along different routes between this country and Canada, Halifax, in Nova Scotia, being the Canadian terminus. New landlines across Canada would be required to secure complete immunity from foreign risks for the Pacific Cable. A British-owned cable already connects the West Indies with Halifax *via* Bermuda. A further connection between this system and Gibraltar *via* Bathurst would give an entirely British line to the Cape, and link up the principal parts of our Empire.

The lecturer concluded by urging that the essential features of the scheme would cost less than one Dreadnought, and that in view of the strategic value of the proposal it would be a suitable subject for inclusion in the Naval Estimates.

Mr. Bright was heartily thanked for his lecture, and the following resolution was unanimously passed:—

"That, in view of the facts revealed in Mr. Bright's address, representations be made to His Majesty's Government, urging, for National and Imperial reasons, that—

"1. The licences formerly granted to British Atlantic companies be not transferred to any foreign corporation.

"2. If, however, such licences be transferred, seeing that this will involve the control of all trans-Atlantic cables between the United Kingdom and Canada being in foreign hands, it be strongly urged that His Majesty's Government should co-operate with the Governments of our Dominions—and especially with Canada—for the establishment of an independent and strictly 'All-British' trans-Atlantic cable and landline connecting with the Imperial Pacific Cable; that this should be in duplicate (on different routes) if possible, and worked on a low-rate basis.

"3. It is further urged, on National and Imperial grounds, that the latter course should, in any case, be pursued, but especially if the said licences are transferred—even if favourable terms are thereby secured."

Brazil.—The action brought by the Western Telegraph Co. against the Government for the cancellation of the decree authorising Mr. Reidy to lay submarine cables along the Brazilian coast has been dismissed. The Judge held that the decree only implied an authorisation, and it had not been put into execution.

Japan.—Negotiations are in progress between the Japanese Department of Communication and the Danish Great Northern Telegraph Co., for the purchase by the Government of the cable service between Nagasaki, and Shanghai and between Nagasaki and Vladivostock.

Manitoba.—The operation of the Manitoba Government telephone system for the year 1911 will show a loss of nearly £30,000. The Commissioners managing the system will recommend to the Government a number of radical changes bearing upon the matter of rates. There are 200,000 telephone users in Manitoba.

Norway. — Officials from the telegraph and telephone administration are visiting Continental capitals with the object of studying various telephone systems, as the telephone service of Christiania, which is now the property of the Government, is to be altered to a new system.

Pacific Cable.—The new cable between Australia and New Zealand, which will be sanctioned by the Bill now going through Parliament, will cost about £175,000, which will be taken out of the reserve fund of the Pacific Cable Board, leaving £100,000 still in reserve. The cable will run between Sydney and Auckland, and the New Zealand headquarters of the Board will be removed to Auckland, in order to expedite the transmission of messages.

Spain.—The four largest of the eight stations under construction for the Spanish Compania Nacional de Telegrafia sin Hilos by Marconi's Wireless Telegraph Co. have been completed, and (with the exception of that at Teneriffe) were opened on Tuesday; they are situated at Cadiz, Teneriffe, Las Palmas and Barcelona, and have a radius of 1,800 km. The smaller stations are situated near Madrid, Vigo, Soller, in the Balearic Islands, and at Alicante, and have a radius of 800 km.

La Compania de Telegrafia sin Hilos is the name of a new company which has been formed in Madrid, with a capital of £260,000, to acquire from the Oerlikon Co. the Spanish rights in the Marconi wireless telegraph system.

Sweden.—With reference to the application for a concession to build a wireless station in or near Stockholm, with the object of establishing a regular wireless connection with other countries, it is stated by *Affärsvärlden* that the existing contract between the Swedish Government and the Store Nordiske Telegrafselskab, of Copenhagen, gives that company the monopoly of cable connection with certain foreign lands, and even a preferential title to a concession for wireless telegraphy, which leaves very little chance for the new concession seekers.

Wireless Telegraphy.—A Reuter dispatch from Melbourne, dated November 28th, says that the Marconi Co. has notified the Commonwealth Government of its intention to take proceedings to test the right of other companies to use certain systems, including the Telefunken.

In a paper read by Herr Bredow, of the Telefunken Gesellschaft, at a meeting of the German Institution of Naval Architects, on November 23rd, the author stated that orders had been received this year for 390 stations for erection in 30 different countries. Communication between Germany and her colonies, in connection with which a distance of 3,720 miles had to be bridged over, was no longer impossible, as the station at Nauen had already covered a range of 3,100 miles. The official list of the Berne Telegraph Bureau showed that there were 713 stations on warships, 673 stations on merchant vessels and 197 land stations, a total of 1,583, of which 270 appertained to Germany.

The tower at Nauen, 100 m. in height, has recently been extended to a height of 200 m., making it second only to the Eiffel Tower in elevation. It had a range of 5,000 km. before the alteration, which will, of course, greatly increase its capabilities.

The Marconi station erected at Coltano, in Italy, is said to be the most powerful yet constructed. It is provided with plant of 1,000 KW., and has effected communication with Clifden in Ireland and Glace Bay in Canada without difficulty.

The need of a calling apparatus has been filled, it is said, by the Gesellschaft für Drahtlöse Telegraphie, of Berlin. A moving-coil galvanometer is provided with a sensitive indicator which, on the calling station giving a signal of 10 seconds' duration, makes a movement which is transmitted to a wheel connected with clockwork. This closes a circuit and actuates an audiblo signal.—*B.Z.a.M.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

January 3rd, 1912.—Sixty-nine switchboards, magneto, non-multiple, for the P.M.G.'s Department. See "Official Notices" November 24th.

Melbourne.—December 19th. Deputy P.M.G. 2,750 rolled steel beams for use as telegraph and telephone poles (Sched. 579), 8,320 protectors and 16,640 fuses for main distributing frame (Sched. 619). Specifications, &c., High Commissioner in London, 72, Victoria Street. S.W., and at Board of Trade Commercial Intelligence Department.

South Australia.—January 3rd. One wire-testing machine, for the P.M.G.'s Department. See "Official Notices" Nov. 24th.

N.S.W. Government Railways. January 8th, 1912.—Four 1,000-KW. rotary converter units. January 22nd, 1912.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th, 1912.—A 25-KW. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

Belgium.—December 19th. The municipal authorities of Saint Gilles-lez-Bruxelles are inviting tenders for a 1,000-H.P. steam engine with direct-coupled continuous-current generator, and a similar dynamo to be directly coupled to an existing engine.

December 27th.—La Société Nationale des Chemins de Fer Vicinaux, of Brussels, is inviting tenders for the contract for the overhead electrical equipment of the light electric railway line between Saint Vaast (Wazoir) and Bracquegnies.

Bosnia.—Bjelina.—December 20th. The T.C. invites offers for the complete installation of a public and private service, including station and staff dwellings. The pressure and system are left to the discretion of the tenderers. The street lighting is to consist of arc lamps for the principal thoroughfares, and metal-filament lamps in the secondary streets. The private lighting will require about 2,500 25-C.P. lamps, about half in use at the same time. Brown coal and water-power are available, and oil can be procured from Breka, 40 km. distant by rail. Plans, &c., will be forwarded, cost free, on application to the Stadtbauamt, Bjelina.

Brighton.—December 11th. One 750-H.P. three-phase induction motor, for the Corporation. See "Official Notices" to-day.

Cardiff.—December 7th. One hundred tons of British Standard No. 4 Section tramway rails, 46 ft. long, of British manufacture, for the T.C. J. L. Wheatley, Town Clerk.

Croydon.—December 22nd. The B.C. invites tenders for 2,000-volt and 5,000-volt switchboards, and erection of same complete (estimate £4,000). See "Official Notices" to-day.

Darlington.—December 4th. 500-KW. D.C. dynamo coupled to a reciprocating steam engine, for the Corporation. See "Official Notices" November 17th.

France.—January 5th, 1912. The French Post and Telegraph authorities in Paris are inviting tenders for a multiple telephone board for the Central Telephone Exchange.

Middleton.—December 12th. Feeder and distributor cable, for the Corporation. See "Official Notices" to-day.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Norway.—January 31st, 1912. The Norwegian military authorities in Christiania are inviting tenders for the supply of 100 sets of field telephone apparatus.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

BANGKOK.—March 15th, 1912. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 KW. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column last week.

South Africa.—JOHANNESBURG.—December 29th. Spare parts for tramcars and materials for overhead equipment, for the Municipal Council.

Spain.—The municipal authorities of Gelida (province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of 12 years.

Trimdon Grange (Co. Durham).—December 9th. Electric fittings for a year, for Walter Scott, Ltd., Trimdon Grange Colliery; the Storekeeper.

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. For further particulars, see this column for October 27th.

West Ham.—December 4th. Electric light installation at the Gainsborough Road Schools, for the Corporation. See "Official Notices" November 10th.

CLOSED.

Australia.—According to the *Australian Mining and Engineering Review*, tenders have been accepted as under by the Municipal Council of Sydney:—

Bare copper cable, £4,756.—British Insulated and Helsby Cables, Ltd.
Arc lamp contact and suspension gear, £293.—Lawrence & Hanson Electrical Co., Ltd.
Electrical accessories.—W. G. Watson & Co., Ltd., and India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Motor-testing equipment.—Generators: Welsbach Light Co. of A., £244. Instruments: Noyes Bros., £524. Switchgear: Australian General Electric Co., £175.

Blackpool.—The Tramways Committee has accepted the tender of the United Electric Car Co. for six new "toast-rack" cars.

Bolton.—The B. of G. has accepted the tender of Messrs. W. Watson & Son, Ltd., for an X-ray installation, at £215.

Grimsby.—The Council has accepted the tender of Kabelfabrik und Draht Industrie Aktien-Gesellschaft for cables, at £1,017.

London.—L.C.C.—The Stores and Contracts Committee has recommended the following firms' tenders for acceptance for general stores required for 1912:—

ELECTRIC INSULATING MATERIALS.—G. Angus & Co., Ltd.; British Electrical and Manfg. Co.; B.I. and Helsby Cables, Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; D. Jaroslaw; Micanite and Insulators Co., Ltd.; J. N. Hardy & Son; G. Schultz & Co.; Siemens Bros. & Co., Ltd.; J. Thompson; Whiteley Bros.

LAMP GLASSES, SHADES, GLOBES, &c.—City Glass Co.; Falk, Stadelmann and Co.; General Electric Co., Ltd.; Johnsen & Jorgensen, Ltd.; Carl. Quitmann; Reform Lighting Co.

INDIA-RUBBER FOR MECHANICAL PURPOSES.—L. Andrew & Co.; J. E. Baxter and Co., Ltd.; I.-R., G.-P. and Telegraph Works Co., Ltd.; J. G. Ingram & Son; Irwell & Eastern Rubber Co., Ltd.; Leyland and Birmingham Rubber Co., Ltd.; G. MacLellan & Co.; Micanite and Insulators Co., Ltd.; New Liverpool Rubber Co., Ltd.; N. British Rubber Co., Ltd.; F. Reddaway & Co., Ltd.

HORNSEY.—The B.C. has accepted the tender of Messrs. Frith, Blakeley, Sons & Co., Ltd., at £638 10s., for the erection of coal-bunkers at the electricity works.

South Africa.—Our Durban correspondent sends the following information:—

BETHLEHEM (O.F.S.).—The electric light plant at Bethlehem is to be added to as follows:—

One 120-B.H.P. Premier gas engine, 80 KW. A.E.G. generator, storage battery of 260 cells, switchboard, &c.—A.E.G. Electrical Co., Johannesburg, £3,261.
One Dowson's bituminous gas producer plant, consisting of two retorts and vapourisers.—Haway & Co., Johannesburg, £943.
One travelling crane complete.—H. Davies & Co., Johannesburg, £130.

The present plant consists of Tangye's suction-gas producer and engines.

JOHANNESBURG.—The following contracts have been given to Henley's (S.A.) Telegraph Works Co., Ltd., of Johannesburg:—

5,500 ft. of ·05 sq. in., 3-core, paper-insulated, lead-covered and armoured cable, with conductors of their patent type for the Cinderella Cons. Mines.
2,000 pairs of 25 ampere 250-volt cut-outs, for Johannesburg Municipality.

Taunton.—The T.C. has accepted the tender of Messrs. Goodland & Son, of Taunton, for 2,500 tons of coal for the electricity works, at 15s. 5d. per ton.

West Ham.—The Electric Light and Tramways Committee has accepted the tender of the British Westinghouse Co. for the supply of converters required at the Bridge Terrace sub-station.

FORTHCOMING EVENTS.

Northampton Institute Engineering Society.—Friday, December 1st. At 5.45 p.m. At the Institute. Open debate on "The Prospects of the Technical v. the Practical Man."

Thursday, December 7th.—Smoking concert.

Friday, December 8th.—At 7.30 p.m. Annual prize distribution, by Sir Wm. H. White.

Association of Engineers-in-Charge.—Saturday, December 2nd. Social. Dance.

Society of Engineers (Inc.).—Monday, December 4th. At 7.30 p.m. At the Institution of Electrical Engineers. Paper on "The Design of Tall Chimneys," by Mr. H. Adams.

Institution of Civil Engineers.—Tuesday, December 5th. At 8 p.m. Further discussion on paper on "Electric Lighting of Railway Trains: The Brake-Vehicle Method," by Mr. R. T. Smith.

Wednesday, December 6th.—Students' visit to the Liverpool Street extension works of the Central London Railway.

Institution of Electrical Engineers (Yorkshire Section).—Wednesday, December 6th. At 7 p.m. Meeting at the University, Leeds.

Faraday Society.—Wednesday, December 6th. At 8 p.m. At the Institution of Electrical Engineers. Papers on "A Redetermination of the Density and Coefficient of Linear Expansion of Aluminium," by Mr. F. J. Brislee; "The Influence of the Physical Condition of Metals on Cathodic Over-voltage," by Messrs. J. N. Pring and J. R. Curzon; and other papers. Exhibitions of silica mercury lamps for spectroscopic and polarimetric work, by Dr. T. M. Lowry, and the Benko primary battery, by Mr. W. R. Cooper.

Institution of Electrical Engineers.—Thnrsday, December 7th. At 8 p.m. At the Institution of Electrical Engineers. Paper on "Notes on National and International Standards for Electrical Machinery," by Dr. R. Pohl.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

The following orders are issued:—

Monday, December 4th.—"A" Company. Technical work and musketry instruction (standard tests), 8 to 10 p.m.
Tuesday, December 5th.—"B" Company. Lecture, 7 to 8 p.m; technical work and musketry instruction (standard tests), 8 to 10 p.m.
Wednesday, December 6th.—Gymnastic classes, 7 to 10 p.m.
Thursday, December 7th.—"C" Company. Lecture, 7 to 8 p.m.; musketry instruction (standard tests), 8 to 10 p.m.
Friday, December 8th.—"D" Company. Lecture, 7 to 8 p.m.; technical work and musketry instruction (standard tests), 8 to 10 p.m.
Saturday, December 9th.—Mobilisation week-end runs for "A" and "B" Companies at Dover, "D" Company at Coalhouse Fort, Gravesend. Trains leave for Dover (Victoria Station, L.C. and D. Ry.) at 1.30 p.m.; for Low Street (L.T. and S. Railway, Fenchurch Street Station) at 3.10 p.m. Dress for above runs: Service dress, putties, great coats, belts and haversacks.

URGENT.—All members of the corps are requested to attend headquarters on their company night to sign Association Form 20, recently received from the County of London Association.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

To Boost Electricity in Spain.—According to *Industria e Invenciones* it is the intention to call together a congress of Spanish electricians, with a view to considering the means for stimulating the development of electricity and its various applications throughout Spain.

Mining Prosecution Fails.—Among the charges brought against a Dumbartonshire mine manager, and found not proven, was one of having an electric safety lamp relighting apparatus in use which was not securely locked so as not to be available for use except by a person duly authorised. The prosecution was the sequel to a fatal explosion.

Fatalities.—Mr. W. G. Grant, electrician at Messrs. Gray's carpet works, Ayr, has died in the County Hospital as the result of burning injuries received through falling into a tank of boiling dye.

Robert Hobbs, a Glasgow electrician, was found dead last Saturday at the bottom of the hold of a new steamer. He was employed by Messrs. Watson & Co., Ltd., electricians, of Glasgow.

BULK SUPPLY AT TURTON, LANCS.

Turton is situated some three miles from Bolton, and is a favoured residential district. The Council applied for and obtained its provisional order in 1909; nothing was done, however, until 1910, when the Council sought the services of Mr. R. B. Leach, with a view to turning its powers to account, and appointed him as its electrical engineer.

Mr. Leach drew up a scheme which, when completed, will consist of some 8 miles of mains and 150 street lamps. The system includes a duplicate supply from an outside source through a ring main, but, owing to the distance from the source of supply, it has been necessary to allow for step-up transformers. This has a twofold advantage: (*a*) copper sizes are reduced to a minimum; (*b*) as the copper lines, where run overhead, can be kept small, it follows that light steel poles can be used, and this alone adds considerably to the appearance of the work.

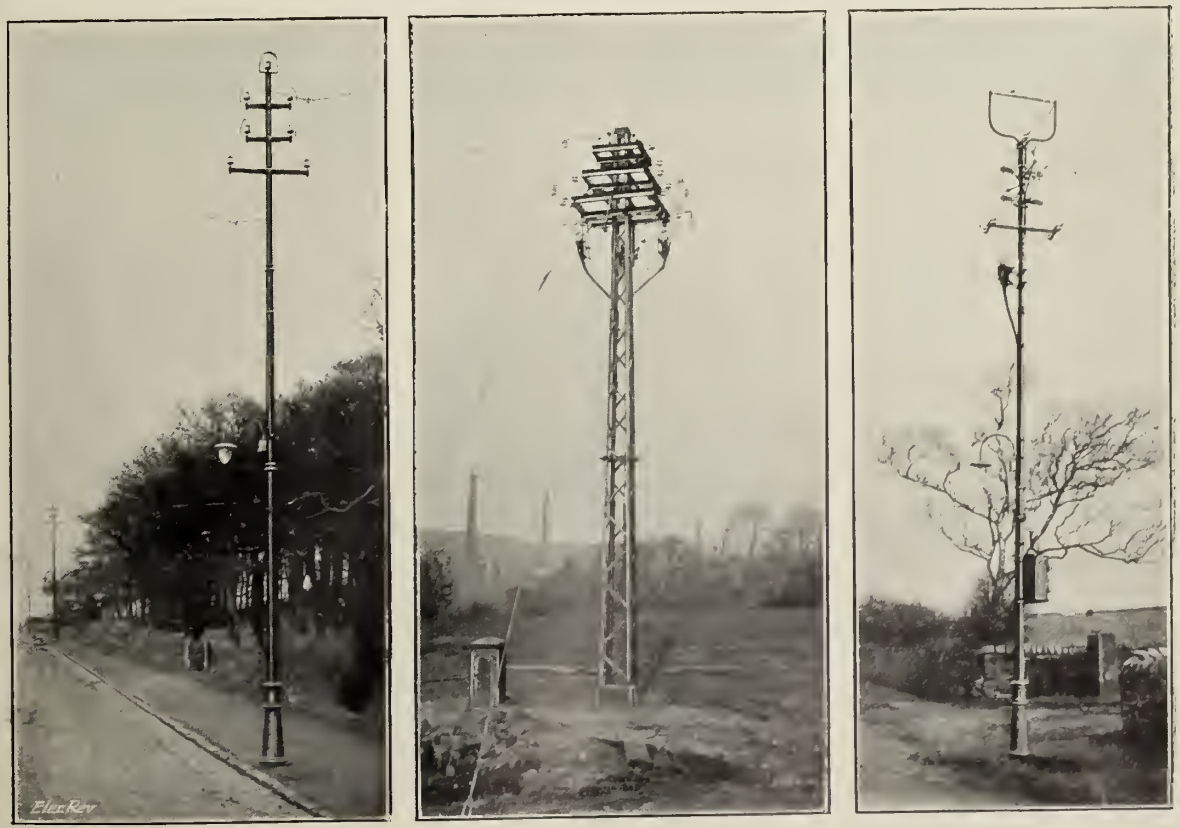
One point which augurs well for the permanent service of the scheme is that the Council, after fully discussing the matter with its engineer, came to the conclusion that it would not pay to build a station entailing high capital charges, with either heavy fuel-transport costs or water difficulties, especially as the Lancashire Power Co. had a sub-station in the area and was able to offer a supply to the Council upon very favourable terms. It must be quite obvious even to the lay mind that a large works turning out many millions of units can, by low works cost and centralisation, generate very much cheaper than a small station where supervision and management must be out of proportion to the units generated, and that fact the Turton Council readily grasped.

The first portion of the scheme was formally opened on November 2nd.

Three-phase, four-wire, 50-period current is delivered from the Lancashire Power Co.'s bus-bars at 230 volts between phase and neutral wire to a Prescot switchboard, on which are mounted two Aron three-phase 100-ampere meters, fitted with a Merz time element, three edgewise type ammeters, and one edgewise type voltmeter fitted on a movable arm bracket, three main 100-ampere fuses and two Prescot cable units, one of which is spare. From the sub-station a three-phase four-wire circuit is run on wooden poles (each wire being ·05 sq. in. section) to a lattice steel distribution pole,



Sub-station, Turton Electric Supply.



Examples of Pole-Line Work, Turton Electric Supply

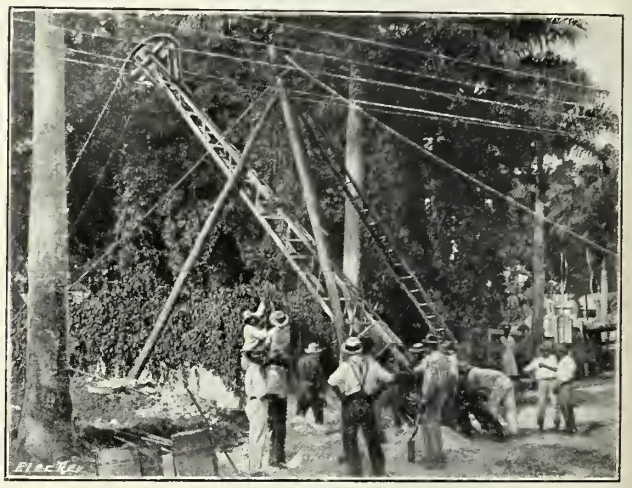
a distance of ¼ mile. Here is fixed a three-way feeder pillar which controls on the west a circuit some 350 yards long to



Laying Cable, Bridgetown, Barbados.

Chapeltown Road district, and, on the east, the circuit to Bradshaw Road district. The mains from the feeder pillar to a position about the middle of Bradshaw Road are run on





Views showing Overhead Distribution, &c., Bridgetown (Barbados) Electricity Supply (see p. 909).

wood poles (two phases only and two neutrals), each wire being ·025 sq. in. section, the length being 570 yards. At this point is fixed a cast-iron pole box containing two Venner time-switches, which switch on the 65 lamps along Bradshaw Road. The switches are arranged to operate twice during the 24 hours during winter, so that the work-people may have light on their way to the mills in the morning. In the evening the light is switched on from dusk until 11.15 p.m. From here to the southern terminus of the line, situated some 1,500 yards away, the poles are arranged to take an additional four wires, which will supply the Bradshaw area; also, to a point some 2,300 yards northwards along the Bradshaw Road, one phase wire and two neutrals are run. The neutral wire is in duplicate throughout, and being placed below the line-wires and cross-laced, forms an effective guard cradle.

The steel poles are 29 ft. long for three-wire circuits, and 31 ft. long for seven wires, made up in three sections—5 in., 4 in. and 3 in. dia. respectively. All cross-arms carrying insulators are of iron, those on the line poles being of flat section and those on terminals of channel.

The actual lighting is effected by means of a 50-c.p. metal-filament lamp fixed in a neat bracket attached to each steel pole, and spaced approximately 200 ft. apart and 12 ft. from the ground-level. At night the effect is all that can be desired, a dull country road being transformed into a well lit county thoroughfare.

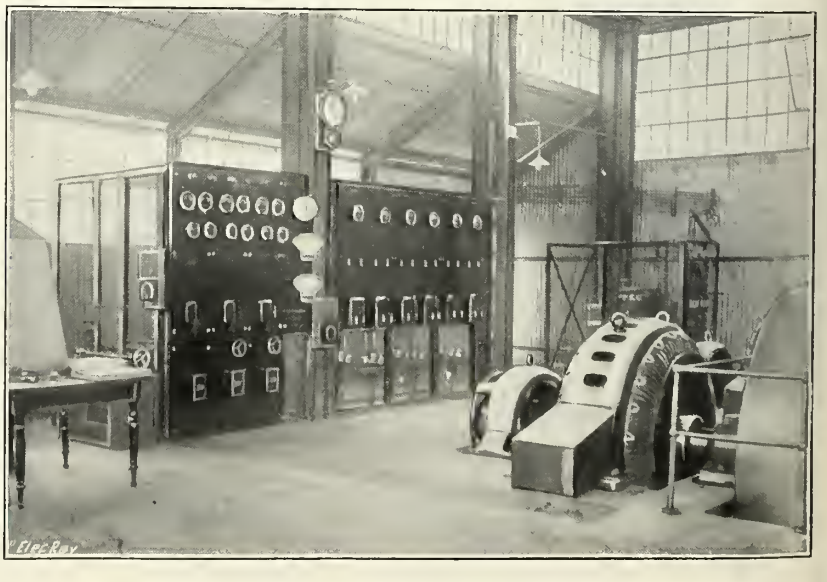
To have lighted this road by gas would have necessitated laying a 5-in. main, which in itself would have been an expensive item, while the price of 3s. 1d. per 1,000 cb. ft., which the Bolton Corporation would have charged for gas, would also have been a heavy expense.

Supply is being given to several large houses on the route, and the Council will be busy for some time adding connections to the system; persons who have private plants are finding it advantageous to discard them and take a supply from the Council's mains.

A show room is shortly being opened, which, with the wiring department which it is intended to start, will soon be in full swing.

In conclusion, we believe there are numerous small townships similar to Turton (situated in the area of one or other of the large supply companies) which, by taking bulk supply, would find an easy solution to their lighting problems, especially when it is considered that the cost to many small districts for street lighting alone runs into some hundreds of pounds per annum.

We are indebted for the above particulars to the Council's chief electrical engineer, Mr. R. B. Leach, and to Mr. Lang, of the British Insulated and Helsby Cables, Ltd., which company carried out the whole of the work.



Interior of Power Station, Bridgetown, Barbados.

ELECTRICITY SUPPLY IN BRIDGETOWN, BARBADOS.

Ever since 1899, when the Barbados Legislature passed the Electric Light and Power Act, 1899, efforts have been made

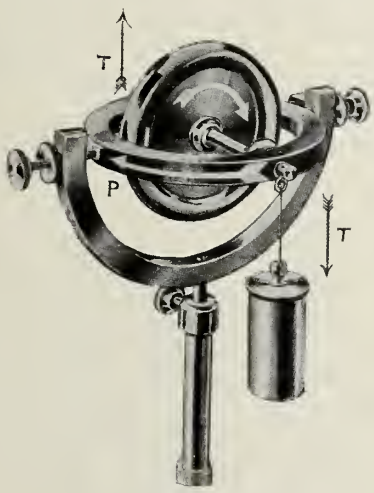


Fig. 1.—Experimental Gyrostat (see p. 910).

to provide the oldest of our West Indian Colonies with a supply of electricity for lighting and power purposes.

That such an undertaking would be a profitable business, could easily be assumed from the ideal conditions existing, and which are more or less present in all tropical towns.

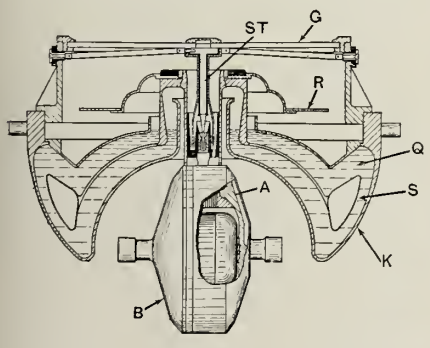


Fig. 2.—Section of Gyro Compass.

Among these might be cited the price of gas—11s. per 1,000 cb. ft.—charged by the existing gas company; the ease and small outlay with which outlying suburbs and sugar estates can be reached by overhead lines as compared with gas pipes, seeing that the soil consists of corral rock; and, finally, the low cost at which electricity could be generated by Diesel engines, having regard to the oil developments in the neighbouring island of Trinidad.

Notwithstanding these obvious advantages, efforts to promote a company for the purpose of supplying electricity failed until July, 1909, when, through the efforts of Messrs. Hooghwinkel, Anthony Brown & Partners, a company was registered under the title of the Barbados Electric Supply Corporation, Ltd.

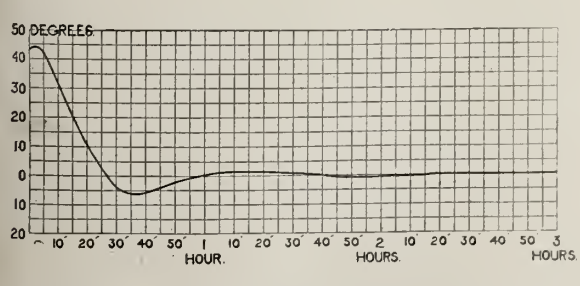


Fig. 4.—Compass Settling on the Meridian.

The required plant was ordered, and the erection pushed forward in the face of many difficulties, so as to be ready for a supply on Coronation Day, which was fortunately achieved.

The generating station building consists of a steel frame with corrugated iron sides and double corrugated iron roof, and is situated on the main road which skirts the sea, on land formerly belonging to the Royal Mail Steam Packet Co.

The plant consists of two 200-h.p. Mirrlees-Diesel oil engines, running at 250 r.p.m., and direct coupled to two G.E.C. three-phase alternators, each capable of an output of 135 kw. at 3,300 volts, 50 cycles, at unity power factor.

The open protected type direct-coupled exciters are mounted on brackets fixed to the outboard bearings, and foundations for a third set have been provided.

A cooling tower to supply the necessary cooling water, fuel tanks, pumps, pipes, &c., complete the installation.

A 250-ton oil tank with two hand pumps has been erected near the pier, where the oil can be pumped from the tank barges. This will enable the company to store a six months' supply, an absolute necessity at present when oil is used in a public supply of electricity. The consumption of fuel has been guaranteed at 0·47 lb. per b.h.p. at full load, or 0·57 lb. per b.h.p. at half-load, but probably a lower figure will be obtained.

The main switchboard, in addition to the generator panels, contains six feeder panels and a single-phase lighting panel.

The distribution system consists of a 3,300-volt underground feeder system, and overhead distributors on wooden poles at 120 volts with a four-wire star connection giving about 210 volts for power supply between the outers; most of the distributors are 0·1 sq. in. bare hard-drawn copper wire.

The feeders are nearly all of 0·1 sq. in. three-core paper-



Fig. 3.—Component Parts of Compass.

insulated lead-covered double-tape armoured cable with a preservative tarred serving overall, laid direct in the ground:

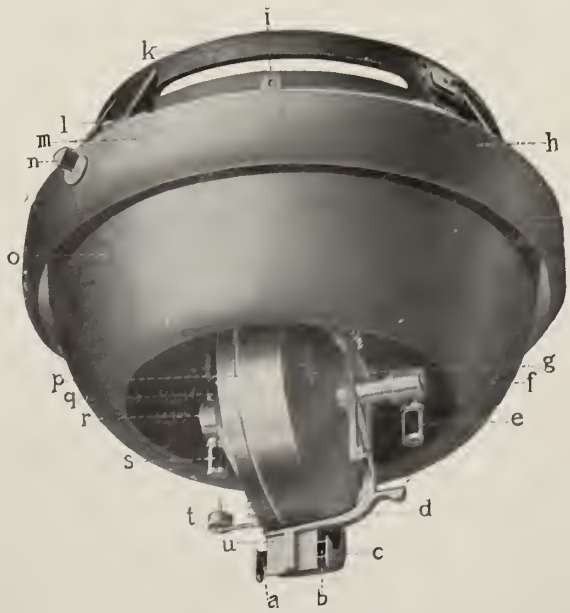


Fig. 5.—View showing Damping Device

the feeders are about 13,000 yards, and the distributors about 65,000 yards, in length.

There are six transformer sub-stations of 150-50 kw., one in the power station, and the largest housed in a small brick building. The others are housed in specially-constructed ventilated corrugated-iron transformer houses with hinged doors to provide for the inspection of the switch-gear and voltmeters.

The transformers are of the oil-cooled Berry type.

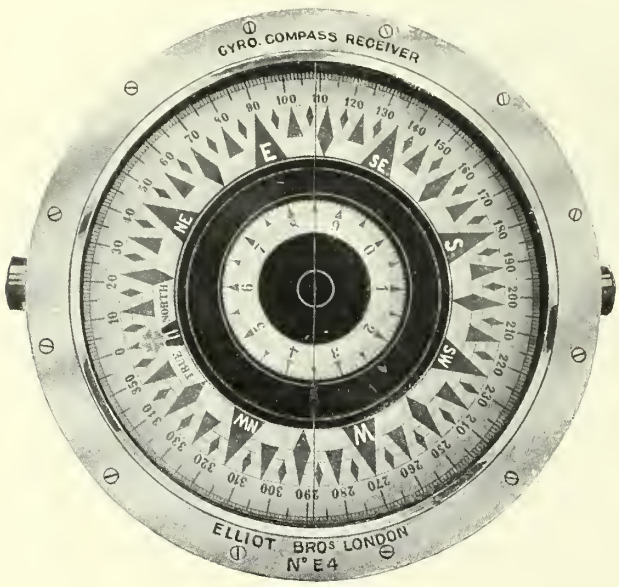


Fig. 6.—Receiver Dial.

Six special lattice poles with angle-iron distributor rings on the top act as feeder points to the overhead system, the leads rising inside the poles.

The lines are well protected with lightning arresters, and where necessary guard wires have been erected to protect the existing telephone wires.

Most of the installation work is being carried out by the



Fig. 8.—Receiver on Pedestal.



Fig. 9.—Ordinary Gyro Compass.

company with exposed wiring carried on cleats, which is, of course, the only proper system in a tropical damp climate with many wooden houses, besides being cheap.

The consulting engineers to the company are Messrs. Hooghwinkel, Anthony Brown & Partners, London, and they have been responsible for the design and the construction of the works.

THE GYRO COMPASS.

Of all the interesting instruments shown at the recent Electrical Exhibition, none could possibly excel in interest and mechanical perfection the Anschütz "Gyro compass" exhibited by Messrs. Elliott Brothers.

This instrument affords another admirable example of pure physics applied to industrial purposes, for it was the famous French physicist, Foucault, who first investigated the laws controlling gyrostatic phenomena, and laid down the fundamental proposition upon which the working of the

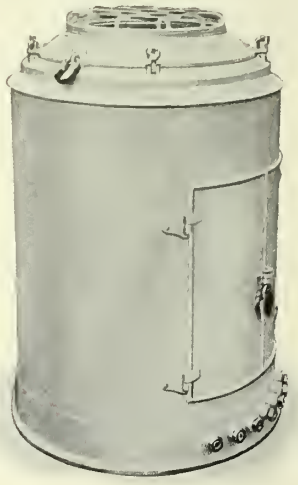


Fig. 7.—Gyro Compass (Master).

Anschütz compass depends, namely, that a gyrostat with freedom to move in two planes only would at any place on the earth's surface (other than the poles), tend to set itself with its axis of rotation parallel to the axis of the earth, by reason of the relative rotations of the two bodies.

Although the experiments on which this law was based were carried out nearly 60 years ago, no serious attempt was made during the last century to utilise the gyrostat for the purpose of a compass. The increasing use of steel, however, in the construction of ships, and especially the use of immense moving masses of steel for the guns of modern battleships, rendered it more and more difficult to compensate the magnetic compass so as to eliminate the effects

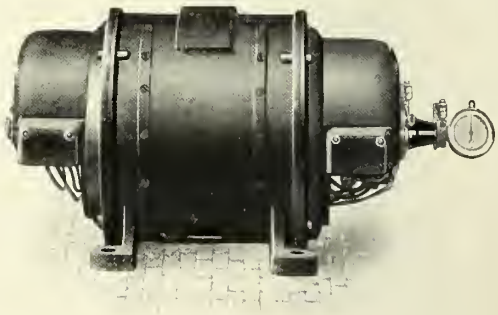


Fig. 10.—Motor-Alternator.

of such disturbing factors, and gave that stimulus to the demand for an efficient substitute which has led to the development of the gyro compass.

The earlier attempts were directed to the construction of a gyro with three degrees of freedom, which would preserve a direction fixed in space: but it was found impossible to overcome the difficulties which arose. The adoption of the gyro with two degrees of freedom was found to afford a satisfactory solution, but for one serious drawback—that owing to the great mass, high speed, and small friction of the moving parts, if the gyro were deflected from the meridian it would oscillate to and fro for a very long time, so that it was practically useless on board ship. This final difficulty was removed by the adoption of a most ingenious damping device, which has proved perfectly effective in steadying the compass

and enabling it to be developed to a degree of efficiency never attained by the magnetic compass.

The result is that the gyro compass has been adopted by all the leading navies and by many merchant vessels, and is certain to be more and more widely used as its merits become better known. It also affords a solution to the problem of equipping submarine boats with compasses independent of terrestrial magnetism.

The gyro compass, however, is not independent of electro-magnetism; it is, indeed, only by the aid of this agency that its operation is rendered practically possible, for no other known means could maintain its fly-wheel in rapid rotation for an indefinite period, and it is for this reason that we give below a description of the apparatus. The gyro, in fact, is an electrical device, embodying within its innermost recess a squirrel-cage three-phase motor, and transmitting its indications to any desired point by electrical means.

The limitations of our space prevent us from explaining in detail the dynamical principles upon which the compass depends, and a brief statement must suffice. It is well known that if a gyrostat mounted as shown in fig. 1 (p. 909), with its wheel revolving rapidly in the direction of the arrow, is subjected to a turning couple, indicated by the arrows T T, the frame carrying the wheel will tend to rotate in the direction of the arrow P—in a plane *at right angles* to that containing the couple T T. The direction of the rotation P is always that which tends to bring the plane in which the wheel revolves into that containing the couple T T, and so that the wheel rotates in the same direction as the couple T T. When (if ever) that condition is reached, the frame has no further tendency to rotate. The rotation of the frame is termed "precession," and always takes place by the shortest path to the position of stability.

In the gyro compass the case containing the revolving wheel is carried by a float in a bowl of mercury. The surface of the mercury is maintained by gravitation always in a plane tangential to the earth's surface, and assuming for simplicity that the compass is situated at the equator, with its axis pointing east and west, it will be seen that the rotation of the earth from west to east is always tilting the plane of the liquid surface with regard to the gyrostat, and in effect applying a couple exactly analogous to that indicated by T T in fig. 1. Hence the floating gyrostat rotates, trying to place its axis north and south, in which position the wheel would revolve in the same plane and in the same direction as the earth at the equator. The directive force acting upon the gyrostat diminishes as this position is approached, passes through zero as it is attained, reverses as the inertia of the system carries it beyond the meridian, and finally brings the gyrostat to rest in a position practically opposite to that in which it started. Precession then recommences in the opposite sense, and the frictional damping being comparatively negligible, the oscillations thus set up might continue indefinitely, were it not for the damping device described below. The effect of the latter is always to oppose precession to a degree proportional to the tilt of the gyrostat, and thus, while an undamped gyrostat would oscillate for an indefinite period, the actual instrument attains a steady position on the meridian in a few hours from the starting-up of the motor.

A little consideration will show that at any other latitude than the equator, the directive force due to the earth's rotation will be less than at the equator, in proportion to the sine of the latitude, becoming, therefore, zero at the poles—just as the magnetic compass loses direction at the magnetic poles. The directive force acting on the gyrostat, however, is estimated at 15 times as much as in the case of a magnetic compass, and is always ample for practical purposes, even at the highest latitudes usually attained. A number of small corrections are necessary: for change in latitude, for the direction of the ship, and for changes in the speed of the ship; in practice, the last two can be combined, and all of them are readily ascertainable from tables. Variations in the pressure of the electricity supply exert no appreciable influence upon the gyro.

Having thus briefly indicated the nature and performance of the gyro compass, we may now proceed to describe its mechanical details. Fig. 2 is a vertical section through the centre of the compass; A is the gyro wheel, housed in a casing B, which is carried by a tubular stalk from the float S; the latter is supported by mercury Q in the bowl K, and carries also the compass card R, the N-S line being directly over the axle of the gyro. The instrument has a glass cover G, which supports a steel stem S T at the centre, for the purpose of keeping the floating system central: the stem also dips into a mercury cup on the gyro, and is connected with a terminal at the periphery of the cover, whilst a steel tube concentric with the stem makes contact with an annular mercury cup, as shown, and is connected to a second terminal. These two connections are insulated from one another and the metal of the apparatus, and carry two phases of the motor supply; the third is conveyed by way of the mercury bath, float, &c., the whole instrument being insulated from the binnacle. The mercury bowl is suspended on gymbals in the usual way, the outer ring being borne on springs to protect the apparatus from shock.

The fly-wheel of the gyro, which is fashioned with its shaft out of one piece of special nickel steel, contains the rotor of the three-phase induction motor, with short-circuited copper bar winding, while the stator is mounted inside the case B. The motor has two magnetic poles, and drives the wheel at 20,000 R.P.M. The spindle runs on ball bearings of specially hard steel, and is flexible, so that, above the critical speed, the gyro wheel is free to revolve about its centre of gravity. Owing to the arduous conditions imposed by the very high speed and considerable mass of the gyro wheel, every part has to be constructed of the finest materials and the best possible workmanship.

Fig. 3 shows the component parts of the complete instrument, namely, the mercury bowl and gymbal rings, the gyro wheel, the floating system with compass-card attached, and the top cover.

The damping device is shown in fig. 5. It consists of a small shutter *u* attached to a pendulum arm *d*, which is carried on pivots, and swings to the right or left when the axis of the gyro is tilted. Air is admitted to the gyro case by the inlets *g*, and is expelled by the rotation of the wheel through the channel *c* in two streams, through *a* and *b*. When the gyro is tilted, the shutter partly closes one outlet and opens the other more widely, so that the issuing streams of air are no longer equal, and the resultant effect is a torque tending to rotate the gyro round a vertical axis in such a sense as to bring the axis of the gyro horizontal, as above explained. The powerful damping effect produced is well shown by the curve, fig. 4, from which it will be seen that, even if the axle is 45° from the meridian when the motor is started, the compass settles down to within 1° of the meridian in less than two hours. In the case of the master compass, a still simpler damping device is employed, working on a similar principle.

A peculiarity of the gyro compass—that while the card can oscillate about a north-south axis, it cannot oscillate about an east-west axis—has the valuable result that a point on the east or west of the card can only move straight up and down, not in a circular path, and this renders it easy to apply a system of transmission mechanism that would be impossible with a magnetic compass. When this is done, the master compass containing the gyro, and fitted with a transmitter, can be situated anywhere low down in the ship where it is best protected from injury—in positions where a magnetic compass would be rendered useless by its being surrounded with masses of steel—and any number of receivers can be fixed wherever desired, accurately reproducing the indications of the master compass. The latter is provided with a revolving case or binnacle, driven by a reversible motor, which is controlled by contacts actuated by the gyro. Fig. 7 is a view of such an instrument. Whenever, through the movement of the ship, a contact attached to the binnacle touches a contact on the compass card, the motor begins to rotate in that direction which tends to separate the contacts, which being done, the movement ceases. A commutator on the spindle of the motor sends currents to all the receivers, which are provided with mechanism which causes the receiver cards to rotate in exact agreement with the transmitter. Fig. 6 shows the dial of a receiver, which it will be noted is provided with a central card reading to 10°, in addition to the outer card. The small card is geared to the larger one so as to make a complete revolution while the latter rotates through 10°, and provides, therefore, a reading about 15 times as sensitive

as that of the large card—allowing for their relative diameters. The importance of this will be obvious when it is considered that it enables a much straighter course to be steered, effecting a very material economy of time and fuel on a long voyage. Fig. 8 shows the receiver mounted on a pillar.

A small motor-generator, supplied from the ship's mains, is used to generate three-phase current at 120 volts, 333 cycles per second, for the gyro-motor. The machine, which is shown in fig. 10, runs at 2,500 R.P.M., and the three-phase part of it has 16 poles. The D.C. and A.C. circuits are entirely insulated from one another. The power taken by the machine is about 700 watts. It is controlled by a suitable switchboard, fitted with meters, duplex fuses, &c.

Fig. 9 shows a complete gyro compass with the top cover removed ; *a* is a spirit level, *b* the central stem, and *c* a clamp screw for adjusting the "lubber point," to make the latitude correction already referred to.

We are indebted to Messrs. Elliott Bros. for the particulars upon which the foregoing article is based.

NOTES.

Electrical Engineers' Ball, 1912.—The ninth annual ball is to be held at the Hotel Cecil on Friday, February 16th. A strong committee has been formed, the first list of its members being as follows :—

Committee :

Alabaster, H.	Gavey, Sir J.	Nash, E. A.
Andrews, Leonard	Gray, Jas.	O'Meara, Major
Bailey, Frank	Gray, R. Kaye	Pearson, Hugh A.
Baldwin, O. H.	Hadley, A. E.	Petersen, T.
Belfield, R.	Hammond, R.	Railing, M. J.
Blunt, W. W.	Hill, Charles	Raworth, J. E.
Bowden, J. H.	Highfield, J. S.	Roberts, Martin F.
Browett, T.	Hirst, H.	Rutherford, W.
Brown, C. S. Vesey	Holden, Col. H. Capel	Rowell, G. F.
Byng, E. G.	Hooper, J.	Sharp, Sydney
Callender, Jas.	Kingsbury, J. E.	Shepherd, J.
Cramb, A. C.	Lacey, E. M.	Siemens, Alex.
Davenport, F. R.	Lane, W. E.	Sillar, A. M.
Dickinson, Harold	Leaf, H. M.	Scholey, H.
Dobson, Sydney	Leigh, F. A. C.	Spagnoletti, J. E.
Erskine, R. S.	Madgen, W. L.	Sparks, C. P.
Ferranti, S. Z. de	Mathews, W. Lee	Steinitz, J. J.
Fox, E. J.	Mordey, W. M.	Sutton, G.
Garcke, E.	McMahon, P. V.	Taylor, J.
Gatehouse, T. E.	Murray, Lee	Wallis-Jones, R. J.
	Nalder, F. H.	Wordingham, C. H.

Executive Committee.—Baldwin, O. H. ; Fox, E. J. ; McMahon, P. V. ; Wallis-Jones, R. J.

Hon. Secretaries.—Alabaster, H. ; Sillar, A. M.

Hon. Treasurer.—Kingsbury, J. E.

Educational Notes.—A course of eight lectures on "Illumination and Photometry," will be delivered at University College, Gower Street, W.C., by Mr. W. C. Clinton, on Wednesdays at 6.30, beginning on January 10th, 1912. The fee for the course is two guineas ; by the courtesy of the Provost, we are authorised to nominate three persons for admission to the course at a special fee of one guinea each, and we propose to nominate those three applicants who give the best reasons for our doing so, before December 17th.

The eighteenth annual dinner of King's College Engineering Society was held at the Hotel Cecil on Friday last. Dr. W. C. Unwin, F.R.S., President of the Institution of Civil Engineers, occupied the chair. Dr. Headlam, in responding for "The College and Staff," said there was great need at the present time that the three great engineering colleges of London should work together to introduce a more rational, more professional, and more practical system of examinations in engineering.

On Friday last, the new Mechanical Engineering Laboratory of the Belfast Municipal Technical Institute was formally opened by Prof. J. Perry, F.R.S., who delivered a heavy indictment of the methods of so-called teaching in vogue in the public schools and Universities, and advocated training in natural science.

Appointments Vacant.—Assistant engineer for the Liverpool Corporation (£200) ; senior operator at Bristol for the Provincial Cinematograph Theatres, Ltd. (50s.) ; assistant civil and electrical engineer for the Public Works Department, Trinidad (£300—£350) ; foreman for the Newport Tramways repair department. See our advertisement pages to-day.

"The Adventures of Eddie Currant."—In the Co-operative Hall, at Rugby, on Thursday, December 7th, and two following nights, "The Donuts" will give performances of the burlesque, "The Adventures of Eddie Currant." Who are the "Donuts ?" and what is this burlesque ? The former are the staff members of the British Thomson-Houston Co., Ltd., who, in their spare time, become members of the "Donuts" Association. The latter is a play written and produced by electrical men for electrical men. It is a technical burlesque ; the scenery and stage effects a described as truly remarkable, and the performances take place "three nights only." We have no doubt that the many friends the B.T.-H. staff will be interested to learn of the arrangements, a if any of them happen to be within easy reach of Rugby on any the nights named, at 7.30 o'clock for 8 o'clock, they may be sure a good reception and that their presence will be greatly appreciat The tickets are 1s. and 6d., with reserved seats at 2s. 6d. and 1s. 6 and the honorary "Donuts" secretary is Mr. T. H. Relton, of 1 Clifton Road, Rugby.

Parliamentary. — *Electric Lighting Undertakin (Auditors).*—Mr. Grant, on Monday, asked the President of t Board of Trade if he would state whose duty it was to fix t remuneration of Government auditors for annual reports up electric light undertakings liable to be taken over by municipaliti and why it is that the amount charged by such Governme auditors is, in cases, in excess of ordinary prices.—Mr. Buxt replied that the duty of fixing the remuneration of these audito who are in all cases chartered or incorporated accountants, re with the Board of Trade. He was not aware that the amount fix was in any case unreasonably high, but if the hon. member wou inform him of any such case, he would be pleased to inquire into

Peel-Conner Telephone Works, Ltd.—Mr. O'Grady asked t Postmaster-General whether he was aware that the Peel-Conn Telephone Works, Ltd., Manchester, had during the time th were carrying out a Government contract reduced the piecewo prices of girls on certain portions of the contract from 10s. 6d. 7s. 6d. ; whether he was aware that a strike ensued in consequen and if so, could he state whether the firm, having tendered for Government contract on a definite price, was entitled thereafter the advantage arising from their action in reducing wages. T Postmaster-General said he was aware that the company had ma certain alterations in their piecework prices, with the consequer that some of their staff of girls had struck work. There was recognised district rate for the work on which the girls we engaged, and he was concerned with the piecework prices fixed the company only so far as those prices would affect the aeti earnings of the workers. The matter had been specially inves gated by his inspecting officer, and in view of his report, he w not satisfied that the new prices would result in a reduction wages, or that they were inconsistent with the Fair Wages Clau The girls who struck work did so before the new rates could given a trial, and he was informed by the employers that so who remained at work were earning higher wages than under t old rate. If the hon. member gave him further information would have further inquiry made.

Continuously-Loaded Telephone Cable.—The Ind Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silv town, Essex, have recently made and delivered to the Ital Government a shipment of bi-core continuously-loaded telepho cable, of a total length of 30,000 metres. The cable consists two gutta-percha insulated cores, the conductor of each being strand of seven 0·7 mm. copper wires, covered with a layer of soft annealed iron wire 0·2 mm. diameter, and then insulated w three layers of pure gutta-percha to a diameter of 6·5 mm., the t cores being then laid up together, wormed and served with special prepared jute yarn, taped and covered with a special alloy tu As the company possess large hydraulic presses, it was possible make this cable in lengths of 300 metres without joint and witho any stoppage for refilling the container. The results of electri tests on the cable showed :—

- Electrostatic capacity under steady current 0·0894 mfd. (betwe wires) per km.
- Conductor resistance under steady current 11·745 int. ohms (loo per km. at 15° C.
- Conductor resistance with alternating current 1,000 p.p.s., 12·5 int. ohms per km. at 15° C.
- Inductance with alternating current 1,000 p.p.s., 5,872 mil henries (loop) per km. at 15° C.
- Attenuation Constant.—The attenuation constant of the ir whipped cable per kilometre loop at 1,000 p.p.s. is 0·024.

It may be observed that without the iron whipping a cable this type would have had an attenuation constant of 0·057 kilometre loop. In other words, the attenuation constant reduced by 58 per cent., owing to the iron whipping. The latt therefore, more than doubles the speaking range of the telepho cable.

Copper.—The position of the copper market is discuss in an article in the *Financier* for November 24th, touching up the increase in price both of the metal and securities pertaining it ; the writer considers that this is due, in the States, to persiste curtailment of production, though in Europe it may be indication of reviving trade. According to the statistics American production, last month's (October) was 59,127 to against 63,234 tons in October, 1910. At the same time, deliver for home consumption and for export have fallen from 68,000 62,076 tons. Consumption has thus fallen off to a still great extent than production. The European situation is more favo able. Supplies have advanced from 431,313 tons for the 12 mont ending October 31st, 1909, to 440,970 tons in the 12 mont ending October 31st, 1910, and 459,865 tons in the 12 months October 31st last. Consumption has also risen, from 451,905 t in 1909-10 to 486,451 tons in the year to the end of last mon The price of the metal is only 27s. higher per ton than at same date last year. The increase in European supplies, coup with decrease in those from United States, implies an increa production over here.

The Light of the Firefly.—Experiments recorded in *Nature*, of November 23rd, indicate that the light emitted by fireflies possesses some of the properties of the X-rays and ultraviolet light, producing strong effects upon photographic plates through media opaque to light, but not through glass.

The M.E.A. Bill.—On Tuesday, Sir Howell Davies introduced a Bill (on behalf of the I.M.E.A.) in the House of Commons, to amend the Acts relating to electric lighting, the primary object of which is to obtain powers on behalf of municipal electricity suppliers to provide, sell, let for hire, and fix, repair, maintain and remove (but not manufacture for these purposes) lamps, meters, electric lines, fuses, switches, fittings, lampholders, motors and other fittings, and provide all materials and work necessary to that end. Another important clause relates to the borrowing of working capital in connection with electricity undertakings; we note also that one clause seeks to legalise delegates' expenses to such gatherings as the M.E.A. conferences. There are 9 clauses in all.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. S. Taylor has been appointed deputy engineer and manager to the Hankow Light and Power Co., Ltd., Hankow, China, and he has therefore resigned his appointment as chief assistant to the Hendon Electric Supply Co., Ltd. He sails for China at the end of December.

The salary of Mr. Seddon, electrical superintendent at the West Ham generating station, is to be increased to £250 as from April 1st next.

The salary of Mr. J. C. Gill, borough engineer at Peterborough, and electrical engineer, has been increased from £100 to £150; Mr. Gill also receives £300 as waterworks engineer, and other emoluments. The electrical undertaking showed last year a profit, after paying financial charges of £500, and it already shows £200 more than that sum this year.

General.—Our Indian correspondent says it is reported that Mr. J. S. Pitkeathly, the Electrical Inspector to the United Provinces, India, has resigned his post, and will leave the country after the Durbar in February, 1912. His successor will be appointed through the Secretary of State. Mr. Jansen, who was Assistant Electrical Inspector under Mr. Pitkeathly, has also resigned his post, and has returned to England. In spite of the "Official Secrets Act," rumour has crept about that these two resignations are not entirely disconnected with the fact that certain Royal Engineers, drawing very much higher salaries than the engineers who have resigned, were appointed assistants on the Delhi Durbar works. The Government is losing a good sound engineer, and an energetic one in Mr. Pitkeathly, and will find it hard to get such a useful man. Our correspondent also writes that Mr. J. W. Shorth, who has for about 14 years been chief engineer to Messrs. Balmer, Lawrie & Co., of Calcutta, has just resigned his post and left the country for good. It is whispered that he has made a handsome fortune in a comparatively short space of time. He departs with the best wishes of many friends, who have known him to be a keen business man, a fair dealer and a good fellow generally. His place has been filled by Mr. W. Hodgskinson of the same firm.

Indian Engineering says that Mr. A. E. McCloskey, expert in telegraph, telephone and railway signalling systems, "who comes from the engineering department of the British Post Office and has been on loan to the Bombay, Baroda and Central India Railway during the past 18 months, has now handed in his report on the reorganisation of the company's telegraphs." It is understood that he has been successful in obtaining for the company several concessions from the Government.

The appointments of external examiners for the session 1911-12 by the Liverpool University contains the following:—Faculty of Engineering—Electrical Engineering, S. P. Thompson, D.Sc., F.R.S., Principal and Professor of Physics, City and Guilds Technical College, Finsbury, E.C.

Mr. Glazebrook, director of the National Physical Laboratory, has been suffering from a very serious attack of enteric fever, but is now, we are glad to say, on the road to recovery.

Mr. Albert W. Marr, of Aberdeen, has been appointed chief electrical engineer to the Raneegunge Mining Association at their Bengal coalfields. He sailed on Saturday last to take up his duties.

Mr. E. V. Johnson, late technical representative for Messrs. Evans & Robinson, Ltd., in South Wales, has joined the firm of Messrs. W. V. Waite & Co., Ltd., Cardiff.

The Edison and Swan United Electric Light Co., Ltd., are shortly sending Mr. Pakenham W. Beatty out to Buenos Ayres as their South American representative and manager, with the object of establishing in that city their headquarters for South America, and their first branch in the country. We are informed that in view of their rapidly increasing trade in South America, the Edison & Swan Co., feel it imperative that a representative of the company should reside there, and that a stock of electrical goods should be available in the great South American commercial centres. In time the company intend to establish branches in all the large towns in the South American Republics, Buenos Ayres having been chosen as a site for their first branch on account of the many obvious commercial advantages it possesses to-day. Mr. Beatty has already had several years' experience in South America, having acted as resident electrical engineer to the South American Light and Power Co., of Bahia Blanca, an undertaking in which the Buenos Ayres and Pacific Railway Co. are the largest shareholders. In that city Mr. Beatty recently superintended, under the direction of Mr. J. F. C. Snell, of Messrs. Preece, Cardew & Snell, the complete remodelling of the lighting company's plant, the erecting of a large generating station for the Buenos Ayres and Pacific Railway Co., and the electrification of the Bahia Blanca Tramway's Co.'s system. During his stay Mr. Beatty was also responsible, under the same direction, for the design and carrying out of several large lighting and motor installations for the railway company at their docks, workshops and sheds. The preparation of the Edison & Swan Co.'s new South American catalogue in Spanish and Portuguese is now in hand, and will shortly be ready for publication.

Obituary.—Caryl David Haskins.—We regret to record the death of Mr. C. D. Haskins, an electrical engineer of great eminence in the U.S.A., and manager of the lighting department of the General Electric Co., of Schenectady, which occurred suddenly from pneumonia at Salt Lake City on November 18th. Mr. Haskins, who was only 44 years of age, was born in America, but received his education in England. In 1888 he entered the employ of S. Z. de Ferranti & Co., as a junior assistant engineer, and was placed in charge of the manufacture of electric meters, assisting also in preparing the plans and specifications of the original Deptford station. In the following year he was in the employ of the Thomson Electric Welding Co., of Lynn, U.S.A., later joining the Thomson-Houston Electric Co., of Lynn, Mass., as an electrical engineer. In 1891 he was appointed manager of the meter department of that company, and upon its consolidation with the General Electric Co. he took charge of the engineering and manufacturing of electrical instruments and meters. Mr. Haskins organised and became commander of a corps of electrical engineers which rendered valuable service in the Spanish-American war. His technical knowledge was also utilised in harbour and coast defence—indeed, his experience on the applications of electricity for defence in time of war was such that he frequently acted in an advisory capacity for the U.S.A. Government in matters of this nature. Eleven years ago he took charge of the G.E. electric switchboard department, and in 1906 received the appointment of manager of the company's lighting department. He was well known as an author and lecturer, and was a member of a number of American electrical and engineering societies.

The Marquess of Tweeddale, K.T.—We record with deep regret the death of the Marquess of Tweeddale, who passed away in London on Saturday last, at the age of 85 years. Lord Tweeddale was one of the leading men in the realm; not only was he of great distinction by lineage, but he had in the course of his very lengthy career figured in public in India, and in the House of Commons at home. In the City he had for many years been a familiar figure at the meetings of submarine telegraph companies, over which he always presided with courtliness and grace, and his continuance in office, in spite of the increasing infirmity of advanced years and his inability to hear, well show his sustained interest in telegraph matters. The companies with which he has been associated, either as chairman or director, include the following:—The Eastern, Eastern Extension, and Eastern and South African Telegraph Companies, the Europe and Azores Telegraph Co., West African Telegraph Co., Direct Spanish Telegraph Co., and the Globe Telegraph and Trust Co., Ltd.

An Australian exchange announces the death, from heart failure, quite unexpectedly, at the age of 68 years, of Mr. Norman Selfe, M.Inst.C.E., M.I.M.E., a consulting engineer, who had been well known in Sydney, N.S.W., for many years.

NEW COMPANIES REGISTERED.

Hadley Engineering Co., Ltd. (118,777).—This company was registered on November 25th, with a capital of £250,000 in £1 shares (150,000 6 per cent. cumulative preference), to acquire and combine several kindred manufacturing businesses hitherto carried on (1) by Joseph Sankey and Sons, Ltd., at Hadley, near Wellington, Salop; (2) by Thomas Tilling, Ltd., at Peckham, S.E., and (3) by W. A. Stevens, Ltd., at Maidstone. The subscribers (with one preference share each) are: R. S. Tilling, Winchester House, Peckham, S.E., chairman, Thomas Tilling, Ltd.; E. W. Tilling, Winchester House, Peckham, S.E., director, Thomas Tilling, Ltd.; W. Wolsey, jun., Winchester House, Peckham, S.E., director, Thomas Tilling, Ltd.; W. A. Stevens, 26, Victoria Street, S.W., and St. Peters Street, Maidstone, director of W. A. Stevens, Ltd.; J. W. Sankey, Foxhills, Womhourne, Staffordshire, chairman of Joseph Sankey and Sons, Ltd.; G. H. Sankey, Finchfield House, Wolverhampton, director of Joseph Sankey & Sons, Ltd; F. E. Sankey, Waterdale, Wolverhampton, director of Joseph Sankey & Sons, Ltd. 120,000 preference, and not more than 12,000 ordinary shares, are offered for subscription; subscribers for preference shares have the right to apply at same time for ordinary shares equal to not more than 10 per cent. of such preference shares; minimum cash subscription, 25 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the first are G. H. Sankey (chairman), W. Wolsey, jun., and W. A. Stevens; qualification, £500; remuneration, £150 each per annum, and £150 extra for G. H. Sankey, as chairman. Preference shares confer no rights to attend or vote at meetings except under special circumstances. No debentures may be issued without the sanction of preference shareholders. Solicitors, Underhill, Thorneycroft and Smith, Wolverhampton; general manager, S. L. Brunton, M.Inst.C.E., M.I.E.E., secretary (*pro tem.*); and registered office, W. S. Clarke, 1-2, Great Winchester Street, E.C.

Automatic Telephone Manufacturing Co., Ltd. (118,664).—This company was registered on November 20th, with a capital of £1,000,000 in £1 shares (500,000 preference), to carry on the business of manufacturers of and dealers in (so far as may be lawful) automatic and other telephones, telegraphs, wires, cables, and lines of all kinds, electricians, mechanical engineers, suppliers of electricity for light, heat and power, &c., to acquire from the Automatic Electric Co., of Chicago, certain patents relating to automatic telephones; also to acquire from the British Insulated & Helsby Cables, Ltd., certain freehold lands at Edge Lane, Liverpool, together with the works and plant, &c., thereon and goodwill of business carried on there, and to adopt agreements *(a)* with the Automatic Electric Co., of Chicago, and *(b)* and *(c)* with the British Insulated & Helsby Cables, Ltd., the *(c)* agreement relating to the guarantee of the preference dividend of 200,000 of the company's preference shares. The subscribers (with one share each) are:—J. Taylor, Heathercliffe, Helsby, manufacturer; D. Sinclair, The Grange, Huyton, electrical engineer; A. Brooker, Ashfield, Huyton, electrical engineer; J. S. Harmood Banner, 24, North John Street, Liverpool, chartered accountant; F. E. V. Russell Roberts, 10, Water Street, Liverpool, solicitor; V. D. Heyne, 10, Water Street, Liverpool, solicitor; J. Bruce, 10, Water Street, Liverpool, clerk. Minimum cash subscription 10 per cent. of the share capital offered to the public. The number of directors is not to be less than five or more than seven; the first are J. Taylor, D. Sinclair, J. S. Harmood Banner, E. A. Mellinger, 1,001, Van Buren Street, Chicago, U.S.A.; J. B. Russell, 46, Wall Street, New York; and M. Muspratt, 12, Fulwood Park, Liverpool; qualification, £1,000; remuneration, £400 per annum (chairman £450). Registered by Bower, Cotton & Bower, 4, Bream's Buildings, E.C.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

The directors' report which is to be presented at the meeting in London on December 4th, states that during the year ended August 31st, 1911, they have continued their policy of energetic development, and have expended a further sum of £52,554 on capital account in the provision of additional land, buildings, plant and mains. For the purpose of providing the necessary additional capital to continue such development and to keep pace with the remarkably rapid growth of the undertaking, and in pursuance of authority obtained from meetings held in May last, £100,000 5 per cent. debenture stock was offered for subscription at par and allotted in full on June 2nd. The profit and loss account shows a credit balance for the year of £40,983. After payment of the dividend on the preference shares for the half-year ended February 28th, 1911, and of an interim dividend of 3s. 6d. per share on the ordinary shares, and after writing off the cost of the debenture issue, as well as the cost of the stamp duty and other charges in respect of the increase in the authorised amount of the share capital as sanctioned at the last annual general meeting, there remains, including the amount carried forward from the previous year, an available balance of £31,635, which the directors recommend should be applied as follows:—Dividend on 30,000 6 per cent. preference shares for the half-year ended August 31st, 1911 (paid on September 1st, 1911), £4,500; final dividend of 6½ per cent. on 30,000 ordinary shares, making 10 per cent. for the year, £9,750; bonus of 2s. per share on 30,000 ordinary shares, £3,000; transfer to general reserve, £5,000; transfer to dividend equalisation account, £5,000; carrying forward, £4,385. The directors further recommend that the above-mentioned final dividend and bonus should be paid free of income-tax. The directors point out that the profits of the company during the last three years have been materially increased in consequence of the large amount of power supplied to the Adelaide Municipal Tramways Trust, pending the completion of the Trust's own power house. During the last few months of the company's financial year, this supply was gradually reduced as the Trust became able to generate its own supply; and before the close of the year the revenue from this source had practically ceased. In consequence of this, the directors again recommend that a portion of the profits be transferred to a dividend equalisation account. The officials of the Tramways Trust have publicly acknowledged their indebtedness to the company for the satisfactory supply which it maintained in circumstances of considerable difficulty. Such supply was only rendered possible by the expenditure of a large sum in additional plant and machinery. The following table sets out in detail the progress made by the company during the past four years:—

Date.	Lighting in 30-watt lamps.	Motors in rated H.P.	Total in 30-watt lamps.	Total units sold.
August 31st, 1908	71,138	1,837 H.P.	129,922	1,666,974
August 31st, 1909	91,338	2,369 H.P.	167,146	2,073,550*
August 31st, 1910	112,154	3,101 H.P.	211,386	2,538,062*
August 31st, 1911	147,034	3,986 H.P.	274,586	3,390,530*

* Excluding traction units sold to the Municipal Tramways Trust.

In view of the largely increased work of auditing the local accounts, the Local Board advise the appointment of Mr. W. E. Dalton, of Adelaide, as an additional auditor of the Adelaide accounts.

Castner-Kellner Alkali Co., Ltd.—The Right Hon. G. W. Balfour presided at the annual meeting at Cannon Street Hotel, E.C., on November 23rd, and in moving the adoption of the report, he said that the profit had been higher than the company had ever earned before (£178,853). With the final dividend they paid in all 20 per cent. on the shares, and carried £1,422 forward. There was no serious cloud on the horizon, but he thought that having in view how essentially precarious an industry the chemical industry was, the Press had been too optimistic regarding their future. Apart from the possibility of labour troubles, they could look forward to a prosperous year. The report was adopted.

Nairobi Electric Power and Lighting Co., Ltd.

The directors report that the accounts for the year 1910 show t the progress of the company's affairs has been even more sa factory than was predicted at the last annual meeting, and progress is well maintained up to date; there appears to be ev likelihood of its continuance in the future. The following co parative figures will be found of interest:—

	At Dec., 1909.	At Dec., 1910.	At Jun 1911.
Number of customers connected	178	257	312
Motors connected, B.H.P.	64	147	160
Lights connected, 8-C.P. equivalents ..	3,628	5,732	6,715
Street lighting ,, ,, ..	nil	2,000	2,000

The managing director has visited England during this year, returned to Nairobi on November 9th. Mr. Chas. Udall, the cl engineer, whose agreement for service expired in July last, has b re-engaged for a further term of service at Nairobi. Since the annual meeting the directors have elected Mr. A. W. Mayo-Robi C.V.O., D.Sc., to a seat on the board. Mr. W. H. Hooker resigns seat on the board.

Prospectuses.—*Automatic Telephone Manufactur Co., Ltd.*—This company's prospectus is before the public as write, and the list of subscriptions is to close on Monday n The nominal capital is £1,000,000 in £1 shares, one half them 6 per cent. cumulative preference and one-half ordinary sha The promoters, the British Insulated and Helsby Cables, Ltd., offering 200,000 of the preference, and 100,000 of the ordinary subscription, and they guarantee absolutely the payment of dividend on the 200,000 preference shares now offered, until general reserve fund of the Automatic Telephone Manufactu Co., Ltd., shall amount to £100,000. The company has been for to manufacture automatic telephone apparatus on the Strov system, to a demonstration of which in London, by the British I lated and Helsby Cables, we referred on page 871 of our issue. It is estimated that the works erected by the British I lated at Edge Lane, Liverpool, in 1903, will, by an outlay £50,000, be able to undertake, in addition to the general telepl trade, the manufacture of the complete automatic apparatus 100,000 telephones in the year. It is estimated that the capital offered for subscription will leave, after providing for the portio purchase price payable in cash, the formation and other expe and for the additions to the works, further working capital of less than £75,000. The price to be paid to the Automatic Elec Co., of Chicago, for assets particularised in the prospectus £240,000 (£100,000 in cash, and £140,000 in ordinary shares). price payable to the British Insulated and Helsby Co. is £170, payable as to £50,000 in cash, and £120,000 in ordinary sh The amount payable for the goodwill of the Edge Lane Works been fixed at £30,000. The particulars of the registration of company appear in the preceding column.

The Hadley Engineering Co., Ltd.—This company is offering subscription, until December 4th, 120,000 6 per cent. prefer shares, and not more than 12,000 ordinary, all of £1 each. company is to combine the businesses of Joseph Sankey & S Ltd., of Hadley, Shrops., makers of wheels, bodies and other p for motor vehicles; Thomas Tilling, Ltd., Peckham, makers of Tilling-Stevens chassis for motor-omnibuses and mail vans; W. A. Stevens, Ltd., Maidstone, makers of the Stevens pa electric transmission equipment for motor vehicles. It is clai that the amalgamation will enable the vehicles to be built rap and at low cost. A report by Mr. W. M. Mordey (Mordey Dawbarn, consulting engineers) on the Hadley Works, and on Tilling-Stevens system accompanies the prospectus, which app in our advertisement pages to-day. The purchase price the Sankey business, &c., is £105,000 (£25,000 in c £30,000 in fully-paid ordinary shares, and £50,000 in fully-p preference shares, or in cash). The purchase price payable to W Stevens is £12,000 (£11,000 cash and £1,000 in ordinary sha To Thomas Tilling, under an agreement which is detailed, £5, is payable in ordinary shares. It is anticipated that the profi the combined businesses will, from the first, suffice to pay the d dend on the preference shares now offered, leaving £12,800 ordinary dividend and reserve. Subscribers for preference sh are allowed to apply for up to 10 per cent. of that amoun ordinary shares.

Montreal Street Railway Co.—The directors' re states that the gross earnings for the year to September increased $422,749, or 9·71 per cent., the operating expe $224,505, or 9·14 per cent., and the net earnings $198,245, or 1 per cent. The gross earnings (says the *Financier*) continue to s very satisfactory increases. The ratio of expenses to gross earn is 56·12 per cent., against 56·41 per cent. for the previous y During the year the company secured an amendment to its cha authorising the sale, lease or transfer to any person or company all its undertakings, upon such terms as might be approved by majority of the shares. On October 5th last a special gen meeting of the shareholders was held for the purpose of conside the sale of the whole of the undertakings to the Montreal Tr ways Co. The proposition was carried by the majority of the iss shares. It is hoped that the amalgamation of this company v its subsidiary companies under the name of the Montreal Tramv Co. will help to speedily complete the negotiations for a franchise, more applicable to present-day conditions. The comp has paid to the city of Montreal taxes and percentage on earn amounting to $380,679, and on account of snow removal $73,3(total of $454,044, being an increase over the previous year of $15,

British Columbia Electric Railway Co., Ltd.

IE fourteenth annual report, which was submitted at the meeting ld yesterday at the Abercorn Rooms, Liverpool Street Hotel, C., states that for the 12 months to June 30th, 1911, the gross ceipts show an increase of $1,323,028, or 43 per cent., and the net rnings, including income from investments and subsidiaries, and ter charging renewals, show an increase of $369,521, or 34 per nt., over the preceding year. From June 30th, the close of the ancial year under review, up to September 30th last, there has en a still further increase in gross earnings of $401,783, or 45 per nt., and in net earnings of $63,282, or 17 per cent. During the nole of the 12 months under review an exceedingly large sum of pital has been involved in various works and extensions under nstruction, and has consequently remained unremunerative. The mpany will derive a considerable increase in its earnings from ese works and extensions as they are completed. The following arges have been made against the revenue account of the year, z.: Provision for renewals maintenance (from which £32,022 has en deducted for adjustments and expenditure on renewals during e year) £76,136, amount written off old steam plant £10,000, nount added to capital amortisation fund £2,183. The net profit r the year, after making the above deductions, amounts to 81,126, plus £5,607 brought forward, making £286,733. There e then deducted: Interest on debentures and debenture stock to ne 30th £82,670, dividends already paid, on 5 per cent. cumula- e perpetual preference stock for the year £35,000, on preferred linary stock for the year £42,000, on deferred ordinary stock for months to December 31st, 1910, £32,000, leaving available for ther distribution and reserves £95,062. From this the directors commend a dividend on the deferred ordinary stock at the rate of per cent. per annum for the last six months, making 8 per cent. the year, £32,000, transferring to reserve fund £56,472, and rying forward £6,590. There has been deducted from the erve fund £20,862, representing the difference between the net ount realised by, and the par value of, £600,000 4½ per cent. enture stock, issued in March last, and there has been added to reserve fund £53,994, representing the premium on £600,000 w capital, less expenses, issued in November, 1910. After the nsfer now recommended by the directors as above, the reserve nd will amount to £337,000.

In December Mr. Blundell Brown visited New York on behalf of company in connection with important negotiations. During t summer three of the directors, Mr. G. P. Norton, Mr. Harold Brown and Mr. E. Maes Harvey, made a prolonged visit to tish Columbia in order to study local conditions and inspect the mpany's property. They were greatly impressed with the remark- e progress and development throughout the Province of British umbia, and were satisfied that for some years this development st continue. The report proceeds to quote interesting figures en from the President's address to the Vancouver Board of Trade March last, showing the rapid developments that are taking ce.

A large amount of construction work has been carried on during year, not only in new developments, but in extensions of the sting railway, lighting and power systems. A large terminal tion and central offices, necessary to meet the requirements of iness, are also in course of construction in Vancouver City, and andsome new station was recently opened in New Westminster. e growth of the company's business is indicated by the following ures:—Miles of track in operation: 1909, 97·74; 1910, 141·65; 1, 233·65. Total cars of all classes: 1909, 248; 1910, 427; 1, 647. The number of passengers carried during the year was 541,448, an increase of 12,064,644. The number of lamps in use June 30th, 1911, was 563,542, an increase of 124,227. A satis- tory feature of the year's business is the growth of the revenue eived from the new suburban lines.

uring the year great dislocation of traffic and large expense to the company been caused by the large amount of street paving and improvement that been undertaken by the cities of Vancouver and Victoria. This has not adversely affected the company's profits, but has caused much irregularity ne service and consequently great inconvenience to the public.

onsiderable progress has been made with the construction of the dam at quitlam, an undertaking which is the largest of its kind in Canada. This n, when completed, will be 90 ft. high and contain about 554,000 cb. yards of h work, and by its means the level of Coquitlam Lake will be raised 60 ft., ering 54,000 million imperial gallons of water storage available for power poses. The enlargement of the tunnel between Lake Coquitlam and Lake tzen, which has been in progress during the last two years, has been suc- fully completed. This tunnel, 12,775 ft. in length, originally had a cross- ional area of about 81 sq. ft., and has been enlarged to 172 sq. ft., thus easing its capacity three times. It is now possible to bring up the power ake Buntzen to upwards of 70,000 H.P., which will be available to meet the d growth of the demand in Vancouver.

There is at present being installed at the power house a third 000-H.P. water wheel, which it is hoped will be ready for opera- n in December, bringing the capacity of the plant at the power use up to 42,000 H.P. Plans are now being prepared for a large ension of the power house and the provision of two new 15,000- . turbine units. In addition, the company have in progress an ension of the auxiliary steam plant, which has been provided temporary breakdowns on the transmission lines, bringing the acity of the steam plant up to 12,000 H.P.

ans have now been filed with the Government for the construction of ts for the utilisation of the company's water powers at Lillooet and Jones e, Chilliwack. The board have a carefully considered scheme for the ision of power to meet the requirements of the company in future years. Vancouver Island the installation of a water power at Jordan River has n satisfactorily completed, and there should shortly be available a sufficient ntity of power to meet the increasing demands of the city of Victoria and rict. The company has commenced the construction of a line of about 20 s in length from Victoria through the fertile Saanich Peninsula, and it is erally expected that this line will considerably augment the growth of the ertaking in Victoria, which, during recent years, has been making rapid es. Towards the end of 1910 the directors were asked by the Mayor and oration of Vancouver to consent to a unification of the franchises, under h the company operates its railway business in various parts of the city and suburbs, with a view of facilitating the consolidation of the city and the various separate suburban municipalities which surround it into one great city.

The directors consented, in order to meet the wishes of the citizens of Vancouver, to enter into an agreement whereby the municipality would have obtained the right to purchase the company's railway lines within the extended limits of the new city in 1934, but in the negotiations that followed, some of the representatives of the city endeavoured to introduce restrictions of a general nature, to which the directors could not see their way to agree, and, in consequence, no arrangement has been concluded. The company operates its line within the narrow boundaries of the old city under statutory powers and subject to an agreement renewable in 1919 for successive periods of five years, until the city determines to buy the railway property within the old city limits. The price, in the event of dispute, is to be fixed by arbitration. In fixing the purchase price, the arbitrators are to take (*a*) the then market value of all lands to be taken over, and (*b*) the value of all improvements, buildings and machinery then made, affixed or erected on the said lands, and of the personal property to be taken over, which values shall be arrived at by taking the cost to the company, including the cost of constructing the railway lines and of installing all the plant and machinery, and deducting therefrom a reasonable sum for depreciation. The portion of the company's railway which the Corporation of Vancouver will be entitled to purchase represents 49 miles out of a total of 234 miles operated by the company. Should the city exercise this right the company will retain various lines of entry into the city in perpetuity or for a long period of years. The whole of the remaining lines are operated under franchises extending over periods of not less than 36 years. The company's business has during the last few years developed to such extent, particularly in the outlying districts, that the receipts from the railway lines within the old city limits are no longer such an important part of the whole receipts of the company as they were, and are steadily becoming a smaller proportion of the whole. The lighting franchises are either perpetual or for a very long period of years.

To prepare for handling a greatly extended and increased volume of business in the future, the directors, after consulting with the general manager, thought it advisable to engage additional expert assistance, and decided to associate with the management several highly qualified officials to take charge of important departments, now rendered necessary by the magnitude of the company's business. During the year the directors have received, with great regret, the resignation of Mr. Francis Hope, for many years secretary of the company in London and assistant general manager in Vancouver. Mr. Hope served the company during the whole period with great devotion and ability, and has resigned his post for family reasons. The directors have again pleasure in expressing their appreciation of the very satisfactory services rendered by the management and staff in British Columbia.

Year ended June 30th.	Gross earnings.	Net rev. inc. investments income.	Passengers.	Lamps in use.	Balance available for dividend.	Pref. ord. stock, div. per annum.	Def. ord. stock, div. per annum.	Amount to reserves.
1909 ..	£478,146	£190,444	25,183,739	347,026	£123,417	6 %	8 %	£65,095
1910 ..	628,763	226,803	34,476,804	439,315	139,391	6 %	8 %	108,265
1911 ..	901,553	302,993	46,541,448	563,542	198,455	6 %	8 %	158,571

Cordoba Light, Power and Traction Co., Ltd.

Sir J. Irving Courtenay (chairman) presided, on November 22nd, at the offices, 62, London Wall, E.C., over the third annual meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 837), the Chairman said he thought they might congratulate themselves on the results shown. This was the third annual general meeting, and their progress had, he thought, been satisfactory. In their first year they made a net profit of £13 400, and paid a dividend of 2 per cent. In their second year the profit earned was £17,500, and they paid a 3 per cent. dividend. The accounts before them showed a profit for the year of £19,900, and they were enabled to recommend a dividend of 4 per cent. They hoped that after the construction work of their subsidiary companies was completed and in full operation, and with a fair supply of water, they would be able to report further substantial progress in the profits. Dividends had been declared by both the subsidiary companies in respect of their year to March 31st last, but the dividend on the common stock of the Light and Power Co., which was not paid until 1st inst., and which on their holding of common stock represented £3,205, was not included in the profits for their year to September 30th last, but would be taken into the accounts for the current year. He had not a great deal to say that day regarding their business, as they met only about four months ago. The progress made with the construction work had continued to be satisfactory. It was true that when they met a year ago he mentioned that, as far as they could then judge, the first portion of the power from the new Calera works would be available by about September. It was not yet ready, but they expected to hear before the end of next month that it was at work. One reason for the delay was the fact that, owing to the scarcity of water, they were not able to supply their contractors with as much electrical energy as they required for the construction work. One satisfactory and, he might say, most unusual point regarding this construction work was that the Calera hydraulic station, transmission lines, transformer station and other works incidental thereto would cost considerably less than was originally estimated. This was in part due to a cause which had, in other respects, been one of great anxiety to the directors. That was the emptying of the San Roque dam by the Government engineers, and the consequent scarcity of water in the river during the dry season. The dam was emptied for repairs at the end of August, 1910. They were advised that the work had been completed by November 3rd, 1910, but for one reason or another the whole of the repairs were not actually completed until May, 1911. In consequence the bulk of the rainfall during the wet season was lost, and they were left with very little water until August last, and were obliged to have recourse to the steam plant for the generation of the electrical energy. This had greatly increased the operating expenses of the Light and Power Co., and also necessitated for a time the cutting-down of the tramway service. However, what had been lost in revenue was, he was glad to say, more than

made good in the reduction in the cost of their new plant. This did not mean that they had these savings in hand. As they had previously explained, the growth of both the lighting and the tramway businesses had required further extensions of plant, for which they had raised the funds by means of the promissory notes referred to in the balance sheet. As regarded the construction of the tramways, they were now approaching the completion of the programme covered by their new concession, and would shortly have the whole 29 miles converted. The operation of that part which was in service was quite satisfactory. Notwithstanding the comparatively small amount of track which had been open, the difficulties with regard to power and the continuance of horse service on certain routes, the net receipts of the Tramways Co. for the six months to September 30th last showed an improvement of 16½ per cent. over those of the corresponding period of the previous year. They hoped soon to complete the electrification and to suppress the horse traction entirely. The business was advancing, the extensions upon which they had been engaged for the last three years were fast approaching completion, and they could look forward with confidence to the continued prosperity of the company. The latest report stated that 19½ miles were now open for public service by electric traction.

Mr. Frame Thomson, in seconding the motion, said they had been fortunate in having been able more or less to follow the programme anticipated when the company was formed, viz., that they should make a start with a small dividend of 2 per cent., and increase at the rate of 1 per cent. per annum. They had been able to do that up to now, and unless some unforeseen difficulties transpired, it was extremely possible they would be in an improved condition next year. So far they had had a month of the present wet season, and the level of water in the dam was quite up to the usual. They had three or four months of the wet season to come, so that when they got the Calera works in full working order, they ought to be able to work economically. They had a slight competition to face, for there was a company already supplying electric power, but as that company depended almost entirely on coal for the generation of power, he looked on it as being more in the nature of a healthy stimulation to their efforts than any impediment to their progress. They were now getting over the transitory stage, and the many difficulties which they had overcome were a good augury that they would be able to face any difficulties which might arise in the future.

The resolution was then carried, and a vote of thanks accorded to the board.

British Electric Traction Co., Ltd.

Mr. E. Garcke (chairman) presided on Wednesday last week at the Cannon Street Hotel, E.C., over an extraordinary general meeting of the above company for the purpose of considering and, if thought fit, confirming certain resolutions to alter the articles of association, and further to consider the resolutions converting the preference and ordinary shares.

The Chairman said the first resolution was to confirm a resolution for the alteration of the articles, and the second resolution dealt with the amended scheme. At the extraordinary meeting held on November 3rd, the amended scheme for the rearrangement of the capital was carried by a large majority, and it was decided to adjourn the meeting and also the separate class meetings. Since then they were advised by counsel that it would be better, in view of the material alterations which the amended scheme contained, as compared with the scheme for which the first proxies were obtained, to hold fresh meetings and issue fresh proxies, and this had been done. The scheme now submitted was the same scheme as that submitted on November 3rd, but he would ask them to make two or three verbal alterations in the resolution. He could not say anything further in support of the resolution beyond what he stated at the last meeting. He then explained the cause which had led the directors to submit the amended scheme, and the reasons why the original scheme could not be proceeded with, and he thought he explained fully and accurately the effect which the amended scheme had upon the existing preference shares and ordinary shares respectively. Moreover, the arguments for and against the scheme were fully stated by others in the course of the discussion at the last meeting. They had received proxies from over 1,200 shareholders in favour of the amended scheme—new proxies he meant—and only one proxy against the scheme from a holder of 39 preference and 4 ordinary shares. In these circumstances, he did not think it was necessary that he should detain the meeting by again stating the reasons why they recommended the scheme for adoption, although they were prepared to give any explanation which might be asked for. There was one technical point which had arisen. In the first statement of the amended scheme, they explained in a footnote how they proposed to deal with the unissued capital of the company. They were proposing to divide the £4,000,000 authorised capital into £500,000 cumulative preference stock, and £1,000,000 non-cumulative preference stock, £1,500,000 preferred ordinary stock, and £1,000,000 deferred ordinary stock, each of which would include a margin of unissued capital. But they were advised by the lawyers that although this could be done if the intention were to issue shares, it could not be done now that they proposed to issue stock, because unissued shares could not be converted into unissued stock. To get over the difficulty they proposed to convert the whole of the unissued capital into ordinary shares, with power to the company to convert them into other classes if so decided by a special resolution. It was not thought desirable to cancel the unissued capital, as it would necessitate the payment of a considerable amount of stamp duty in the event of the company being hereafter required to do so. The chairman concluded by moving the resolution.

Sir R. Hampson seconded the motion.

After brief discussion, the resolution was carried by 38 votes to 12.

At the subsequent meeting of preference shareholders 19 voted for the resolution and 13 against, and consequently the requisite majority was not obtained, and a poll was demanded.

The Chairman said they had received proxies for 39,930 preference shares in favour, and only one of 39 shares against.

A meeting of the ordinary shareholders passed the resolution unanimously, and then a poll was taken of the preference shareholders, and the resolution was carried.

Manaos Tramways and Light Co., Ltd.

Mr. G. M. Booth presided at the offices, 9, Cloak Lane, E.C., on Friday last, over the second ordinary general meeting of the company.

In moving the adoption of the report (see Electrical Review, page 874), the Chairman called attention to the fact that the accounts had this year been closed at the exchange of 16d. Brazilian milreis, whereas last year's accounts were closed at 15d. This alteration gave them a direct additional profit of about 7 per cent., and it was not a book-keeping addition, but an actual one. During the year under review exchange was continuously at or above 16d., and the Brazilian Government had altered the legal rate of exchange from 15d. to 16d., and it was in accordance with this improved basis that their accounts had been closed. As they received their income in milreis in Brazil, remitting the surplus to London, this higher rate of exchange was obviously much to their advantage. Referring to the revenue account, their gross tramway receipts had increased from £78,169 to £105,867; the gross lighting receipts had increased from £27,866 to £33,594, and the total gross income had increased from £106,854 at 15d. to £139,938 at 16d., an actual increase, after allowing for exchange, of 22 per cent. on the business. The operating expenses had remained high during the year, but the net earnings had increased from £18,895 to £29,862, or a total increase of 58 per cent., while the ratio of operating expenditure fell from 82½ per cent. for last year to 7[illegible] per cent. for this year. During the whole of the year under review construction work was going on, and the company's services were interfered with by the necessities of this work. The cost of new construction work carried out during the year amounted approximately to £40,000, and with this expenditure the construction included in the original programme was completed by April 30th, 19[illegible]. Although the operations of the company did not, for the reasons just given, reach a normal stage last year, the balance of profit after the payment of all London expenses and providing for income tax and debenture interest, amounted to £12,446. The directors, however, considered that the time had not yet come to commence the payment of dividends, and that the interests of all the security holders would be best served by placing to a reserve account practically the whole of these profits. Accordingly they would notice from the appropriation account that £10,520 was being added to the contingent reserve, while the amount carried forward to the credit of profit and loss account was increased by £1,926 to £3,509. They trusted that the shareholders would concur with the directors in the belief that at this early stage in the company's existence this conservative policy was essential, in order that once the payment of dividends was begun the company's position would be strong enough to make continuance at a good rate reasonably assured. There was one further point that he would mention in connection with the balance-sheet, viz., that the sum of £3,020 for accident claims paid out during the year was charged against the contingent reserve set aside in last year's accounts. During the period of reorganisation and reconstruction the company had had a rather large number of accident claims to settle, and under the procedure in Brazil, it was frequently many months after the accident before the settlement was made. The £3,020 was all paid on account of accidents which occurred in 190[illegible] prior to their taking over the property; accidents which occurred and which had been settled during the current year, had been charged direct to the operating accounts for the year. There were still outstanding a few accident claims on which the company was now negotiating settlements, and which similarly would in next year's accounts be charged against the contingent reserve. As soon as the board had reliable statistical evidence of the amount they might have reasonably to pay year by year by way of compensation for accidents, they would advise the adoption of the practice usual with all tramway companies of setting aside an annual amount to a specific accident reserve account. For the last 18 months no serious accidents had occurred, and current claims which were not of serious moment, were being settled promptly. They trusted, therefore, that in future reports this item would not be an important one. The general business conditions in Manaos during the latter part of the year, ended April 30th, 1911, were not at all satisfactory. As they all knew, there had been a very considerable drop in the price of rubber, and rubber was practically the sole article of export from Manaos. While the present price of rubber was only about one-third of that ruling 18 months ago, it was a price at which rubber could be produced profitably and in large quantities in the Amazon Valley. So serious a fall in price, however, required much readjustment in local business circles, and had produced a severe local financial crisis. That the company had been able to show so large an increase, both in gross and in net earnings, in spite of this crisis, was a matter for congratulation, and an indication that with the business recovery

which was sure to occur, the company would enjoy increased prosperity. He was glad to be able to tell them that during the first six months of the current year, that was to say from May, 1911, although the rubber crisis had continued, their earnings had registered steady increases, and the returns for these six months showed an increase of net earnings of approximately £7,000 over the corresponding months of last year. As he had said before, reconstruction work was going on throughout the year, and the full benefit of the new capital expended on the undertaking had not yet been realised. This benefit would accrue in the year now current and in future years. They had now on order additional material to increase the public lighting by 50 arc lamps; further extensions of mains would be needed, and they had found it necessary to order four large cars. The construction work of the future, however, would not disorganise their operation, and such expenditure would be incurred only as required by the development of the system. On the whole, the directors felt that they were to be congratulated on the satisfactory results of the past year, hearing in mind the adverse conditions under which those results were obtained, and they looked forward with confidence to the future of the company, anticipating continued expansion of the earnings. It was never wise to prophesy as to when dividends could be recommended. They would not recommend their payment until they felt fairly confident of their permanence, but they hoped that when they met next year they could be able to feel satisfied to make a start in that direction.

Mr W. C. Burton seconded the motion, and the report was adopted without discussion.

Barbados Electric Supply Corporation, Ltd.

The directors' report to June 30th, 1911, states that it was expected that the construction would have been completed early in the current year, but the work was delayed, and it was only at the end of June that a supply was commenced. Since the close of the period to which the report refers, considerable progress has been made in connecting consumers to the mains. Mr. W. C. Kenny, a director of the Royal Mail Steam Packet Co., joined the board in June, 1910.

The first ordinary general meeting was held at the offices, Basildon House, Moorgate Street, E.C., on Monday, Mr. A. W. Tait presiding.

The Chairman, in moving the adoption of the above report, said as they were aware the company was formed to construct and operate at Bridgetown, in the island of Barbados, an electric power supply system pursuant to an order granted by the Government of Barbados. This order gave to the company the exclusive right to supply electric energy for lighting and domestic purposes within the City of Bridgetown and its environments for a distance of 5 miles from the limits of the city, for a period of 42 years from 1907. In May, 1910, the company made an issue of 7 per cent. preferred and participating shares to provide the necessary funds to install the system. In the prospectus it was stated that the engineers anticipated that the works would be completed in eight months from the time they were put in hand. Some time naturally elapsed in fixing up the contracts, but these were finally settled and the engineers proceeded to Barbados in July, so that under the estimate the work should have been completed about the end of March, 1911, but the supply was only commenced at the end of June, and the whole of the construction of that originally planned was not completed until about the middle of September. There were various causes which contributed to this delay, and one of the chief was the usual difficulty experienced of getting contractors to keep the promised dates of delivery. Another thing, which might seem somewhat trivial, but in reality proved of much trouble, was the difficulty experienced by the general manager in getting sites for their poles. This would require some explanation to those who were accustomed to see well-laid-out streets in big cities. The streets of Barbados through which their overhead mains passed very frequently had no footpaths at all, and as they were not permitted to place the poles in the gutters, it was necessary in many instances to make arrangements for the erection of poles on private property, which in some cases necessitated the consent of two or three different parties. As he had said, the work originally contemplated was completed about the end of September, and they had already received the return of one-half of the deposit made under the terms of the order, and expected that by this time the balance would had been received. It had been thought necessary to authorise extensions of the original lay-out of mains, and no doubt it would be necessary to make more or less constant additions, but the additions at present contemplated were not of an expensive nature, and did not require much capital outlay. They were able to get the plant running in time to assist the illumination of the town for the King's Coronation, but no actual supply to consumers was commenced until July. This was due to the fact that the work of wiring and fitting consumers' premises was not completed earlier. This work was now proceeding rapidly, but the general manager complained that he had experienced difficulty in training the local workmen. No doubt as time went on these men would become more proficient at the work. They had also been hampered somewhat in the last summer by the labour unrest in this country, which caused delay in the delivery of the necessary wiring and fitting material, because even after the strike there was considerable congestion of the railway and steamship routes for some time. According to the report received from the general manager, there were connected to the mains in the month of October the equivalent of 723 25-c.p. lamps, and motors and fans giving a load equivalent to 607 25-c.p. lamps, a total equivalent to 1,330 25-c.p. lamps, while the number of consumers was 60. The general manager in Barbados anticipated that by the end of the year there should be connected to the mains for lighting purposes only the equivalent of 4,000 25-c.p. lamps. This figure was a long way behind that mentioned in the prospectus, which gave the probability of 10,000 16-c.p. lamps, but he had no doubt that this would ultimately be reached and probably exceeded, although they had to meet the keen competition of the gas company. There was also a fair number of small power consumers in the neighbourhood of Bridgetown. They were supplying current to one or two of these, and the manager was in negotiation with others, who were no doubt waiting to see the results of the motors already installed, and if they were successful, as was anticipated, a considerable number of further consumers would be obtained in this way. They would see that of the authorised issue of 40,000 7 per cent. preferred and participating shares, 32,521 had been issued at the date of the accounts, leaving a balance of 7,479 unissued. With regard to the completion of construction, some of the contractors had agreed to subscribe at par for a portion of the balance, and when these shares had been issued there would be available for the purposes of the company a balance of approximately 5,000 shares. The items of sundry creditors and credit balances stood at £5,590, and represented principally retentions on contracts and a substantial proportion of this amount would be set off against the subscriptions for shares. The property account amounted to £50,403, and included the cost of the Lighting Order, viz., £20,853, of which £20,000 was paid in fully paid ordinary shares of the company. The balance of the amount represented the expenditure on the purchase of land for the power house buildings, the erection of the power house, machinery and plant, feeder cables, distributing mains, transformers, consulting engineers' fees, &c. The plant at the power house consisted of two Diesel oil engines of 200 h.p., direct coupled to two generators of 135 kw. capacity. So far, the plant had worked without hitch or trouble, and the directors believed the installation of the oil engines would enable them to show economical costs for the generation of power. To provide additional working capital, a temporary loan of £3,000 for two years at 6 per cent. had been arranged with the Anglo-American Debenture Corporation, and if the business continued developing, it might be necessary to increase the amount of this loan. The chairman proceeded to refer to the work done by the local directors, and to the thanks they owed the general manager, Mr. W. C. Shettle.

Mr. W. C. Kenny seconded the motion for the adoption of the report, which was agreed to without discussion.

A vote of thanks was accorded the board on the motion of Mr. Salmon.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Brush Electrical Engineering Co., Ltd.—£97,703 5 per cent. prior lien debenture stock.

Buenos Ayres Lacroze Tramways Co., Ltd.—Further issue of £50,000 5 per cent. extension mortgage debentures, Nos. 397 to 446 of £500 to 1,501A to 1,570A of £100 each.

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co.)—£800,000 5 per cent. forty-year first mortgage bonds of £100 each, Nos. A1 to 8,000.

Westminster Electric Supply Corporation, Ltd.—Further issue of 20,573 4½ per cent. cumulative preference shares of £5 each fully paid, Nos. 191,280 to 211,952.

Fraser & Chalmers, Ltd. — The directors report that the profit for the year ended June 30th, 1911, is £31,892, which shows an improvement over the year ended June, 1910. The volume of business has been large, but the margin of profit in all branches has been very close, so that the percentage on turnover is small. The manufacture of large gas engines has been taken up as an additional line of work for Erith, the design adopted representing improvements upon a well-established type. It was considered necessary to enter upon this business in addition to turbines, in order to keep up with the tendencies of the highest engineering in the matter of future power production. Very successful work has been done during the year in the building of turbo-blowers and ventilating fans. Highly satisfactory results have been obtained by the new Bettington boilers for the use of pulverised fuel, and they are showing great economy in operation. After paying the full preference dividend of 7½ per cent., the directors recommend a final dividend of 3½ per cent. on the ordinary shares, making 7 per cent. for the year, and £84,132 is to be carried forward.

Barcelona Traction, Light and Power Co.—A Frankfort message to the *Financial News* quotes a Paris report to the effect that the well-known Canadian group who control the Rio de Janeiro Tramway, Light and Power Co., Ltd., have acquired, in Barcelona, two big water-chutes, and propose to erect two large electrical stations, of 120,000 h.p. The group, it is added, has already obtained a concession to complete a tramway line in the centre of Barcelona. A new company has been created, called the Barcelona Traction, Light and Power Co., and a capital of £4,000,000, it is added, has already been provided.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The directors report that the accounts for the year to June 30th, after providing for interest on debentures and loans, show a net profit of £550, increasing the credit balance brought forward to £5,855.

Mackay Companies.—The regular quarterly dividends of 1 per cent. on the preferred shares and 1¼ per cent. on the common shares are announced.

Canadian General Electric Co.—A quarterly dividend of 1¾ per cent. on the common stock is announced.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fort-night ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Nov. 22	2,711	+ 240	25	38,869	+ 2,192	..	..
Ayr	,, 25	366	+ 19	23	11,044	+ 60	8	..
†Bath	,, 15	678	+ 25	46	38,896	+ 1,156	..	..
Birkenhead	,, 25	2,049	+ 70	34	89,458	+ 1,417	13·7	..
Birmingham Corp.	,, 18	18,822	+5,098	33	279,976	+53,778	56·4	..
Blackburn	,, 22	2 108	+ 218	34½	49,803	+ 3,475	14·6	..
Blackpool Corp.	,, 23	794	+ 85	..	56,077	+ 7,226	..	..
Blackpool-Fleetw'd	,, 25	481	+ 67	21	24,540	+ 2,028	..	..
Bolton	,, 26	4,830	+ 341	35	88,163	+ 5,868	25	..
Bournemouth	,, 22	2,852	+ 269	34	63,957	— 461	21·95	..
Bradford	,, 18	10,070	+ 512	33	188,249	+12,776	56	1·2
Brighton	,, 25	1,545	+ 138	34½	37,918	+ 2,266	9·5	..
Bristol	,, 24	11,490	+ 743	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 17	502	+ 76	46	10,362	+ 302	3·65	..
Barnsley	,, 17	373	+ 41	,,	8,554	+ 633	..	..
Barrow	,, 17	695	+ 147	,,	14,291	+ 2,005	5·37	..
Devonport	,, 17	959	+ 171	,,	23,065	+ 3,429	8·85	..
Gateshead	,, 17	2,094	+ 144	,,	48,150	+ 2,627	11·25	..
Gravesend	,, 17	407	+ 46	,,	9,898	+ 363	6·5	..
Greenock	,, 17	1,367	+ 445	,,	33,538	+ 5,058	7·25	..
Hartlepool	,, 17	490	+ 115	,,	12,544	+ 1,235	6·72	..
Kidderminster	,, 17	185	+ 17	,,	5,439	+ 309	..	..
‡Leamington	,, 17	288	+ 2	,,	8,255	+ 391	..	..
Merthyr	,, 17	410	+ 31	,,	9,570	+ 155	2·9	..
Metropolitan	,, 17	16,786	+2,970	,,	405,425	+60,999	22	..
Middleton	,, 17	191	+ 48	,,	15,795	+ 1,250	8·5	..
Mid. Joint Com'tee	,, 17	8,512	—2,932	,,	242,979	—24,096	..	..
Oldham—Ashton	,, 17	1,144	+ 101	,,	26,515	+ 1,068	9·13	..
Peterborough	,, 17	222	+ 29	,,	5,975	+ 603	5·31	..
Potteries	,, 17	4,240	+ 396	,,	90,513	+ 8,356	29	..
Rothesay	,, 17	75	..	,,	9,957	+ 57	2·75	..
Southport	,, 17	482	+ 23	,,	14,133	+ 548	8·17	..
S. Metropolitan	,, 17	1,481	+ 146	,,	40,072	+ 2,085	..	..
Swansea	,, 17	2,192	+ 114	,,	52,138	+ 3,054	12·5	..
Tynemouth	,, 17	393	— 2	,,	12,281	+ 385	3·75	..
Weston-s-Mare	,, 17	63	+ 7	,,	8,088	+ 1,050	3	..
‡Worcester	,, 17	521	+ 49	,,	13,738	+ 530	5·75	..
Wrexham	,, 17	204	+ 32	,,	4,725	+ 255	..	..
Yorks. Wool. Dist.	,, 17	2,034	+ 191	,,	48,783	+ 3,255	17	..
Miscellaneous	,, 17	409	+ 82	,,	10,517	+ 672	..	..
Burnley	,, 25	2,628	+ 301	..	..	..	11·7	..
Burton-on-Trent	,, 26	498	+ 25	34	10,048	+ 615	6·6	..
Bury	,, 26	2,418	+ 326	34½	44,813	+ 3,886	22·5	..
Cardiff	,, 25	4,401	+ 423	34	86,064	+ 6,066	..	..
Chatham and Dist.	,, 23	1,508	+ 91	47	40,292	+ 51	.5	..
Cork	,, 23	880	+ 16	47	23,505	+ 561	9·9	..
Croydon	,, 17	3,256	+ 357	33	61,055	+ 4,441	11·4	..
Darlington	,, 25	448	+ 56	35	7,788	+ 745	..	..
Darwen	,, 24	509	+ 31	34	9,270	+ 707	4·36	..
Dover	,, 18	409	+ 48	33	9,107	+ 1,331	4·75	..
Dublin	,, 24	10,186	+ 408	..	131,525	+11,258	54·5	..
Dundee	,, 22	2,212	+ 57	27	82,513	— 750	15	..
East Ham	,, 25	2,044	+ 207	34	37,815	+ 1,957	7·8	1
Exeter	,, 24	545	+ 30	34	12,169	+ 863	5·5	..
Glasgow	,, 25	37,339	+3,730	..	489,246	+34,690	98	..
Hastings	,, 23	1,424	+ 114	..	..	..	..	..
Huddersfield	,, 23	3,659	+ 219	34	66,034	+ 6,974	29·5	1
Hull	,, 25	5,870	+ 559	34	99,594	+ 5,402	14·25	..
Ilkeston	,, 23	242	+ 7	34	4,572	+ 92	..	..
Ipswich	,, 25	674	+ 52	34	15,923	+ 911	10·5	..
Kilmarnock	,, 25	295	+ 19	28	4,095	+ 376	4·25	..
Lancashire United	,, 22	2,489	+ 183	47	63,579	+ 2,257	39	..
Leeds	,, 18	14.527	+1,376	33	262,879	+17,544	50·75	2
Leicester	,, 25	4,870	+ 491	..	..	..	..	..
Leith	,, 25	1,120	+ 130	27⅝	18,662	+ 1,385	8·7	..
Liverpool	,, 18	22,885	+1,269	46	527,708	+15,780	116	2·5
‡L.C.C.	,, 15	86,463	+5,723	..	1,456,247	+79,367	140	6
London United	,, 25	10,512	+ 955	..	307,041	+10,860	..	..
Lowestoft	,, 25	328	+ 20	8	1,468	+ 41	3·5	..
Manchester	,, 25	31,536	+3,570	34	558,246	+30,461	183	..
Newcastle	,, 25	8,364	+ 995	..	146,396	+10,678	14·5	..
Newport	,, 25	1,502	+ 68	34	24,462	+ 964	14·5	..
Oldham	,, 26	3,787	+ 222	35	68,415	+ 3,108	28·75	·5
Pontypridd	,, 25	815	+ 28	34	14,324	+ 14	5·5	..
Portsmouth	,, 25	3,264	+ 278	34	80,079	+ 6,692	15	..
Preston	,, 22	1,419	+ 54	34	27,054	+ 2,002	..	..
Rotherham	,, 23	1,342	+ 111	33⅝	23,440	+ 1,913	12	..
Salford	,, 20	9,322	+ 495	33	164,503	+ 7,265	..	..
Sheffield	,, 28	12,759	+ 986	..	225,964	+14,541	40	..
Southampton	,, 22	2,178	+ 318	34	48,191	+ 5,894	22	..
Southend-on-Sea	,, 22	920	+ 185	34	25,311	+ 3,869	..	..
†South Shields	,, 18	570	+ 89	33	21,281	+ 2,213	..	..
Swindon	,, 22	294	+ 33	..	5,551	+ 615	..	..
Tynesíde	,, 22	845	+ 192	21	10,925	+ 1,614	..	..
Wallasey	,, 11	1,960	+ 158	32	33,856	+ 5,275	..	..
Walthamstow	,, 25	1,243	+ 110	34	26,700	+ 1,711	9	..
West Ham	,, 16	5,599	+ 627	33	90,781	+ 8,598	15·25	..
Wolverhampton	,, 22	1,824	+ 90	34	33 900	+ 2,017	25	..
Cen. London Rly.	,, 25	10,484	— 740	21	98,385	—15,585	6·32	..
City & S. Lon. Rly.	,, 26	6,633	— 133	21	66,149	— 168	7·26	..
Dublin-Lucan Rly.	,, 21	214	..	21	3,240	— 51	7	..
G.N. and City Rly.	,, 25	3,239	+ 173	21	29,847	+ 669	3·5	..
L'pool Overh'd Rly.	,, 26	2,825	+ 186	..	31,641	+ 1,801	6·8	4·3
Llandudno-Col. Bay	,, 24	253	+ 24	51½	15,256	+ 607	..	..
London Elec. Ry. Co.	,, 25	28,975	+1,405	21	267,385	+ 9,025	21·25	..
Mersey Railway	,, 25	4 274	+ 164	21	40,437	— 1,214	4·5	..
Metropolitan Rly.	,, 26	35,527	+ 376	21	348,784	— 4,890	24·5	..
Met. District Rly.	,, 25	24,208	+1,023	21	233,559	+ 10,619	24	..
Anglo-Argentine	,, 25	103,923	+3,211	..	2,300,097	+193,166	..	..
§Auckland	Oct.	16,485	+1,412	..	64,857	+ 5,028	23·3	·6
Bombay (B.E.T.)	Oct. 27	6,748	+1,017	43	124,307	+ 8,219	..	..
§Brisbane	Oct.	21,820	+2,020	40	205,980	+24,290	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 25	7 965	+ 395	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Oct.	3,251	..	..	34,779	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Nov. 15	1,421	+ 118	..	31,067	+ 2,688	..	..
§Montevideo	Oct.	25 034	+2 022	52	298,558	+18 563	..	..
Perth (W.A.)	Nov. 24	3,318	+ 428	..	75,869	+16,444	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

The tightening of money rates in advance of the usual end-of-the year requirements did not catch the Stock Exchange by surprise and quotations have been little affected by the stiffness in Lombard Street. The Stock Exchange hung with keen expectation upon the speech made by Sir Edward Grey in the House of Commons last night. On the whole, it was received with a good deal of favour but the improvement started in markets in the anticipation of improving pacific became lost later on in most of the Home markets rumours being current of fresh political troubles in connection with the Dardanelles.

Railwaymen took a holiday from violence in their speechmaking on Sunday last, much to the relief of the market in the Stock Exchange. The pendulum swung upwards again, and chief amongst the stocks to harden was London Brighton Deferred, in expectation of a good dividend next month. The Tube Railway stocks are not much changed. Metropolitan eased off ¼, but Districts remained at 30, while the Central London and City and South London group have not an alteration between them. District 4 per cent. Debenture stock, however, put on a point.

Electricity Supply shares are steady, but there is no especial feature. The quotation for St. James' Ordinary has been widened in the upward direction. Notting Hill 6 per cent. non-cumulative Preference are this week officially quoted at 10¼ middle.

Home Tramway issues in the electrical market are mainly quiet. British Electric Traction Ordinary fell ⅛ to 1 1/16 after the directors' scheme was confirmed at the second meeting last week. Potteries Preference are 3/32 higher, and the Ordinary shares retained their previous improvement.

Colonial and Foreign Tramways are fairly steady. The principal movement in the group is a rise of 2 secured by British Columbia 4½ per cent. Vancouver Debenture. The Preferred and Deferred stocks keep firm. Brisbane Ordinary rose ¼, and the Debenture stock at 104½ is 1 up. The Mexico Tramways bonds are lower in both cases, and Rio Tramway shares again went down on the coming new issue, but recovered their loss. The latter company's bonds are both better, each description rising ¼.

The Latin-Canadian division is steady as a whole, but a few sellers appeared towards the end of the account. The ordinary demand for money has caused a little selling of bonds in this department. Shawinigan 4½ per cent. Debenture is easier. Electrical Development of Ontario Bonds lost half of their recent rise. Monterey Bonds dwindled to the same extent. Mexican Light and Power Common shares receded to 90. The company's newly issued Second Debenture remains firm at ½ discount, and the floating supply is being slowly absorbed. Allotments of the new South American Light and Power appeared towards the end of last week, and selling by the stags brought about a reaction from 3 premium to 2½ premium, dealings being effected for the ordinary fortnightly account, instead of being carried forward to special settlement as is the case with the majority of new issues. Calgary Power First Mortgage Bonds were weakened, although not quotably so, by the offer of the Western Canadian Natural Gas, but as the underwriters of the latter were left with about 75 per cent. of their commitments, it is evident that the public did not take very kindly to the new comer. Cordoba Light and Power Ordinary shares advanced 1/16, and the company's 5 per cent. Debenture stock is worth noticing as a good investment of its class. Northern Light and Power Bonds followed up their rise of 6 with a further increase of a point, the price now standing at 42 middle. Kalgoorlie Electric Ordinary are steady at 5s. 7½d. and the Preference show a slight rise at 14s. 4½d.

Wild excitement prevails over the vivid movements in Marconi shares. The price is now, of course, *ex* rights, and these latter jumped up to 7s., while for special settlement the new shares rose to 7s. 6d. premium. Probably the little dispute which arose in connection with certain patents, the ownership of which is claimed by Marconi's and the Universal Cheap Cables, Ltd., led to bear sales by market operators, who have had to pay handsomely for their temerity.

The Anglo-American Telegraph group is steady to firm, Anglo Deferred being the only exception. Western Telegraphs continue to harden. Eastern Extensions have eased off a shade, and Globe Preference at 13 are ⅛ lower.

National Telephone Deferred is a quieter market, the price showing a recovery of 10s. after its drop. No changes have occurred in the quotations of Uruguayan companies' issues, although the proposal of the Government to nationalise all the electrical projects in that country is regarded without much favour by the markets concerned on this side.

Babcock & Wilcox Ordinary have gained 5s., and Crompton Debenture put on 1½. General Electric Preference shares fell 5s. and the Debenture stock lost a point.

May we repeat here the notice which, for some weeks past, has appeared at the foot of our price lists, viz., that the yields are calculated upon the dividends paid for 1910. It will be manifest that some uniform plan must be followed, for the avoiding of confusion: when the full results for 1911 are available, they will take the place of the 1910 basis at present used.

Sao Paulo Tramway, Light and Power Co., Ltd.—

The directors have declared a quarterly dividend at the rate of 10 per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 28th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅞ — 8⅜	..	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electrio Supply, 4 % Guar. Deb.	100	4	4	100 —103	+1	3 17 8
Charing Cross, West End & City	5	5	5†	9¼ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12⅜ — 12⅞	..	5 8 9
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅝ — 9⅛	..	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11⅞	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6⅞ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Eleo. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	8	2	..	1½ — 2	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅛ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3¾ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	..	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Sup. 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 10½	..	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 9	+ ¼	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	8 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2¾ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	..	6 3 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord,	5	10	10†	7½ — 8⅜	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 28th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6½ — 7 xd	..	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	115 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	+ 1/16	3 0 0
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91 — 93	— ½	5 7 6
Kalgoorlie Eleo. P. and L., Ord.	10/-	Nil	..	7/32 — 11/32	+ 1/32	Nil
Do. 6 % Pref.	1	6	6	21/32 — 25/32	+ 1/32	7 13 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	98 —100	+1	5 0 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	89 — 91	—1	4 7 11
Do. 7 % Cnm. Pref.	$100	7	7	108 —110	..	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	— ½	5 8 1
Montreal, Lt., H. and Power	$100	7	8	185 —190	..	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	41 — 43	+1	11 12 6
River Plate, Ord.	Stock	10	..	223 —233	..	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —113	+1	5 6 2
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	122 —124	..	8 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½ — 101½ xd	— ½	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11⅞d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ — 108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 28th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	Nil	..	7¼ — 7⅞	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	144 —146	+1	5 9 7
Do. Collat. Trust	$1000	4	4	95 — 97	+ ½	4 2 6
Anglo-American Telegraph	Stock	3⅜	3†	66 — 68	—1	5 8 8
Do. 6 % Pref.	Do.	6	6	110¾ — 111½	..	5 10 4
Do. Def.	Do.	30/-	..	25¾ — 26¼	— ⅛	5 14 3
Anglo-Portnguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6⅞ — 7⅛	..	4 18 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86½ — 88½	— ½	4 10 5
Cnba Telegraph	10	6	6†	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	7⅜ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	137 —140	..	5 0 0
Do. 8½ % Pref. Stock	Do.	3½	3½	83½ — 85½	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½	..	3 18 1
Eastern Extension	10	7	5†	13⅜ — 13⅝	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	100½ — 102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritins Sub.	25	4	4	98½ — 100½	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6	10⅜ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	12⅞ — 13¼	— ⅛	4 10 9
Great Northern Telegraph	10	18	5†	32½ — 33¼	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	74 — 77	..	5 8 11
Marconi's Wireless Telegraph	1	5	..	2⅞ — 2⅞	+ 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	1⅞ — 2⅛	..	..
Monte Video Telephone, Ord.	1	6	6	15/16 — 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ — 105½	..	5 13 9
Do. Def.	Do.	6	6†	122 —124	+ ½	4 16 9
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10½	..	5 14 8
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10½	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5½	..	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	8 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	8 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ — 101½	..	4 8 8
Oriental Telep. and Elec.	1	8	..	1⅜ — 1⅝	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 5/32	..	4 13 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5†	8¾ — 9¼	— ⅛	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 7/16 — 1 9/16	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99 —101	+ ½	3 19 3
West India and Panama Teleg.	10	1¼	..	2⅞ — 3	..	4 3 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10½	..	5 14 8
Do. 5 % Debs.	100	5	5	103 —105	+1	4 15 8
Western Telegraph, Ltd.	10	7	6†	13⅜ — 14½	+ ¼	4 18 3
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	+ ½	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ — 102½	+ ½	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 28th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Batb Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1¼	— 1/8	Nil
Do. 6 % Pref.	10	1½	1½	3 3/4 — 4 3/4	..	3 8 7
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	..	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord. ..	100	1½	1½†	30½ — 31½	..	4 14 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 — 105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Nortbern & City, Pr'f. Ord	10	Nil	..	1 — 1¼	..	Nil
Hastings Trams, 6 % Pref. ..	5	Nil	3†	5/8 — 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 14 8
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	2 7/8 — 3 1/8	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Metropolitan Railway Consol. .	100	1⅞	2†	42½ — 43	— ¼	3 3 11
Do. Surplus Lands	100	2¾	3†	65 — 67	..	4 2 1
Do. 8½ % Deb.	100	8½	8½	89 — 91	..	3 17 6
Do. 8½ % Pref.	100	8¼	8¼	85 — 87	..	4 0 6
Do. 8½ % Con. Pref.	100	8¼	8½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	..	29⅞ — 30½	..	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	97 — 99	† 1	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3¼	4¼†	88 — 90	..	3 12 3
Do. 8½ % Gtd.	100	3¼	3¼	74 — 76	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5¼	5†	3 7/32 — 3 1/4	..	5 12 4
Do. Def.	1	Nil	..	3 7/32 — 3 1/4	..	Nil
Do. 5 % Pref.	1	5	5	3 7/32 — 3 1/4	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	100½—102½	..	4 7 10
Do. 5 % Deb.	100	5	5	100½—102½	..	4 17 7
Potteries, Ord.	1	2	..	15/16 — 1 7/16	..	..
Do. 5 % Pref.	1	5	5	1 — 1 1/16	+ 1/32	6 13 4
Do. 4½ % Deb.	100	4½	4½	87½ — 90½ xd	..	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	3/4 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 7/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1¼†	63 — 65	..	1 10 9
Do. Power House Debs. ..	100	4	4	100 —102	..	3 18 5
Yorksbire (West Riding), Ord.	5	Nil	..	1/8 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/8 — 2 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½†	4 15/16 — 5 3/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4 3/4 — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	94 — 96	+ 1/2	4 3 4
Do. 4½ % Deb.	100	4½	4½	101½—103½	— 1/2	4 7 0
Do. 5 % Deb.	100	5	5	100½—102½	..	4 18 0
Auckland Trams, 5 % Deb. ..	100	5	5	104 —107	..	4 13 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾— 11½	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½—100½	..	4 19 6
Brisbane Trams Invt., Ord. ..	5	8	8†	7 3/4 — 8 1/2	+ 1/4	4 17 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	103 —106	+1	4 5 9
B. Columbia Elec. Rly., Def. ..	100	8	..	143 —147	..	5 8 10
Do. Pref. Ord.	100	6	6	124 —128	..	4 13 9
Do. 5 % Pref.	100	5	5	109½—112½	..	4 8 11
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb. ..	100	4½	4½	104 —106	+2	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 5/8 — 6 1/8	..	4 18 2
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	1/16 — 1/8	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 5/8 — 5 7/8 xd	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½—104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Elec. Trms, Prf, ..	1	6	6	3/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6†	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb. ..	100	5	5	96 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 94	..	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 —101	..	4 19 0
Mexico Trams Com.	$100	7	7†	123 —125	..	5 12 0
Do. Gen. Con. 5 % Bonds ..	..	5	5	98 —100	— 1/2	5 0 0
Do. 6 % Bonds	100	6	6	102 —104	—1	5 15 3
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	6 7/8 — 7 1/8	..	6 18 0
Do. 6 % Pref.	5	6	6	5 1/2 — 5 3/4	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99 1/2—101 1/2	..	4 18 6
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 3/8 — 1 1/2	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101 1/2—103 1/2	..	4 16 7
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/2 — 5 3/4	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	115 —116	..	4 6 2
Do. 1st Mort. 5 % Bonds ..	..	5	5	102 —103	+ 1/4	4 17 1
Do. 5 % Mort. Bonds ..	100	5	5	95 3/4 — 96 3/4	+ 1/4	5 3 4
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	185 —189	..	5 5 10
Do. 5 % 1st Deb.	$500	5	5	104 1/2—106 1/2	..	4 13 11
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 1/2 — 97 1/2	..	5 2 7
Un. Elec. Trams Monte Video ..	5	6	7	5 3/4 — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5 1/2	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	Nil
Do. 6 % Pref.	1	9	6	2 3/4 — 2 7/8	..	7 2 2
Babcock & Wilcox	1	26	24†	6 — 6 1/4	+ 1/4	4 3 1
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/4 — 7 1/4	..	6 17 11
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref. ..	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb...	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Prcf.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord...	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb. ..	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/2 — 3 13/16	..	5 5 3
Do. Deb...	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb...	100	5	5	60 — 70	+1½	7 2 10
Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/8 — 1 1/8	..	5 12 11
Do. Deb...	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid ..	5	Nil	..	3/8 — 7/8	..	Nil
Do. fully paid	5	Nil	..	1 7/8 — 2 3/8	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb. ..	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/2 — 3/4	..	6 13 4
Do. Pref.	2	7	7	1 3/4 — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7 3/4 — 8 1/4	..	8 5 8
Do. Deb...	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8 3/4 — 9 3/4	— 1/4	5 8 5
Do. Deb...	100	4	4	85 — 90	—1	4 8 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/8 — 5 1/8	..	4 5 11
Do. Deb...	100	4½	4½	106 —108	— 1/2	4 3 4
India-Rubber, G. & T.	10	10	..	12 1/2 — 14 1/2	..	6 17 11
Do. Pref.	10	5	5	9 1/2 — 10 3/8	..	4 16 5
Telegraph Construction.. ..	12	20	10†	35 — 37	..	6 7 5
Do. Deb...	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	..	1/8 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb...	100	4	4	55 — 65	..	6 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

PROCEEDINGS OF INSTITUTIONS.

Graphite as a Lubricant.

On November 11th a special meeting of the Faraday Society was called to meet Dr. Acheson, who has been spending a few weeks in Europe, and to hear him relate the fascinating story of his discoveries of the wonderful products he has succeeded in producing by means of the electric furnace. As the chairman, Mr. J. Swinburne (Past-President), aptly remarked, Dr. Acheson belongs to that small body of inventors who are really entitled to be called "great," and for this reason: his discoveries have been the result not of chance intuition or of wild guessing, but of steadfastly following up step by step a continuous train of experimental researches, each of which, although perfected in itself, has proved the starting point for a new line of investigation again ending in the appearance of a new product even more wonderful and useful than its predecessor. The members of the Faraday Society, it was pointed out by Mr. Robert Mond, had special reason to be grateful to Dr. Acheson, for without Acheson graphite it is probable that not a single electrolytic process now flourishing as an industry would ever have emerged beyond the laboratory stage.

Dr. Acheson's electric furnace work dates back 20 years to 1891. In March of that year he made his first carborundum experiment, by mixing clay and coke, putting the mixture in an iron bowl and passing a powerful current by means of a carbon electrode. The small bright speck that appeared on the point of the carbon, and that was so hard that it would easily cut glass, was the first piece of carborundum (carbide of silicon) ever made—or at least, ever recognised as such. A small brick furnace was quickly built and the product made on a somewhat large scale, but wonderful as were its properties—it was eventually proved to be actually harder than diamond, though not so tough—nobody could at first be found to put it to practical use, excepting a few engineers for grinding valves. The emery wheel makers pronounced it useless. It is worthy of note that pure carborundum is not purple-black in colour at all (this is due to the presence of iron), but is perfectly colourless and transparent, with a refractive index greater than that of diamond.

It was soon noticed that carborundum is only produced in the core of the furnace, where the temperature is vastly higher than the walls of the furnace could stand, were they not protected by the material between them and the core. If the core was overheated the carborundum crystals were destroyed, the silicon being driven off and true graphite remaining behind. *Acheson graphite*—this was the inventor's second great find; 13,000,000 lb. of this material were sold last year, and on it depends the future of almost every electro-metallurgical process that has any hopes of industrial survival.

Dr. Acheson's next step was to try and cheapen his process, and he, therefore, looked round for a cheaper form of carbon than the coke he had hitherto employed. He eventually—in 1906—used a waste ash product from the Californian coalfields. When all the foreign material in this was evaporated, a non-coalescent, easily pulverised and exceedingly light form of graphite, remained behind in the furnace.

An incidental development of about the same period was the reduction of silicon, now made in thousands of tons. The difficulty is to make up a charge that will conduct the current, but this was overcome by using the soft Acheson graphite as a reducing agent, and grinding it down with fine amorphous silica. The silica particles are completely encased by the soft graphite and the mixture rendered conductive. The graphite has also been used for the reduction of aluminium from bauxite.

But the most striking application of this form of graphite has been in the production of the wonderful lubricators known as "aquadag" and "oildag." These merely consist of the graphite transformed to a colloidal or "deflocculated" form, and held in suspension in water and oil respectively. The transformation of the graphite is brought about by treatment with gallo-tannic acid and a little ammonia. The action reduces the graphite particles to $\frac{1}{1000}$th of their linear dimensions, and renders them perfectly suspensive, so that they will pass through filter paper. Many other organic agents, such as extract of straw, glass, tea leaves, and even dung, will act in the same way, although the *rationale* of the process is not understood. It is certain that the agent becomes fixed to the graphite, and it probably penetrates its particles, throwing off groups of molecules, or even molecules themselves, each of which is surrounded by the organic jelly.

Many applications of deflocculated graphite have been initiated, such as in electrotyping and the manufacture of lead pencils. But the most important application at present is as a substitute for ordinary oil lubrication. Apart from the fact of the objectionably high viscosity of oil, on account of which some 50 per cent. of the power generated in the world is at present wasted in the lubricant in overcoming friction, the present demand for natural petroleum is so enormous (in 1908 it was 290,000,000 barrels of 42 gallons each), that only a 50 years' limit has been assigned to the present suppliers. "Aquadag," which is colloidal graphite made up with water (about 1 cb. in. to 3 gallons), and "oildag," in which the medium is oil—usually kerosene—form ideal lubricators, as their viscosity is extremely low. In the fine colloidal state the graphite cannot be squeezed out from between the bearing surfaces, but it enters the pores and "evens up" the metals, so that eventually a glass-like surface covered with a veneer of molecular graphite, is produced. Strange to say, steel will not rust in "aquadag." Prolonged experiments have been made in America with these lubricants, and they are at present in use, giving entire satisfaction, in all the transport power houses in New York.

Another most interesting application of deflocculated graphite was mentioned by Mr. Albert Hioeth, of Norway, in the course of the discussion, namely, for guns and rifles, where it not only diminished friction but prevented leakage of the powder gases and stopped the usual discharge of powder in front of the bullet. Where it was not used, the barrels eventually burnt out, so that its use not only enormously enhanced the life of the guns, but increased the range by some 15 per cent. Dr. Acheson stated that its use in the United States for gun lubrication was very extended. Only about four grains of graphite were required for each bullet, and its use almost entirely did away with any wear of the rifle barrel.

The hope was expressed that Dr. Acheson would erect works in Europe for the manufacture of graphite, which was at present expensive over here. The present consumption, however, did not admit of an economical sub-division of its production, although it might not be long before this could be done. In the meantime, he anticipated considerable reduction in price in the near future.

The Mechanical Design of Direct-Current Turbo-Generators.

By R. J. Roberts, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, November 7th*, 1911.)

The most common defects of D.C. turbo-generators are found in the collecting gear, and take the form of sparking, which may arise from unsuitable brush gear or collectors, want of balance generally, or unstable construction of the commutator.

Another common defect is found in the insulation. It is noticed that all high-speed machines, especially with forced ventilation, rapidly accumulate dirt or soot; and frequently it accumulates where it is impossible to clean, either by blowing or brushing.

The bands are another frequent source of trouble; the bands over the armature end windings sometimes break, which, of course, means a wrecked machine.

The design and construction of the stator or field magnet is one of the simplest details of this class of machine. The windings should be arranged so that the cooling air may have ready access to all conductors, and yet leave no pockets for hot air. All conductors must be clamped so as not to leave more than a 10-in. length unsupported.

The radial ventilating ducts in the rotor core must not be placed directly opposite similar duct in the pole-faces, as whistling or shrieking is the inevitable result. The aim of the mechanical designer should be to get the greatest quantity of air through that part producing greatest loss, with the expenditure of least power.

It is now usual to find dust screens fitted in the air ducts to turbo-generators. These are perhaps the simplest and cheapest remedy we have for keeping the machine clean. To cool large transformers, it is usual to pass the transformer oil through a cooling system of water pipes. It appears practicable to pass the cooling air of a generator through a similar system, which might conveniently be placed under the generator, and so use the same air over and over again without its being contaminated with external air. This scheme would generally be more expensive, though less troublesome, than a dust screen, but is particularly adaptable for a separately driven fan.

The quantity of air generally used for cooling purposes is 80 to 100 cb. ft. per minute per kilowatt loss. The power required for fans and air friction is generally a large proportion of the total loss, ranging from 4 per cent. at 100 KW. output to 2·4 per cent. at 750 KW. 1 KW. per 100 cb. ft. of dry air per minute will raise the temperature of air 30° F.

By doing away with radial ventilating ducts in the rotor, and merely using axial ducts, a reduction in fan loss of 1 to 1½ per cent. might be effected. A still greater reduction might be obtained by discarding inefficient fans on the rotor and using a more efficient separately driven fan.

It is the author's experience that, excepting where a shaft is continuous, all bearings should be treated as self-aligning. The reason for this is that the running clearance in a forced lubrication bearing is generally so large as to prevent the bearing having any influence upon the critical speed of the shaft. A machine with rigid bearings ran well with a least 10 mils clearance all round the shaft, and a want of truth of circularity of bearing bush of at least 5 mils.

A well-forged axle-steel shaft is generally good enough for this class of machine. The ultimate strength should be from 35 to 40 tons per square inch, and the elastic limit 25 to 30 tons per square inch. The carbon should be 0·14 per cent., and sulphur and phosphorus less than 0·035 per cent. each. Owing to the tendency of long shafts to warp during turning, it is desirable to anneal them carefully before the finishing cuts and grinding are attempted.

The art of balancing can only be learnt and not taught. The essential attribute of a balancer is patience, without which he will be tempted to rush his machine through the critical speed before the quality of balance warrants it. Excessive vibration may not only damage the shaft, but it may also damage other parts of the rotor, notably the supports of the commutator.

For the purpose of balancing, the author prefers very rigidly fixed bearings with ample clearances round the shaft to any form of spring controlled or sliding bearings.

The rotor core should be so fixed to the shaft that it cannot become loose. Shrinking the plates on the shaft may increase the core losses, and stampings cannot satisfactorily be pressed on. However, this may be overcome by suitably designing the shaft and core so that the diametrical strains of shaft and core are equal.

Difficulty in reducing the reactance voltage per segment of commutator has resulted in the adoption of open slots, the armature conductors being retained in place by means of wedges driven into recesses in the teeth. To reduce the depth of wedge it is customary to half close the slots and thus reduce the span of the wedges. With two bars per slot, each bar is usually divided into three separate ones in parallel, which enables the bars to be put into slots with narrow openings. The middle bar is dropped in last between the other two. With four bars per slot the opening is often placed to one side, so that the bars can be dropped in one by one, and yet leave the slot opening about one-half the slot width (see fig. 1).

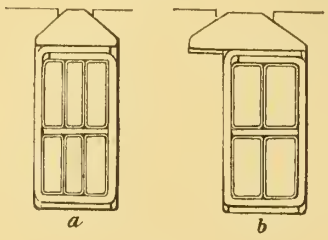


Fig. 1.

The rotor end connections are usually of the ordinary diamond or barrel type tightly packed together on top of the winding drums. Each separate conductor must be well taped and insulated from its neighbour, and a substantial band of insulation must be put between the top and bottom layers. Some prefer micanite, which, when soft, can be moulded to a certain extent. Others use a combination of leatheroid and micanite, the leatheroid being in overlapping segments and giving the necessary mechanical strength whilst the micanite gives the dielectric strength.

At the back end of the armature, the winding can be finished off and leave no exposed part of the current-carrying system. At the commutator end, however, this is not attainable, and this place is the weakest of all for insulating purposes. Where the conductors leave the support of the winding drum, there is a high-velocity current of air which will deposit dirt rapidly in any corner or eddy. The result to be obtained here is not only a sufficient creepage surface, but the elimination of all corners or ledges where dirt might collect.

Equalisers are absolutely necessary with a field of more than two poles. They must be well insulated, and should not show the bare conductor, upon which dirt may collect. They must be very rigidly

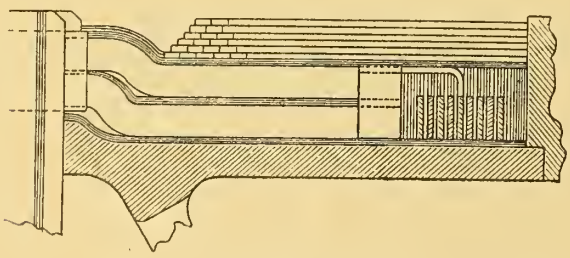


Fig. 2

fixed and supported, lest they should move and so cause unstable balance and harm to the insulation. The best position is at the back end under the band. The equalisers are made of complete rings of copper with projecting tags that are sweated on to the armature conductors. The whole (fig. 2) is first firmly packed up with insulating strips of presspahn or fibre and then banded, which holds everything absolutely rigid and well covered up.

Wire is much preferable to metal rings for the end-winding sheaths. The winding-on of the band in no way disturbs the insulation underneath, and, at the same time, it presses each individual conductor down hard into its place, and so gives less chance of movement. It is not advisable to use round wire for the bands, as it has a smaller space factor than square or rectangular wire.

The majority of the usual defects are traceable to the commutator, and it is of the greatest importance that this should not only be carefully built, but also correctly designed. The segments after proper preparation are assembled in jigs in the usual manner, whilst care is taken that the segments lie parallel to the axis of the cylinder. The insulating segments contain, as a rule, a quantity of superfluous varnish, and this is got rid of by successive bakings and tightening of clamps. The whole, whilst still in clamps, is next turned for the insulating bands under the rings, and banded with temporary bands of steel wire upon that portion of the face where the shrink rings do not come. These bands must not be thick enough to prevent the shrink rings passing freely over them. The insulating bands are next built up in place, banded with fine steel wire and the clamps removed. The shrink rings are then shrunk on, and the whole cylinder is machined where needed and mounted upon the rotor. The advantages of having a non-inflammable surface of fine wire for the ring to shrink on is easily apparent. When an experimental ring was cut it was found that the hot shrink ring had annealed the wire and partially flattened it, and that beyond a distinct marking of the mica there was no sign of any cutting. Further, if the ends of wire were left sticking out beyond the ring it was found impossible to pull any out from under the ring, because the wire sooner broke, where it was held at all.

It is the practice of some manufacturers to leave the insulating bands projecting beyond the rings, whilst others prefer to turn the mica off flush with ring. The latter makes a thoroughly good job; after running some time this mica face becomes coated with dust, but it is easy to clean the surface of the mica by merely wiping it when cleaning the commutator.

A projection of the mica beyond the ring certainly increases the creepage surface. It is not sufficient to leave the mica projecting beyond the ring when shrinking on. The shrink ring should be cut away from the mica, which is then left lying close and compact against the copper face.

It is most important, in choosing the micanite segments, to get them as free from superfluous varnish as is practicable. There has recently been put upon the market a form of micanite that has no varnish in its composition, and, although dearer, is much to be preferred to the ordinary quality. This micanite is stoved at a red heat during its process of manufacture.

In designing a commutator, we must see that there is always sufficient tangential pressure between the copper segments to retain a unit of mica.

The insulating bands under the shrink rings should preferably be built of strips of pure mica of 20 or 30 mils thickness. Sufficient numbers of these are used by even layering to give the required total thickness of band. The use of shellac or other varnish as a binding material is to be deprecated.

The simplest practical commutator is a two-ring, and has a ring at each end of the segments. As the rings are shrunk on, there will be a hoop tension therein, and a corresponding reaction or hoop compression in the segments—fig. 3 (*a*). The compression hoop stress in segments may be resolved into a series of radial forces tending to drive each segment out again—fig. 3 (*b*). Further, it is noticed the compression stress is not necessarily limited to that portion of the segments immediately under the ring, but is distributed along the segments. Hence, as there is a force pushing each segment out again, and as each segment is not absolutely rigid, it will bend, and by that means lower the compression stress at that point of segment proportionally to the amount it deflects. The degree of loading upon each segment pushing it out again will vary, and the maximum load is at the ends where there is no deflection

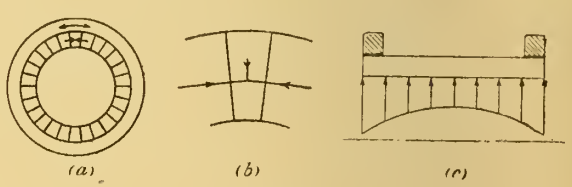


Fig. 3.

and the minimum at the middle, where there will be the greatest deflection—fig. 3 (*c*). By increasing the length of span, ultimately we must reach a particular length such that the reaction in the centre of the span becomes zero.

It is a criterion of good construction in a commutator that there must be no loosening of any part when run up to speed. We must therefore see that the initial deflection given to the bars is always as great as that due to centrifugal forces.

We may conveniently treat all other designs comparatively with that of a two-ring. Thus each end span of a three-ring commutator is equivalent to a simple beam, and a cantilever supporting one end of the simple beam. The middle span of a four-ring commutator consists of a simple beam supported at the ends of two cantilevers.

The theoretical shrinkage allowances may be found by summing up the decrease in diameter of the bars due to the maximum tangential pressure and the increase in diameter of the ring due to the expected initial stress therein. This will be found, as a rule, to give too small a value for the shop to work to, because of the want of circularity of the wire band over the mica, caused by uneven layering of the mica; hence something must be added to the values found to allow for this, as well as for the lack of elasticity of the mica band and segments. The necessary shrinkage allowance, therefore, should be got only from experience.

With some designs of commutators it is not possible to allow sufficient shrinkage allowance on the rings. This difficulty may be overcome by using a hydraulic press to make the rings smaller while still hot and in place on the commutator. Although these presses are reported to be in use on the Continent, the author has not heard of them being used in England.

The supports of the commutator upon the shaft of the generator have been the cause of much trouble. The usual method, which has many slight variations, is to mount it upon two metal cones insulated with micanite, one at each end of the commutator.

The first possible trouble comes from the expansion of the bars themselves, which by several heatings and coolings may ultimately grind the micanite to a powder. Again, some designs are found with the bars not tapered, but left parallel and shrunk upon a uniform sleeve of micanite. This shrinking process is an extremely difficult one to carry out successfully, and if it is not well done, the diametrical expansion of the commutator will make it quite loose upon its supports, possibly sufficient to upset the balance of the

whole machine. Some makers use a spring washer behind one of the tapers to take up the longitudinal expansion, but this may be a danger rather than a remedy unless the tangent of the angle of taper is more than the coefficient of friction between micanite and copper or iron.

Commonly, it is found that the diameter of the shaft under the commutator is smaller than it should be for a perfect shaft, and the difference in slope of the line of deflection of the shaft at the two ends of the commutator is appreciable. This causes a great grinding action on the mica at each revolution of the machine, and is augmented if there is vibration when running through the critical speeds. This is not eliminated by any selection of taper, and the only design the author has heard of that does eliminate this trouble is that of Messrs. Parsons, by which the whole commutator is hung by steel disks from the shrink rings, a construction, however, that calls for great care in design. There are many machines running, nevertheless, where this grinding effect has not been experienced even after years of use. These successes may be attributable to a thoroughly stiff shaft where most needed under the commutator, rendered possible by the use of a high commutator peripheral speed. In general, it may be said that the shaft should be kept fairly uniform in the middle of the span, and should not be reduced to permit a small diameter of commutator.

The commutator risers should be flexible and strong, or else breakages will occur. Of recent years it has become the practice to use a separate fan for the purpose of ventilation; this allows the risers to be made very flexible, and covered by band.

The cooling of commutators on turbo-generators is a great problem, and one that has lately brought forward many solutions. The neatest of these is Messrs. Siemens's design, where the cooling air is brought through the commutator segments themselves by means of axial ducts therein, and drawn through by a fan placed in the middle of the commutator.

The wearing away of the brush upon the commutator face is to be expected, but it is quite common to find that there occurs considerable abrasion of carbon against the holder itself. This is, of course, due to the brush pressing against the holder and the inequality of surface of commutator or even vibration of the holder itself producing the movement. Whatever type of brush-holder is used, experience has shown that the brushes should preferably not be supported on the bearing, because the latter transmits the rotor vibrations which may be greatly amplified in the brush-gear generally.

To look forward to probable improvements of construction, we see that one of the ultimate aims is the decrease in span between bearings. This may lead to a reversion to the Eickemeyer or butterfly winding for the armature, with the equalisers possibly combined in the end connections. The radial type of commutator is possibly the ultimate general design, but it will be some years before this type is generally adopted, and in the meantime we may effect great improvements by the use of higher brush pressures and

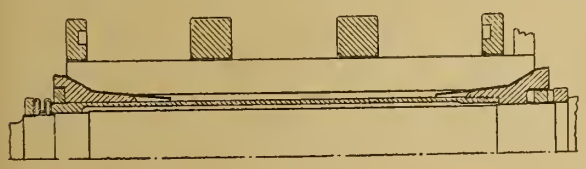


Fig. 4.

higher current densities and peripheral speeds. A suggestion for mounting the commutator is shown in fig. 4. The brush-holders are yet very far from perfect, and possibly the present almost universal box-type holder will disappear for some form of the old lever-type holder.

The present ventilating schemes need much improvement, and an air-cooling system with a separately driven circulating fan is a probable solution.

The author believes that it is possible to make direct-current turbo-generators as reliable as any other electrical machine, and that their mediocre performance in the past has been caused by an inadequate comprehension of the mechanical problems.

Discussion.

Mr. R. Livingstone said that the oil-throwers were often made so that they threw the oil violently from the shaft against the bearing housing, with the result that some of the oil splashed back to the shaft on the wrong side of the thrower, and travelled along the shaft to the armature or commutator. It was much better to rely on oil-glands for retaining the oil in the bearing housing. The efficiency of fans running at peripheral speeds of 12,000 to 18,000 f.p.m. was in the neighbourhood of 10 to 30 per cent., whereas Sirocco fans running at the correct peripheral speeds had efficiencies varying from 45 per cent. to 65 per cent. With separately driven fans the motor efficiency must also be taken into account, but when the fan power exceeded about 5 H.P. a saving was effected. Where such a fan was used, the generator rotor should be made with as little fan action as possible, so as to make it easy to guide the air to where it was required. With air under a pressure of 5 in. water gauge the H.P. of the fan motor would be $\frac{\text{Cb. ft. per min.}}{1{,}200 \times \eta}$ when η was the fan efficiency. Bearings for 3,000-R.P.M. machines having a diameter of 4 to 5 in. would run well if the clearance was 50 to 100 per cent. greater than the amount stated by the author. It was necessary to have a large clearance, to provide for the oil film between the surfaces. One of the chief causes of warping of shafts was the cutting of the keyways, and this was usually done after the shaft was turned. The best practice was to buy shafts rough turned, oil toughened and annealed, and cut as small keyways as were consistent with the torque. A pressure of 8,000 lb. per sq. in. on the laminations was not excessive. Most D.C. machines had to run through the critical speed, and in such cases it was advisable to have the whirling speed two-thirds of the normal speed. It was impossible to design the shaft and core so that the diametrical stresses were equal. The most that could be done was to keep the tangential stress at the inner surface of the core as small as possible. He had designed rotors with a stress of 12,000 lb. per sq. in. in a 3,000-R.P.M. machine, and had not experienced any trouble due to the expanding of the core. It was possible to press a laminated rotor on to the shaft. He liked the slot shown in fig. 1A; fig. 1B was not so good, as the load on the tip of the tooth was eccentric. With good fibre wedges a bending stress of 1,500 lb. per square inch was not excessive, and he had not found the depth of wedge too great even with ordinary open slots $\frac{3}{16}$ to $\frac{5}{16}$ in. in depth, covering all ordinary machines. He most certainly preferred the solid end bell to binding wire. If the windings and bell were made slightly conical, the bell was quite easily put on and taken off. It was advisable to press the windings into their conical shape on a conical support formed by the end plate, so as to give a true hard surface for the end bell. The author was to be congratulated on the clear manner in which he put the theory, and the curves given simplified the working of problems. It was quite correct that the bending of the bars reduced the tangential stresses at the centre of the bar (in a two-ring commutator), and increased it at the ends; in practice however, they must start out with the assumption that a certain minimum tangential pressure was required on the mica, say 500 lb. per square inch. Then it would be found that the ratio of depth to length of bar did not vary very greatly.

Mr. Catterson Smith said that even under good conditions, with commutation poles, one could rarely guarantee the current change in the coil undergoing reversal to be a linear function of time, and thus the ordinary nominal current density was limited to 40 or 45 amperes per sq. in. Any departure from the linear current-change law raised the density over parts of the brush to high values of the order of 200 or 300 amperes per sq. in., and thus it was quite impossible to work with the high densities indicated. With regard to the possibility of cooling the air with a refrigerator, in view of the trouble experienced through the accumulation of dust and dirt brought in by the cooling air in the ordinary system, some such system might well be tried. The commutator risers were one of the most difficult parts to design satisfactorily; he could recall an instance of a turbo-generator which, after 5,000 hours' run, showed $2\frac{1}{2}$ per cent. of the risers fractured and 25 per cent. in a bad condition. He had seen thin steel bands put on the mica bands, and afterwards turned true on the outer surfaces, which were then easily gauged for the shrink rings.

Mr. A. R. Everest said there could be little doubt as to the desirability of filtering the air supply to D.C. turbo-driven generators. Accumulation of dirt was objectionable not only on account of possible loss of insulation, but also because it interfered with the proper cooling of the parts. In the figure referring to the possible looseness which would occur in a rotor due to the expansion of the punchings from centrifugal force, the possible displacement of the centre of gravity, and the resultant out-of-balance would be one-half that suggested in the paper.

Mr. R. Harrison said he was surprised at the careful attention Mr. Roberts had given to the stresses in the commutator, where the results were so uncertain, because the rings were shrunk on mica. Shrinking the core on the shaft had a tendency to make the shaft stiffen, and therefore to increase the critical speed above the calculated value. Hence it was advisable to made the critical speed above the normal running speed where possible, so that if the core stiffening effect did not raise the critical speed, it was making the machine still safer.

Mr. W. Hoult pointed out that as it was extremely important to keep the commutator of the machine cool, and it was better to make the supply of air to the commutator entirely separate from the supply of air that passed through the core, otherwise the air was heated before it got to the commutator. Air filters should be installed wherever the atmosphere contained dirt in suspension. As regarded cooling with a water-jacket or freezing plant, a cheaper and better way for large generators would be to draw the air through fine sprays of water and then through a series of vertical corrugated plates, so as to throw off the water. The water mixing intimately with the air would take away the particles of dust, and also cool it to practically the same temperature. He agreed with other speakers that the use of binding wire for end sheaths was wrong. He agreed with the author that the majority of the usual defects were traceable to the commutator, and that it was of the greatest importance that this should be carefully built and correctly designed.

Mr. G. W. Worrall said the mechanical problem of commutation was twofold. In the first place, the frictional force tends to tilt the carbon on to the rear tip considerably increasing the contact resistance at the forward tip. The other factor was the expansion of the brush surface. The rear tip of the brush was cooled by the air drawn round by the commutator, but the front tip was not so cooled, and the expansion of the contact surface due to heating caused this tip to lift from off the commutator surface and set the brush vibrating. The tip might, however, be kept in proper contact by placing metal foil in close contact with the front of the carbon, and so conveying the heat away.

Mr. F. H. Whysall said the tendency of the mica to rise had

been got over by reducing it slightly below the surface of the commutator segments. The turbo-generators in use at Dickenson Street were run all day and they had no trouble at all. Their success was largely due to Mr. Hoult.

Mr. F. H. Clough said that if it was dangerous to pass through the critical speed, he agreed with the author that it was necessary to keep the length between the bearings as short as possible, and to use butterfly connections for the armature windings, but if it was possible to pass through the critical speed with safety, it would seem desirable to make the shaft smaller than indicated and so have the running speed well beyond this critical value. The mica might be prevented from becoming displaced by making it slightly wedge-shaped or by suitably roughening the commutator bars.

Mr. R. H. Barbour (communicated):—The commutator is by its very nature unsuited to high peripheral speeds. Its component parts have just the shape which gives them the minimum of resistance to centrifugal force. In a machine having, say, 60 commutator segments, and running at 3,000 r.p.m., each brush has to change from one segment to another 3,000 times in every second. Centrifugal force is continually doing its best to produce unevenness in the height of each one of the 60 segments, and the moment one of them shifts, be it even $\frac{1}{10000}$ in., the fat is in the fire. These considerations render imperative the use of commutators of small diameter, and consequently of long length. In the present turbine machines at least 240 watts are turned into heat per square inch of the contact surface; this is already double what is found best in slow-speed machines, and any further increase is likely to aggravate the present troubles. By adopting the homopolar principle, commutation difficulties are entirely eliminated. Mechanical construction is immensely simplified — slip-rings, if once set true, have no tendency whatever to take up eccentric positions. Even if they are assembled slightly out of truth the forces set up are negligible. Instead of a long thin shaft, a short one may be used, and its effective diameter increased one-third of its length by pressing on a solid steel core, or the core and shaft may be made in one forging. Efficient ventilation of a long commutator is impossible; that of a number of slip-rings is easy, and the use of slip-rings enables more efficient brushes to be used. Cost is reduced by the absence of interpoles and of compensating windings, and the speeds permissible are double those of commutator machines, so that, for a given steam consumption, the cost of the steam turbine is reduced 50 per cent.

Mr. R. Roberts, in reply, said his experience had been that rotors with wire bands retained their original balance better than those with solid rings. The efficiency of the fan that was used in calculating the tables of ventilating losses was 25 per cent. The scheme of cooling the air by sprays of water would scarcely commend itself to a designer until someone else had found it satisfactory; and the greatest objection would be found when starting a cold machine. Water in suspension carried into the machine would then endanger the insulation; but once the machine was warm, this danger would possibly disappear. He agreed that oil throwing was a great trouble, and that oil glands were the only reliable cure; but as the bearings were usually supplied by the turbine builder, this was scarcely in the province of the generator designer. It had been his experience that the shrinkage allowance usually given was far too small, and that 3 to 5 mils per inch diameter was not, as a rule, any too much.

Modern High-Voltage Power Transformers.

By W. T. Taylor.

(Discussion by the Institution of Electrical Engineers *at Birmingham, November 15th,* 1911. *For abstract of the paper see* Electrical Review, *page* 856, *et seq.)*

Dr. C. C. Garrard thought the most valuable part of the paper was that dealing with the installation of transformers, drying out, &c. He disagreed with the author in several of the constructional details mentioned. For example, in describing a core type transformer the author described the core as being held together with linen tape only. This was an unsatisfactory method of construction. The tape must in time give way, and there would be nothing to prevent the laminations bulging out and cutting through the insulation of the coils. Steel bolts should be put right through the laminations, with gun-metal clamping plates on either side. The ends of the bolts should be riveted over, and if they, with the plates, were insulated from the core, no appreciable increased iron loss would result. Coils of all high-voltage transformers should be dried and impregnated by a vacuum process. Equally good results could be obtained with either shell or core type of construction. He preferred the core type owing to its greater simplicity and the ease with which repairs could be carried out. It was often economical to reduce the cross-section of the core and increase that of the yoke owing to securing a lesser mean turn. Also, it often paid to make the shape of the coils of core-type transformers elliptical rather than round, as mentioned by the author, as this resulted in a general saving in weight, and thus reduced material cost. The star-delta connections shown, with the star on the primary side, led to inferior regulation on unbalanced loads. The star-delta connection, with the delta on the primary side, was very good when lighting and power current were both required to be taken from the same transformer. The motors would be supplied from the three phases, and the lighting from phase to neutral. With this system the regulation would not be affected by unbalanced load. The three-transformer method was new to him; he would like to know how it compared in regulation and balancing with the two-transformer method

Mr. Forrest considered that the most troublesome feature in connection with oil-filled transformers was the choking-up of the cooling ducts with oil sludge—a substance resembling soft soap—and the consequent abnormal heating of the transformer due to impaired circulation of the oil. Oil-filled transformers had to be lifted out of their tanks and washed down with oil after they had been in service a year or two, and this was a troublesome and costly process with large units. He thought the forced-oil cooled was the ideal type for large units. The oil was circulated very rapidly by means of a pump, and flowed through the cooling ducts quickly enough to wash them clear of sludge. The hot oil was conveyed through pipes to a cooler (a worm surrounded by water) fixed outside the transformer room, and as the oil was under pressure, if a leak occurred in the pipe or worm, oil escaped, but water could not enter the pipe.

Mr. R. Orsettich said that the troubles usually experienced with all high-tension transformers could be classed under three headings: (1) Trouble with the terminals due to shorts, which sometimes cracked the porcelain. These had been obviated in extra-high-tension sets by the use of the condenser type terminal consisting of a number of concentric tubes. (2) Moving of coils under the strain put on them in switching on and off heavy loads. This was obviated in all the modern types by clamping tightly the core in itself and independently from it the coils, so that no movement was possible either in the portion embedded in the core or in the parts projecting from it. (3) Piercing of the insulation between adjacent turns due to surges. This was obviated by making the insulation on the first coil of the primary connected to the terminals much heavier than on any other coils. Tappings and extra terminals were easily made on transformers of moderate voltage up to 10,000 volts, but became a very serious matter for higher voltages.

Mr. A. M. Taylor pointed out that the paper was written from the point of view of South American experience, where very high voltages were the rule, and breakdowns were much more frequent than in this country. At the Löntsch station in Switzerland, Messrs. Brown, Boveri & Co. had installed three-phase transformers for a 48,500-volt transmission. These transformers were each of 5,250-k.v.a. capacity, for 50 periods. They were water-cooled. Some English transformers of 1,700-k.v.a. capacity, 25 periods, and air-cooled, had now run most successfully for three years in one of the largest English stations. Taking into consideration the value of floor space and the lowness of pressures in this country, they were warranted in installing three-phase transformers in most cases.

Institution of Electrical Engineers.

Yorkshire Local Section.

A meeting was held on November 20th to consider the proposed new Articles. Mr. T. Harding Churton presided, and Messrs. R. Hammond and J. E. Kingsbury, members of Council, were present.

Members unable to attend wrote expressing their dissatisfaction with the proposals to increase the subscriptions, and to give the Council power to raise loans and to incorporate other societies. It was pointed out that provision should be made to enable provincial members to vote without the necessity of attending meetings in London.

Mr. T. Roles said that the proposed increase of subscription appeared to be connected with the purchase of the new building, about which the provincial members had had little to say, as only the usual eight days' notice was given, and the meeting was called when the I.M.E.A. was meeting at Nottingham. He had looked into the question of expenses of the Local Sections, and found that the grant in aid of these, together with travelling expenses, amounted to £729. The number of members within 50 miles' radius of London was 2,397, and their subscriptions amounted to £5,125. Outside that radius there were 3,870 members, of whom 2,550 were in the provinces and 1,320 in the Colonies; the subscriptions of the former amounted to £5,101, and of the latter to £3,004. One-third of the provincial subscriptions (Mr. Hammond's figure) came to £1,700, not £729. There was a discrepancy between the total as reckoned above (£13,000) and that given in the statement of accounts (£11,314), perhaps due to compounding. The grant to the Yorkshire Section was £70, plus £4 7s. 3d. for the printing of papers; the subscriptions came to £509. The *Journal* cost altogether £1,409 net, less than 5s. a head—a paltry sum.

He thought the local members ought to have more say in the business of the Institution, and ought not to be compelled to go to London to vote. The London members had a representation on the Council of 63 3 per cent., while they constituted only 37 per cent. of the membership. The country members did not derive many benefits from their connection with the Institution, compared with those enjoyed by the London members. Of the latter, including Members and Associate Members only, 58 per cent. were Members, while in the provinces only 32 per cent. were Members, and there must be some reason for the difference.

Other speakers endorsed the views of Mr. Roles, and spoke to similar effect. Mr. W. N. Y. King said that they should adhere strictly to electrical science and engineering. Mr. F. W. Cook approved of the adoption of examinations. Mr. W. Emmott said that the present feeling amongst the members was the most healthy sign of activity he had seen in 34 years. Mr. A. B. Mountain suggested that if the Institution wanted money, there were plenty of people willing to take up shares to the amount required.

Mr. W. B. Woodhouse objected to the increase in subscriptions, but said that if it were necessary, it would have to be done. He feared the Institution would become a trading society instead of a

cientific Institution. Mr. S. Clegg thought that many of the Associates would not be able to pass the examination for Associate Membership, and would drop out.

Mr. Hammond pointed out that of 24 Members on the Council, nine were from the provinces. The Institution was not in financial difficulties. It appeared that the members of the Yorkshire Section were not prepared to assist in developing the scope of the Institution if it meant half-a-guinea a year. He defended his estimate that "one-third was expended on the Local Sections," and said that the Council had no desire to raise the subscriptions against the wishes of the members. Anyone in the class of Associates who possessed the technical qualifications would be put in the class of Associate Members.

Mr. Kingsbury said the Council wanted more money to carry out the work of the Institution, and that membership would be more valuable in the future than at present.

Mr. W. Hartnell said the present suggestions came upon them as a thunderbolt. Mr. Schofield and Mr. Laing criticised the new Articles, and a resolution, proposed by Mr. W. Emmott, requesting the Council to defer the question of amending the Articles for a period of 12 months, was put to the meeting (without the consent of the chairman), and carried unanimously.

Dublin Local Section.

A meeting was held on November 14th to consider the new Articles. In deference to the request of the President of the Institution, no resolution was put to the meeting.

The members of Committee raised, point by point, the "opinions" which they had proposed as resolutions at a Committee meeting held on the 13th, and each point so raised was discussed. At the close of the meeting, the members present were invited to sign such opinions as they agreed with, and so well had the Committee gauged the views of the members on vital points, that every opinion was signed by practically every Corporate Member present. One half of the total number of Corporate Members in the Section were present and signed; the signatures obtained next day brought the total percentage of those signing to 60 per cent. of all Corporate Members of the Section. These signed opinions were sent to the Council. We understand that their tendency was adverse to the new Articles of Association.

We have received several lengthy letters on the new Articles, which would occupy many columns if printed *in extenso;* we therefore give the gist of them below:—

Mr. A. H. Dykes:—While he formerly held that members who practised in a consultative capacity should be indicated in some way in the list of Members, he has come to the conclusion that the idea is fallacious, seeing that few consulting engineers confine themselves rigidly to one branch of work, and that there are separate Institutions dealing with Civil, Electrical, Mechanical and other branches of Engineering, each of which would have its own rules for professional conduct. What is wanted is an Association consisting only of practising consulting engineers, and covering all branches of engineering, and he hopes that before the end of the present year such an Association will be actually at work.

If consulting engineering were to be a commercial business, there would be no need for any rules, and any engineer could engage in it, advertise, employ agents, and so on, like a contractor or manufacturer; limited companies, employés of manufacturing firms, and insurance companies could also carry on consulting work. But if it is to be a profession, a code of professional conduct is necessary, and the adoption of such a code by the Institutions of Civil and Electrical Engineers shows that that is their view of the matter. The Association of Consulting Engineers will take these rules as a starting point, and gradually enforce such further regulations as may be considered advisable. At the same time, having accepted such restrictions, they are entitled to corresponding privileges, and as the Institutions have decided that consulting engineers must conform to a different standard to that obtaining in ordinary commercial work, they must support those who undertake to be bound by those restrictions. Such an Association will be of the utmost value, not only to its members, but to the whole body of engineers and the public at large.

Mr. E. W. Cowan: The method of election of its executive is of vital importance to an Institution, quite apart from its effectiveness in selecting the most efficient men. The members should feel that they are governing it themselves, but if the executive is chosen vicariously, they are apt to be apathetic as to their duties and responsibilities and to think only of their rights and privileges—often in a critical and dissatisfied spirit. This attitude is destructive of corporate feeling.

It is clear that the alterations embodied in Articles Nos. 51 and 52 are aimed at strengthening the voice of the general body of the members in the selection of members of Council, &c., but the condition that 25 must support every nomination will not be made use of excepting when there is a feeling of discontent.

I submit that Articles Nos. 51 and 52 be amended to provide:—

1. That a nomination form be circulated amongst the members three months (?) before the election with notification of the vacancies to be filled up, and with an invitation to the members to submit nominations (one month to be allowed).

2. That the results of these nomination votes be tabulated and brought before the Council. The Council then to prepare its own nomination list, endeavouring, in its choice, to interpret, as far as may be consistent with the general interest, the wishes of the members.

3. That one month before the election a paper be circulated amongst the members which will contain two proposal lists—(*a*) a list of the names of those nominated by the members for the vacancies on the Council, together with the number of nomination votes given to each name. Provided that no name be published for which less than 3 per cent. of the total votes recorded has been given. (*b*) A list of the nominations of the Council for the vacancies. This list to constitute the balloting paper, and to be detachable; members to hand in these papers either unaltered, or altered by the substitution of any name or names on the general nomination list.

The above method of election will be recognised as being nearly identical with that adopted by the American Institute of Electrical Engineers, but it is not by any means peculiar to that institution. I have had personal experience of its beneficial working elsewhere.

I do not think that the Council will be out of sympathy with this suggestion, but it rests with the members, now that the constitution is in the melting pot, to express their views plainly and frankly in the proper quarter.

Mr. T. Roles: In the course of the discussion at the meeting of the Yorkshire Local Section I gave certain statistics with a view to showing that the number of country and foreign and Colonial members, as compared with those living near London, is very much greater than is generally realised, and that in view of this fact they should have a much larger share of representation on the Council, and also that it should not be necessary for a member to have to attend a special meeting in London in order to record his vote on a question of vital importance to the Institution, such as the alteration of the Articles of Association.

In order to obtain the figures given in the enclosed statement, the list of officers and members, corrected to August 31st, 1911, has been taken, and for the purposes of this statement all members residing within a radius of 50 miles of London have been regarded as London members, resulting in the inclusion of such towns as Bedford, Brighton, Cambridge, Colchester and Reading, although it is questionable whether the members residing in some of these towns will agree that they are London members.

The Institution of Electrical Engineers.

	London.		Country.		Foreign and Colonial.		Total.*	
	No.	% of total members.	No.	% of total members.	No.	% of total members.	No.	% of total members.
Members ...	568	23·7	391	15·3	369	27·9	1,328	21·2
Assoc. Members	977	40·8	1,209	47·6	603	45·7	2,789	44·6
Associates ...	371	15·4	318	12·3	200	15·2	889	14·1
Students ...	486	20·1	636	24·8	148	11·2	1,270	20·1
	2,402		2,554		1,320		6,276	
Proportion of Members to Assoc. Members... ...	58 %		32 %		61 %		47 %	
Proposed subscriptions ...	£6,689 1		£6,652 5 6		£3,503 6 6		£16,841 13	
Present subscriptions ...	£5,130 12		£5,106 3 0		£1,540 0 0		£11,776 15	
Addition ...	£1,558 9		£1,546 2 6		£1,963 6 6		£5,067 18	

* The totals shown in this column differ slightly from those given in the list of officers and members. This is due to Honorary Members not being included, and the fact that the addresses of a number of members are not given.

	Total.	*Percentage.*
London Members	2,402	38·3
Country, Foreign and Colonial Members ...	3,874	61·7
Representation on Council (excluding Past Presidents).		
London Members	19	63·3
Country Members, including Chairmen of Local Sections	11	36·7

With regard to subscriptions, the total, according to my statement, is £11,776 15s., whereas according to the accounts of the Institution for the year ended December 31st, 1910, only £11,314 19s. 6d. was received. It must, however, be remembered that a number of new members were enrolled between the end of last year and August 31st, 1911; further, that certain members have compounded for their subscriptions, which would account for some discrepancy between the two amounts.

I think the figures given will speak for themselves, and that country members can draw their own deductions, and decide for themselves whether they are being fairly treated as regards representation, voting power, and the amount of their subcriptions provided for under the new Articles of Association.

As the country members' present total annual subscriptions, according to my reckoning as given on the statement, are in the neighbourhood of £5,000, it would appear that the sum expended by the Council on the local sections is very considerably less than one-third of such subscriptions, as stated by Mr. Hammond.

Up to the present country members have been apathetic, and have left the management of the Institution in the hands of a

Council which has been practically self-constituted. I think there is little doubt that such members have not realised their numbers and their power, if the Articles of Association were such as would allow them to exercise it.

The general feeling of all members I have come across in this district is that the present subscriptions are ample considering the meagre advantages obtained by membership, and that if it were possible for the country member to obtain advantages nearly approaching those possessed by members residing in the London district, they would not so much object to the raising of the subscriptions. As far as I can see, the only method of effecting this is for country members to send members to the Council who thoroughly understand and are prepared to express their needs, and the result would be that the position of the Institution would be greatly strengthened in every way.

SILVERTOWN TRAIN LIGHTING SYSTEM.

We recently visited the works of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., at Silvertown, to inspect a new train lighting equipment which the company has brought out. The apparatus is being made under a patent taken out by Messrs. Anderson, Russell & Gray, and is at present undergoing trials on one of our principal railways; the system has been developed during the past two years at Silvertown, and has been brought to a remarkably high stage of efficiency. Its most noteworthy feature perhaps is its simplicity; the dynamo is quite an ordinary type of machine, the controlling gear is such as has been used for years with satisfactory results, and, in fact, there are no novel or untried devices in the whole equipment. The system, however, is quite new and of a very promising description.

The equipment consists of a dynamo, driven from the coach axle, and carrying on its shaft a governor, which is used to operate the switchgear; and two batteries of accumulators, one of which is normally connected to the terminals of the lamp circuit, whilst the other is connected to the armature terminals, so that it may receive a charge.

The dynamo is of ordinary construction and design, except that the field magnets are differentially wound, one winding being a shunt winding connected by the switchgear to the terminals of the battery which, at any given time, is connected to the lamps (hereafter called the "discharge battery"), whilst the other is a series winding, through which is passed the whole, or a part, of the current supplied by the dynamo to the second battery, called the "charge battery." This winding is connected up by the switchgear so that it opposes the shunt winding, and tends to demagnetise the magnets and weaken the field in which the armature is rotating.

Connected as a shunt across the series winding is a resistance or diverter, which can be adjusted by hand to regulate the proportion of the charging current passing through the series winding, so that if the conditions of working are such that there is an increase in the ampere-hours of discharge from the batteries, the rate of charge of the charge battery can be increased, or if there is a decrease, the rate of charge can be decreased. By so adjusting the diverter resistance that, with any predetermined (nominal) value of the charging current, the proportion of this current passing through the series coils gives a demagnetising effect equal to the magnetising effect of the shunt coils, the charging current can be limited to something *less than* this predetermined value; for, obviously, if the charging current could reach this value, there would be no magnetising force, and the dynamo could not generate an electromotive force, and consequently could not supply any current to the battery. At the same time, as none of the current passing to the lamp circuit passes through the series coils, their demagnetising effect is not dependent on the number of lamps in

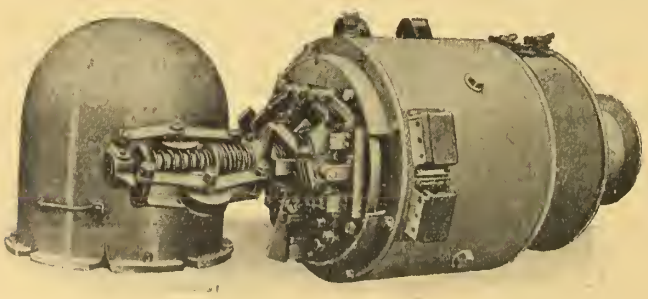


Fig. 1.—Silvertown Train Lighting Dynamo.

circuit, and whether full, half or no lights are on, it is still impossible for the charging current to reach the predetermined value.

The armature shaft carries a centrifugal governor, so arranged that it operates a cut-in switch when the speed of the armature is such that the dynamo, if excited by the shunt coils only, would give a voltage equal to the normal lamp voltage. This cut-in switch first connects the shunt circuit to the discharge battery so as to excite the magnets of the dynamo, and then connects the armature of the dynamo to the charge battery through the demagnetising series coils and the diverter, as well as to the discharge battery and lamp circuit through resistances.

The governor also carries on its collar a projection which, as soon as the armature begins to rotate, engages with a rocking lever, which operates a reversing switch, provided there has been a change in the direction of the rotation of the armature. This collar works against a light spring for the first ½-in. of its movement, so that it is quickly drawn away by the governor when making only a few revolutions per minute, sufficient for the projection to be clear of the rocking lever, thus preventing the

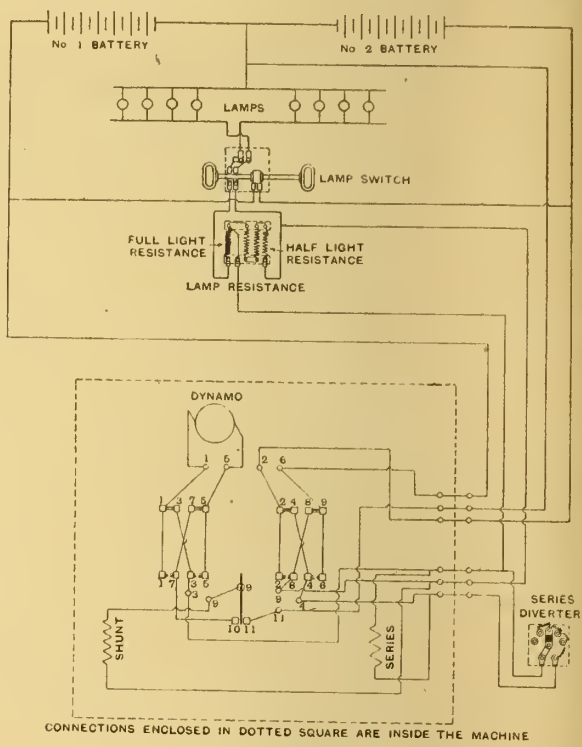


Fig. 2.—Diagram of Connections.

repeated striking of the former against the latter. This reversing switch not only changes the connections between the armature and the batteries so that the dynamo gives current in the proper direction, but also changes the batteries over, so that the one that was the discharge battery becomes the charge battery, and *vice versa*. In addition to the above apparatus, a lamp switch is provided, so that all the lights, or half the lights, can be switched on, and this also couples the two batteries in parallel for charging when all the lights are switched off.

The appearance of the dynamo and controlling gear is shown in fig. 1, and the construction of the governor and switch gear is shown in figs. 3 and 4.

Referring to the diagram of connections, fig. 2, all the connections enclosed in the dotted square are inside the machine. The numbers on the switchboard where a circle is shown denote the points at which the connections pass through the switchboard. The other numbers refer to the reversing and cutting-in and out switches; 9, 10 and 11 are the cutting-in and out switch, and 1, 3, 7, 5 and 2, 4, 8, 6 are the upper contacts, and 1, 7, 3, 5 and 2, 8, 4, 6 the lower contacts of the reversing switch.

If we assume that the train is just starting and all the lamps are switched on, the direction being such that the reversing switch is in the position shown by the full lines (upper contacts), the current will flow through the various circuits in the following manner: from No. 1 battery to upper contacts 6 and 8, to lamp switch and lamps, and back to No. 1 battery. A part of the current will be supplied by No. 2 battery through contacts 2 and 4, through the series winding and its diverter, then through the lamp resistances to the lamps and back to No. 2 battery.

When the speed has been increased sufficiently, the shunt winding will be connected to No. 1 battery to excite the shunt, through contacts 6 and 8 to shunt coils and contacts 9 and 11 back to No. 1 battery, thus ensuring that the voltage is built up before the armature is connected with the batteries and lamps.

Increase of speed will now connect 9 and 11 to 10, and the armature will supply current to the load in the following manner:—The current passes from the armature to contacts 1 and 3, after which it divides, part going through the lamp resistances to the lamps, and part going through the series winding and its diverter and contacts 4 and 2 to No. 2 battery (which is the charge battery when running in this direction). The current from No. 2 battery will now join that from the lamps, and pass through contacts 11, 10, 7 and 5 back to the armature.

If only half the lamps are required, the current will flow as before except that there will be no circuit through one group of lamps, nor through one of the lamp resistances, which were in parallel for full lights. In the event of no lights being used, the two batteries are placed in parallel by the act of switching the lights off. In this case, the current will flow in the following manner: From the armature to contacts 1 and 3, after which it

divides, part going to the series winding and its diverter and part to the "half light" lamp resistance. The current, after passing through the series winding, diverter and lamp resistance in parallel, again divides, passing through both batteries and the shunt winding in parallel, and through contacts 11, 9 and 10 to 7 and 5, and so to the armature.

The system of regulation described above renders it practically impossible to charge the battery at an excessive rate, and provides an easy means of adjusting the amount of charge to the requirements of the battery; the cost of maintenance of the battery should be appreciably reduced, as it will not be necessary to wash it out as frequently, or to replace the plates as soon as in some systems. The dynamo, governor and switchgear are of very simple and robust design and construction, so as to reduce the cost of maintenance, and special attention has been paid to providing easy access to those working parts which require inspection, and to affording facilities for dismantling any parts of the gear when it becomes necessary.

In fig. 3 is given an end view of the switchgear with the governor removed, and a longitudinal section of the governor and switchgear. Fig. 4 illustrates the method of operating the reversing switch, the governor being shown in the position where it is just on the point of changing over the reversing switch from the upper to the lower contacts—a position which, of course, is passed through in a moment, directly the train gets into motion.

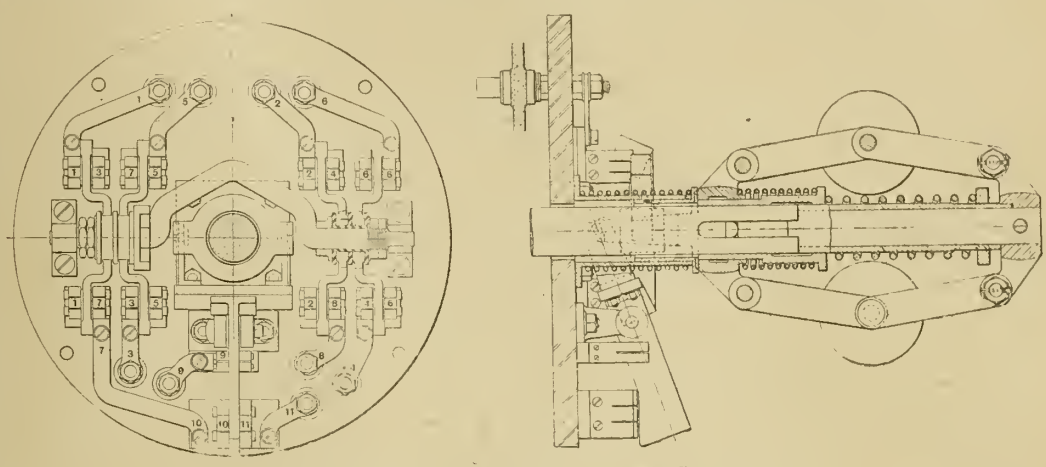


Fig. 3.—Details of Switchgear and Governor.

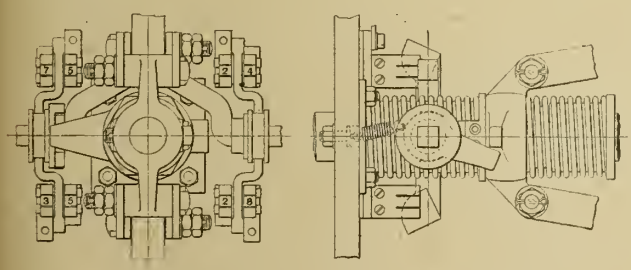


Fig. 4.—Operation of Reversing Switch.

It will be seen that in this system, on a journey in one direction, with the lamps in use, one battery is being charged and the other is either discharging at a low rate, or practically floating, while the dynamo supplies current for both charging and lighting. While the train is standing still, both batteries feed the lamps—one direct, the other through the lamp resistances. The interposition of the latter ensures that the newly charged battery, with its higher voltage, shall not cause the lamps to be over-run. On the return journey, as explained above, the battery connections are interchanged, so that the fully charged battery is now connected to the lamps and the discharged battery is put on charge. Only when the lamps are out of use are the two batteries put directly in parallel and charged together. The voltage on the lamp circuit is remarkably uniform; the greatest variation we observed during a cycle of operations ranged between 23 and 25 volts—about 4 per cent. from the normal—and this only takes place on reversal, that is, at the moment of starting a journey, when a fresh battery is put on to the lamps.

The question may arise whether, if a train were put on a schedule which involved travelling always in one direction by day and returning at night, one battery would be continuously drawn upon to too great an extent. The fact that both batteries would be charged in parallel in the daytime, and that the one which had been in use would naturally take the lion's share of the charge, would go far to remedy this, and the periodical inspection of the equipment that should always be provided for would ensure the detection of any such progressive tendency. Moreover, when the discharge battery is much lower than the other, the latter affords it material assistance when the train is standing with the lights on. These and other points are well illustrated by the test results in the preceding column, supplied to us by the makers.

The figures in the table show the voltage at the lamp terminals, and the current in the dynamo, lamp and battery circuits, at different speeds. No. 1 test was taken with the dynamo at rest and all lamps on; Nos. 2 to 6 with dynamo running and all lamps on; Nos. 7 to 9 with half lamps on; Nos. 10 to 13 with all lamps off and batteries charging in parallel, and No. 14 with dynamo at rest and half lamps on. Other figures show that the diverter can be used to vary the maximum charging current over a wide range. In all cases, at a given speed, the charging current is practically the same, whether all the lamps or only half of them are in use.

The system appears to possess many valuable features, and is so simple that there is little chance of anything going wrong. In view of the great desirability of lighting all trains by electricity, we welcome the system and wish it a full measure of success.

Speed, R.P.M.	Lamp circuit.		No. 1 battery.		No. 2 battery.		Dynamo amps.	Reading No.
	Volts.	Amps.	Charge amps.	Discharge amps.	Charge amps.	Discharge amps.		
0	23·25	19·0	...	13·0	...	6·0	0	1
440	23·4	19·0	...	12·5	2·0	...	7·5	2
900	24·5	19·3	...	1·75	19·0	...	35·5	3
1,400	24·6	19·4	...	·5	24·5	...	44·0	4
1,480	24·75	19·5	0	0	25·5	...	45·5	5
700	24·25	19·2	...	3·5	15·0	...	30·5	6
1,300	24·75	10·8	...	·5	23·5	...	35·0	7
1,000	24·5	10·6	...	·25	20·5	...	31·0	8
1,490	24·8	10·8	1	...	25·5	...	37·5	9
600	0	0	16·0	0	0	0	16·0	10
900	0	0	20·0	...	11·0	...	31·0	11
1,480	0	0	23·0	...	14·5	...	37·0	12
600	0	0	10·0	...	5·0	...	15·0	13
0	24·5	10·6	...	7·25	...	3·25	0	14

A Bavarian Railway Contract.—It is announced that the Bergmann Electricity Enterprises Co., which is a financial subsidiary of the Bergmann electricity works, has secured a contract from the Bavarian Railway Ministry for the electrical equipment of two sections from Garmisch to Mittenwald and from Garmisch to Griesen, the total length of these main lines being 26 miles. Both sections lead to the frontier, and are connected with Austrian railways, the conversion of which is also proposed by Austrian firms. By means of these connections the Garmisch-Mittenwald section would be continued to Innsbruck, and the Garmisch-Griesen section with Vermoos-Fernpass. The success of the Bergmann Co. in obtaining the contract is all the more remarkable inasmuch as Bavaria has hitherto been considered for various reasons to be the special preserve of the Schuckert Electricity Co., of Nuremberg. As far as the transformation of the Austrian sections is concerned, the question arises whether the Austrian Bergmann Co., of Bodenbach, will receive the order for this particular work. Technical considerations are doubtless in favour of this solution of the problem, but it is said that the Austrians are not very favourably disposed towards manufacturing works situated on the frontier, and that they would endeavour to place the contract with Vienna firms, although these are more or less closely associated with German works.

Spanish Hydro-Electric Works.—It is stated that a company has been formed in Barcelona under the title of the Energia Electrica de Catalunya, with the participation of Spanish, French and Swiss financiers. The object is to erect hydro-electric works in the Pyrenees for the transmission of power to Barcelona, where distributing stations are to be established for the supply of energy for lighting and industrial purposes, both in the town of Barcelona and in the province of Catalonia. The share capital has been provisionally fixed at 10,000,000 pesetas, with power to make successive increases according to requirements. At present the company has already commenced the erection of two hydro-electric works, one of which has a fall representing 30,000 H.P. Among the French companies interested in the company is the Compagnie Générale d'Electricité, of Paris, whose chairman is one of the directors of the Spanish company, whilst other directors are representatives of the Madrid General Electricity Co., the Swiss Electrical Industry Co., and the Compagnie d'Electricité, of Marseilles.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,211. "Electric reading lamps." R. E. Burnham. November 13th.

25,216. "Connecting means for automatic telephone systems." G. A. Betulander. (Convention date, November 16th, 1910, Sweden.) November 13th. (Complete.)

25,244. "Electric clocks." W. J. Blenheim. November 13th.

25,278. "Wireless telegraphy." J. Gardner. November 14th.

25,311. "Electric incandescent lamps adapted for motor-cars and the like vehicles and other purposes." F. von Madaler. November 14th.

25,328. "Process and means for pressing an intensifying screen against a photographic plate in X-ray apparatus." W. Otto. November 14th. (Complete.)

25,331. "Electric lighting of vehicles." Compagnie Internationale d'Electricite. (Addition to 21,364 of 1911. Convention date, February 1st, 1911, Germany.) November 14th. (Complete).

25,344. "Pole-changer for use in connection with electrical systems of railway signalling." J. P. O'Donnell and British Pneumatic Railway Signal Co., Ltd. (Divided application on 2,887 of 1911, February 4th.) November 14th.

25,345. "Electrically-actuated and controlled apparatus for operating railway semaphore signals." J. P. O'Donnell and British Pneumatic Railway Signal Co., Ltd. (Divided application No. 2,887/1911, February 4th. November 14th.

25,355. "Electric signals." A. C. Brown. November 14th.

25,364. "Overhead systems for transmitting electricity." J. Paul. (Addition to No. 28,687/1910. Convention date, November 29th, 1910, France.) November 14th. (Complete.)

25,369. "Process for the magnetic preparation or oiling of ores or the like, and in apparatus therefor." Murex Magnetic Co., Ltd., and A. A. Lockwood. November 14th. (Complete.)

25,377. "Couplings for electric mains or wires on railway passenger coaches and other vehicles." J. Stone & Co., Ltd., and A. H. Darker. November 14th.

25,391. "Sparking plugs." H. Powell. November 15th.

25,416. "Miners' electric safety lamps." H. F. Atherton. November 15th. (Complete.)

25,432. "Conduit box for electric switches, wall connections, cut-outs and other purposes." E. H. Fennemore. November 15th.

25,446 "Electrical alarm apparatus for cash boxes, jewel boxes and like receptacles." G. Downing (trading Henry & Co.) and P. S. Moulton. November 15th. (Complete.)

25,459. "Electrically driven planing machines and similar reciprocating tools." Vickers, Ltd., and A. D. Williamson. November 15th.

25,477. "Electrode in the form of a woven fabric for utilising the heating effect and other properties of the electric current." G. Jahr. (Convention date, November 15th, 1910, Germany.) November 15th. (Complete.)

25,488. "Magnetic tachometers." W. P. Thompson. (Akt.-Ges. Mix and Genest Telephon und Telegraphenwerke, Germany.) November 15th. (Complete.)

25,489. "Electrical means for producing sound." W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon und Telegraphenwerke, Germany.) November 15th. (Complete.)

25,490. "Method for securing the diaphragms in microphone, telephone, gramophone cases and like sound-reproducing apparatus." W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon und Telegraphenwerke, Germany.) November 15th. (Complete.)

25,491. "Method for securing the diaphragm in the cases of microphones, telephones, gramophones and like sound-reproducing apparatus." W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon und Telegraphenwerke, Germany.) November 15th. (Complete.)

25,517. "Electric-power timber band-saw machines." G. Pickles. November 16th.

25,518. "Footsteps for telegraph posts or poles and other like posts or poles." Bullers, Ltd., and J. W. Jones. November 16th.

25,528. "Portable miners' electric lemp." T. Woods. November 16th.

25,529. "Circular accumulator or storage battery." A. L. Gladwell. November 16th.

25,558. "Electrical signalling devices." C. E. Mayer. November 16th.

25,562. "Infantry field telephone heel plate earth connection." E. N. F. Hitchins. November 16th.

25,564. "Lampholders and other electrical connectors." W. J. Badman and F. Keeping. November 16th.

25,580. "Electrolysis of fused salts and anodes therefor." E. A. Ashcroft. November 16th.

25,586. "Regulating devices for three-phase current arc lamps." A. Heimann and W. Schaffer. (Convention date, November 17th, 1910, Germany.) November 16th. (Complete.)

25,616. "Electrical magnetic switch." G. Nixey, jun., and L. Martin. November 17th.

25,649. "Ornamenting incandescent electric lamps." Mc I. J. D. Carter. November 17th.

25,669. "Dynamo-electric generators and motors." H. K. Whitehorn. November 17th.

25,672. "Insulation of electrical conductors, coils or the like." Specialfabrik fur Aluminium-Spulen und Leitungen G m.b.H. (Convention date, November 21st, 1910, Germany.) November 17th.

25,683. "Method and apparatus for localising faults in cables and circuits." J. H. J. A. Stephenson. (Convention date, November 17th, 1910, Germany.) November 17th. (Complete.)

25,707. "Secondary batteries or accumulators." W. Clark. (V. de Karavodine, France.) November 17th.

25,718. "Improvements in wireless telephony, applicable also to wireless telegraphy." H. G. Matthews. November 17th.

25,743. "Electrical switch gear." B. Thomas and E. Thomas. November 18th.

25,756. "Electric light fittings for attachment to musical instruments and music holders." P. R. J. Willis. (J. G. Mackenzie, Canada.) November 18th.

25,776. "Safety devices for electrical installations." W. Dierman. (Convention date, August 22nd, 1911, France.) November 18th. (Complete.)

25,785. "Conversion of single-phase into polyphase alternating currents." J. K. Catterson-Smith. November 18th.

25,797. "Electromagnetic device for moving points to be operated from moving vehicles." R. D. Hunt. November 18th.

25,813. "High efficiency electric incandescent lemp and holder." J. S. Banajee. November 18th.

25,814. "Electric dynamo and alternator and current distributing systems." J. S. Banajee. November 18th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Cooling of Dynamos and the like. G. H. Fawcus. 25,036. October 28th. (April 28th, 1911.)

Automatic Telephone Systems. W. Wanisch. 25,243. October 31st.

Method of and the Means for the Electric Lighting of Pictures, Works of Art and the like. S. W. Maddick. 25,371. November 1st.

Ceiling Roses and like Electrical Fittings. E. I. Parkes. 25,478. November 2nd.

Variable-Speed Self-Regulating Dynamo-Electric Machines. C. A. Vandervell and H. H. Midgley. 25,588. November 3rd. (Applications Nos. 29,493 of 1910 and 2,158 of 1911.)

Electric Horns. G. E. Tate. 25,858. November 7th.

Electrically-Driven Drilling Apparatus. Justice, P. N. (Soc. Anon. Electricité et Electro-Mecanique.) 27,701. November 28th.

Construction of Rotary Electric Switch specially applicable for Controlling the Electric Lamps of Motor-Cars. A. A. Price. 28,501. December 7th.

Suspension Apparatus for Electric Arc Lamps and other purposes. H. Smithson and Sharpe. 29,314. December 16th.

1911.

Method for Reducing the Loss of Energy in Lines with Variable Electromagnetic Equalising. F. A. Becker. 65. January 2nd. (January 4th, 1910.)

Galvanic Socks. A. W. Boston. 233. January 4th.

Joint for Earthenware or Stoneware Trouching for Electric Cables and the like. R. Shuttleworth. 2,765. February 3rd.

Means for Supporting Electric Incandescent Lamps and other Articles. G. A. Phillips and H. M. Phillips. 3,526. February 11th.

Electric Motors. W. R. Macdonald. 4,286. February 20th.

Automatic or Semi-Automatic Telephone Exchange Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 7,852. March 29th.

Magnetic Speed-Indicators and the like. W. K. Menns. 9,575. April 19th.

Method of Producing Disk-like Electric Flaming Arcs for Carrying Out Gas Reactions. Electrochemische Werke Ges. and Rothe. 13,335. June 2nd. (July 8th, 1910.)

Systems of Electric Lighting. S. W. Rushmore. 14,478. June 19th.

Process for the Electrolytic Production of Ammonium Nitrate from Hydrated Nitric Acid. Elektrochemische Werke Ges. 16,426. July 17th. (July 16th, 1910.)

Electric Plug Couplings. F. Clapham. 16,935. July 24th.

Flexible Electric Conductors. E. V. Cheese. 17,387. July 31st.

Arc Lamp Electrodes. British Thomson-Houston Co. (General Electric Co.) 17,723. August 3rd.

Siberian Trade.—Our contemporary, *The Engineer*, is calling attention to the mistake British engineers are making in neglecting Siberia. "All reports appear to indicate that our hold over that country is getting worse and worse, whilst our most active trade rivals, America and Germany, are leaving no effort untried which may improve their position. . . . It is sufficiently obvious from the energy with which others are exploiting the market that it is worth making an effort to recover at least some of the ground we have lost. An exceptional opportunity offers itself at present, for the present Governor-General of the Pri-Amur is much more progressive than his predecessors, and appears to be making efforts . . . . to encourage commercial and industrial progress. Indeed, it is clear that a new policy has been awakened, and that the great natural resources of Eastern Siberia are to be developed. Railways and shipping are being encouraged, whilst public works are projected, and inducements are being held out to agriculturists to settle in the district. All this means an increase of the very market that Britain can supply, and it will be a matter for supreme regret if she allows the opportunity to escape her. Her indifference to the Omsk Exhibition has already been the subject of comment in these columns; we hope to have a different tale to tell of the Khabarovsk Exhibition of 1913. If more glory is to be got from the great popular exhibitions of Europe and American, more solid value is to be won at such exhibitions as Omsk and Khabarovsk, which, being in a more or less inaccessible part of the world, appeal less to the general public, and are therefore more thoroughly devoted to the object of encouraging trade." Our contemporary suggests that the Board of Trade should pay particular attention to the Exhibition in question, and endeavour to encourage British manufacturers to take a more active interest in a country full of possibilities.

Charge Dismissed.—Frank Woods, electrician, 1A, Lee Crescent, Portobello, was charged at the Dunfermline Police Court last week, with having stolen, from the Townhill Colliery, 90 lb. of copper wire and 17 lb. of rubber insulation. Woods stated that he had been employed by the Admiralty and on the *Mauretania* and *Lusitania*, and it was contended for the defence that it was a custom of the trade that electricians got the clippings as a perquisite. The Magistrate dismissed accused with an admonition, remarking that he was willing to believe that Woods was under the impression he had a right to do what he had done. At a later sitting of the Court, a dealer who had purchased the material, claiming he had paid the full price, applied for its restoration to him. The Magistrate, however, pointed out that he had made an order for the return of the goods to the colliery owners.

THE

ELECTRICAL REVIEW.

VOL. LXIX. DECEMBER 8, 1911. No. 1,776.

ELECTRICAL REVIEW.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ELECTRICITY AND FIRE-DAMP.

THE New Coal Mines Bill now before Parliament reached the report stage on Friday, the 24th ult., when the now notorious clause suggested by Sir A. Markham when in Committee—that no electricity should be used in any mine, or part of a mine, where ½ per cent. of fire-damp was present—was discussed, and, we are glad to say, on the motion of the hon. baronet himself, amended. It is true the discussion was mainly one-sided, and by gentlemen both honourable and worthy, we admit, but the speakers had little or no knowledge of coal mining, and very much less of the nature or application of electricity. We say one-sided because throughout the whole of the discussion on this question, both in Committee and in the House of Commons, the dominant note has been the thunder of Sir A. Markham, who seems to have terrified the Government into meeting his views on this point, and it is, without doubt, representations from the coal trade that have influenced the hon. baronet to alter his ½ per cent. to 1¼ per cent.

The discussion was opened by Mr. Newman, who moved (see *Times*, November 25th) to omit Sub-sec. 2, Clause 59, which provides that "if in any place of a mine or part of a ventilating district of a mine the amount of inflammable gas in the air currents exceeds ½ per cent., the use of electricity *shall be at once discontinued until* the air current is clear of the gas, or the amount shall not exceed ½ per cent." The italics are ours and we shall refer to these later on. Mr. Newman contended that in "providing for the safety of the miners they ought not to forget other interests," which, to say the least, was very unhappily expressed, as the Mines Bill is designed exclusively for the greater safety of workmen in mines, and quite rightly no other interests can possibly be considered; the electrical engineering industry would be the last to suggest that their interests be considered when dealing with such an important question as the safety of the workmen. Mr. Gordon, who seconded the amendment, was equally unhappy in his statement to the effect that "he had received a representation from men employed in an electrical establishment in his constituency which paid £10,000 in wages, that this sub-section would be destructive to their interests." We, in fact, are sincerely sorry that any such representations were made, as however unintentional it may have been, they betray a thoughtlessness that is not consistent with the electrical industry. Had representations been made to the effect that the clause was based upon mismanagement and cheeseparing on the part of colliery managers and owners; cutting prices and bad workmanship on the part of contractors; and very much exaggerated fear on the part of the workmen, they would have been much nearer the mark, and the two members of Parliament might have had sufficient information placed at their disposal. This, backed up by examples of accidents taken from the reports of H.M. Inspectors of Mines, together with a few instances of where electricity has been the means of cheapening the production, increasing the wages, and lessening the more arduous labour of the miner,

would have enabled them to completely rout Sir Arthur and give the Government a very hard nut to crack. As it was they played directly into the hands of the hon. baronet and provided him with capital to further his own view, and eventually the amendment was withdrawn. At the same time, however, we must give credit to Messrs. Newman and Gordon for their kindly intentions, which would undoubtedly have been productive of better results had they been more conversant with the subject they had in hand.

In opposing the amendment, Sir A. Markham said "any man who took electricity into a mine where more than 1¼ per cent. of gas was present was mad." A few weeks ago it was ½ per cent. What, we wonder, has induced Sir Arthur to alter his opinion? He also said "there was no such thing as a *gas-tight* motor, but there were *flame-tight motors* in which, although an explosion might take place in a motor, *it was not communicated to the outside atmosphere.*" Well, what more is required? It has never been suggested—so far as we are aware—that an explosion in a mine could be initiated by anything else than *flame*, and if the motor can be made flame-proof, *in case* an accident should cause an explosion in the interior, which, we believe, is so far absolutely unknown to have occurred, why should anyone hesitate about taking electricity into a gassy mine? Another statement by the hon. baronet was that "Every Inspector of Mines regarded the advent of electricity into mines with the greatest alarm, and that alarm was shared by the miners." With the latter we agree, but we do not agree that they are competent to form an opinion, and in proof of our assertion, we may mention that, during the previous day's discussion, there was considerable bickering—in which the hon. baronet took a prominent part—because the miners objected to the use of safety lamps being made compulsory. On this point, we may mention what we believe to be a fact—that the men originally objected to electricity in the pit not so much because they looked upon electricity as something to be afraid of, but as an excuse to get naked lights introduced in place of safety lamps. They said, as electric motors which emit sparks—the first electro-motors in mines undoubtedly did spark—are allowed down the pit, why should we be obliged to work with safety lamps? Hence, we think we are justified in our statement—and we think Sir A. Markham, in his heart, will agree with us—that the men are not competent to judge; and as regards the opinions of the inspectors, their alarm is more apparent than real, and their objections are more academic than practical.

Sir Arthur, however, had the support of the Government, and in spite of one or two very reasonable suggestions and opinions put forward that the best thing to do would be to omit the sub-section and deal with the matter by regulation, the amendment, as already mentioned, was withdrawn, and Sir Arthur Markham's amendment to substitute 1¼ per cent. in place of ½ per cent. was adopted, and with this alteration the clause is embodied in the Bill.

As to the danger of electricity igniting fire-damp, we have on many occasions pointed out that with reasonable precautions and competent supervision the risk of personal accident is very remote, and the risk of igniting fire-damp practically infinitesimal. Not a scrap of evidence can be adduced—except in the wilfully-perverted minds of the miners' representatives and others who want to believe—that electricity caused either the West Stanley or the Hulton colliery disasters, and not a single accident due to electricity, either personal, fire, or ignition of fire-damp, has yet occurred which could be taken as an example to prove the opposite. The most dangerous instrument in the pit to-day is the ordinary oil safety lamp, and this danger would be removed if electric safety lamps were introduced. It is just as reasonable to enact that no timber shall be drawn in the "face" because it might result in an accident, as it is to debar the use of electricity for the same reason. Electricity has proved to be the most useful agent ever placed at the disposal of the miner, and we have little doubt that its usefulness will become more and more recognised; as time proves that with first-class plant and competent supervision accidents can be avoided, the present panic fear will pass away, and eventually all hampering restrictions will be removed.

We are in some doubt as to the correct interpretation of the clause as it stands, but there is no doubt whatever that the intention of Sir Arthur Markham was to prohibit absolutely the use of any electrical plant in any mine, or part of a mine, where the percentage of gas exceeded 1¼ per cent. If this is the correct interpretation it will involve very considerable hardship upon many colliery owners, as they will—unless it is possible so to arrange the ventilation that the gas is always diluted to this quantity—be obliged to pull out their present plant. On the other hand, turning to our italics, the clause reads, "The use of electricity shall at once be discontinued until the air current is clear," and if we may substitute for "the use of electricity," "the working of electrical machinery," and for "discontinued" the word "stopped," the clause becomes "the working of electrical machinery shall be at once stopped (and the men withdrawn) until the air-current is clear of the gas," &c., which makes it much more reasonable, and one which, in conjunction with the words regarding the withdrawal of the workmen, few people would cavil at. Under the proposed new electricity rules the use of electricity is to be "prohibited in any part of a mine where on account of the risk of explosion of gas or coal dust such use would be dangerous to life." Judgment on this point is left to the inspector, and any difference of opinion between inspector and owner is to be settled by arbitration.

It is, however, interesting to refer back to the report of the Departmental Committee who drafted the proposed new Rules and note what they say with regard to this question. They say:—"The Committee know of *no place below ground* in which electricity is in use to-day where both kinds of accident (viz., risk of ignition of explosive gas, &c., and risk of electric shock) *would not be avoided* if the best present-day practice as regards construction and maintenance were complied with," and further on the Committee practically apologise for the prohibition rule when they say:—"The existing rules do not prohibit the use of electricity in any part of a mine, whatever the working conditions may be, but as it *is difficult absolutely to ensure continuous and universal compliance* with the best present-day practice, the Committee are of the opinion that there are parts of some mines from which electricity should be excluded. The daily or frequent occurrence of inflammable gas in *any place in quantity detectable by the ordinary safety lamp* in use at the mine would make that place one to which prohibition should apply." Here the Committee think electricity ought to be excluded, not because in itself it is dangerous, but because the danger lies in carelessness in installation and management, as we have so often contented. Further, it will be noticed, the word "quantity" is very indefinite, and the question is left for settlement between inspector and manager. Now, however, this quantity is definitely fixed, and, reading the two rules together, we have the actual prohibition of electrical machinery in any part of a mine where "the daily or frequent occurrence of inflammable gas exceeds 1¼ per cent."

In face of this we are afraid electricity will receive a severe set-back, as far as the present development in coal mines is concerned, but we are also confident that it can be only for a time, as electricity is too useful and too economical in power transmission to be dispensed with, and even yet there may be embodied in the Bill a clause giving the Home Office authority to make new regulations, or to remove old restrictions if these bear hardly on the industry or even on individuals. But in spite of all opposition and ill-advised mischievous legislation, we are convinced that the development of electricity in mines will continue to progress, and it is to the advantage of the miner himself no less than to the owner and the community at large that this should be so.

THE INDUSTRIAL SITUATION.

The trend of events in the industrial world during the year now rapidly drawing to a close has belied the optimistic forecasts made during the earlier months.

It was confidently anticipated that after the years of depression, industrial conflict and unrest through which not

only we, but other countries had passed, the tide had, at last, turned, bringing with it the promise of a period of prosperity, industrial content, and commercial peace.

There were, however, not lacking those whose past experience caused them to fear that as soon as the wheels of trade tended to accelerate, the demands of labour would act as a dynamic brake and counteract the forward tendency. But the most pessimistic among them scarcely anticipated that the brake would so nearly bring the machine to a standstill as recent events have proved.

We need not here refer in detail to the labour disputes which have arisen during the year in various sections of our national industry, not only in manufactures such as the cotton spinning, coal and iron trades, but also in those trades concerned with electrical distribution and passenger transport, for the outstanding feature which almost brought the industrial machine to a standstill, viz., the great railway strike, has overshadowed everything else, and the shadow has not yet entirely passed away.

One very disquieting feature of the situation at present is the lack of authority on the part of the recognised leaders of labour. Whilst capital and labour are divided, as at present they are, into two hostile camps, it is an essential to the success of any negotiations between the two rival forces that the leaders should be able to count on the loyalty of the rank and file of their followers. Unfortunately this loyalty does not exist.

In addressing the shareholders of Richardsons, Westgarth and Co., Lord Furness said that the responsible leaders of the workmen had not only lost authority, but that "they lack sagacity and wisdom; and from one cause and another—perhaps because they have given more attention to politics than to business—their strength has departed, their power has been dissipated, and the clamour of inexperience and irresponsibility overwhelms everywhere the dictates of common sense." Proceeding, he said, "The need of the moment is a leader of labour—a man of the acutest insight, of wide and clear vision, and of cool judgment. Failing the speedy appearance of such a man, one can look forward to the future only in the spirit of the gloomiest anticipation."

Referring to strikes and their effect, Lord Furness pointed out that in connection with the shipyards controlled by Richardsons, Westgarth & Co., 30 per cent. of the 52 working weeks during this year had been affected by strikes, whilst holidays, sickness and miscellaneous lost time. accounted for another 10 per cent. During the whole of this disturbed or ineffective period—40 per cent. of the entire year—the establishment charges went on as usual. "The imperative necessity of keeping abreast of the times, technically, commercially and industrially, brings the establishment costs of an engineering business to a higher point every year. Development is so continuous and so rapid as to demand the services of a highly-trained technical staff that cannot in wisdom be disbanded during temporary slackness or a temporary cessation of work from any cause, whilst on the commercial side, those modern conditions which render necessary a large and expensive selling organisation at all times, make such an organisation imperative when orders are scarce, if any proper share of available work is to be secured."

It is obvious that these necessary and continuous expenses, which must form a serious burden to an industry during the best of times, must press with exceptional severity during times of slackness or enforced stoppage of work, and under these conditions may quite easily turn what might have been a profit into a certain loss. Unless, then, some marked change in the relationship of capital and labour can be brought about, by which a continuity of work shall be assured, it is not to be expected that men who have money to invest will risk it in enterprises which are at present so full of strife and uncertainty. To quote again from Lord Furness's address: "We are approaching the point when capital will refuse to respond, in adequate measure, to the ever increasing demands of progressive manufacture, and at that point decadence begins."

There is, however, another factor to consider when discussing the apparent decline in the prosperity of the engineering industry, and that is the lack of co-operation among engineering manufacturers—a want which tends more and more to a state of ruinous beggar-my-neighbour competition. Whilst this state of things lasts there is bound to be labour trouble. When orders for engines, turbines or electrical machinery are secured simply by cutting down the price in order to undersell some other manufacturer, and when the buying departments of these competing firms find themselves up against the combinations of merchants or manufacturers of the raw material necessary for the production of the machinery, who decline to imitate this insane policy, and insist on a fair and reasonable price for their goods, it is obvious that, if the cost of material and standing charges cannot be reduced, someone or other has got to suffer for it.

If, under these circumstances, labour strikes against a reduction of wages, what is the shareholder to do? He can only strike by declining to invest any more money in such a profitless industry; and without the shareholder—who is the hated capitalist—business will very soon come to a standstill.

Work and Wages.

A striking lesson in political economy was inculcated only the other day in the Court of Appeal—*apropos* the coal trade. It is a principle, however, which applies with equal force to any industry. It came out in the course of a case under the Workmen's Compensation Act, 1906, that the general effect of the Miners' Eight Hours Act had been to lower wages throughout the Welsh coalfield. No doubt the colliers who loudly acclaimed the measure when it first became law had been taught to believe that they would get the same wages for eight hours' work as they formerly received for nine; but notwithstanding the boasted strength of the trade unions this belief has been utterly falsified How long will it take to teach the proletariat that an advance in wages or its equivalent—a reduction in working hours—cannot be secured unless a number of conditions are fulfilled? As Mr. Cairns wrote in his "Principles of Political Economy": "An advance in wages may be effected in certain departments of industry by the action of trade unions where this is accompanied by an equivalent fall in others; and supposing the workmen in such departments of the industry had it in their power to exclude the competition of outsiders, it is quite possible that an advance of wages so effected might be permanently maintained." Was it explained to the miners that they must "exclude the competition of outsiders" before they could hope to gain any permanent benefit? The lesson might be inculcated by comparing small things with great. Suppose the labourer who cleans up at a generating station were to claim an advance in wages. What would be the reply of his employers? "If we put up a notice in the window, there will be a hundred applicants for your job to-morrow. You must take the wages you are earning or else clear out." All the trade unions in the world cannot raise wages even in skilled employments above a certain market value. In this connection the address of Mr. T. Harding Churton to the Yorkshire Local Section of the I.E.E., of which we give an abstract on a later page, will be found of interest.

The I.E.E. Articles.

As will be seen elsewhere in our pages, the discussion of the proposed new Articles by the Local Sections, in the presence of the leading members of the Council, has been steadily carried on during the past fortnight. We cordially agree with Mr. Ferranti and other members of the Institution that, after all, the error of judgment on the part of the Council in the first instance is likely to prove in the end of

great advantage to the Institution, for never before in our experience has the whole body of members, down to the Students, displayed so keen and individual an interest in the welfare of the society. Doubtless the fact that the pocket is touched has been a material factor in arousing the members to action ; but as we have pointed out on previous occasions, the initial stimulus was certainly a feeling of irritation at the seemingly high-handed action of the Council. Frank acknowledgment of the mistake, and the ample amends which have followed, have gone far to dissipate that feeling, and the local conferences which have been held have been free from the "asperity," to use Mr. Trotter's apt expression, which characterised the first meeting.

While London is necessarily the headquarters of the profession, the centre of gravity of the industry is certainly nearer Lancashire, and without quoting the hackneyed proverb, we attach great weight to the views of the Manchester Local Section. As will be seen, the Committee of the Local Section very carefully deliberated upon the proposals and formulated a series of suggestions which bears witness to the earnestness and broad views with which the subject has been approached. The proceedings at the conference, conducted by the chairman, Mr. W. Cramp, were also most systematic and businesslike, comparing favourably with the procedure at some of the other centres.

The Manchester members gave their approval to the proposal to increase subscriptions, but qualified it with the recommendation that differentiation be introduced not only between London and provincial members, but also between those who are within range of a Local Section and those who are not. Mr. Pearce's suggestions regarding the mode of election of the Council were also useful. They embody a condition which we advocated in our issue of November 17th—namely, that the number of names on the ballot list shall always exceed the number of vacancies, so as to ensure that there must always be a real election, not a mere acquiescence on the part of the members. We do not suppose that a Council chosen by any of the systems of popular election which have been proposed would be one whit more efficient than the Councils of the past and present—that is not the point ; the one essential condition is that the members must feel that it is a Council of their own choice, and we are confident that when the revised version of the new Articles appears, it will be found to contain suitable provision to this end.

The Manchester Students also have taken vigorous action, which we feel sure will not be ignored by the Council, though the proposal to appoint Student Delegates to confer with the Council seems rather unnecessary. Surely the Committees of the Students' Sections can keep the Council fully informed as to the needs and wishes of their members. Amongst minor points not mentioned in our report was a request that the age limit for studentship (26 years) be reinserted. As we have already pointed out, this provision has never been cancelled—being now embodied in Article 17.

While there is at present no power to submit important questions to the members by a postal referendum, it would certainly seem advisable that some such provision should be made, for it is clearly a sore point with many of the provincial members that they are unable to vote on such matters without incurring the expense and inconvenience of the journey to headquarters.

The Council is still at a loss for a name for the class of "Licentiate," that title having clearly been condemned on all hands. We once more urge the claims of "Junior Member" for the class in question ; it adequately describes the member, is incapable of abuse, and offers no inducement to its owner to "stick" in the class—while at the same time there is nothing objectionable in the title. It should, of course, not be used in any abbreviated form, for it expressly implies not the possession of technical qualifications, but the reverse, the class being primarily intended as a half-way house between Student and Associate Member.

The term "Graduate," which essentially implies that the owner has completed a course of instruction and has qualified for a degree, is obviously and entirely inapplicable to a class of members whose distinctive feature is the fact that they have *not* attained that position ; "undergraduate" would be a less misleading description, but neither term is appropriate when removed from its academic associations.

The London Electric Supply Act.

The proceedings of the L.C.C. during the past week or two have been of more than ordinary interest, in view of the attention directed to the position created by the London Electric Supply Act, 1908.

This Act, it may be remembered, facilitated the making of agreements for mutual assistance between authorised undertakers within the Administrative County of London, and transferred to the Council the power of purchasing the company-owned supply undertakings in London in 1931, or at subsequent dates.

So far as actual results are concerned, the permissive powers of this Act have for the most part been ignored, and it is high time that the County Council, if, indeed, it has any intention of exercising its future powers of purchase, and thus becoming the principal authority for electricity supply, should go thoroughly into the whole question of the means to be employed, and obtain financial security and unity of purpose in the future.

While we quite appreciate the businesslike policy which has been adopted by some of the supply authorities in London, even the best of them cannot under existing conditions be expected to look beyond their own boundaries—in fact, there is no obligation on them to do so.

For this very good reason we trust that the Council will make full inquiry into the existing conditions of electricity supply, and that the difficulties, real and imaginary, which stand in the way of anything like concerted effort on the part of the various authorities, will be fully discussed.

We very much doubt whether any coercion which the Council may be able to exercise will appreciably help towards the great end in view—an end, which in our view, would mark the real beginning of commercial electricity supply in London.

The A.E.G. General Meeting.

The general meeting of the A.E.G. in Berlin, on November 21st, was the first occasion in recent years, if not in the history of the company, when any information has been officially given concerning the profits realised on the sale of securities, and the proportion of such profits devoted to depreciation of machinery and plant other than the comparatively small sum actually shown in the annual accounts. In reply to questions, Herr Rathenau stated that including the balance brought forward from 1909-10, the security account yielded £456,000, the syndicate account £66,300, and interest £61,700, making a total of £584,000. This sum was disposed of by placing £334,000 to the depreciation account and carrying forward the balance of £250,000. Referring to the turnover in 1910-11, which was not specified in the annual report, the speaker remarked that the reason the figures were not given was not because they were specially low, but because they were extraordinarily high, and might lead to erroneous conclusions, and unfavourable comparisons next year. The works were now employed to the maximum of their capacity, and a large increase could only be expected when the extensions in progress were completed. Subject to this reservation, it was mentioned that the value of the total turnover at the chief works and branches amounted to £15,300,000 in 1910-11, as compared with £12,600,000 in the preceding year, whilst the orders on hand on September 30th, 1911, reached £18,100,000, as contrasted with £13,500.000 on the corresponding date in 1910. It was added that the augmentation in the turnover should not lead to unjustified expectations in reference to future financial results, as the profits were not according to the volume of business, but were largely determined by selling prices. The latter exhibited a tendency towards a slight improvement, although they could not be regarded as satisfactory.

THE NEW WORKS OF THE FOSTER ENGINEERING CO., LTD.

The development of the Foster Engineering Co. from a small private firm to a prosperous limited company with a flourishing manufacturing business, in the course of a comparatively short period, is a striking illustration of what can be done even in this country, in the face of keen competition, by dint of unflagging industry and good management on sound business lines. It is by no means a unique instance, however, of the fact that a small undertaking, in which the directors are personally engaged, and over which they maintain direct supervision, may be conducted with very great efficiency and economy, and may thus be enabled to compete with large establishments in which it is impossible for the directors to fulfil the functions of management and supervision without delegating a large part of their duties to others, with the result that, unless highly competent and conscientious managers are employed, various forms of loss are inevitably incurred.

Eight years ago we paid a visit to the works of Messrs. Foster & Co. at Worple Road, Wimbledon, to inspect the now well-known hot-wire lamp which was patented in 1901, and which has since been manufactured and sold in great numbers—being largely used, for instance, by the Post Office on A.C. circuits at the present time. The lamp was described in our issue of July 31st, 1903. Since that date continual progress has been made, and the firm have successively taken up the manufacture of various patterns of open, enclosed and flame arc lamps, transformers, and metallic-filament lamps.

The business was converted into a limited liability company in July, 1907, under the title of "Foster Arc Lamp and Engineering Co., Ltd." A notable event took place last year, when the business of the Brockie-Pell Arc Lamp Co. was acquired, and the manufacture of the lamp associated with that name—one of the oldest, most reliable, and most widely known types of arc lamp ever put on the market—was vigorously undertaken, the name of the company being at the same time changed to "Foster Engineering Co., Ltd."

These various developments — especially the growth of the metallic-filament lamp business —naturally entailed expansion of the manufacturing facilities, and in August last year a new building erected by the company at



Portion of Metal Lamp Pump Room.



Lamp Sealing Department.



Machine Shop.



Coil Winding Shop.



Arc Lamp Assembling.

The Foster Engineering Co.'s Works, Wimbledon.

D

Morden Road, Wimbledon, was occupied, the whole of the works and offices being transferred to that site. The new factory is of one storey throughout, and has been designed on the most modern lines, ensuring ample lighting, ventilation and accessibility. The site is 3½ acres in area, of which 1 acre has been covered with buildings; but when we visited the works some time ago, the need for further extensions had already been felt, and two new bays were under construction. We are informed that even now there is insufficient accommodation to meet the growing demand for the products of the works, in which 300 hands are employed.

We give herewith a few illustrations of the interior of the new works, showing some of the departments. Perhaps the most important of these is the metal-filament lamp factory, which at present has a capacity of about one million lamps per annum. All the plant used in connection with this factory is made in the company's own workshops, and we believe other lampmakers have come to the Foster Co. for certain appliances. The pumping apparatus, which in a tungsten lamp factory is of even greater importance than in a carbon lamp works, is of the most up-to-date design. A feature of the "Foster" metallic-filament lamp, to which special attention has been given, is the strength of the filament, and we understand that in this respect the lamp has proved exceptionally satisfactory.

Searching tests are applied at every stage of the manufacture of the lamp, and during the exhaustion of the bulb the lamp itself is kept in a state of vibration, so as to ensure that only the fittest shall survive. After the lamp has been pumped, sealed and rated, it is put on a two-hour test, and after completion it is again tested before being wrapped up. A special method of packing is also employed, which has proved effective in reducing the percentage of breakages in transit to a trifling amount, although a large proportion of the lamps are exported to China, Australasia and South America.

On the introduction of the low-voltage tungsten lamp, the company took up with energy the manufacture of auto-transformers, making it a speciality. Contrary to what might be supposed, in view of the development of the high-voltage lamps of small candle-power, the sale of these auto-transformers is still increasing, and they are at present being turned out by the company at the rate of no less than 12,000 a year. Quite recently the design has been materially improved, and the price reduced, the no-load losses being brought down, for instance, to 10 watts in the case of a 1,000-watt 200-25-volt transformer, and 5 watts in the case of a 250-watt transformer for the same ratio. The coils are fireproofed by a special process, and carry heavy overloads for long periods quite safely. These are, perhaps, the best-known of the Foster manufactures. Large transformers are also made, and the company is making a special feature of their manufacture in all types and sizes.

The arc lamp department is capable of an output of 300 lamps a week, and facilities are provided for testing lamps and other apparatus at the actual voltage and frequency on which they will be run. Besides over 300 corporations in the United Kingdom which use the Foster arc lamps and transformers, many of the principal railway companies, the Post Office and the Admiralty are customers of the company. The "Q" flame arc lamp, which we described some two years ago, is noteworthy for its long burning hours, due to the use of a special multiple carbon patented by the company, with low carbon cost.

Having an extensive equipment of modern tools, the company also undertakes general mechanical engineering work.

It will be seen that in the course of its development the company has extended its interests in various directions, and apparently with invariable success, a continuance of which, we trust, will attend its further operations.

THE UTILISATION OF CRUDE PETROLEUM FOR ELECTRIC POWER PRODUCTION.

There have been numerous attempts, some of them very successful, to utilise crude petroleum as a means of obtaining mechanical and electric power, but for the most part the energies of inventors have been directed towards the direct use of the crude oil in special forms of gas or oil-vapour engines. Another department of activity in which considerable progress has been made, however, is that involving the previous gasification of the crude oil in some form of producer, the gas then being drawn to a gas engine adapted to the requirements of the fuel supplied. The problem of making producer gas from crude petroleum, comparable with that obtained from coal, and especially adapted, by automatic control of both quantity and quality, for use in gas engines, has been exceedingly difficult of solution, but is of great interest to engineers on account of the important reduction in cost of power to be thereby obtained. This problem has now apparently been solved, and it is our purpose to describe an important equipment installed by the International Amet Gas Power Co., of Los Angeles, California, in the electric power house of the Holton Power Co., at El Centro, California.

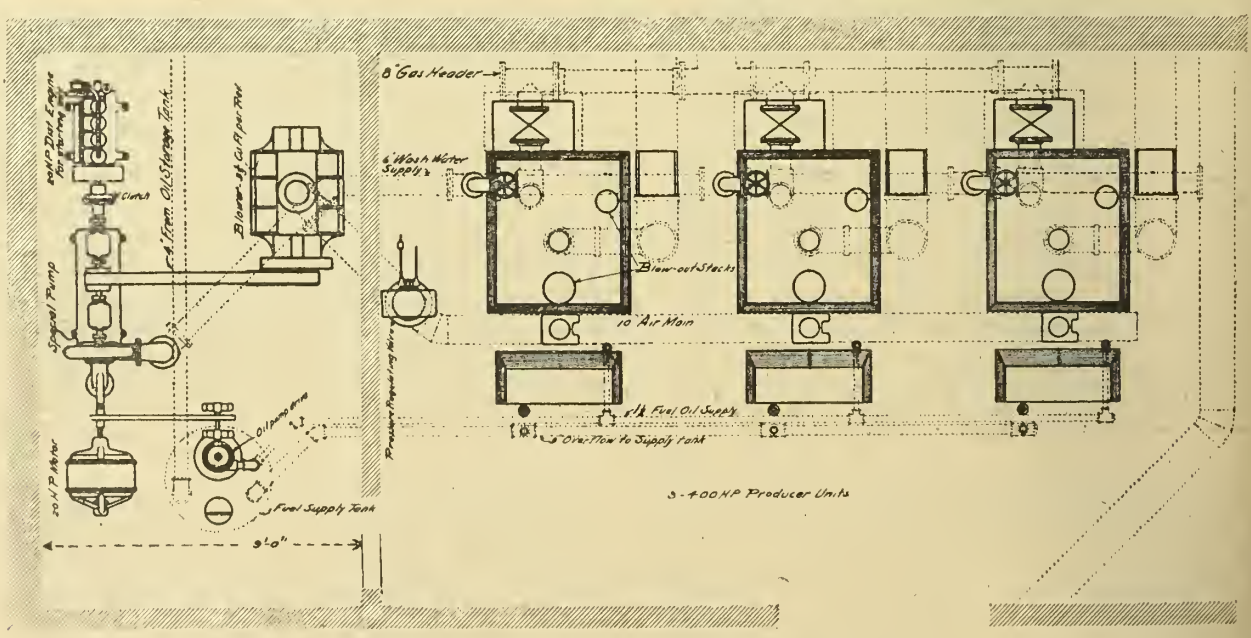


Fig. 1.—Lay-out of Oil-Gas Producer Plant.

The Western States of America yield an oil having an asphaltum base, which has not been heretofore successfully volatilised for direct use in the gas engine, as a temperature sufficiently high to distil the usable vapour has carried asphaltum fumes into the cylinder, where they "carbonise" on the surfaces and piston rings, causing scoring of the walls, so that the cylinder must be frequently rebored.

Distillates such as gasoline and kerosene, which are free from asphaltum, have, therefore, been the only available fuels for direct engine use, and the consequent enormously extensive introduction of the distillate engine, notwithstanding its high cost of operation, is well known. The successful gasification of crude oil results in putting that material on a practical parity with distillate in the production of power, with the resulting saving of the large difference in cost, which is approximately 75 per cent. It also makes possible a saving in fuel cost over steam plants of approximately 50 per cent. The thermodynamic efficiency of the vapours from distillate, gasoline, &c., in a gas engine is low, on account of their high explosiveness, which causes pre-ignition, thus limiting compression to so low a value that it requires about 20,000 B.TH.U. per brake H.P.-hr., while the slow burning producer gas will use only 9,000 or 10,000 B.TH.U. per brake H.P.-hr., or an increase of utility of 50 to 55 per cent. Up to within a very recent period the only gas produced from crude oil has been a gas having a value from 550 to 680 B.TH.U. per cb. ft., used for domestic lighting and cooking. This gas has been produced by the process known as the "cracking" of the crude oils, which is largely disruptive in effect, and frees a very large percentage of hydrogen and carbon, resulting in a gas carrying 50 per cent. and upwards of free hydrogen. This gas will give no higher efficiency in a gas engine than the distillate above referred to. The system to be described generates a gas that has more than 70 per cent. of its heat units in hydrocarbon gases, a small quantity of carbon monoxide and free hydrogen makes it possible to run the compression up to the limits of good engine construction, and as the economy of a plant is in a measure proportionate to the compression allowable, it is probable that this gas may result in the highest possible economy that may be obtained in a gas engine suitably designed. The most advantageous value of this gas is between 200 and 250 B.TH.U. per cb. ft., depending on the character of oil used. It may be adjusted, however, anywhere between 170 and 270 B.TH.U. The following analyses illustrate its character :—

B.TH.U.	267	225	210
CO_2	4·2	5·4	6·5
O	0·2	·3	·4
CO	8	8·6	7·8
$Cn\,H_{2n}$	2	4·2	4
CH_4	16·2	7	6·0
H	12	10	9·8
N	57·4	64·5	65·5

One of the greatest difficulties in the operation of oil-gas producers has been the control of the value of the gas for all conditions of load. In the producer to be described it is accomplished by automatic means by keeping the oil at a fixed temperature to maintain a constant viscosity, and providing for an absolutely proportionate quantity of oil to be carried along with whatever volume of air is forced into the producer. The proportions of air and oil are adjustable and under the control of the operator, but after any particular adjustment is made, the load can be varied from one-fourth to fifty per cent. over full capacity, and the value of the gas will remain constant for all practical purposes. The economies resulting from this system, when compared with distillate engines or steam power plants, are exceedingly interesting to the user of power for any purpose. Constant operation is practicable at loads ranging from 30 per cent. of full capacity to 50 per cent. over the normal rated capacity of the producer without serious change from the maximum economy. In the large units steam is introduced by automatic means to raise the economy and maintain the best operating conditions, with the result that the Amet-Ensign oil gas producer, in combination with the high-efficiency producer gas engine, has been found to develop very great economy. A number of operating runs have been made producing 8 B.H.P.-hrs. to the gallon, and further tests made on low-gravity oil from 12° to 16° Beaumé indicate that, under proper operation, as high as 10 to 12 H.P.-hrs. may be expected from a first-class well-designed engine combined with this producer. Tests have also been made with oils from which the gasoline and distillate have been removed, which proves that this form of fuel can be used to excellent advantage.

The illustration, fig. 1, shows the lay-out of the gas-producer equipment at El Centro, from the dimensions of which the great economy in space, as contrasted with a boiler-house design for the same power, will be apparent; producer plant of 1,200 H.P. divided over three units, and including producers, pipework and auxiliary apparatus such as blower, pumps and motors, is housed in a space of approximately 512 sq. ft. The oil is stored in a concrete tank, and is led as required to the producers by pipework. The producer, shown in fig. 2, is a very simple and distinctly unique apparatus

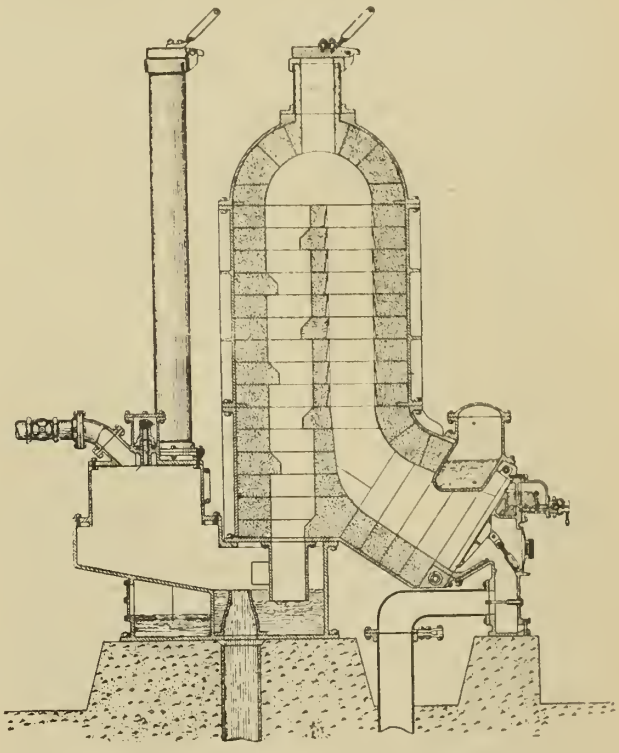


Fig. 2.—Section of Oil-Gas Producer.

for the conversion of the crude oil into gas. The operation consists of a sustained combustion carried on in a furnace of a peculiar and definite form of construction, the air and petroleum uniting in such a manner as just to distil the higher constituents of the petroleum away from the air, and consume the heavier constituents—such as asphaltum—to produce the heat for carrying on the process. This is all accomplished in an open combustion chamber free from baffles or checker work. An extension to the combustion chamber, called a combining chamber, is sinuous in form, so as entirely to mingle the vapours and the dissociated products of combustion for finishing the gas-making process, the passage for the gaseous products being perfectly clear, with air entering at the extreme lowest portion. This form of construction ensures an absence of clogging of the producer with deposits of carbon in any form that cannot be easily removed by the simple operation of shutting off the oil for very short periods of time, and allowing the air only to pass through the producer, this constituting what is known as a "burn-out." During this period the gas is furnished by a small gasholder. The duration of the burn-out is, at most, but 10 per cent. of the total time of the operation.

Thus, it may be seen that this producer is quite distinctive in its construction and operation. The washing apparatus is extremely simple, operated on the rotary or centrifugal principle at a moderate speed by the force of the applied wash water. Its simplicity permits operation for an indefinite period without attention or repairs, and prevents clogging or fouling in any manner. A pressure blower capable of furnishing air under 1 lb. pressure, in volume about equal to one-half the capacity of the producer, a centrifugal pump furnishing water under a pressure of 100 ft. head, a small geared oil pump, all driven from the main engine, and a gas holder of small capacity for equalising the gas pressure and automatically regulating the rate of make of gas to meet the demand, are installed. These auxiliaries require about 2½ per cent. of the capacity of the producers. All parts of the producer are readily accessible. The design and construction of the entire apparatus has proved to be

such that, with constant operation for four years on other similar installations, practically no repairs have been necessary, except the renewal of a few fire bricks, and in view of the fact that the plant shows no deterioration, the original efficiency will probably be maintained indefinitely. The depreciation on a plant of this character is, it is claimed, much less than that of a steam plant. The producer itself, being made of cast-iron, which is in the form of a case, holding brickwork, is subject to no wear and tear. The remainder of the plant will have the same wear and tear as would be expected of any plant for similar uses and purposes. In three years' operation there is no indication as to how long the brick will last.

From the gas holder the gas passes to a 700-KW. gas engine unit built by the Allis-Chalmers Co. This is of the twin-tandem type with cylinders 21 in. × 30 in., provided with a compressed-air starting device. The cylinders, exhaust valves, pistons, piston rods, and all parts coming into contact with the hot gases of explosion are water-cooled. The inlet valves allow of the separate control of both the gas and the air, the mixture being thus properly proportioned to meet the load. The valves are automatically operated and controlled by a centrifugal governor, belt-driven from the main shaft. Very close speed regulation is provided by a 15-ft. fly-wheel, weighing about 16½ tons, in order to operate the gas engine unit in parallel with both hydro-electric plant and steam plant. The gas engine drives by direct connection an Allis-Chalmers three-phase 60-cycle alternator running at 150 R.P.M., and developing 2,400 terminal volts. Owing to the relatively high hydrogen content of the oil gas, the Allis-Chalmers Co. are not carrying as high a compression as is used with gas produced from coal, and particular attention is being given to the proper water cooling of all the parts which come into direct contact with the hot gases. To this end specially designed water-cooled igniters are provided. Apart from this detail, there are no variations from their standard practice.

It will be seen that this installation opens up a very important field of development. In the producer gas engine, using either bituminous or anthracite coals, the washing problem has not always been solved to the very best advantage of the engine, resulting in the rapid wearing-out of valves, piston rings and cylinders, or a continual annoyance from sticking of the valves due to tar and other ingredients, causing frequent shut-downs and numerous repairs. With this producer process, experiments have been made allowing quite a perceptible amount of finely divided carbon, which is in the gas before washing, to pass the washer with absolutely no damage to the engines or interference with the operation. Naturally, from an oil fuel there are no ashes, and this process properly operated will produce absolutely no tar. Engines have been operating on this system for four years, and it is claimed that no pre-ignition has ever occurred, the compression in the engine cylinders running as high as 190 lb. Not a single valve has been reground, or piston ring renewed, or anything done in repair to the cylinder or pistons, and the compression is still maintained at its original value. The renewal of igniting points on the engine and general examination of working parts have up to the present been the only reasons for shutting down. One great advantage of this process and a further economy is the instantaneous operation from cold plant. In warm weather, or by artificially heating the oil in cold weather to 100° temperature, it is stated that a producer can be put into full operation under full power in a minute and a-half to two minutes, the time necessary to start the auxiliary apparatus. The operation of such plants is exceedingly simple. They will only require the intermittent attention of the attendant, so that one man may operate a power plant up to 300 H.P., and if sufficient care is taken in laying out the plant, one man may operate a 500-H.P. plant. In fact, a large plant with a number of units can be made almost automatic.

The actual attention required is regular and no more than is given to a similar installation with a steam boiler fired with oil. Any single producer requires attention for three minutes every half hour; for the balance of the time it will take care of itself much better than a steam boiler fired with oil, for it will absolutely follow the load, which a boiler cannot be expected to do. The gas has a heat value of from 180 to 270 B.TH.U. per cb. ft., and unlike other processes, there is a minimum of lampblack produced, and the gas is easily washed to any degree of freedom from such matter. The technical interest of this development is, therefore, not confined to California, but will be of value to electrical engineers wherever crude oil can be obtained at a cheaper price than steam coal.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

During last week's discussion at the I.E.E. one speaker said: "We stand as a learned society; as one of the scientific societies of the century." This is illuminating; one had not thought of the Institution in quite that light. However, it is evident that the reforming fever is in the air, and general opinion favours change.

From the discussion one learns that it is proposed: To establish five classes of membership; to admit legal and commercial persons of eminence connected with the industry to a special class: to institute an entrance examination; there are other questions, but the three foregoing have the widest interest. The first and second proposals are interdependent, as a class is to be reserved for non-engineers; but it is not clear that non-engineers will be satisfied with the provision made for them.

If it is really desirable that every person connected with the electrical industry should be a member of the I.E.E., the inducement to join must be considerable.

Assuming the five classes and the relative numbers and composition of each to be:—Fellows (engineers), 10; Members (engineers 30, non-engineers 10), 40; Associate Members (engineers), Associates and Students, 50, it would clearly be much to the advantage of every engineer, lawyer and commercial person interested in the electrical industry to become connected with the Institution—an Institution well-balanced and representative.

There does not appear to be any necessity for an entrance examination; already there is quite a large number of engineering examinations available, from London B.Sc., which should satisfy anyone, down to B. of T. "chief's," which, I am told, confers a variety of weird powers and benefits on the happy holder. At the same time, there is no reason why Associate-Membership should not be made a guarantee that a person is a "duly qualified engineer." If an entrance examination is instituted it will be at least 10 or 15 years before this effect can be produced. If, on the other hand, all Associate Members, not engineers, were transferred to the Associate class and all future candidates required to submit a detailed statement of experiences, give references and be interviewed by a Selection Committee, membership of this class would almost immediately be accepted as due qualification.

With all the opinions provided by Press and local centre discussions before them, the Council will be in a position to formulate a scheme of revision that will place the Institution on a sound basis and thus confer lasting benefit on the electrical industry.

J. F. D. Hale.

Liverpool. *November 28th*, 1911.

Perhaps you will allow me space in your valuable paper to express an opinion upon the new Articles of the I.E.E. As a sales engineer and manager and one considering the question of making application to the I.E.E. for membership, I have followed with interest the accounts printed of the various discussions and views expressed. Possibly I may not be entitled to offer any opinion at the present time, but I venture to think that there are many men placed in the same position as myself to-day and who would make application to join the I.E.E. providing, by so doing, they could be assured of the advantages appertaining to the Associate Member. I consider

Mr. Ferranti is right in suggesting the policy of broad-mindedness, as it is, in my humble opinion, essential for the welfare of the electrical industry as a whole, that both the technical and commercial sides should be welded together as one.

After carefully studying all the available opinions, I, however, am forced to the conclusion that those people who at the present time are engaged on the commercial side of the industry are to be relegated to a class by themselves together with members of the legal profession, commercial and financial; quite right—but what about the commercial engineers—men who have served their time in the shops, and afterwards held engineering positions of responsibility, and who later on have gone over to the commercial side? Are these men to be classed in a grade lower than the Associate Members, and not to be allowed the same status? I am of opinion that if the I.E.E. were to make it clear that these men would be ranked equal to the Associate Member, they would then obtain a class of new membership which would in every way uphold the prestige of the Institution. With regard to the question of examination, I consider that your correspondent, Dr. Garrard, is quite correct in his views, and it is quite possible that commercial engineers of position will not submit to the indignity of entering for examinations.

L. G.

In connection with the proposed alteration of the Articles of Association of the Institution of Electrical Engineers and the increased subscriptions, it appears that the great objection to the increase of subscriptions is that corporate members are to have such a small return for their money. I assume that an increased subscription is necessary and desirable, and that everyone will wish to pay the same when assured of an adequate return. An adequate return can easily be obtained by raising the status of the corporate members, and this can be done by the Council obtaining power to take the necessary steps to have the Institution chartered on the lines of the accountants, the Institution to be then known as the Chartered Institution of Electrical Engineers and the corporate members as Chartered Electrical Engineers, or. for short, as Chartered Engineers. This would at once enable members when filling up legal documents, club membership application forms, &c., to distinguish themselves from electricians, wiremen, fitters, &c., who all call themselves electrical engineers or engineers. Why should this not be undertaken at once, or as soon as the examination scheme has been put in hand? No good purpose can be served by waiting for the other two great engineering institutions to make a move. Unless they are forcibly aroused by the Institution of Electrical Engineers taking the necessary steps they are likely to remain in the same state of somnambulism as the Institution was in until Mr. Ferranti took it in hand.

In conclusion, I would point out that anything that raises the status of the corporate members must be of lasting benefit to the science and industry which supports the Institution, and without which it could not exist.

Norman R. Corke.

South Croydon, *December 4th*, 1911.

In your issue of December 1st, your report of the proceedings of the meeting of the Yorkshire Local Section, which was held on November 20th, to discuss the proposed new Articles, states that a resolution was put to the meeting without the consent of the chairman. Will you please correct this misstatement. The resolution in its amended form was, in fact, accepted by me and put to the meeting from the chair.

T. Harding Churton,
Chairman, Yorkshire Section.

Leeds, *December 4th*, 1911.

Two-wattmeter Method of Measuring Power in Three-phase Circuits.

There is one important extension of this method which has not been considered in your article of last week under the above title. This is the method of obtaining power factor by the ratio of wattmeter readings.

Consider the testing of an induction motor. Within a very small percentage the phases are balanced, so that for all practical purposes I (the current) and θ (the angle of lag) are the same in each phase. It then follows that—

$$\frac{W_2}{W_1} = \frac{\cos(\theta + 30)}{\cos(\theta - 30)},$$

and if a standard curve of values of cos θ be plotted against this function—

$$\frac{\cos(\theta + 30)}{\cos(\theta - 30)},$$

then the value of cos θ = power factor may be read off for any observed ratio of W_2 and W_1.

If θ be taken as rising from 0° to 90° (the limits of an induction motoring current), the corresponding values of the ratio will be found to vary from + 1 through zero to − 1. For currents in the other quadrants the same curve will serve, it only being necessary always to take the ratio of the smaller reading to the larger.

One further simplification is possible in practice.

The normal connections for this method may be taken to be, for leads A, B and C :—

1. Current coil in A, volt coil A to B.
2. Current coil in C, volt coil C to B.

Since the circuit is balanced, the latter reading is obviously equal to either—

3. Current coil in B, volt coil B to A ; or
4. Current coil in A, volt coil A to C.

Hence, readings 1 and 4 give the same result as 1 and 2, or it may be said—

The current coil is left permanently connected in circuit A, and the readings taken with the volt coil connected first across to B, and then across to C, the motor being of course in a stable condition while the readings are taken.

The curve of cos θ against the ratio W_2/W_1 is, of course, a standard, and, once drawn out, will last a lifetime.

An alternative method to the constant reference to the curve, which I have found extremely handy, is to draw a double scale of power factor (corresponding to the positive and negative limbs of the curve) on a slide rule under the slide. When the wattmeter readings have been obtained, it is only necessary to push the slide to one side, and then read the power factor direct from the ratio by looking down through the cursor.

This method saves considerable time when power factors are constantly being determined.

It must be pointed out that this means of obtaining the power factor is considerably more accurate than the standard watts/volt-amperes method, for in the latter, there are the errors of three separate meters to be reckoned with, whereas in the former, there is only the difference of error of two parts of the scale of the same meter.

Laurence H. A. Carr, M.Sc.Tech.

Birmingham, *December 4th*, 1911.

The article by Mr. Ogley on the measurement of three-phase power by the two-wattmeter method, has prompted me to send along a method of obtaining the power factor in a three-phase balanced circuit by means of a single-phase wattmeter and a simple calculation. This method occurred to me a week or so ago, and, so far as I am concerned, is original.

Let fig 1 represent supply leads, which are in connection with a star-connected source of supply, with the current coil of wattmeter inserted in A phase. The method consists of alternately connecting the pressure coil across A B and B C, and noting the readings on the instrument. Calling these R_1 and R_2, respectively, the power factor, *i.e.*, cos θ, may be found from the tables, after finding value for cot θ in formula—

$$\frac{\sqrt{3}\cot\theta - 1}{2} = \frac{R_1}{R_2}.$$

The proof is as follows :—

In fig. 2 let O A, O B, O C represent current in the phases.
,, ,, ,, O A_1, O B_1, O C_1 represent pressure in the phases at unity power factor.

IC As is well known, current and pressure differ by 30°. Suppose this angle be increased (fig. 2) by lag of $\theta°$ between

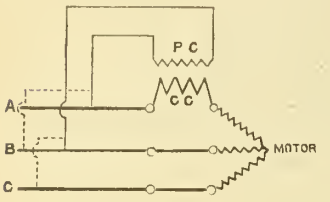


Fig. 1.

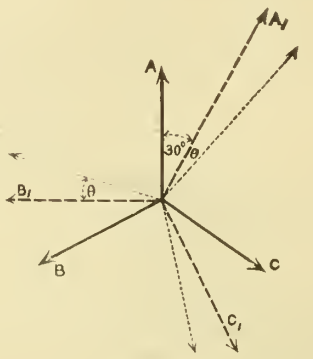


Fig. 2.

current and pressure. Each wattmeter reading equals $A \times V \times \cos \phi$.

Therefore, $R_1 = A \times V \times \cos (30° + \theta°)$,

$R_2 = A \times V \times \cos (90° - \theta°)$.

Dividing R_1 by R_2, this equals—

$$\frac{\text{Cos } (30° + \theta°)}{\text{Cos } (90° - \theta°)} = \frac{R_1}{R_2} = \frac{\sqrt{3}/2 \cos \theta° - \frac{1}{2} \sin \theta°}{\sin \theta°}.$$

$$= \frac{\sqrt{3} \cot \theta - 1}{2} = \frac{R_1}{R_2},$$

which is a form suitable for easy calculation.

If the reading R_2 is negative, power factor is leading.

W. F. Kearsley.

London, S.E., *December 1st*, 1911.

P.S.—To me it seems more practical to substitute R.M.S. values after establishing the vector proof, than to leave the formula in terms of maximum values, as in Mr. Ogley's article.

A Reliable Rectifier Wanted.

Having seen Mr. George Sutton's letter upon the above subject in the "Correspondence" column of your last issue, I feel that in justice to myself I should trespass upon your space again to further explain matters, although I am sorry that from private correspondence which we have had together, Mr. Sutton does not understand my reason for bringing up this subject. I neither had heard of Mr. Sutton in connection with "Batten" rectifiers before, nor did I aim at any one particular piece of apparatus, but by "Batten type" I referred to relay instruments as a whole. He is wrong when he states that I have not had experience with "the unit"; I actually purchased and used a genuine "Batten" rectifier some years ago, and although the maker himself came down several times, and attempted to make it work satisfactorily on the local supply, and provided me with sundry extra condensers, it would not work correctly throughout the day. The reason was attributed to the different characteristics of the generating plant supplying from time to time.

After a time I was able to dispose of the whole at a considerable loss to a motor engineer in another town, where it worked more or less satisfactorily on another supply company's mains. Mr. Sutton condemns electrolytic and vacuum rectifiers; but, owing to the publicity given the matter, I have been assured by the makers of these, contrary to my experience, that they are perfectly reliable.

My views are that the demand is for a rectifier that will work under the ordinary commercial conditions of a public supply, irrespective of the different characteristics of the generating plant that may be feeding the mains during the day. That the debated apparatus is found wanting in practice, is only proved by the number of such being replaced by small motor-generators at the present time, and by the number of the cheaper forms of instruments that are withdrawn from the market. I have no doubt that under ideal conditions all will behave well.

If I have unwittingly done your correspondent any harm in mentioning the name "Batten," I express my regret.

J. R.

ELECTRICITY AT THE NEW WHITELEY'S.

The firm of Whiteley, in its association with Westbourne Grove, has been one of the most prominent factors in the London shopping world for many years. The passage of time, however, marks many changes, and it will not be surprising, in view of the palatial building—the new Whiteley's—which has been erected in Queen's Road, if "Whiteley's of Queen's Road" displaces the old-time association.

Messrs. Whiteley, of course, still retain extensive premises in Westbourne Grove, but the handsome adjoining structure which has made its appearance must necessarily eclipse the older shops.

Prior to the completion of the new building we were enabled, through the courtesy of Mr. W. Stewart, Messrs. Whiteley's engineer, to look over the electrical portion of the work.

The firm has for some years had its own generating plant, which, in addition to a new 200-kw. Belliss-Siemens set recently added, includes four 125-kw. Willans-Lahmeyer sets, and two 60-kw. Willans sets, all with compound engines and generating current at 200 volts pressure.

The plant has previously been called on to supply from 2,500 to 3,000 amperes at times of maximum load, and from 500 to 800 amperes day load, mainly for the numerous motors used in the various departments. Steam is supplied at 120 lb. pressure from six 30 ft. × 8 ft. boilers fitted with motor-driven machine stokers and Galloway superheaters.

The exhaust steam from the engines is passed through steam heaters, by the Atmospheric Steam Heating Co., for heating the buildings, and Webster feed heaters for the boiler feed.

An extensive switchboard is provided in the engine room, and from it two pairs of feeders run to the new building to two main distributing boards in the basement.

These boards, each fed by one pair of feeders, are situated in the basement of the nearest block to the engine room, and serve as the starting point of subsidiary feeders which run through the basements of the seven blocks into which the new building is divided, and feed a sub-main board in alternative blocks; the sub-main boards in the basements supply local lighting distribution boards on each of the four floors above, as well as one fixed nearby for basement lighting.

All the basement boards are of the Spagnoletti ironclad pattern; each main board is arranged for four 250-ampere circuits, one being spare, and fitted with switch-fuses and tandem knife switches on slate bases.

The sub-main boards are eight-way in each case, fitted with 50 to 100-ampere switch fuses on slate bases, while the local distribution boards carry usually seven 5-ampere ways. In the case of stair lighting, some of the lamps are run off each of the main circuits, with a view to avoiding total extinction of the lighting should one supply fail.

The wiring throughout is by means of Siemens 600 grade QR cable, rated on 750-ampere per sq. in., and run in solid screwed conduit, with iron boxes; the conduit is copper bonded to 3-in. cold water service piping and earthed at the sub-main boards.

At each iron distributing board the conduit is run through clearing holes in the case, a brass bush is inserted in the end of each tube, and a lock nut screwed down on to a spring washer outside the case, ensures good metallic contact.

The wiring throughout is on the loop-in system, and terminates in concealed metal boxes on which are fixed the bases for tumbler switches, ceiling roses, &c. Exterior wiring on fire stairs, &c., is run in screwed galvanised conduit.

A feature of the wiring in the shops is the use of Middleton patent distributing boards, in which each circuit is provided with enclosed fuses of ingenious design, and small tandem switches; the whole of the wiring work was carried out by H. J. Cash & Co., Ltd.

In the new building some 2,000 incandescent points are provided for, including 500 in the windows, where Siemens tungsten lamps with strip reflectors are employed all through for indirect lighting.

There are also 450 Brockie-Pell arcs (by the Foster Co.), and some idea of Messrs. Whiteley's total lighting requirements can be gathered from the fact that over 600 arcs and 7,000 incandescent points will be supplied from their private station.

A special power circuit supplies the motors in the new building, numbering about 40, and bringing up the total of motors in use by Messrs. Whiteley to over 100.

Amongst the various applications of power may be mentioned 16 large Waygood lifts, as well as some smaller ones; a parcel sorting and conveying plant by Messrs. Sauvée & Co., situated in a basement and in communication with each shop, also an escalator from the basement to the loading bank for dispatching goods by the firm's carts; three motor-driven turbine vacuum plants, which by means of pipe lines throughout the building, and detachable hoses, render cleaning a comparatively easy matter; a ventilating plant; a pneumatic tube installation, for conveying mail matter, orders, &c., between the counting house and the various shops; and refrigerating plants, both for the kitchens and for the storage of furs, many thousand pounds' worth of which are lodged with Messrs. Whiteley each summer for safe keeping.

One further prospective electrical feature is worth noting, although it has not yet taken definite shape, and that is a Marconi wireless telegraph installation which it is proposed to erect on the roof, for the convenience of customers from afar—one wonders how far!

A complete automatic sprinkler installation is provided to extinguish or help to extinguish fires, and to more completely safeguard the firm, an installation of Aero fire alarms is provided in addition.

LEGAL.

The Lot's Road Arbitration.—British Westinghouse Co.'s Appeal Dismissed.

On Monday, in the Court of Appeal, composed of Lords Justices Vaughan Williams, Buckley and Kennedy, judgment was given in the case of the British Westinghouse Electric and Manufacturing Co., Ltd., *v.* the Underground Electric Railways Co. of London, Ltd., on the appeal of the plaintiffs against the refusal of a Divisional Court (Mr. Justice Pickford and Mr. Justice Lush) to set aside an award of an arbitrator. The facts have already been fully reported in our pages.

Sir Alfred Cripps, K.C., Mr. Disturnal, and Mr. Tangye appeared for the appellants ; and Mr. J. P. Fitzgerald, K.C., Mr. Roskill, K.C., Mr. A. B. Shaw, and Mr. L. Macassey for the respondents.

Lord Justice Vaughan Williams, giving judgment, said that in his opinion the words " reasonable and prudent " in the arbitrator's findings, meant, not reasonable and prudent as a matter of railway management, but a reasonable and prudent mode of avoiding the very heavy loss which might otherwise fall upon the plaintiffs, and that as between the plaintiffs and the respondents the purchase of the Parsons machines would not have been reasonable and prudent as a matter of mitigating the damages accrued if some other cheaper and better mode had been available for avoiding and mitigating the damages. He understood from the arbitrator's finding that no better mode was available for the mitigation of the damages for which the plaintiffs would have been liable in future. It seemed to him that if the railway company had not effected the purchase of the Parsons machines, it would have been a prudent course for the plaintiffs to have purchased such machines themselves, and have substituted them for their own machines ; and in such an event they could no more have charged the railway company with that expense than they could have charged the railway company the money they expended in making alterations and improvements in their own machines in the hope of bringing those machines into conformity with the specification. The award, in his opinion, followed the directions given by the first Divisional Court, and that being so the appeal must be dismissed.

Lord Justice Buckley disssenting, said that it seemed to him that the Arbitrator's finding came to this : that the purchase of the Parsons machines by the railway company was reasonable and prudent, but that if there had been no breach of contract it would have been equally reasonable and prudent ; nay more, that it would have been to their pecuniary advantage to purchase the new machines at their own cost. The course they took, therefore, was attributable not only to the breach but to considerations for their own pecuniary advantage. In his opinion, the appellants were entitled to have the view of the Arbitrator as to whether the purchase of the Parsons machines, of greater power, greater efficiency and longer life, was reasonably prudent for the purpose of mitigating damages apart from considerations of their own pecuniary advantage. For these reasons he thought that an error of law appeared on the face of the award, and that the award ought to be set aside or remitted for reconsideration. The other members of the Court, however, did not read the special case as he did, and in the circumstances he did not know, if he had adopted their opinion as to its meaning, that he would have differed from their conclusions.

Lord Justice Kennedy agreed with Lord Justice Vaughan Williams. He said he thought that if there was an error on the face of the award it was open to the Court to send the case back, but he was of opinion on the facts that there was no ground for allowing the appeal. In his view, the railway company availed themselves of the only course open to them to mitigate the damages, and the arbitrator's award gave the plaintiffs the full benefit of that mitigation. The award was not erroneous in point of law and the appeal must be dismissed.

By a majority of the Court, the appeal was accordingly dismissed, with costs.

F. A. Glover & Co., Ltd., *v.* Living Picture Palaces Co.

At the Bromley County Court recently, plaintiffs, electricians, of Clerkenwell, sued defendants, of St. James's Street, London, claiming £94 3s. for work done at the Palais de Luxe and goods sold and supplied. There was a counterclaim for £30 for damages for defective work. For plaintiffs it was stated that there was first a dispute concerning a small claim for extras which had to be added to the electric light fittings because certain alterations were made in the original building. Another point in dispute was as to the construction of the contract. Defendants wanted arc lamps, but, when the things came to be put in, the lights required ornamental brackets, and the question was whether they were entitled to the extra for them or not. On the counterclaim the defendants said that the work was defective in consequence of the negligent manner in which the wiring was done, allowing the damp to get in and cause fusion of the wires. They further complained that wooden terminal boxes had been used in a number of places instead of iron boxes. Plaintiffs admitted that in those places no iron boxes were used, and contended that they were not necessary. A good deal of evidence was given, and ultimately his Honour said that he would give his judgment at the next sitting of the Court.

BUSINESS NOTES.

Worthington Contracts.—The following are amongst recent orders booked by the Worthington Pump Co., Ltd., of London and Newark-on-Trent :—

One triple-expansion pumping engine complete with superheater for collier service in the North.

One outside packed compound plunger pump completo with surfaoe condenser, vacuum pump, feed pumps, hydraulio air compressor, oil separator, &c., for railway service on the Continent. Also a oompound plston pump for oil service on the Congo.

One surface condensing plant oomplete with Triplex air pump and oentrifugal circulating pump for the Dunlop Ruhber Mills, and one ditto with Simplex air pump and centrifugal circulating pump for the Coventry Corporation.

Two sets of low level jet condensers of the oounter current type arrangod with their patent eleotrioally-driven horizontal rotative dry vacuum pumps and oentrifugal pump for iron works in the Midlands.

One complete patent oombination of air and oentrifugal pumps for nse in connection with a refrigerating plant, the installation being required to maintain a very high vacuum to reduce the temperature in brine reservoirs to the lowest possible extent.

Two eleotrically-driven low llft oentrifugal pumps for Caloutta Tramways. Also one ditto of the vertical type for Manaos Tramways, heing a repeat order.

Two low lift centrifugal pumps for Southend-on-Sea Corporation.

One horizontal high lift centrifugal boiler feed pump with alternating current motor for Ireland, through Messrs. Bahoock & Wilcox, Ltd.

Besides the above a large numher of orders have heen seoured for Worthington duplex pumps, including over 150 for marine servioe, also power pumps, vacuum pumps, air compressors, water meters, &o.

Diesel Engines for Electricity Works.—The Diesel Engine Co., Ltd., have received the following contracts for Diesel engines exclusively for electricity supply :—

Bath U.D.C. Eleotricity Works.—One engine 680 b.h.p.
Oxford Electricity Supply Co.—One engine 650 b.h.p.
Isle of Thanet E.T. and Ltg. Co.—One engine 600 b.h.p.
North Metropolitan E.P. Supply Co. (repeat order).—One engine 400 b.h p.
Sheerness and District E.S. Co. (repeat order).—One engine 400 b.h.p.
Messrs. C. H. Walker & Co., Ltd.—Four engines 1,000 b.h p.
Great Northern Railway Co. (repeat order).—Ono engine 420 b h p.
Punta Arenas Electricity Supply Co.—One engine 250 b.h.p.
General Electric Co., Ltd., of Australia.—Two engines 100 b.h.p.; one of 200 b.h.p.
Dacca Electricity Supply Co.—Three engines 350 b h.p.
Messrs. Agar, Cross & Co., (for Argentine).—Four engines 650 b.h.p.
For the Canadian Government (repeat order).—Two engines 400 b.h.p.
Aldershot U.D C. Electricity Supply.- One engine 200 b.h.p.
Bridgwater E.P. and Traction Co.—One engino 150 b.h.p.
Bangor Electricity Works.—One engine 140 b.h.p.
Bude Electricity Supply Co.—One engine 130 b.h.p.

In addition, they are supplying a large number of smaller sets in sizes ranging from 30 to 120 b.h.p. The majority of the above orders are for their latest type of Diesel engine which is specially designed to meet central station requirements.

Tube Platform Illumination.—The accompanying illustration shows Oxford Circus Station, on the Central London Railway, which is illuminated by means of 100 c.p. "Onewatt" drawn tungsten lamps in conjunction with suitable Holophane



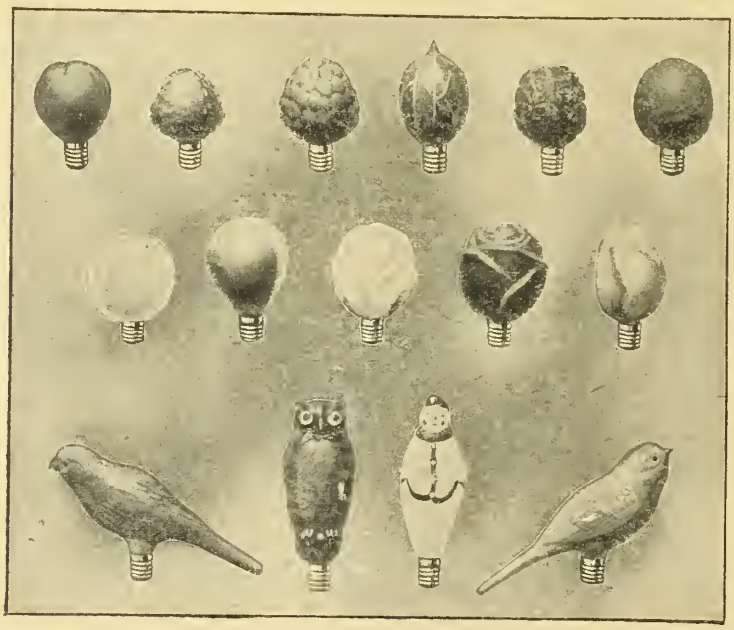
Tube Platform Illumination.

glassware. It will be observed that a very uniform platform illumination is obtained, the improvement being very marked in comparison with lighting by arc lamps on other tube railway platforms. This method is also interesting by reason of its great economy, the consnmption, of power being less than one-fourth the consumption with arc lamps. The scientific diffusion of the light, enables a lower candle-power unit to give adequate illumination in all directions. For instance, the Oxford Circus "Onewatt"

installation gives a practically uniform illumination of 4½ c.p.-ft. at a height of 4 ft. above the platform throughout its entire length. The illustration is reproduced from a photograph which has not been re-touched, and which can be seen in the offices of Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.

South African Trade.—We have several times referred to the efficient arrangements that are provided at the British Trade Commissioner's Office at Cape Town for imparting commercial information to local buyers concerning the trade of the United Kingdom, and to firms at home regarding South African trading opportunities, &c. We have now received from the office a printed list of the commercial and trade journals, trade and other Government reports and statistics, and other publications that are filed for reference. We are sure that nothing will please Mr. Sothern Holland better than for our firms to take the fullest possible advantage of these and other ways in which he and his staff are trying to further the interests of British traders in South Africa.

Christmas Decorations. — Messrs. Ward & Goldstone, of Springfield Lane, Salford, Manchester, have issued a list of their decorative lamps for bazaar and Christmas-tree illumination, shop-window displays, and other like purposes during the approaching festivities. The lamps, as the accompanying illustration shows, consist of tiny bulbs in the form of fruit, flowers, and figures in coloured glass. They are 14-volt carbon series lamps, and are supplied with lampholders as required, or ready wired complete. The firm has issued a priced circular regarding these goods.



Christmas Decorations.

Dissolutions and Liquidations.—Kearney High Speed Railway Co., Ltd.—A petition for the winding up of this company has been presented by Messrs. Ransomes & Rapier, Ltd., creditors, and is to be heard in London on December 12th.

Wakelin Bros., Ltd.—A petition has been presented by J. F. Wakelin, electrical engineer, 4, Squires Mount, Hampstead, and E. Dixon, engineer, of Kentish Town, for the winding up of this company. It is to be heard on December 12th in London.

Cowper-Coles Engineering Co., Ltd.—It has been resolved to wind up voluntarily, with Mr. W. H. Peat, 11, Ironmonger Lane, E.C., as liquidator.

Vaughan, Hughes & Baty, analysts, metallurgists and electrical engineers, 130, Edmund Street, Birmingham.—Messrs. T. V. Hughes & E. J. Baty have dissolved partnership. Mr. Hughes will attend to debts, &c.

Bankruptcy Proceedings.—W. R. N. Gard, electrician, West Ealing.—The public examination of the above debtor was held at the Court House, Half Acre, Brentford, on Tuesday last week, before Mr. Registrar Russon. It transpired that the debtor started business in 1903 at the Orchard Electrical Works, Canterbury, in partnership with another. In 1905 this concern was sold, and all the debts were paid in full. Debtor continued the business until December, 1906. Since he had known of his position he had incurred two further debts, but he was relying upon his earnings. The liabilities amounted to £283, and there was a deficiency of £276. The failure was attributed to want of capital and bad trade. The examination was formally adjourned for closing.

Bert Newman (B. Newman & Co.), electrician, 4, Cranbrook Road, Ilford.—Receiving order made November 29th on a creditor's petition.

"A Reliable Rectifier Wanted."—Referring to the correspondence on this subject in our pages, the Crypto Electrical Co. put forward the claims of the A.C. to D.C. motor-generator. They have for many years manufactured a combined alternating to continuous-current transformer with outputs of 100 and 350 watts on the secondary, but from several remarks contained in letters they gather that what is required is a still smaller and consequently cheaper machine. They have, therefore, arranged to put on the market a combined alternating to continuous-current transformer which can be wound on the primary for any voltage and periodicity, and will give an output on the secondary of 50 watts, and expect to have this machine ready for delivery in about three weeks' time.

Meter Approved.—We learn that the E.A.C. high-torque meter of the Electrical Apparatus Co., Ltd., has been approved by the Board of Trade.

The Proposed Aluminium Syndicate.—The idea of resuscitating the former syndicate of makers of aluminium has by no means been abandoned, and a first conference of representatives of international interests was recently held in Paris. A definite result was, however, not reached. The discussion was principally concerned with the question of tonnage allotments in the syndicate, it being eventually decided to hold a further conference. In interested circles on the Continent it is considered that an understanding is now not out of the question. The situation of the aluminium industry is at present more favourable than in recent months, as the consumption has largely increased. It is also thought that the recent rise in the price of copper will favourably influence the use of aluminium, as the latter is frequently substituted for the former when copper advances in price. The quotation for the white metal has also risen on the Continent in the past few weeks, and is at about 1s. 2½d. per kg., whilst, at the same time, producers are reserved in making offers.

Catalogues and Lists. — The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New catalogue Section "S" (54 pages), containing fully-illustrated notices and prices of a large variety of electric lighting accessories. That the company has for a long time past devoted close attention to the production of a line of Home Office accessories specially designed to meet the requirements of the Electrical Inspector of Factories and Workshops, is a fact well known to our readers, and the manufactures of this class that are listed include distribution boards, shielded fuses, branch switches, wall plugs and adapters, factory plugs, cut-outs, "Coates" lampholder shields, and china lampholders. Other lines included, and calling for mention, are the new "Slick" flat switches which have met with an excellent reception; an improved line of wall plugs in three principal gauges—"Midget," "Standard," and "Union"—all plugs being interchangeable; plaster-lined cut-outs, the prices of which have been considerably reduced; and a new circular type of detachable fuse; while the other contents of the catalogue comprise distribution boards, strip lighting material, and advertising sign flashers—both motor-driven and "Thermic" types. All articles have catalogue numbers, and there are both general and numerical indices.

Messrs. Schaffer & Budenberg, Ltd., Whitworth Street, London Road, Manchester.—Three new descriptive price lists as follows:—Section 6 (24 pages) relating to their relief and safety valves; Section 19 (6 pages) describing their pulley block reducing gear and non-stop indicating gear; also Section 22 (4 pages) fully describing their patent "Concentra" oil pump.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—The company has just issued a new binding case containing seven sections of its lists of electric lamps and lighting accessories. A thumb index guides the reader to the separate sections. The material is given very fully, is well arranged, and includes numerous illustrations, and, of course, detailed prices, but we think that there may be just a little too much in the case for easy handling for reference purposes. In our experience the most useful catalogue is one which does not require the aid of the hands to keep it open on the desk. We understand that other lists are in course of preparation for early issue, covering switch fuses, distribution boards, insulators, carbon-filament lamps, Holophane fittings, glass work, bells and telephones. Those already issued and included in the binder before us, cover the following manufactures:—No. 101/1—Arcturus lamps, standard and magazine flame, also enclosed types, including carbons, winches and accessories; No. 102—Auriga metal-filament lamps; No. 111—Electrical accessories of every description; No. 127—Trafford lanterns and weather-proof fittings, for offices, workshops, mines, docks, railway stations, and public street lighting; No. 136—Trafford conduit and fittings; No. 140/3—Ariel electric fans; No. 150—Electric heating and cooking appliances, including radiators, heaters, &c.

The Wolseley Sheep-Shearing Machine Co., Ltd., Sydney Works, Alma Street, Aston, Birmingham.—20-page illustrated catalogue showing their Wolseley electric motors, as employed for sheep-shearing and horse-clipping purposes. They have standardised a set of motors to work at 2,000 r.p.m., this being the highest speed desirable for horse-clippers. The motors are fitted with either flexible shafts or steel tubes, and are adaptable to any of their standard shears or clippers. The list also shows and describes electric sharpening machines, portable petrol-electric outfits and the Wolseley-Brewerton starter. Other lines are also included, and a couple of pages set out technical information. A separate eight-

page catalogue illustrates and briefly describes the Wolseley petrol engines.

Messrs. Laing, Wharton, Ltd., 7, Great Newport Street, London, W.C.—This firm are the sole agents in the United Kingdom for Messrs. Vedovelli, Priestley & Co., manufacturing electrical engineers, of Paris, and they have issued an English catalogue of some 44 pages, in the course of which they give illustrated descriptive information and tabulated prices of high and low-tension switchgear, including "Robur' switches, high-tension oil-break switches and change-over switches, pole switches, high-tension isolation switches for interior and exterior service, "Robur" and "Carter"-automatic circuit breakers, relays, fuses, switch fuses, lightning arresters, &c. We have also received a complete set of the Vedovelli, Priestley French catalogues. One of these is Part I of their catalogue of electrical apparatus; another is devoted to electric traction material for overhead and third-rail construction, signalling apparatus, &c.; while smaller publications relate to monolithic alabastrine panels, luminous letters for advertising purposes, electric fountains, &c. We understand that Messrs. Vedovelli, Priestley have been awarded two Grands Prix at the Turin Exhibition, one each in Classes 28 and 29, Group 5. They have carried out some large power transmission and railroad electrification schemes in France, and are just completing two sections of the experimental single-phase line which is being erected by the Chemin de Fer de Midi, the tests of which are to take place almost immediately.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall. —Further advance leaflets, part of the firm's catalogue, have been issued giving brief illustrated information and tabulated prices of Walsall soft-iron meters, transformers, wire net resistance type board. circuit-breakers, master switches, special switchboards, &c. Copies can be obtained on application.

The Electrical and Engineering Supplies Co., Ltd., 36 and 37, Upper Thames Street, London, E.C.—List showing a number of typical designs of electric signs (transparent box type), and illuminated wood letters, and giving prices of same.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—Revised price list of "Efesca" metal-filament lamps, announcing further reductions in prices of low-voltage and high candle-power lamps.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. —Mailing card making a special offer of electric advertising signs.

Messrs. Major & Co., Ltd., Sculcoates, Hull.—Their new booklet, "The Manufacture of Insulating Varnish," contains a number of photographic views showing the firm's works, and describes the methods briefly. Copies may be had on application to the firm.

Electrical Engineering and Agency Co., Ltd., 109-111, New Oxford Street, London, W.C.—Pamphlet describing and illustrating their type "L" high-lift centrifugal pump, the chief feature of which is a patent hydraulic balancing device.

The King's Batteries.—The Hart Accumulator Co., Ltd., have been appointed by Royal Warrant, purveyors of accumulators to His Majesty King George V.

Mazda Lamps on Battleships.—A very extensive series of tests have been conducted during the past year by the United States Navy on drawn-wire Mazda lamps, to determine their serviceability for use on warships. The formal test, which was started in November, 1910, was continued until July 1st, 1911, at which time such satisfactory results had been obtained that the test was considered concluded. Since that time, however, the officers on the ships have kept track of the lamps, and a recent letter from the ordnance officer of U.S.S. *Washington* states :—"Mazda lamps have made an excellent showing, and every day adds to their record. Many of the lamps (about 80) are still burning which were installed in November and December, 1910, and, to all appearances, are just as bright as ever." The following is a summary of the results given by Mazda lamps on board battleships for the period from November and December, 1910, up to July 1st, 1911 :—

Size.	Total installed.	Average life.	Lamps broken during target practice.
25-watt	375	755 hours	12 lamps, or 4 %
40 ,,	842	1,155 ,,	28 ,, ,, 3 %
60 ,,	36	1,677 ,,	1 ,, ,, 0 3 %
400 ,,	8	1,386 ,,	—
500 ,,	9	2,563 ,,	—

These tests speak well for the durability of the drawn-wire Mazda lamps, and show that it is now possible to employ these high-efficiency lamps on board war vessels or any kind of boats; for since they successfully withstand target practice, they are suitable for any kind of service conditions on board ship.

Stoke-on-Trent Electricity Department.—Mr. C. H. Yeaman, chief electrical engineer, announces that the address of his department has now been altered, and all letters and communications intended for him, and in connection with electricity supply in the County Borough of Stoke-on-Trent, should be forwarded to "St. Peter's Chambers, Glebe Street, Stoke-on-Trent," where the central offices of the Electricity Supply Department of the borough are now situated. In these offices all business connected with the electricity works in Burslem, Hanley, Longton and Stoke will be transacted.

Vibration Prevention.—We are informed that the Korfund Co. have just completed the insulation of a Diesel engine foundation at Friary Brewery, Guildford.

Stoker Contracts. — Among stoker orders recently executed by the Underfeed Stoker Co. are the following :—

Sheffield Corporation Electricity Works, 4A; Colombo Tramways, 1E; Corporation of Glasgow, Dalmuir and Partick Pumping Stations, 8B; Portsmouth 90-H.P. Pumping Station, 2E; Midland Railway Carriage and Wagon Works, 4E.

Trade Announcements.—The Electric and General Stores Co. are removing their head offices, warehouses and showrooms to Pudding Chare, Newcastle, whilst retaining the Sunderland premises for some months longer. The premises in Newcastle will open on January 1st.

Messrs. W. F. Johnson & Co., electrical engineers, have opened larger premises at 7 and 9, Wellington Street, Douglas (Isle of Man).

Mr. James Taylor, who has been a partner in the firm of Gooding & Taylor, electrical engineers, of 43 and 44, Upper Russell Street, and 3, Blucher Place, Brighton, has commenced business as an electrical engineer at 75, North Street, and 92, Osborne Road, Brighton.

India.—India, says a German Consular report, affords an enlarging outlet for electrical goods, although it is only in the towns and in the newer portions that houses are fitted with electric light, fans, and heating apparatus. No figures are available of the imports of electric lamps, but German statistics show imports in the last three years of M.54,000, M.165,000, and M.110,000 respectively. Second only to lighting is ventilating, and the imports of electric fans of sundry kinds reach considerable figures. Opportunity for the export of a large quantity of electrical machinery and transmission material is supplied by the great hydro-electric station, whose construction the firm of Tata is financing. It will supply current to drive over 3,000,000 spindles and 40,000 weaving spools in Bombay. It is also stated that in the course of next year a large portion of the Bombay spinning and weaving mills will be worked by electricity.—*Zeitschrift fur Turbinenwesen.*

Book Notices.—"*Mechanical World* Electrical Pocket-Book for 1912." Manchester : Emmott & Co. Price 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVII, No. 9. November, 1911. New York : The Society.

"*Bulletin* of the Imperial Institute." Vol. IX, No. 3. 1911. London : Eyre & Spottiswoode, Ltd. Price 1s.

"Atti Della Associazione Elettrotecnica Italiana." October, 1911. Milan : Stucchi, Cenetti e C.

"*Bulletin* of the Association des Ingenieurs Electriciens." September, 1911. Liége : The Association. Price 4 fr.

"*Journal* of the Institution of Municipal Engineers." Vol. III, No. 3. November, 1911. London : The Institution Offices. Price 1s.

Consular Notes.—Sweden.—The British Consul at Gothenburg, in a recent report, states that the year 1910 recorded an important increase in the amount of water power made available. No less than 21 water-power installations were completed; 20 of these are private installations, varying from 300 H.P. to that of the Stora Kopparbergs Bergslags Aktiebolag at the Bullerforsen with 24,000 H.P., and the Sydsvenska Kraftaktiebolag's last two stations of 10,000 H.P. One installation is the property of the State, namely, that at Trollhätten, which, with its 40,000 H.P., is the largest of them all. In addition, there are five water-power installations of altogether 7,650 H.P. that were rebuilt during the year, whereby the increase of electric power which the country received during 1910 amounted to 111,280 H.P. There are building seven private water-power stations with a total of 65,000 H.P., and, furthermore, the installation by the State at Porjus was also begun during the year, and with its 50,000 H.P., raises the total horse-power at the stations now building to 115,000 H.P.

The British Vice-Consul at Halmstad reports that the great power plant on the Lagan River was completed during 1910, and was opened by the King. An extension, on which work is to be begun at once, has been decided on, and the money necessary for this purpose has been provided. The work already done is excellent, and provides proof of the high standard to which electrical engineering has been brought in Sweden.

The British Vice-Consul at Ystad reports that plans have been adopted for the construction of an electrical works in that town. These works are expected to be completed in the course of next year.

Formosa.—The British Council in Formosa reports that six electric cranes of the kind known as the electric tower transporter have been ordered from the United Kingdom. They are said to work very rapidly, and a feature of great importance at Keelung, where during the winter half-year the rain is almost continuous, is that the cargo can be worked under a movable covering which is attached to the crane. Electric capstans will be erected on the quays to move the cranes, which will run on rails. A wireless telegraph station was completed on October 11th, 1910, at Fukikaku, the northern extremity of the island. A submarine cable was completed from Tamsui to Nagasaki on November 1st, 1910, from which date the use of the old cable from Keelung to Kagoshima was discontinued, the cable being much out of repair. A contract has been obtained by a British firm for the Takow waterworks, and the plant will be of British manufacture. The pumps are driven electrically, and will receive their supply of power (three-phase) either from the Government electric power lines or from their own steam power station, which has a Babcock & Wilcox boiler. Practically the whole of the electrical supplies had hitherto come from German and American makers. The water is to be taken from the river and pumped up to a height of 250 ft. through a length of 10,000 ft. of mains.

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LIGHTING and POWER NOTES.

Abercarn.—The U.D.C. has decided to apply for a prov. order for extending the period for carrying out the order obtained in 1906, and to enable the Council to lease the order to the South Wales Electrical Power Distribution Co.

Accrington.—The borough surveyor and the electrical engineer have been requested to prepare plans and estimates for the installation of a special gas engine plant for generating electricity in order that the Committee may cope with the increased output involved by the supply of current to neighbouring townships. It is desired to obtain the services of Mr. Percy Allen, of the Castner-Kellner Alkali Co., as consulting engineer in connection with the proposed plant.

The Corporation recently quoted special terms for the supply of current for the working of a cotton mill in Victoria Street. This was tried as an experiment for six months, and it has proved so successful that the agreement has been renewed for a further period of 12 months. The Electricity Committee has also quoted terms for the supply of current to the Altham Colliery, some few miles away.

Afghanistan.—A scheme for giving Kabul an electricity supply is being prepared by Messrs. F. & C. Osler, who have arranged to put down a water-power plant near the River Salong, where a head of 130 ft. can be obtained, and to install three 500-KW. sets of three-phase 60-cycle turbo-generators, which as arranged will be able to deliver close upon 1,500 H.P. to the Government workshops in Kabul, and supply the public and private lighting, &c., in addition. The transmission distance is about 40 miles, and a pressure of 44,000 volts is proposed. The cost of the scheme, says the *Indian Textile Journal*, is estimated at Rs. 10,000,000, and the bulk of the plant is coming from America.

Argentina.—Tne River Plate Electricity Co.'s riverside station at the Port of Ensenada is now practically completed, and successful trial runs have taken place. The plant consists of two Westinghonse turbo sets of 2,000 KW. each with boilers, condensers, &c. This station, with its corresponding sub-stations, will probably not be put into continued service until March. Extensions have been commenced for the erection of a further 3,000-KW. turbo-generator. Steps are being taken to extend the company's business in other towns of the Province of Buenos Ayres.—*Review of the River Plate.*

Barrow.—The T.C. has decided to support the Bill being promoted by the I.M.E.A., and guarantee a share of the expenses involved, providing that the liability does not exceed £10.

Bath.—At the last meeting of the City Council considerable time was taken up in discussing a recommendation from the E.L. Committee that the Council should join in the promotion of the I.M.E.A. Bill, provided that its share of the costs incurred did not amount to more than £100. In moving that the recommendation should be deleted, a councillor said that the Bill contained some very favourable clauses, but, on the other hand, it contained some clauses he was not in agreement with. The clause he took exception to was that which he considered would conduce to trading by the municipality, which would make the position of private traders uncertain. It having been pointed out that the number of private traders would be very small, another speaker said that the interest of even a limited number of Bath tradesmen should be very carefully considered. Then came speeches in support; the first speaker said the electric lighting undertaking was a municipal affair, the property of the ratepayers, and if it was to be carried on successfully, they must adopt such measures as were adopted by private undertakings. They had already contributed to the prosperity of private business, by establishing the electricity undertaking, and at least they were not likely to damage it wantonly. The Council should recognise its obligations not only to individual traders, but to the whole of the ratepayers, who were proprietors of the undertaking. Other speakers referred to the progress at Bristol, and alluded to the time when arc lamps were introduced into the city. Shopkeepers could not afford to buy them, and the tradesmen refused to let them out on hire for a small rental; if it had been in the position, the Council could have improved its electric light undertaking enormously by the supply of such lamps. It was pointed out by another speaker that when they placed electricity at the doors of houses, and had to leave it there, because they could not supply the fittings, it was apparent they were losing a most remunerative part of the undertaking. The discussion was concluded by the chairman of the Committee, who said they were only asking the Council to contribute £100 in order to assist the promotion of the Bill, so that they might adopt some of the clauses which they might find necessary. The undertaking was the property of the whole ratepayers. They had over 10,000 ratepayers, and some 12 of these might be affected. But the Council must remember its duty to the 10,000 ratepayers. In the end the amendment was defeated by a large majority.

Bolton.—The borough electrical engineer has been requested to submit to the next meeting of the Electricity Committee his scheme for the proposed new station at Back-o'-th'-Bank.

Brighton.—The recent electrical exhibition promoted by the Corporation was in every way a success, judged by the numbers attending—some 40,000—during its three weeks' run. During the time 32 practical electric cooking demonstrations were held, two of them being on an exceptionally large scale, and we understand from Mr. John Christie that an evident interest has been aroused amongst those who will possibly adopt electrical cooking.

Burnham (Somerset).—At a special meeting of the Urban Council, the Electrical Committee brought up a report on the Council's electric lighting scheme. A motion was unanimously carried that the Council apply before December 21st to the B. of T. for a provisional order.

Bury.—The T.C. has appointed a committee to consider the advisability of opening an electricity showroom, on the lines of that worked by the gas department.

Cheltenham.—It was stated at the meeting of the T.C. that the Corporation electricity undertaking had made a gross profit of £13,485, which, after deducting financial charges, gave a net profit of £3,225.

Chester.—The Corporation has abandoned the site of the electricity works for the proposed refuse destructor. One of the strongest opponents of this site was the Chester General Infirmary Board of Management, because of the detrimental effect it was alleged it would have upon the well-being of the infirmary patients. The proposed site was in the immediate neighbourhood and to the windward of the infirmary, in connection with which a scheme of extension, amounting to £25,000, has been provisionally adopted.

Continental Notes.—GERMANY.—A beginning has been made with the construction of the ebb and flow or tide-driven power station at Husum, which is expected to be completed next year, and by 1913 the districts of Tondern, Flensburg, Sleswick, Eckernförde, Rendsburg, Norder and Süder Dittmarsch, Eidersted and Husum, in the province of Sleswick-Holstein, will be supplied with cheap electricity for all purposes. The scheme contemplates the building of a dam from Nordstrand to the mainland, whereby, by means of a transverse dam, two immense water basins will be created, the high-water one having an extent of 600 hectares and the low-water basin of 900 hectares. A simple but ingenious sluice arrangement will provide a fall between the sea and one of the basins, whereby the turbines will be driven. The ebb and flow of the tide will cause a rise and fall of the water in the basins, but between the level of the sea and that of the basins there will always be a difference. The turbines will drive constant-current dynamos. When completed the installation will serve as many as 700 communes in the province. The Nordstrand dam is already finished.—*Zeitschrift für Turbinenwesen.*

The projected power plant which is to be erected in the province of Hanover, is, according to information communicated to the District Council, to serve 12 districts, besides the cities of Kassel and Göttingen. The erection of three dams is projected, one near Hemfurt, on the Eder, one near Helbinghausen, on the Diemel, and one between Gimbe and Münden, on the Weser. An aggregate of 29,000,000 KW.-hours a-year will be furnished. This power will be distributed to the several districts in definite proportions, by a company to be formed representative of them. According to calculations, husbandry will require for light and power 5,000,000 KW.-hours, and industries 12,000,000 KW.-hours for power alone, and 6,000,000 KW.-hours for lighting. Over and above this, calls are expected later on behalf of the projected Upper Weser Valley Railway.—*Elektr. Zeitschrift.*

The large power station which it is proposed to build at Franken has advanced a stage towards realisation by the adhesion to the project of the city of Nürnberg and the commune of Fürth, and the assent of the commune of Nürnberg is alone awaited. The estimated cost of the scheme is 18,000,000 marks, and a company is being formed with 4,000,000 marks to carry on the work. It is proposed to raise additional capital by the issue of bonds.

FRANCE.—A beginning of the extensive hydraulic works in connection with the comprehensive scheme to utilise the River Durance for the production of electricity is about to be made. The Ministers of Public Works and of Agriculture have found common ground with regard to a credit of 150,000 fr. required for the preliminary surveys, and the work of taking soundings on the bed and below the bed of the river is about to be undertaken. It is intended to sink a shaft to the depth of 30 metres, and then drive a tunnel under the Durance. This will give valuable information regarding the nature of the subsoil, in view of the construction of the dam, which will rise to a height of 80 m. above the present water level. This undertaking is, in fact, a portion of the gigantic scheme drafted by M. Wilhelm, engineer in chief of the Ponts and Chaussées des Hautes-Alpes, to appropriate for industrial uses the whole of the watershed of the Upper Alpes.—*Revue Pratique de l'Electricité.*

SWITZERLAND.—An important hydro-electric scheme is projected in the Valley of the Emme River. The idea is to create at Rehbloch, near Schangau, a reservoir of 35,000,000 cb. metres capacity and capable of yielding at the start 4,000 H.P., raised eventually to 16,000 H.P. The cost of the dam and station are estimated at 8 million fr. The current will be supplied to the various industries along the course of the river. A subsidiary benefit derived from the scheme is the lessening of the loss from the freshets incidental to this river and the equalisation of its waterflow in the various seasons.—*Revue Pratique de l'Electricité.*

SPAIN.—A new company has just been formed in Barcelona with a capital of £400,000 and the title La Sociedad Energia Electrica de Catalunya. The Compagnie Générale d'Electricité, of Paris, is interested in the new undertaking.

Sweden.—As far back as 1905 the city authorities of Stockholm acquired the waterfalls of Tammsforsen and Kvarnforsen, but they have hitherto had no opportunity of utilising the water power owing to the State laying claim to the falls on the ground of sovereign rights. The differences between the contending parties were adjusted some time ago, and as the city has made provisional arrangements for the purchase of the land surrounding the falls, the latter have now become the undisputed property of the city. The managers of the municipal gas and electricity works have now suggested that the construction of the power station which was proposed on the acquisition of the falls should be taken in hand as soon as possible.

According to the plans, the quantity of water counted upon amounts to 250 m. per second, which would given 37,000 H.P. or 21,500 KW. transmitted to and delivered at Stockholm. The average flow of water has during years been about 300 m. per second, which figure, however, during the snow-melting has risen to 1,300, and even up to 2,100 m. per sec., while during the dry season it has been as low as 100, and in exceptional cases, 80 m. per second. The estimate is, however, based on 250 m. per second during eight months of the year, when about 19,000 KW. could be delivered in the town. The total cost of the project has been estimated at £775,000, of which £322,000 would be required for the works in connection with the harnessing of the river, while £228,000 would be required for the power station and nearly £100,000 for transmission purposes. The cost of the plant, exclusive of cables and transformer station at Stockholm will amount to £15 11s. per turbine H.P., which is a normal amount. The working expenses per year, including depreciation, have been estimated at about £55,000, the exact amount being dependent on the percentage of depreciation. On the basis of an average delivery of 19,000 H.P. at Stockholm, the cost of the energy will be from 55s. to 64s. per KW.-year. The difference in the amounts depends on whether the energy is utilised during 3,000 hours per year only, or during 8,760 hours. The corresponding cost of energy from a steam station at Stockholm amounts to about the same on the basis of the energy being utilised during 2,500-3,000 hours. If the time, however, is increased to 8,000 hours, the steam power becomes 100 per cent. dearer. The price of the energy from the Trollhatten works for Gothenberg has, as per contract, been stipulated at 72s. per KW.-year for a working time of 3,000 hours, and at 100s. for a working time of 8,000 hours. The energy for Stockholm will thus be considerably cheaper than that for Gothenberg.

Belgium.—Electricity is being adopted as a motive power at all the pits of the Société des Charbonnages de Strepy-Bracquegnies, in the Hainaut district. Transformer sub-stations are to be established at each of the pits, the current being supplied to the same from a central generating station, at a voltage of 3,200, by underground cables.

Russia.—The adoption of electricity as the motive power in the rolling mills of the Société Metallurgique Dnieprovienne du Midi de la Russie, at Kamenskoie, is making excellent progress. At the central power station three sets of 2,000-H.P. engines and dynamos are already at work, while two additional sets are in course of erection.

Austria.—Messrs. Ganz & Co., of Buda-Pesth, have just signed a contract for the erection of a hydro-electric station in Dalmatia, which will be one of the largest in Europe. It is to be built near Almissa, for the Società per le Utilizzazione delle Forze Hidrauliche delle Dalmazia, of Trieste. The water-power of the Cetina will be utilised, and of the 200,000 H.P. available, only 40,000 H.P., in two units of 20,000 H.P. each, will at present be used. The current will be transmitted at 55,000 volts. The Kreditanstalt, of Trieste, which has just agreed to advance the capital of 6,500,000 kronen, reserves the right for two years to convert its credit into shares and bonds.—*Zeitschrift für Turbinenwesen.*

Corsica.—A concession has lately been granted for the establishment of a plant to utilise the water-power of the River Restonica in the generation of electrical energy for lighting and power purposes at Corta.

Coventry.—The T.C. has decided to support the Bill of the I.M.E.A. seeking powers to enable local authorities to undertake wiring work and the supply of fittings, &c., and to contribute up to £10 towards the expenses.

Derby.—The accounts of the electricity undertaking of the Corporation for the past year show that there was a gross profit of £20,827, as compared with £18,328 in 1910. The net profit realised was £1,770, as against a net loss of £79.

Frome.—At a meeting of the R.D.C. the agreement for the transfer of the electricity works from the Council to Messrs. Edmundson, the contractors, was approved. It was stated that Messrs. Edmundson had agreed to relieve the Council of all income-tax payments, and these, between now and the year 1929, would amount to £2,154. The electricity supply was introduced on condition that the contractors ran it for 25 years, repaid by half-yearly instalments the principal and interest on the money borrowed, and at the end of the 25 years handed over the works to the Council free. Now the ownership of the works is to be transferred to the contractors, and they will continue to repay the loans to the Council

Great Harwood.—The District Council has confirmed its resolution to apply for a provisional order, despite the objection of two members. It has also decided to launch a scheme for the establishment of a generating station on land belonging to the Council in Wood Street, at an estimated cost of £8,085. In due course a L.G.B. inquiry will be held, when there is likely to be some discussion on the part of those who do not approve of the Council's proposals.

Greenock.—Several leading shipbuilding firms in Port Glasgow are co-operating in the movement to secure a supply of electricity from the Greenock Corporation. It has been proposed that a conference be held to discuss the whole question of terms, &c., and the town clerk of Port Glasgow has been approached with this end in view.

Horsham.—By a majority, the U.D.C. has decided to support the Bill of the I.M.E.A., and to contribute towards the cost. The objection on the part of some members was that the powers sought further legalised municipal trading.

India.—The *Indian Textile Journal* states that an Exhibition of Old Bombay is being held during the visit of the King and Queen. Messrs. F. & C. Osler have secured the electric supply work, which will include that to 2,000 50-C.P. lamps for buildings, 120 1,000-C.P. lamps, and over 10,000 smaller lamps for general illumination, aggregating 326 KW. In addition to the above, Messrs. Osler will distribute about 30 KW. for the electric fountain, 97 KW. for the power and lighting required for the scenic railway, and about 44 KW. for sundry other shows, making 246 KW. The current will be supplied from the high-tension mains of the Bombay Electric Supply and Tramways Co. to a sub-station from which Messrs. Osler will distribute over three-phase low-tension mains for the Exhibition lighting as above described.

Lincoln.—The T.C. has applied to the B. of T. for consent to utilise overhead wires for the transmission of current at a pressure of 500 volts to the works of Messrs. Jas. Dawson & Son, Ltd., which are in the area of the Branston R.D.C.

Leeds.—A summary presented to the Tramways and Electricity Committee gives particulars of the city's electric lighting undertaking for the summer half-year ended September 30th. The gross profits were stated at £24,536, as compared with £21,902 in the corresponding period of 1910. The total revenue for the half-year is greater by £2,699 than that of the same period of last year, whilst there is a reduction in the amount of interest payable, and after charging £17,500 towards the yearly contribution for the repayment of debt (£1,100 more than a year ago), the total expenditure shows an increase of £920. Setting the increase of £2 699 in the income against the increase of £920 in the expenditure, the financial result of the half-year's work is £1,779 better than that for the previous corresponding period, the deficit being £7,199 against £8,979. The first half of the municipal year, representing the summer months, must, of course, always show a deficit, whilst the income of the department depends so much, as at present, on lighting. Altogether 6,573,365 units have been sold, or close upon a million more than in the first half of 1910. During the last three or four years the sale of electricity for lighting has been diminishing, notwithstanding increasing use, the larger usage having been more than counterbalanced by the saving due to the introduction of metal-filament lamps. Sales, however, to private consumers for lighting, power and heating purposes have slightly increased, this being due, to some extent, to the larger number of motors in use, the aggregate capacity having grown from 14,034 H.P. to 16,409 H.P. in 12 months.

Leith.—The pumping station at the new dry dock will contain three electrically-driven centrifugal pumps, capable of emptying the dock in 2½ hours; the amount of water to be pumped is about 2,500 tons.

Liverpool.—The Electricity and Tramways Committee has had under consideration the question of renewing some of the Lister Drive generating plant. Tenders were considered for the supply of two new sets to replace two of the ten in use, and it was practically agreed to accept a tender of £100,000, and to sell the old sets for £4,000.

London.—Mr. H. R. Mott, acting electrical engineer to the City Corporation, states in his report for the past year that the incandescent electric lamps now used by the Corporation had been found better for efficiency and light than any of the 10 other different makes which had been tested on these points during the period under review. Visits had been paid to 19 fires in the City, and 4 out of 11 of these fires which had been electrically caused would not have occurred had iron tubing been substituted for the wood casing in which the wiring had been run. The cause of three serious fires were put down to electricity. The department had given technical advice with regard to the agreement between the Corporation and the City of London Electric Lighting Co. for the installation of mains to supply energy at the Coal Exchange. Mr. Mott, concluding, states that an appreciable saving in minor repairs had been effected through the system of monthly inspections.

The County of London Electric Supply Co. is at present giving demonstrations of vacuum cleaning and electrical cooking at its showroom in Upper Richmond Road, Putney. We understand that a vigorous publicity campaign is being conducted by the company in connection with the above, and that the efforts are meeting with a ready response.

Bermondsey.—Application is to be made to the L.C.C. for sanction to borrow £2,782, made up as follows:—Mains, £2,000; services, £250; meters, £500; plant, £32. Tenders are to be obtained for fitting 14 arc lamps in the borough, with lowering gear. With regard to the refusal of the L.C.C. to advance the loan of £18,563 for the Council's undertaking, the Electric and Street Lighting Committee reports that its appeal to the L.G.B. thereon is proceeding.

Norwich.—Owing to the success of electrical street lighting, the T.C. has decided to proceed with the conversion of a second area of the city. The work is to be completed by October 1st, 1912, and will leave only one-third of the city not electrically lighted.

Perth.—Keen interest has been aroused by the intimation of the intention of a company to apply for a provisional order enabling it to acquire the sole rights of Loch Ericht and other waters in the district for power purposes. A similar order, promoted some years ago in connection with the raising of the loch and the carrying through of a scheme for the generation of electricity, never went to proof, on account of the strength of the opposition. The present order, however, contains proposals regarding compensation, water, &c., which may meet the objections to the previous scheme. A special committee of Perth T.C. will be appointed to look after the interests of the city in the matter.

Peterborough.—At its meeting last week, the T.C. discussed means of extending the electricity works in view of the largely increased demand, especially for power purposes. The question of purchasing property near the existing works will come up again for discussion. It was agreed that where electricity is supplied on the ordinary scale for power purposes, a discount of one farthing per unit be made where the supply exceeds 5,000 units per quarter.

Rawtenstall.—The T.C. has decided to give moral, and not financial, support to the Bill of the I.M.E.A. seeking powers for municipal authorities to wire consumers' premises, and to supply fittings, &c.

Reedley Hallows.—The Burnley T.C. has applied to the B. of T. for an order to enable it to extend the mains to this parish, which is in the area of the Burnley R.D.C.

Sherborne.—A prov. order for E.L. is being applied for by Messrs. Purves, of Exeter.

Siam.—Owing to the abandonment of the Petchaburi Palace under construction for the late King, efforts are being made to dispose of the electrical installation for the latter, and it has been proposed to transfer it to Chiengmai, the second city in the kingdom, which is still without any scheme of lighting. The difficulty is that no suitable fuel exists, and only a water power plant appears feasible.

South Africa.—According to *African Engineering*, the Shamva Mine, near Salisbury, Rhodesia, is contemplating the installation of a 4,000-KW. power station.

Southborough.—The U.D.C. has deferred for a year the question of obtaining a prov. order for E.L.

Stalybridge.—The Stalybridge Joint Tramways and Electricity Board has resolved that under the direction of the chairman and engineer, an order for a second 3,000-KW. turbine is to be placed. At the meeting, Councillor Bottomley stated that it was essential that a duplicate turbine set be ordered as quickly as possible, because the demands for motive power were coming in so rapidly that he was afraid that even with this turbine, they would not be able to meet all requirements.

Swansea.—A writ has been issued by the gas company against the R.D.C. for an injunction restraining the Council from supplying electricity for lighting purposes within the Clase and Llansamlet districts. The gas company contends that the Council is debarred by an agreement which exists between them. At present a great part of Llansamlet is lit with electricity, and the Swansea Gas Co. has recently been extending its system considerably in the same area. It is understood that the point at issue is whether the gas company has exercised reasonable expedition in meeting the needs of the district.

Tunbridge Wells.—The Lighting Committee of the T.C. has decided to apply to the L.G.B. for a loan of £6,000 for extensions, &c., for the next three years.

Wednesbury.—The T.C. has received the sanction of the L.G.B. to the borrowing of £3,723 for electricity purposes. This amount is to be expended as follows:—£610 on additions to cells; £715, booster, regulating switches and pumps; £945, feeder main to King's Hall; £558, extensions of central station; £1,395, mains (excess expenditure) and future extensions; and £700, services. The cost of new switches to the amount of £74 is to be defrayed out of current account.

West Bromwich.—The Electricity Committee, in order to meet the increasing demands and to ensure certainty of supply to consumers, finds it necessary to install further generating plant; and for that purpose it is asking the Council for permission to spend a sum of about £10,000 to keep the works up to date so as to meet all emergencies.

West Hartlepool.—It is stated that the L.G.B. has sanctioned the borrowing of £38,651 by the T.C. in connection with the proposed "waste heat" plant which it is proposed to install in agreement with the Seaton Carew Ironworks. It will be remembered that this proposal was strenuously opposed by the local power company.

Worcester.—The Electricity Committee has resolved that application be made to the L.G.B. for sanction to borrow £7,250, which is made up as follows:—Mains in conduits, £3,000; mains direct in ground, £1,000; services, £1,000; meters, £750; transformers, £1,250; transformer chamber and equipment, £250.

Worksop.—The U.D.C. had before it at the last meeting a recommendation of the Lighting Committee to obtain a loan for battery and condensing plant, also that Messrs. E. Bennis & Co., should supply a set of mechanical stokers with self-cleaning bars at a cost of £127 10s. The clerk stated that the cost of storage battery and condensing plant was £2,850. It was proposed to borrow £1,950, and to pay the balance out of current expenditure. The recommendations were adopted, as well as another approving of the Electric Lighting Bill, 1911, promoted by the I.M.E.A.

Worthing.—The T.C. has decided not to entertain a proposal from outside persons to acquire the E.L. undertaking.

Wrexham.—The T.C. has resolved that application be made to the L.G.B. for sanction to borrow £1,200 for electricity mains and £600 for house services.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Tramway Committee is making an experiment by installing a Collins automatic point controller on the system as a safeguard against accidents and for traffic convenience. It will be supplied for £50 by Messrs. Quilliam Bros. The Committee also recommends the adoption of the Bell Punch system of issuing tram tickets and the universal system, which will dispense with the great variety of tickets now issued.

Birmingham.—The City Council has approved of the draft Bill in connection with the proposed Greater Birmingham tramways extension scheme.

Belfast.—The award of the arbitrator in the case of the purchase of the Cavehill and Whitewell Tramway by the Corporation having been put aside, it was announced at the fortnightly meeting of the Tramways and Electrical Committee that the arbitration would be heard again on the 15th inst.

Brighton.—The T.C. has been recommended to approve of the Bill seeking powers to construct rail-less trolley cars and run motor-'buses in Brighton, Hove, Portslade, Southwick and Shoreham. The scheme is estimated to cost £107,400 and a motor-'bus scheme £30,000, £3,000 being included as the cost of obtaining the Act. The Council is advised that, presuming proper fares are charged, the undertaking will be a financial success, and will cast no burden on the rates.

The Hove T.C. sitting in Committee on Monday decided, by 19 votes to 16, to oppose the Brighton Bill and to promote its own Bill. This decision has to be confirmed in open Council.

Continental Notes.—TURKEY.—It is stated that the A.E.G. is becoming interested in the second German electric railway scheme for Constantinople, to which reference was recently made, and that Mr. Rathenau is journeying to the Turkish capital in order to examine the question. The project relates to a line from Stamboul, *via* Pera, to the Black Sea.

ITALY.—The Superior Council of Public Works has sanctioned the conversion to electric traction of the funicular line from Como to Branate, at present worked by steam.—*Giornale dei Lavori Pubblichi.*

SWEDEN.—According to the *Daily Telegraph*, the tram fare in Stockholm is 10 öre, but one can buy a perforated card of 11 tickets for 1 krona, that is to say, the ordinary price of 10 fares. Some time ago a kind of perforated card was introduced, of which the 11th ticket is not available as a tram ticket, but its value goes to schools for teaching poor girls household matters, including the care of children. A great silk firm in Stockholm has found the idea so admirable that anybody who has five such cards, and can show the unavailable 11th tickets, can get 5 per cent. rebate on any goods bought at its warehouse. The cards have now a great sale, to the consequent benefit of the school.

Crewe.—A sub-committee has been appointed by the T.C. to consider the question of adopting the railless trolley system of traction.

Glasgow.—The first half of the financial year of the tramways undertaking ended on November 30th, and it was officially reported that the car receipts for the six months amounted to £501,532, as against £466,612 for the same period last year—a substantial increase of £34,920. This is the first occasion on which a half-year's revenue has exceeded half a million, a result which was in a considerable measure due to the Scottish National Exhibition in the city, and also the phenomenally fine summer, which brought more than the average patronage to the cars.

Subject to the final approval of the T.C., a system will be inaugurated on Sunday, first as a three months' experiment, over the municipal tramway system, by which users of cars will be enabled to travel double the present stages for ½d. In a lengthy report on the subject, Mr. Dalrymple, the general manager, referred to previous occasions upon which the Corporation expressed the opinion that it would be inadvisable to double the length of the ½d. stages. He quoted departmental statistics which went to show that to double the ½d. stage would mean a falling off in revenue of £130,254, out of a total income of £818,768. Replying

to the argument that increased traffic would make up for any reduction in the revenne, he quoted a previous report in which he contended that the increase in passengers could only be ½d. passengers, and that to make up the revenue would require an increase of over 62,000,000 passengers. The cars were now up to their full carrying capacity, so that the department would require to run additional cars, which, of course, would mean additional expenditure —indeed, to carry the increased number of passengers required to make np the revenue to the present amount would take at least 150 cars. The experience gained in connection with the operation of the present two-stage fare was referred to. This experience, however, was not of much value in estimating what would be the financial result of the change now proposed. Their experience with the two-stage fare had, however, shown this, that, as 18 million people per annum were at present using the two-stage ticket, which costs 1½d., all these passengers would, after the halfpenny stage was extended, be carried the same distance for a penny. This meant, of course, an immediate drop in revenue of about £40,000 per annum. The estimate given in the report of November, 1910, when the two-stage fare was instituted, was that 200,000 passengers per day travelled only two stages, for which they paid a penny. The number of passengers at present using the special two-stage ticket was, however, only 100,000 per day, or exactly one-half of the estimated number of those who might do so. Nothing had been said regarding the difficulty that the conductor would meet with in carrying out his work under the new conditions of an extended halfpenny fare; at the present time it was a comparatively simple matter for the conductor to check his halfpenny passengers. Should the experiment be tried, the Corporation should seriously consider whether it would not be wise to delay starting the trial until, say June 1st next, when the department could have 50 additional cars ready to cope with the increased traffic.

Leeds.—A special Investigation Committee of the T.C. has just issued a report on the question of complaints against officials, with special reference to matters affecting the tramways manager. The matter apparently originated with the local Labour party, and as regards Mr. J. B. Hamilton, concerned outside work carried out by him, among other matters. Full explanations were offered by Mr. Hamilton, who pointed out that he was under no definite legal agreement with the Corporation, and that the Committee's sanction had been obtained to various matters mentioned. The Committee endorsed the vote of confidence in Mr. Hamilton passed by the Council. Two of the Committee's decisions, however, appear to qualify the vote of confidence, one being that a direct journey to or from the house of an official, from or to his office, in one of the department's motor-cars be prohibited as private use of the same; the other deprecates the writing of private letters to officials on Corporation business, and suggests that such letters should in future be shown to the Committee concerned and become part of the official correspondence.

London.—Next week the District Railway will introduce a further development in connection with its traffic working. As a result of the opening for traffic of the extra tracks between Hammersmith and Chiswick Park, accelerations will take place all round, and during the busy hours every train will be "non-stop" for a portion of the journey. In view of the wonderful results achieved under electrical operation on this line, it is worth noting that from next week, the following increases in daily train services will be made:—Ealing, with 119 trains each way, will have 198; Turnham Green, 200, will have 270; Hounslow, 121, will have 135; South Harrow, 68, will have 92; and Richmond, 68, will have 70. Stations nearer town benefit proportionately, except, perhaps, where the non-stop working involves only alternate trains stopping at stations. Only some 3½ hours out of the 24 is unprovided with a service. The conduct of this company's service is an object lesson to the various railways which still cling to old-fashioned methods of working; although traffic opportunities may be less than on the District Co.'s route, they are undoubtedly even now beyond the capacity of steam traction methods.

In the annual report of the London General Omnibus Co. the directors, in referring to the negotiations which have been for some time proceeding between the company and the London Electric and Metropolitan District Railways, state that there is at present no definite scheme to suggest, but that if any arrangement should be arrived at the proprietors will be immediately consulted.

The *Pall Mall Gazette*, in commenting upon this statement, says: "Correct, as far as it goes. We can say in addition that, so far as the L.G.O. is concerned, the scheme is agreed. The real difficulty is that the District and the London Electric cannot quite agree as to the apportionment, between themselves, of the burdens and the benefits of the scheme. This alone is causing the delay. But the scheme cannot well be allowed to fail, especially if more 'bus competition is threatened."

Manchester.—The Tramways Committee has had before it the question of issuing contract tickets for use on the city tramways. Mr. McElroy, the general manager, in his report, reminded the Committee of his inquiries and report of four years ago, and stated that he had nothing to add, except that he had had the information corrected to date, and it would be observed that since 1907 the Wigan Corporation had discontinued the use of contract tickets, and the Cheltenham and District Light Railway Co. used them on one ronte only, but they regretted ever having made the concession. The Committee resolved that, in view of the report now presented, it was not desirable to issue contract tickets in connection with the Manchester tramway system.

Todmorden.—A Sub-Committee of the Corporation has been appointed to visit Leeds and Bradford, to view and obtain information as to the system of railless electric cars running there.

Westhoughton. — The U.D.C. has approached the Bolton Tramways Committee with a view to seeing whether the Bolton Corporation will undertake an extension of its system to Westhoughton. The peculiarity of the situation is that although Westhoughton is almost encircled by tramway routes, there are no such facilities in the town.

York.—The City Council has unanimously resolved that application be made to the Light Railway Commissioners for an order under the Light Railways Act, 1896, authorising the Council to make an extension of the tramways commencing in Queen Street and terminating in Victoria Street, a distance of a little over 9 furlongs.

TELEGRAPH and TELEPHONE NOTES.

Cable Rate Reduction.—An important announcement was made by the P.M.G., Mr. H. Samuel, in the House of Commons on Tuesday last, who said that he had been in correspondence with the Western Union Telegraph Co. in connection with the leasing of the Atlantic cables of the Anglo-American and Direct United States Companies, and that the three companies had agreed to accept Press messages not of an urgent character, which might be delayed for not more than 19 hours (clock time at both ends), at one-half the present rates. The Pacific Cable Board and the Australian Government had agreed to a similar reduction. The rates for deferred Press messages from this country to Canada, therefore, would be 2½d. per word instead of 5d., and to Australia and New Zealand 4½d. instead of 9d. He was in communication with the Commercial Cable Co. also on the subject. The service would come into full operation on December 15th. The Eastern Telegraph Co. had consented to carry the messages for Australasia at the reduced rates in the event of interruption to the Pacific Cable.

The Western Union Co. also proposed, on its own initiative, to establish a system of "night letters" and "week-end letters" from this country to places in Canada and the United States, consisting of plain-language telegrams at reduced rates. The former would be delivered on the morning of the second day after they were handed in, the charge being about one-quarter the usual rate, with a minimum of 6s. for 20 words or less; the latter would be accepted on Saturday for delivery on Tuesday, at one-fifth the present rate, with a minimum of 6s. for 30 words. From the 15th inst., the Post Office would accept these letter telegrams for places on the Western Union Co.'s system in America.

The rates for plain-language non-urgent telegrams between the United Kingdom and India, the Dominions, the Crown Colonies, and the United States, he added, would be reduced by one-half from January 1st next. No appreciable cost would fall upon the Treasury through these changes.

Mr. Samuel concluded by stating that he proposed to introduce experimentally the system of cheap night telegrams between London and Aberdeen and Belfast, at a charge of 6d. for 36 words and ½d. for every three words thereafter. The telegrams would be accepted up to midnight at the head offices, and delivered with the first morning delivery of letters.

Telephone Operators.—Medical experts who have been investigating the effect of telephone work on the operators have issued a report stating that no evidence was found of injury of any of the special senses. Anæmia and nervous debility are responsible for prolonged absences, and are the most prevalent complaints amongst young women in any sedentary occupation. Hysterical attacks are not numerous, and no complaint was made of impaired hearing.

U.S.A.—The *Telegraph and Telephone Age* states that the stockholders of the United Wireless Telegraph Co. have organised a protective committee, and will try to formulate a reorganisation plan by which the company may be taken out of the hands of the Federal Receiver. The stockholders in favour of the movement are requested to send in their proxies to the Committee, at 1, Wall Street, New York.

Wireless Telegraphy.—Communication will shortly be established between Banana, Boma and Elizabethville by wireless stations erected along the Congo River, and along the "Kasai-Sankuru."

The use of wireless telegraphy in Russia is being largely extended, and it has been decided to erect eleven stations in the Far East.

Electricity Supply at Bridgetown, Barbados.—In connection with our article on the above on page 909, last issue, we are informed by Messrs. W. T. Henley's Telegraph Works Co. that they carried out the whole of the work in connection with the overhead lines, cables, &c., some of the examples of which were illustrated on page 908.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—January 3rd, 1912. Sixty-nine switchboards, magneto, non-multiple, for the P.M.G.'s Department. See "Official Notices" November 24th.

South Australia.—January 3rd. One wire-testing machine, for the P.M.G.'s Department. See "Official Notices" Nov. 24th.

N.S.W. Government Railways.—January 8th, 1912.—Four 1,000-kw. rotary converter units. January 22nd, 1912.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th, 1912.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

Bosnia.—Bjelina.—December 20th. The T.C. invites offers for the complete installation of a public and private lighting service, including station and staff dwellings. For further particulars see this column last week.

Brighton.—December 11th. One 750-h.p. three-phase induction motor, for the Corporation. See "Official Notices" December 1st.

Croydon.—December 22nd. The B.C. invites tenders for 2,000-volt and 5,000-volt switchboards, and erection of same complete (estimate £4,000). See "Official Notices" December 1st.

France.—January 5th, 1912. The French Post and Telegraph authorities in Paris are inviting tenders for a multiple telephone board for the Central Telephone Exchange.

Germany.—December 30th. The Konsortium Leitzachwerke, of Munich, is inviting tenders for the supply of six turbines and generators of 2,750 h.p., and two exciters of 300 h.p.

Glasgow.—Messrs. William Barr & Sons, coalmasters, invite tenders for the supply of requirements at all their collieries for the year. (10, Bothwell Street, Glasgow.)

Hornsey.—January 11th. One steam dynamo set (either reciprocating or turbine), for the T.C. See "Official Notices" to-day.

Leeds.—December 11th. Underground transformer chamber at North and South Street. Specifications, &c., from Mr. H. Dickinson, manager.

Middleton.—December 12th. Feeder and distributor cable, for the Corporation. See "Official Notices" December 1st.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Sheffield.—December 21st. Two sets of 25-kw. high-speed direct-coupled vertical engines and alternators, for the City Council. See "Official Notices" to-day.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Bangkok.—March 15th, 1912. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

South Africa.—Johannesburg.—December 29th. Spare parts for tramcars and materials for overhead equipment, for the Municipal Council.

The *British and South African Export Gazette* states that large orders for machinery and plant for the Wynberg Municipality are in prospect as the result of the proposal to light the town by electricity. Four "A.E.G." 9,600-kw. turbo sets will be required as a first instalment for the fourth station of the Victoria Falls and Transvaal Power Co., Ltd., now in course of establishment at Vereeniging.

African Engineering states that the Municipal Councils of Claremont, Rondebosch and Mowbray, C.C., are inviting tenders for public and private electric lighting supplies.

South Shields.—December 13th. X-rays installation, West Harton Hospital, for the South Shields B. of G. Mr. J. W. Coulson, Clerk, Barrington Street.

Spain.—Madrid.—The Council of State have authorised acquisition shortly, by way of tenders, of telegraphic posts and insulators (to the value of 800,000 pesetas). Particulars, Direccion General de Corrios.

Las Palmas.—December 15th. The T.C. invites tenders for a water supply concession for 60 years and the use of waterfalls for electric power production. Particulars, Secretario de Ayuntamiento Las Palmas

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. For further particulars, see this column for October 27th.

CLOSED.

Accrington.—The Electricity Committee has accepted the tender of Messrs. Quilliam Bros. for the supply for the tramway system of a Collins patent point-controller, at a cost of £50.

Australia.—An Australian exchange states that the Postmaster-General has accepted the tender of the Western Electric Co. for a new common-battery switchboard at Ballarat (V.), at £4,265.

The Sydney Municipal Council (according to the same exchange) has accepted the following tenders:—

Electricity meters.—Australian General Electric, £1,963.
Arc lamps.—Union Electric Co., £904.
Carbon arc lamps.—Siemens Bros., £1,604.
Fuse-boxes.—W. G. Watson, schedule prices.

The Victoria State Railways Department has ordered a complete set of Stone's electrical equipment, at £275, from Messrs. Noyes Brothers.

The Melbourne City Council has ordered 8,000 yards of fibre conduit (£275) from the Western Electric Co., and an overhead crane, at £180, from the Austral Otis Engineering Co.

Burnley.—The British Insulated and Helsby Cables, Ltd., have received the contract for the supply of various cables required through the widening of Colne Road.

Dunfermline.—The electrical installation in the new Women's Institute for the Carnegie Trust has been entrusted to Messrs. Melville, Robb & Scott, of Dunfermline, at £427.

Eccles.—The T.C. has accepted an offer of the British Westinghouse Electric and Manufacturing Co., Ltd., to supply consumers' electricity meters for the ensuing 12 months.

Glasgow.—The Clyde Navigation Trustees have accepted the following tenders in connection with the electric railway to be laid down for the conveyance of grain from the quay at Meadowside, Partick, to the new granary being erected ercted there:—

350 tons 80-lb. steel rails and 1,050 fish-plates.—Glengarnock Iron and Steel Co., Ltd., £2,065.
77½ tons cast-iron chairs for the 80-lb. rails.—Anderston Foundry Co., Ltd., £308.
72 tons 40 lb. bulb rails and 420 pairs fish-plates.—Steel Company of Scotland, Ltd., £576.
95 chairs for the bulb rails.—Anderston Foundry Co., Ltd., £417.
Switches and crossings.—Mr. George Urie, £350.
4,800 sleepers.—James Kennedy & Co., £980.

The Trustees have also approved of the offer by Messrs. Fullerton, Hodgart & Barclay, makers of the pumping engines at the Prince's Dock power station, for the authorised additional engine, outlying accumulator, and accumulator tower at the Dock, at a total price of £3,613.

Lancaster.—The tender of Mr. E. Dewhurst, of Preston, for electric lighting and provision of electric bells at Dallas Road School, at £290, has been accepted by the Corporation.

Liverpool.—Special meetings of the Electricity and Tramways Committee were held on December 1st and 2nd to consider tenders for plant at the Lister Drive power station. The Committee was faced with the alternatives either of erecting a new power station, the construction and equipment of which takes a considerable time, or of adopting improved plant of larger size and greater output, and the latter procedure was adopted as being the more efficient and less costly in meeting the immediate requirements. The proposal, therefore, before the Committee was for an improvement at the Lister Drive No. 1 station by the gradual replacement of existing sets by new generating and condensing plant, and the tenders recommended by Mr. A. B. Holmes for acceptance are as follows:—

British Westingbouse Electric and Manufacturing Co., Ltd.—Two 2,000-kw. direct-current turbo-generators.
British Thomson-Houston Co., Ltd.—Two 3,500-kw. turbo-alternators, complete with circulating water-pipes and accessories (with the option of ordering two similar machines after test and acceptance of the above-named plant), and for the purchase and removal of the existing plant.
Worthington Pump Co., Ltd.—Four cooling towers and pipes.

The price mentioned for the sale of the "scrapped" engines was £4,000, and during the discussion surprise was expressed by some members of the Committee that two engines which 10 or 12 years ago cost £70,000 should now have to be sold for about £4,000. It was explained that there was a depreciation in plant of this character of 10 per cent. per annum. Councillor A. Gates moved that the report of Mr. Holmes be not accepted, and that outside expert advice be sought, but the proposal was defeated. In the end, the Committee decided to recommend the acceptance of the tenders to the Council. The total cost of the new installations will amount to some £100,000, of which £40,000 is now agreed to by the Committee.

The Tramways and Electricity Committee has accepted the following tenders :—

Messrs. Archibald Batbgate & Sons.—10,000 tons of Pemberton 5 ft. slack coal to the Pumpfields electric power station.
Messrs. Walter Scott, Ltd.—1,000 tons of "Sandberg silicon" rails to Liverpool section.
Lorain Steel Co., Ltd.—400 tons straight section tramway rails to British standard section, aud 100 tons curved section ditto.

London.—L.C.C.—The Stores and Contracts Committee has accepted the tenders of Messrs. Plutte, Scheele & Co., Ltd., and Messrs. Ship Carbons, Ltd., for electric carbons for the year 1912.

The Highways Committee has recommended acceptance of the following tenders for sand crushing and drying plant for the Battersea Bridge and Poplar permanent-way depôts :—

—	(1) Sand-drying plant for both depôts.	(2) Crushing rolls, screens and elevators for both depôts.	(3) Stone-crushing machine, screen and elevator, for Leven Rd. depôt.	Total.
	£	£	£	£
Horsfall Destructor Co., Ltd. ..	—	651	—	651
T. & J. Hosking, Ltd.	1,015	—	—	1,015
St. James' Engineering Co., Ltd. ..	1,920	—	—	1,920
Hadfield's Steel Foundry Co., Ltd.	—	1,555	374	1,928
Joseph Booth & Bros., Ltd... ..	—	3,002	324	3,326
Goodwin, Barsby & Co.	1,715	1,226	441	3,382
James Buchanan & Son	1,950	1,350	500	3,800
The Butterley Co., Ltd.	1,940	1,597	465	4,002
Edgar Allen & Co., Ltd.	3,003	1,863	262	5,128

The lowest in each case is recommended : that of T. & J. Hosking, Ltd., £1,015, for sand-drying plant ; that of the Horsfall Destructor Co., Ltd., £651, for crushing-rolls, screens and elevators ; and that of Edgar Allen & Co., Ltd., £262, for the stone-crushing machine, screen and elevator.

The tenders for the equipment of both of these depôts with grinding machines, motors and switchgear, &c., were as follows :—

THREE PORTABLE ELECTRIC GRINDING MACHINES.—Price per machine.

Bambridge Patent Flexible Shaft Co., Ltd. ..	(recommended)	£73
C. W. Burton Griffiths & Co.	82	(less 2½)
George Robson & Co.	85	(„ 5)
Selson Engineering Co., Ltd.	86	(„ 2½)
Railway and General Engineering Co., Ltd.	95	
United States Metallic Packing Co., Ltd.	110	(„ 2½)
Hadfield's Steel Foundry Co., Ltd.	115	
Consolidated Accessories Co.	128	(„ 2½)

ELECTRIC MOTORS.—Price for five complete motors.

Electric Construction Co., Ltd.	(recommended)	£378
British Westinghouse Electric and Manfg. Co., Ltd.		457
General Electric Co., Ltd.		551
Lancashire Dynamo and Motor Co., Ltd.		571
Dick, Kerr & Co., Ltd.		626
British Thomson-Houston Co., Ltd.	(Not to specification)	

SWITCHGEAR.—Price for complete gear for both depôts.

Evered & Co., Ltd.	(recommended)	£86 (less 2½
Spagnoletti, Ltd.	94	
Johnson & Phillips, Ltd.	95	
Edison & Swan United Electric Light Co., Ltd.	98	(„ 2½)
Electric Construction Co., Ltd.	109	
General Electric Co., Ltd.	114	(„ 2½)
British Westinghouse Electric and Manfg. Co., Ltd... ..	160	(„ 2½)

The lowest tender submitted in each case is recommended.

The tenders received for machine-shop tools required for the same depôts were as under. Only one firm—Tangyes, Ltd.—tendered for all the tools required :—

Judson Jackson Co.	£1,782
Buck & Hickman, Ltd.	2,340
Pollock & MacNab, Ltd.	2,494
Tangyes, Ltd.	3,280
J. Holroyd & Co., Ltd.	1,421
C. H. Caton & Co., Ltd.	1,420
Greenwood & Batley, Ltd.	805
W. B. Haigh & Co., Ltd.	55

The lowest tender which complies with the terms of the specification for each machine is accepted in each case. The total amount of such tenders is £2,054. The tenders accepted are these :

Judson, Jackson & Co.—Four drilling machines, two grinding machines, and two power hack saws, £632.
Buck & Hickman, Ltd.—Two shaping machines, one rail-cutting saw, and one planing machine, £792.
Pollock & MacNab, Ltd.—Three screwing machines, £390.
W. B. Haigh & Co., Ltd.—Timber-cutting saw, £55.
C. H. Caton & Co., Ltd.—High-speed lathe, £185.

A contract has been given to Messrs. G. Hayward & Co., Ltd., for 22 movable platforms for car-cleaning at Streatham car-shed extension.

FULHAM.—The Electricity Committee has recommended the acceptance of the tender of the British Electric Transformer Co., Ltd., for 20 new transformers for sub-stations (14 50-KW. and six 100-KW.), subject to an allowance made by them for 15 old transformers, at £905 net. The tenders received were as follows :—

	20 50-KW. transformers.	Alternative for 14 50-KW. and 6 100-KW.	Allowance for 15 old transformers.
British Westinghouse Co.	£1,100	£1,126	£165
A. H. Greening	Not according to specification.		
Ferranti, Ltd.	£1,150	£1,171	£131
Johnson & Phillips, Ltd.	840	872	222
Carney & Pearn, Ltd...	840	868	75
British Electrical Engineering Co.	1,255	1,280	120
British Electric Transformer Co., Ltd.	710	750	Already deducted from prices quoted.

Rochdale.—The Baths Committee has let the contract for wiring Smith Street baths for electric lighting to the Rochdale Electric Co.

Salford.—The T.C. has accepted the tender of Messrs. Browett, Lindley & Co., Ltd., at £392, for the supply of a 60-H.P. compound vertical steam engine with Lancashire dynamo and switchboards required in connection with their slab-making scheme at the Agecroft Depôt.

Torquay.—The tender of Messrs. T. L. Harding & Sons, of Torquay, has been accepted for the electric light installation at the new post office.

Warrington.—The tender of Messrs. British Insulated and Helsby Cables, Ltd., has been accepted by the T.C. for the supply of medium-tension cable.

Worcester.—The Electricity Committee has accepted the tender of Messrs. Jens Orten-Boving & Co., London, for a vertical turbine and Westinghouse alternator, at £1,828.

Worthing.—The T.C. has accepted an offer by the Anglo-American Oil Co., Ltd., to supply the oil required in connection with the new Diesel oil engines, at 48s. per ton.

FORTHCOMING EVENTS.

Northampton Institute Engineering Society.—Friday, December 8th. At 7.30 p.m. Annual prize distribution, by Sir Wm. H. White.

Royal Astronomical Society.—Friday, December 8th. At 5 p.m. At Burlington House. Paper on "The New 'Synchronome' Astronomical Regulator," by Mr. F. Hope-Jones.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, December 11th. At 6 p.m. At the I.E.E. Paper on "Distribution by Means of Parallel Cables," by Mr. E. A. Pink.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, December 12th. At 7.30 p.m. At the University, Manchester. Paper on "Heat Conductivity in Electrical Machinery," by Messrs. M. Walker and H. D. Symons.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, December 12th. At 6.30 for 7 p.m. At the Grosvenor, Glasgow. Annual dinner.

Royal Society of Arts.—Wednesday, December 13th. At 8 p.m. Paper on "Continuous Service in Passenger Transportation," by Mr. W. Yorath Lewis.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, December 13th. At 7.30 p.m. At the Technical School, Birmingham. Papers on "Automatic Starting of Asynchronous Motors," by Mr. N. Pensabene-Perez, and "Some Notes on the Circle Diagram," by Mr. T. F. Wall.

Junior Institution of Engineers.—Wednesday, December 13th. At 8 p.m. At the Institution of Electrical Engineers. Lecture on "Steel Specifications Considered Commercially," by Maj. H. B. Strange.

Association of Engineers-in-Charge.—Wednesday, December 13th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Methods of Dealing with Losses in Steam Plant due to Condensation," by Messrs. G. and J. R. Wilkinson.

Institution of Electrical Engineers (Dublin Local Section).—Thursday, December 14th. At 8 p.m. At the new Royal College of Science, Dublin. Paper on "Small Electricity Supply Undertakings," by Mr. P. L. Spalding.

Institution of Electrical Engineers.—Thursday, December 14th. At 8 p.m. Paper on "Residence Tariffs," by Mr. A. H. Seabrook.

Electro-Harmonic Society.—Friday, December 15th. At 8 p.m. At the Holborn Restaurant. Smoking concert.

Institution of Mechanical Engineers.—Friday, December 15th. At 8 p.m. Discussion on paper on "Double-cutting and High-speed Planing Machines," by Mr. J. H. Wicksteed.

Institution of Municipal Engineers.—Saturday, December 16th. At 3 p.m. At 4, Southampton Row, W.C. Paper on "The Electric Trolley Omnibus System," by Mr. Horace Boot.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

The following orders are issued :—

Monday, December 11th.—"A" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.
Tuesday, December 12th.—"B" Company. Lecture, technical work and musketry instruction (standard tests), 7 to 10 p.m.
Wednesday, December 13th.—Gymnastic classes, 7 to 10 p.m.
Thursday, December 14th.—"C" Company. Lecture, technical work and musketry instruction (standard tests), 7 to 10 p.m.
Friday, December 15th.—"D" Company. Lecture, technical work and musketry instruction (standard tests), 7 to 10 p.m.
URGENT - All members of the corps are requested to attend headquarters on their company night to sign Association Form 20, recently received from the County of London Association.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

NOTES.

Computing the Speed of Receiving a Telegraphic Message sent by Hand-key or by Automatic Transmitter.—For the above object, Mr. J. Rymer-Jones, M.I.E.E., describes in a short treatise just published a method for manual transmission founded on the only really reliable basis, viz., the actual number of elements received per minute, instead of on the calculated number based on some assumed mean number of elements per letter derived, as hitherto, from a very large number of words of newspaper phraseology, which does not equally apply to a telegraphic message, to code words, or to numerals, code signals, punctuation, &c.

The fact that this method determines the exact number of elements in the text puts hand-keying on the same satisfactory basis, in this respect, as automatic transmission*, and renders it equally suitable for any language expressible in the international or American telegraphic alphabets, for the official or abbreviated codes, and for a message containing only a few words or several hundred words. On this last account a speed calculation is very quickly made with the assistance of printed Form A.†

Although the speed of working is correctly represented by the number of elements per minute, its value in words per minute, of course, depends on the number of elements per word of the particular speed constant‡ employed by different cable companies to suit their value of the dash, spacing and letter-word basis.

It is, however, obvious that the results so obtained are quickly interconvertible, being in an inverse ratio to the number of elements per word in their respective speed constants.

By adopting a recognised number of elements per word, say 40 elements per 5-letter word for siphon recorder, and 50 elements per 5-letter word for Morse recorder, the speeds of working on different cables become standardised and universally comparable.

An important advantage in the method is that the calculated speed is really that of the text itself and is not affected by inordinate spacing between words, due to hesitation in reading the text or to "rub-outs," because spacing between the words of the message is not included when determining the number of elements in the text, but is correctly allowed for in the formula.

The time factor in the formula is, moreover, not affected by bad spacing between words, as it is separately calculated by comparing the linear measurement of some 15 or 20 recorded words (or groups of figures)—selected for the speed computation, and arranged in an unbroken line—with the length of paper strip running during (say) 10 or 15 seconds.

In the description of the method will be found specimen slips of a siphon recorder and Morse recorder message, the speeds of which are both worked out in order to show how the required data are obtained and how the speed is evaluated from them by means of the formula.

Among other particulars as to various known methods for ascertaining the speed of messages automatically transmitted, the formation of signals by the perforated tape, speed-rate constants, &c., will be found a comparison as to speed efficiency between the international and American telegraphic alphabets under different conditions as to the length of the dash and spacing.

Electrical Developments in New Zealand. — Proposals for electrical development in New Zealand are rapidly being elaborated, and once or twice recently we have called attention to possibilities in the immediate future. The Public Works statement just introduced to the New Zealand Parliament by the responsible Minister of the Government contains some interesting details as to the proposals now under consideration. The conditions pertaining to the electrification of the Christchurch-Lyttelton railway are being investigated and the requirements ascertained. It is anticipated that with a supply of power available from Lake Coleridge the conversion from steam to electric working will be profitable, and tenders for the work will be invited in due course with a view to its completion as soon as possible after the supply of current becomes available. After the application of electricity to the working of this line, its application to other sections will be considered. In the meantime, all information on the subject is being collated, and the progress of electrification of railways in other countries is being carefully watched. In view of the rapid extension of electric working in France, Germany, Switzerland, Norway, United States and England, it is intended to make a systematic study of the traffic and train movements throughout New Zealand, with the object of ascertaining definitely the power requirements of the different sections. In other countries the electric working of railways, which has previously been limited to suburban services, is now being extended to main and branch lines, not only where the traffic is heavy, but also on lines with a comparatively infrequent service. Consequently the New Zealand Public Works Department is studying the application of electricity not only to suburban services, where its usefulness is undoubted, but also as an alternative to regrading, which is proving necessary on many of the main lines, in order to cope with the increasing traffic. The use of electric traction would dispense with the necessity of regrading in a great many cases, inasmuch as steeper grades can be worked with electric haulage, and at higher speeds than with steam engines. On new lines also it would be possible to reduce the cost of construction considerably, and to expedite the work by the adoption of higher maximum gradients than are possible with steam haulage, but which can be advantageously operated electrically.

The statement of the Public Works Minister also gives further details as to the hydro-electric works at Lake Coleridge and elsewhere. It appears that much preliminary work has been carried out in connection with the Lake Coleridge scheme. The available market for power in the Canterbury district has been investigated, and the requirements ascertained, and plans and specifications are in course of preparation for works to provide for an ultimate demand of 10,000 H.P.; tenders will shortly be invited for a first instalment of the plant. Arrangements are being made for completing the first section of the work in two years.

It is estimated that a capital expenditure of £375,000 will be required efficiently to install the full 10,000-H.P. plant, and that when installed the district between Rangiora in the north and Timaru in the south can be supplied with electrical energy, with branch lines to the different farming centres. It is hoped to make the system serviceable to country residents as well as to the inhabitants and industries of the cities and larger towns. For this there are very striking precedents in Switzerland, France and Germany, where farms and cottages in rural districts are supplied with electricity for lighting and power purposes at cheap rates. The estimates of capital outlay and operating expenses indicate that power can be supplied at about £6 10s. per H.P. per year for wholesale supply for distribution and for factories.

Although the Lake Coleridge system is the first in importance owing to the urgent demand for an adequate supply of power in the city and suburbs of Christchurch, other available sources of electrical energy are receiving attention. An investigation of the available market in the Whangarei district, where hydroelectric power is available from the Wairua Falls, has been made with satisfactory results, and preliminary steps are about to be taken for the development of power from these Falls, and from Lake Waikaremoana. The electrical engineer to the department is to visit both sources of supply at an early date. It is of fundamental importance for the future development of this work that the fullest possible information should be collected with regard to the rainfalls and variations in flow of the principal rivers over an extended number of years. This information is essential in order that as the population and the markets develop accurate and reliable estimates may be formed of the water power available to meet the demands. For this purpose gaugings will be undertaken of all rivers and streams which are likely to be put under control.

The actual estimates include £290.000 for the Lake Waikaremoana scheme, the Hutt River scheme, the Lake Coleridge scheme and the purchase of material; as well as £10,800 for surveys, &c. The total amount estimated to be required for the current financial year is £50,000.

Under the heading of "Telegraph Extensions" the following sums are included in the estimates:—New telephone exchange stations, £105,000; telephone extensions and new districts, £20,000; trunk wires, £25,000; wireless telegraphy, £7,500; wireless telegraph stations, £7,500.

Strike.—A number of electricians employed by Messrs. Cammell, Laird & Co., Ltd., at their shipbuilding yards, Birkenhead, came out on strike on November 23rd, in support of their demand for a higher rate of wages.

Some 70 men are involved in the strike, and in a statement issued by the company, it is stated that they consider the action of the men in going out on strike at present as most high-handed, and totally contradictory to the avowed policy of the principal Trade Unions that stoppage of work should not take place as long as negotiations are in progress. The electrical trade union forwarded to the firm on November 8th a long list of rules which would be adhered to by their members in their entirety after November 22nd. It is obvious that in a large works it is impossible to allow each small section to draw up rules for itself, especially as regards the hours that the men are prepared to work, and the firm replied to this effect, stating that there was no reason why electricians should be treated more favourably than the members of the many larger Trade Unions. The Union replied on November 16th that the question of the rate of pay was the most important item, and while a letter from the firm proposing a basis of discussion for the rate of pay was still unanswered, an ultimatum was received from the men that, unless the rate of pay they asked for was at once granted, the members would stop work on November 22nd. The rate asked for is stated to be 2s. to 3s. higher than the present rate in this or any other shipbuilding centre, the present rate here being 37s. per week. One of the principal features of the two agreements in the shipbuilding and engineering trades is that no negotiations can take place while a stoppage of work is in progress, and before negotiations with the electricians can be entered into they must first return to work.

Parliamentary.—Peel-Conner Telephone Works.—Following up his previous question (given in last week's Electrical Review), Mr. O'Grady asked whether the inspecting officer who inquired into the strike of girls at the Peel-Conner Telephone Works, Manchester, while the firm were carrying out a Government contract, asked the girls to submit their view of the trouble; and if not, would an inquiry be again undertaken, and the girls' evidence taken in the matter of the reduction in wages which caused the strike. The Postmaster-General replied that he found the girls who struck work were not asked to submit their views. He was sending an officer to make a further investigation, and would communicate the result to the hon. member.

* In automatic transmission the number of elements per minute equals twice the number of centre holes passing through the transmitter during that interval.

† Blank "Forms A," 24 in each pad, are obtainable at the Electrical Review Office, 4, Ludgate Hill, E.C.

‡ Including the recognised allowance for spaces between words.

The City Lighting Scheme.—At the meeting of the Court of Common Council (City Corporation) on Thursday last week, Mr. J. Gunton, on behalf of the Street Committee, submitted a scheme for the lighting in about equal proportions by gas and electricity of the streets of the City, by means of centrally hung lamps as far as practicable for a period of 10 years, whereby an annual saving of about £6,800 would be effected, and an increase in illuminating power obtained of about 600,000 c.p., and recommended that the Gas Light and Coke Co. and the City of London Electric Lighting Co. be permitted to light the public ways in accordance with the said scheme, and that the Committee be authorised to carry out the arrangements, with power to settle all necessary details.

Mr. Gunton, chairman of the Committee, said in 1908 the Corporation appointed a deputation to visit certain Continental cities for the purpose of inspecting the various systems of public lighting. It visited Brussels, Cologne, Düsseldorf, Berlin, Dresden, Vienna, Munich and Paris, and found each of those cities better lighted than London. It had presented its report, and the Council authorised the Committee to arrange for experimental lighting, which had now been in operation for a long time and open to the inspection of the public. The lighting, which he believed had met with universal favour, included the lighting of the St. Paul's end of Cheapside by electric lamps of the Oliver make, fitted with dioptric lenses, and giving 3,000 c.p., and the lighting of King William Street end of Cannon Street by high-pressure gas lamps of 2,000 c.p. Such being the opinion of the experiments, his Committee proceeded to obtain tenders, but only two companies finally sent in prices, namely, the City of London Electric Lighting Co. and the Gas Light and Coke Co. After full consideration, neither company was willing to take a contract for the whole city, mainly on account of the initial cost of the plant, &c., as the whole cost for the complete installation was to be borne by the companies, the Corporation being simply called upon to give the necessary facilities for the work. Another reason why the Committee was in favour of dividing the contract was that it would not render it necessary to take up the streets, except for a very short distance, in laying gas mains where they did not already exist, which would have been almost impracticable, especially in busy centres. It was therefore arranged that both companies should confine their tenders to those portions of the City which they now light, as clearly shown on the plan. The figures submitted, which his Committee, after full consideration, advised the Council to accept for a term of 10 years, showed a cost for gas of £6,719 per annum, as against the present expenditure of £10,099, and for electricity £7,322, against £10,774 10s., being a total cost per annum of £14,041, as against £20,873, or a net annual saving of £6,831. The great point which he hoped would be appreciated was that they increased their lighting by 601,755 c.p., which meant almost doubling the light throughout the entire City. The improved lighting was not only in the main streets, but throughout the entire City. It was not possible everywhere to provide centrally hung lamps, but wherever possible that type would be used, the inverted burner making such lamps practicable.

The report was unanimously adopted.

Electric Time Service.—The example of Durban is about to be followed in Pietermaritzburg of momentarily lowering the electric light at 8 p.m., as an indication of the correct time. This has been done in Durban for about two years, with good results.

The Treasury and Applied Science.—A Blue Book has been issued by the Board of Education on the Universities and University Colleges in Great Britain. It contains over 700 pages, with a tremendous amount of tabulated matter concerning higher education in this country. It is here proposed to mention a few of the points found within this voluminous record which effect higher education in technology.

During the past year £200,000 was given to University College, Reading. Apart from that, the chief endowments provided by private benefaction during the last year have not been comparable with those made in the previous period. "The small extent to which University work is endowed by private benefaction," says the report, "in this country is emphasised if comparison is made with the measure of support forthcoming in other countries. Thus, within a year of its foundation, the Kaiser Wilhelm Society for the promotion of science in Germany has at its disposal a capital of half a million sterling, which is being devoted to the equipment of institutes at which men, already eminent in their respective subjects, will be installed. In France, Monsieur Auguste Loutreuil left a sum of £284,000 towards the promotion of science in that country. In the United States Mr. Rockefeller handed over the sum of £764,000," and so on. The report goes on to speak also of the apathy of the local authorities, several of whom give less than a fair share of support to University work.

So far as engineering work is mentioned, the most noticeable facts are (1) that at Bristol the University Engineering Department has been closed, and the work and staff amalgamated with those of the Merchant Venturers' College in the new buildings of the latter, now recognised as a constituent college of the University; (2) plans for buildings and equipment at Hartley College, Southampton, have been prepared—the cost of the work is estimated at £80,000, but it does not seem to have been raised, nor is the purpose of the extension explained; (3) the East London College, formerly the People's Palace Technical School (one of the earliest and most successful trade schools of this country), now obtains a Treasury grant as a University College. (In passing, it may be suggested that really good trade schools are still urgently needed. The closing of the Carpenters' School at Stratford and the change of work in technology at the institution in the Mile End Road, leave a gap which might well be filled by other institutions in the East End of London.)

Mention is made of the great need of co-ordination in London and elsewhere. London University seems to be at present paralysed by the Royal Commission. That has ever been its fate. Even this Report says nothing can be done until the recommendations of the Commission are published. The fifth annual Report of the British Science Guild contains rough comparisons between the numbers of properly-equipped day students attending the Technische Hochschulem in Germany and the numbers of day students doing similar work here. After making full allowance for the larger population in Germany, there are more than twice as many such students in Germany as in Great Britain and Ireland. It is considered that a more exact comparison would lead to results less favourable to this country.

A table included shows that nearly 33 per cent. of the income of English colleges is derived from fees, about 15 per cent. from endowments, a little more than 14·5 per cent. from local authorities, and 28 per cent. from the Exchequer. The total number of students of all kinds for 1909-10 was 22,187 in England, and of these only 8,174 were full-time students. There seems to be, roughly, some 700 or 800 engineering students attending lectures which lead to a degree, and as far as one is able to estimate the number of engineering graduates to be turned out per annum during the next two or three years, will be from 200 to 250. On the whole the Blue Book makes out a good case for endowment by private individuals. It does not say anything about the difficult problem of co-operation between the manufacturers and the Universities. That has been most successful in some places, and an utter failure in others. Possibly it depends very much upon the personalities of both parties. One of the best examples of such co-operation ever recorded, was that of Mather and Reynolds. It must have been of great intrinsic value to the former, who, be it remembered, generously looked after the engineering department of Owens College. And it possibly kept the attention of Reynolds fixed upon matters of applied rather than pure science.

We understand that the Treasury has now handed over the disposal of the money for university colleges to the Board of Education. We are not altogether satisfied—from the engineer's point of view—that sufficient attention is given to scientific equipment. As an example, we may mention the inspection of a university college, which quite recently took place. Although there are quite as many Science and Engineering students as in the Arts Faculty, yet there were three Arts authorities and only one Science man to decide upon the future of the place. We want science to permeate even into the officialdom of the Treasury.

Damage by White Ants.—An engineering correspondent in South Australia sends us particulars of widespread depredations effected by the so-called white ants (termites) in Adelaide, in connection with the telephone cables of the P.M.G.'s department. The occurrence of crosses between the circuits in a lead-sheathed cable, drawn into earthenware ducts, led to the withdrawal of the cable, when it was found that the sheathing had been partly eaten away in places for several inches, nearly the full thickness of the lead, and in many parts the ants had eaten right through the metal. The presence of living ants in the debris removed from the duct, and the identical nature of the damage with that known to be effected by them in timber, left no doubt whatever as to the cause of the trouble. It is feared that similar damage may be in progress in all parts of the area where underground cables are laid, and it has been suggested that carbon bisulphide may prove effective in putting a stop to it. Hundreds of miles of cable, it is said, have been laid underground, and if the damage is not stopped, enormous expense will be incurred.

In Sydney, some time ago, it was reported that electric light cables were being attacked by the ants, and our correspondent informs us that some three or four years ago it was found on the Sydney tramway system, where the cables were laid on the solid system, that the white ants got through the bitumen compound, and then attacked the lead sheathing, finally eating into the insulation of the high-tension cables, and breakdowns were caused as a result. The authorities decided that it was necessary to provide poison for the termites, and the bitumen in which the cables were laid was loaded with half an ounce of arsenious oxide per cubic foot of bitumen. The Adelaide tramways immediately followed the Sydney practice, as their high-tension transmission line and tramway feeders are laid on the solid system. Half an ounce of arsenious oxide was added per cubic foot of bitumen, and a thin layer was run along the top of the troughing after the main bulk of the bitumen had cooled off, this thin layer containing half a pound of arsenious oxide per cubic foot of bitumen.

It is astonishing how rapidly the white ant works. Some of the wood blocks laid in the main city street of Adelaide between the tram tracks, 2½ years ago, are absolutely riddled with white ants, in spite of the fact that the timber is jarrah (*Eucalyptus marginata*), which is supposed to be white ant-proof.

Electrical Trades Union.—At the Bush Hotel, Shepherd's Bush Green, W., Bro. John Potter will give an address on "Foreign Policy from the Workers' Point of View," Tuesday evening, December 12th, at 9 o'clock.

Colliery Fatality.—A correspondent says that a fatal accident took place at the United Collieries, No. 2 Pit, Nackerty, Uddingston. A haulage rope connected with the colliery electric plant became charged with electricity, and a young man who was in the vicinity came in contact with the rope, and immediately collapsed. Artificial respiration was resorted to, but was of no avail.

Indian Business Methods.—The following letter, received by one of our readers, is a remarkable example of *naiveté*:—

"Please send us by return of mail full details and particulars together with your very latest illustrated wholesale Price Lists of every one of your Specialities.

"We kindly point out that India and all other Countries in the East and in the Far East are most miserably cheap markets, so pray be quite sure to quote us your most liberal trade and cash discounts over and above your latest dreamable wholesale trade prices. Kindly quote as low prices as possible, but please state that you will allow us 50 per cent. trade and 5 cash discounts besides your cheapest conceivable prices. This will enable us to do quite a tremendous business with you if you write back agreeing to appoint us your Firm's exclusive representatives and sole agents in entire East and the Far East, since we have most exceptional trade connections and facilities in all these countries. Provided always that your goods prove to be 'quick sellers' we guarantee A1 business. Therefore please be quite sure to at once send us a totally free sample of every one of your various specialities. Pray do not fail to do this at once. Kindly also state that packing shall be free and that no charge shall ever be made for wooden cases. All our other Principals always do the same.

"Please also inform if you make *revolving hand fans* (of metals) in ladies' and gents' sizes. If yes, pray send a free sample of each at once, and quote lowest prices and highest trade and cash discounts.

"We would always expect you to print our own name and address only (but never yours) on all goods to our orders, just as all our other principals always do. We want you to do this, as we never let our customers and our competitors know who our principals are, or by whom our goods were made. If, then, you agree to print only our own name and address (but never yours) on all your specialities sent to us, we will do quite a brisk trade with you if your goods are quick-selling lines.

"Please do not fail to send free samples at once, and state if freight and duty will be payable by you or by us, and so oblige.—Yours faithfully, &c."

We may mention that the cost of samples of all the specialities of the addressee would amount to several thousand pounds.

Labour Unrest: Some Remedies.—At a special meeting of the Council of the London Chamber of Commerce held recently, Mr. Stanley Machin presiding, the report of the Special Committee appointed by the Council of the Chamber to "inquire into and report on the whole question of the causes and effects of the recent labour unrest and the proper remedies" was presented and adopted. The following are the conclusions and recommendations contained in the report: "That, apart from any questions relating to the methods by which employers individually or collectively may determine to carry on their business, remedies for labour unrest can to some extent be provided by legislation. The Committee, therefore, recommended :—

1. The repeal or amendment of Secs. 2, 3 and 4 of the Trades Disputes Act, 1906, with special reference to the provisions as to "peaceful picketing" and the limitation of the responsibilities of Trade Unions for damages incurred in respect of strikes organised by them.

2. The enlargement of the powers of voluntary boards of conciliation and arbitration under the Conciliation Act, so as to provide for the enforcement of awards and agreements made between employers and employed and the prevention of lockouts and strikes without due notice being given.

3. That effective provisions be made for the maintenance of law and order in the interests of the general community, and for the full protection of those willing to work, and that such further legislative action be taken as will secure freedom of labour and of commerce as well as the protection of life and property.

4. That the statutory monopoly now enjoyed by a privileged class of watermen and lightermen in regard to the navigation of barges and similar craft on the river Thames should be repealed in order to provide for the freer navigation of the waters of the Port of London.

5. That the foregoing recommendations be formally presented to His Majesty's Government with a request that effect should be given thereto at the earliest possible date.

6. That a copy of this report be sent to all members of both Houses of Parliament.

The Committee further recommended that employers of labour should be urged to federate in order to protect their mutual interests, and that the Chamber should give its approval to the proposal for the establishment of a volunteer police force.

Municipal Appointments.—A Cardiff paper says that 48 applications were received for the position of commercial manager of the Newport (Mon.) Tramways and Electric Light Works. It was decided to tabulate these for consideration at a special meeting. At a meeting of the Electricity and Tramways Committee, Ald. Fred Phillips declined to be re-elected as chairman, and said that he did not agree with the policy of the Committee in rearranging the managerial duties of the tramways and electricity undertaking. Mr. John Moxon was subsequently elected chairman, with Ald. Fred. Phillips as vice-chairman.

There were 87 applications for the post of borough electrical engineer at South Shields, at £400 per annum. A selection of six was made, and after these have been interviewed by the Electrical Committee and reduced to three, the Council will be asked to finally settle the matter.

The Electrical Treatment of Tobacco.—We ha rceived from the Voltuma Co. samples of their cigarettes, sor untreated, others treated with electricity, on a system patented Mr. E. J. Lusby. There is certainly a marked difference betwe the cigarettes said to have been treated and those not so treated, favour of the former. Details of the process are wanting, b from the leaflets accompanying the samples it appears that tl patentees are somewhat confused as to its nature, for they speak "electrified or ozonised tobacco." Now, ozone is not electricity, n is it necessarily an electrical product. They say also that "tl added ozone softens or sweetens the tobacco"; one may tre tobacco with ozone, but cannot permanently *add* ozone to tobacc for it very soon ceases to exist as ozone. We are told, too, th well-known electricians have been consulted, and their opinio prove "that when a current of electricity with a greater curre density than that required to decompose water is passed throu the tobacco, ozone as well as oxygen and hydrogen are liberated this, of course, is pure nonsense, and no electrician worthy of t name would make such a statement. Whatever, therefore, may the merits of the treated tobacco, it is evident that the patentee ideas regarding the treatment are extremely crude.

Indian Notes.—Our Special Correspondent in Ind writes: The Calcutta *Statesman* says that the Mysore Public Wor Department have begun operations on the Cauvery reservoir pr ject. The river is to be dammed 9 miles above Seringapatam. T reservoir water will be used partly for irrigating a huge extent land which now lies fallow, between the French rocks and Chenn patna, and, besides, it is calculated that an extra 5,000 H.P. will available for the electric supply works. It is estimated that ful 10,000 coolies will shortly be at work on the 100,000 ft. of da starting on both banks of the river. The scheme is to be carri out departmentally, the establishment consisting of a superintendi engineer, three executive engineers and seven assistants, for all whom temporary quarters are to be built.

The new State electrical engineer, Mr. Beame, has commenc work on the Bangalore tramway scheme. It is proposed for t present to lay down 10 miles of track between the Fort, Fras town, Basvanguti and Maleswaran. The system will be under t control of the Mysore Durbar, who have guaranteed a 4 per ce return. The present available horse-power for this project fr the Cauvery Falls is about 250, but when the reservoir abo mentioned is finished, at least 5,000 H.P. will be available. So of this will probably be used for tramways, and some for the el trification of the Mysore-Bangalore Railway.

Will.—The late Sir W. J. Crossley (founder of Cross Bros., of Manchester), who died in October, left net personal amounting to £578,286.

Institution and Lecture Notes.—Royal Insti tution.—At a general meeting on Monday the thanks of the me bers were returned to Mr. D. J. Blaikley for presenting to the Ins tution, from the bequest of the late Miss J. Barnard and at h express wish, a large volume of Faraday's containing engravin portraits and letters.

The lecture arrangements before Easter include the following: Prof. E. G. Coker, two lectures on "Optical Determination Stress and some Application to Engineering Problems"; Prof. S J. J. Thomson, six lectures on "Molecular Physics." The Frid evening meetings will commence on January 19th, when Prof. S James Dewar will deliver a discourse on "Heat Problems." Su ceeding discourses will probably be given by Prof. Bertra Hopkinson, Dr. J. Mackenzie Davidson, Dr. J. A. Harker, Rt. Ho Sir John H. A. MacDonald, Mr. G. K. B. Elphinstone, Dr. W. J. Lockyer, Mr. F. Soddy, Prof. D'Arcy W. Thompson, Prof. Sir J. Thomson and other gentlemen.

Association of Consulting Engineers.—The inaugur meeting of the Association will be held at the Institution of Ele trical Engineers on January 15th.

The Society of Engineers (Inc.).—A paper on "The Desig of Tall Chimneys" was read by Mr. Henry Adams, M.Inst.C.E., December 4th. Different rules are given for the section area, wind pressure, &c. The safe load in tension a compression upon various materials is given, and t desirability of an independent foundation is pointed out. Son useful notes are given upon combustion, with the temperature a bulk of the escaping gases, the force of the draught and the hors power of the chimney. In an appendix the author gives t detailed calculations and a design for a chimney 150 ft. high a 4 ft. 3 in. internal diameter, including the concrete base and pr tection from lightning.

Mr. W. W. Lackie recently gave a lecture to the members of t Glasgow and West of Scotland Branch of the Smoke Abatemen League dealing with "Electricity and the Smoke Problem." H said that there were over 37,000 H.P. of electric motors connect to the Corporation mains. This alone meant a serious contributi to the solution of the smoke problem, inasmuch as these moto had displaced scores of chimneys used for private steam plant which were now scrapped. This was only an earnest of what wou take place all over the city when the electric drive was universal adopted. The use of electricity for cooking would mean the abol tion of 80 per cent. of the atmospheric pollution from domest chimneys, and the domestic chimney was the largest contributor the smoke problem. The substitution of the electric vacuum clean for the carper-sweeper, hand-brush and duster, and the cleaning cutlery, silver, brasses, and boots, meat mincing and coffee grindi by means of an electric device called the "Electric Mary Ann would solve the servant problem.

Australian Electrical Engineering Institutions.—For some months past proposals have been under consideration for the formation of an "Australian Institution of Electrical Engineers" by the amalgamation of the existing societies—the Electrical Association of N.S.W. and the Victorian Institute of Electrical Engineers. Difficulties, however, have been met with, and the whole scheme has had to be withdrawn for reconsideration and amendment.

The Institute of Metals.—The London meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W., on January 16th and 17th, 1912. The President-designate (Prof. W. Gowland, F.R.S.) will deliver his inaugural address on the subject of "Copper and its Alloys in Early Times," and a number of papers will be read, including "Properties of Certain Copper Alloys at High Temperatures," by G. D. Bengough, M.A.; "Further Experiments on the Inversion at 470° C. in Copper-Zinc Alloys," by Prof. H. C. H. Carpenter, M.A., Ph.D.; "The Influence of Oxygen on Copper containing Arsenic or Antimony," by R. H. Greaves; "The Nomenclature of Alloys," by Dr. W. Rosenhain, B.A.; "Poisoned Brass, and its Behaviour when Heated in Vacuo," by Prof. T. Turner, M.Sc.; and a paper by Dr. Carl Benedicks, of the University of Stockholm, on a zinc-antimony alloy. Membership application forms can be obtained from Mr. G. Shaw Scott, M.Sc., secretary, Caxton House, Westminster, S.W. The third annual dinner of the Institute will take place on January 16th, 1912.

Inquiry.—A correspondent asks for the names of firms who undertake autogenous welding.

Appointment Vacant.—A chief assistant to the Professor of Engineering is wanted at the City and Guilds Technical College, Finsbury. Particulars of the post appear in our advertisement columns.

Nobel Prize.—The Nobel Prize for Physics will probably be divided between Profs. Wien and Planck for their researches in the radiation of heat.

Taxation of Motor-Cars.—In the House of Commons on November 30th, it was stated in reply to a question by Mr. Joynson-Hicks that the Chancellor of the Exchequer was taking steps to appoint a small Committee to consider the existing regulations for calculating the horse-power of motor-cars for taxation purposes.

Charge of Stealing.—At Wolverhampton, on Monday, a number of men were committed for trial, several of them being allowed out on bail, on a charge of stealing and receiving tin ingots, of the value of £90, the property of the Electric Construction Co., Ltd.

Heavy Damages for Sunderland Shipbuilders.—After many days' hearing, the Official Referee, Mr. Edward Pollock, gave judgment in the action of Doxford & Sons, shipbuilders, of Sunderland, against the Wearmouth Coal Co., also of Sunderland. It will be remembered that the plaintiffs claimed damages amounting to £190,000 against the defendants owing to subsidence of land on which their shipyard, electric cranes, and workshops were situated, caused by the defendants' colliery workings. The learned Referee was asked to assess the damages. In giving judgment, he said that some of the particulars of plaintiffs' claim were exaggerated, but held that they were entitled to a sum of £102,276, carrying interest at the rate of 4 per cent. from the day of the judgment in respect of expenses of restoration, loss of profit, &c. He also awarded them $\frac{9}{10}$ths of the costs and granted defendants a stay of execution, in order that they might have an opportunity of considering his judgment.

For Sale.—The Hammersmith B.C. has for disposal by tender a quantity of plant, scrap metal, &c. See our advertisement pages to-day.

Labour Troubles in Berlin.—The Berlin correspondent of the *Standard* states (December 1st):—"For some time past large numbers of workers in all branches of the metal trade have been on strike, and following on the failure of negotiations, the Masters' Union last night decided on a general lock-out. Over 60,000 iron-workers, electricians, engineers, tinplate makers, &c., are now on the streets, and great firms like Siemens and Schuckert and the General Electric Co. are practically at a standstill."

The Royal Train in India.—With reference to our last week's notice under this heading, Messrs. J. Stone & Co., Ltd., write stating that the Royal train for the use of their Majesties the King and Queen, which has been built by the East Indian Railway, is fitted with their electrical installations. "The Royal train referred to, belonging to the Rajputana Malwa Railway, is also fitted with Stone's dynamos which provide the electric light while the train is in use, but in view of the special and abnormal conditions—that is to say, the long stop this train will make at the Durbar celebrations, when the train will, in fact, be used as an hotel—the petrol set has been supplied to charge the cells during the period the train is stationary."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Brighton T.C. is recommended, owing to the resignation of Mr. Fowler, electrical engineer, to re-arrange the staff at the electricity works, and to appoint Mr. Caughton, at present on the staff, as assistant engineer and second in command under Mr. Christie, in connection with the engineering side of the undertaking, his salary to be increased from £300 to £350 per annum, with yearly increments of £25 to £400; and that Mr. Joyce, who has been on the staff for 20 years, be appointed assistant manager, his salary to be increased from £250 to £300, rising by £25 a year to £350.

The E.L. Committee of Derby T.C. has recommended that the salary of Mr. T. P. Wilmshurst, electrical engineer, be increased from £600 to £650 per annum, with a further increase to £700 on January 1st, 1913.

The *British and South African Export Gazette* says that Mr. W. J. Mason, who was for some years town engineer of Uitenhage, has been appointed to a similar position at Bulawayo, while Mr. R. H. Molesworth, late resident engineer to the Oudtshoorn Electric Light and Power Co., Ltd., was recently selected for the Uitenhage post.

The Bispham Council has appointed Mr. S. J. Hollinrake, of Hebden Bridge, to the position of electrical engineer.

General.—Mr. George Paton has resigned his position with the Tientsin Gas and Electric Light Co., Ltd., after serving them for three years as chief engineer of the station, and has taken up a position with the British American Trading Co., of that port, as manager of their electrical engineering branch, they being sole agents for the General Electric Co., Ltd., of Witton, with a head office for the Far East in Shanghai.

The *Review of the River Plate* states that Mr. V. Lindop, general manager of the River Plate Electricity Co., left last month for a short business trip to England.

The Council of the Liverpool University has appointed Mr. J. F. Gill, M.Sc., B.Eng., to be a demonstrator in Electrical Engineering.

Mr. George New, of the Indo-European Telegraph Department, has been appointed Administrator of the Persian Telegraphs.

Obituary.—Mr. J. F. Hall.—We deeply regret to learn of the death, which occurred on December 3rd, of Mr. James Frederick Hall, who had for many years been associated with Messrs. W. T. Henley's Telegraph Works Co., Ltd., in connection with submarine cable work. The deceased gentleman was 60 years of age, and had been ailing for some months. He entered the service of the late Mr. Henley as long ago as 1865—and the whole of his working life was spent continuously and faithfully with the firm. For many years he had occupied the position of chief of the electrical department, and he was holding this office right up to the time of his death. Naturally, therefore, he had had to play the principal part in connection with the manufacture and laying of many submarine cables, included among them being the following:—La Guayra and Caracas; San Domingo to Curacao; Puerta Plata to St. Nicholas Mole, Hayti: Cay Manera, Cuba, to St. Nicholas Mole, Hayti; Aquadores, Cuba, to Cay Mancra; Halifax, Nova Scotia to Bermuda; Port-au-Prince to St. Nicholas Mole, Hayti; Martinique to Surinam; Bahamas, to Florida; and Gotland. In our early days we were for many years intimately associated with submarine cable testing, and it was our good fortune to work on numerous occasions with Mr. Hall, for whom we have ever entertained the highest regard and esteem. From a humble beginning, and without any pretenec to education, he rose by his own efforts to the position he occupied at the end, and we invariably found him to be a man in whom we could place absolute reliance.

The funeral of the late Marquess of Tweeddale took place at Yester, Haddingtonshire, on November 30th. At a memorial service held at St. Columba's, Pont Street, London, those present included Sir J. Denison Pender, Sir J. Wolfe Barry, Sir J. C. Lamb, Sir Henry Mance, and Mr. A. R. Hardie (Secretary of the Eastern Telegraph Co.).

NEW COMPANIES REGISTERED.

Kent-Mitchell, Ltd. (118,721).—This company was registered on November 22nd, with a capital of £600 in £1 shares, to acquire from A. R. Mitchell and G. P. Kent (1) foreign and Colonial patents for an invention known as the "Multiplex Advertising Machine;" (2) the benefit of a British patent for an invention relating to improvements in electric fittings known as the "Lazilite"; and (3) the benefit of a British patent for an invention relating to improvements in gearing known as the "Kent Mitchell Gear," to develop and turn to account the same, and to carry on the business of electrical, mechanical, motor and general engineers. The subscribers (with one share each) are:—A. R. Mitchell, Southampton House, High Holborn, W.C., engineer; G. P. Kent, Southampton House, High Holborn, W.C., director. Private company. The number of directors is not to be less than three or more than seven; the first are A. R. Mitchell, G. R. Kent and A. D. Mitchell; qualification, £10. Registered by Jordan & Sons, Ltd., 116, 117, Chancery Lane, W.C.

Thos. E. Morgan, Ltd. (118,687).—This company was registered on November 20th, with a capital of £100 in £1 shares, to carry on the business of electrical, gas, mechanical and general engineers, light, heat and power suppliers, ironfounders, plumbers, glaziers, &c. The subscribers (with one share each) are :—T. E. Morgan, 367, Ecclesall Road, Sheffield, electrical engineer; H. Allsopp, 163, Devonshire Street, Sheffield, traveller. Private company. The number of directors is not to be less than two or more than five; the first are T. E. Morgan and H. Allsopp. Registered by the Midland Mercantile Association, Ltd., Albert Buildings, 151-7, Fitzwilliam Street, Sheffield.

Oswald Carr, Ltd. (118,798).—This company was registered on November 27th, with a capital of £500, in £1 shares, to carry on the business of electrical, mechanical, hydraulic, constructional and general engineers, dynamo manufacturers, contractors, wagon makers, &c. The subscribers (with one share each) are :—J. Draper, 169, Parkside Road, Bradford, cashier; J. W. G. Butterfield, 2, Darley Street, Bradford, chartered accountant. Private company. The number of directors is not to be more than five; the first are O. Carr (managing director) and Gertrude Carr; qualification, one share. Registered office, Oak Works, Headingley, Leeds.

Harvey Electro-Chemical Co., Ltd. (118,778).—This company was registered on November 25th, with a capital of £25,000 in 23,000 preference shares of £1 each, and 40,000 ordinary shares of 1s. each, to carry on the business of contractors, founders, metal depositors, refiners and inlayers, electroplaters of metals and other substances, electrical engineers, gold and silversmiths, to acquire the businesses of the Metal Depositing Syndicate, Ltd., and the Alexander Harvey Exploitations, Ltd. The subscribers (with one share each) are :—C. Bowen, 25, Ely Place, Holborn, E.C., solicitor; E. A. de Buriatte, 25, Ely Place, Holborn, E.C., solicitor. Private company. The number of directors is not to be less than three or more than seven; the first are Sir William B. Hudson (chairman), Major H. de L. Walters, H. A. Harvey and Q. Marino. H. Harvey is permanent; qualification (except first directors), 250 shares; remuneration, £200 each per annum. Registered office, Norfolk House, Lawrence Pountney Hill, E.C.

National Ottoman Syndicate, Ltd. (118,864).—This company was registered on November 30th, with a capital of £55,000 in 50,000 preference shares of £1 each and 100,000 ordinary shares of 1s. each, to acquire, construct, complete, equip and maintain and work and finance the acquisition, construction, completion, equipment, and working of railways and other appurtenances, tramways, lines of telegraph, telephones or other means of communication in the Turkish Empire or elsewhere (except in the case of telephones and telegraphs in the United Kingdom), to generate, accumulate, supply and use electricity for light, heat, motive power or otherwise to acquire lands, mines, minerals or other property, to carry passengers and goods, to act as concessionaires, capitalists, financiers, &c. The subscribers (with one share each) are :—P. H. Wiggins, 141, Station Road, Church End, Finchley, clerk; R. C. Howley, 11, St. Anne's Road Leytonstone, clerk. Private company. The number of directors is not to be less than two or more than nine. The subscribers are to appoint the first; qualification, one share; remuneration, £200 each per annum (chairman £300.) Registered by Ashurst, Morris, Crisp & Co., 17 Throgmorton Avenue, E.C.

North-Eastern Electric Smelting Co., Ltd. (118,843).—This company was registered on November 29th, with a capital of £25,000 in 24,750 preferred ordinary shares of £1 each and 5,000 deferred ordinary shares of 1s. each, to carry on the business of electric and general smelters and refiners, &c.., and to adopt an agreement with O. Stalmann. The subscribers (with one preferred ordinary share each) are :—F. H. Haviland, 15, Old Christchurch Road, Bournemouth, solicitor; C. D. Willard, Cromwell House, Surrey Street, Strand, W.C., gentleman. Private company. The number of directors is not to be less than three or more than seven; the first are F. H. Haviland, C. D. Willard and F. M. Sanders; qualification, £100 preferred ordinary or £5 deferred ordinary shares; remuneration, £100 each per annum and 5 per cent. of the net profits in any year when 10 per cent. dividend is paid on the preferred ordinary shares (such remuneration not to exceed £250 for each director). Registered office, Cromwell House, 6, Surrey Street, Strand, W.C.

Dynamic Thermometer Co., Ltd. (118,790).—This company was registered on November 27th, with a capital of £1,000 in £1 shares, to take over the business of automatic temperature regulating experts, manufacturers and consultants carried on at 11, The Terrace, Barnes, as the "Dynamic Thermometer Co.," and to adopt an agreement with H. S. Benson. The subscribers (with one share each) are :—W. G. Hollinworth, 124, Wrottesley Road, Harlesden, N.W., gentleman; W. V. Harman, 25, Craven Park Road, South Tottenham, N., clerk. Private company. The number of directors is not to be less than two or more than three; the first are H. S. Benson and J. Stuart. Registered office, 11, The Terrace, Barnes.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Phonopore Telephone Co., Ltd. (44,654).—Charge on freehold land at Hayes, Southall, with factory thereon, dated November 14th, 1911, to secure £500, and all moneys for which A. Hacs, A. F. Liddell and F. C. Liddell may become liable under a guarantee to Barclay & Co., Ltd., securing an overdraft up to £2,000. A memorandum of satisfaction to the extent of £300 on December 18th, 1908, and to the extent of £500 on October 17th, 1911, of charge dated September 10th, 1906, securing £2,500, has also been filed.

Electrician Printing and Publishing Co., Ltd. (26,898).—Mortgage debenture dated November 7th, 1911, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Coutts & Co., 440, Strand, W.C.

Newtons, Ltd.—Return dated September 27th, filed October 25th, 1911. Capital, £40,000 in £10 shares. 3,265 shares taken up. £18,650 paid. £14,000 considered as paid. Mortgages and charges: £13,000.

Warren Beattie, Ltd. (70,585).—Return dated September 11th, filed September 13th, 1911. Capital, £10,000 in £5 shares (400 deferred). 400 deferred and 796 ordinary shares taken up. £5 per share called up on 400 ordinary. £2,300 paid. £3,680 considered as paid on 336 ordinary and 400 deferred. Mortgages and charges: £4,000.

Marconi International Marine Communication Co., Ltd. (65,759).—Particulars of £250,000 debentures, created July 17th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £125,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Melksham Electric Supply Co., Ltd. (118,263).—Debenture dated November 14th, 1911, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. H. Bell, Melksham.

Corona Lampworks, Ltd. (116,327).—Issue on November 9th, 1911, of £500 debentures, part of a series of which particulars have already been filed.

Switchgear & Cowans (1911), Ltd.—Particulars of £3,500 debentures, created October 27th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £2,700. Property charged: The company's property, present and future, including uncalled capital. No trustees.

CITY NOTES.

German Electrical Companies.

The Siemens Elektrische Betriebe, of Berlin, which own or manage electric supply works established by the Siemens & Halske Co., report an increase of £5,500 in the gross profits for 1910-11. The net profits amounted to £28,700, as compared with £28,400 in 1909-10, and it is proposed to pay a dividend of 6½ per cent., being the same rate as in the previous year.

The accounts for 1910-11 of the *Helios Electricity Co., of Cologne* which is in liquidation, show net profits from interest which permit of the reserve fund being increased from £158,000 to £163,000. On the other hand, the debit balance remains unchanged at £419,000, or the total amount of the ordinary share capital. The claims of the debenture-holders have been reduced from £345,000 to £268,000, and a further repayment of 14 per cent is held in prospect for the beginning of next year.

The Telephonfabrik A. G. vorm. J. Berliner, of Hanover, after making the usual provision for depreciation and reserve funds proposes to pay a dividend of 8 per cent. for 1910-11, as contrasted with 12 per cent. in 1909-10, 11 per cent. in 1908-9, 10 per cent in 1907-8 and 9 per cent. in 1906-7. It is said that the less satisfactory results are partly due to the reduction in the orders received by the Vienna branch from the Austrian military authorities, who placed large contracts during the crisis incidental to the annexation of Bosnia and Herzgowina, and to the expenses which arose from the subsequent conversion of the Hungarian branch into an independent company.

The report of the *Bayrische Stickstoff Werke (Bararian Nitrogen Works)* for 1910-11 refers to the third preparatory year of the company's existence. It states that all the constructional works were completed at the end of April, 1911, when production was partially commenced. The plant worked satisfactorily and yielded a good marketable product, and the advantages of nitrogen of lime as a fertiliser were being recognised by agriculturists to a increasing extent. The demand was so large that the entire output had been sold to the spring of 1913. The accounts show that including the deficit brought forward, the year 1910-11 closed with a loss of £3,400, which has been carried forward.

The A.E.G.-Lahmeyer Werke, Aktien Gesellschaft, which was formed by the Berlin A.E.G. in 1910 for the purpose of taking over the Frankfort dynamo works, reports profits of £32,000 for the first half of 1911. After allocating £2,380 to depreciation of buildings and £926 for management expenses, the accounts show net profits of £28,800. It has been decided to pay a dividend at the rate 6 per cent. for the six months on the ordinary share capital £500,000, the whole of which is held by the Berlin A.E.G., and to place £12,500 to a special reserve fund, leaving a balance of £1,3 to be carried forward. The ordinary reserve fund, which was created on the formation of the company, stands at £50,000, and the credits open with the A.E.G. and the banks are returned £411,000.

The Elektrizitats Gesellschaft Colonia is the title of a new company which has been formed at Cologne to take over and continue the undertaking of the E. H. Geist Electricity Co., which went into liquidation a year ago. The enterprise is being acquired according to an agreement which was approved at a meeting of the Geist C last September, and which is on an annual rental basis with the option of purchase. It is intended to supplement the existing equipment by the installation of modern labour-saving machinery to retain the existing staff of workmen and to take over the incomplete orders on hand on January 1st, 1912, the works having hitherto been continued by the liquidation company, whose financial position has experienced a further improvement since last June.

R. Waygood & Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the year to September 30th.

J. G. White & Co., Ltd.—The directors have declared an interim dividend, payable January 1st next, of 6 per cent., less income-tax, for the half-year to August last, on both the preference and ordinary shares. This interim dividend is 12s. per share on the preference shares, against an interim dividend of 10s. per share paid last year.

Power Gas Corporation, Ltd.—A dividend of 4 per cent. on the ordinary shares for the year ended September 30th announced.

Melbourne Electric Supply Co., Ltd.—The directors have declared a dividend of 2½ per cent. on the ordinary stock for the year ended August 31st. £7,000 is placed to depreciation and general reserve, £6,000 to extinguish suspense account, and £5,2 is carried forward.

The Siemens and Schuckert Companies.

As will be seen from the following financial statements, the Siemens-Schuckert group of companies realised larger net profits from the favourable course of business in the 12 months ended with June, 1911, than in the preceding year, although only two are declaring higher dividends than in 1909-10 :—

The directors of the Siemens & Halske Co. announce that the balance-sheet for 1910-11 shows net profits of £616,000, as compared with £575,000 in the preceding year. It is proposed to pay a dividend of 12 per cent., being the same rate as in 1909-10; to place £110,000 to the special reserve fund, as against £75,000, and £17,500 to the disposition fund, the same as in the previous year; to allocate £40,000 to bonuses to staff and workmen, as compared with £35,000, and to carry forward £54,000, as against £53,000 in 1909-10. The dividend is distributed on a share capital of £3,150,000, and the same rate was also paid in in 1908-9, and 11 per cent. in each of the two preceding years on a capital of £2,725,000.

The financial statement of the Siemens-Schuckert Works, whose share capital of £4,500,000 is held in almost equal halves by the Siemens & Halske Co. and the Schuckert Electricity Co., of Nuremberg, indicates net profits of £671,000 for 1910-11, as contrasted with £530,000 in the previous year. It is intended to distribute among the proprietary companies a dividend of 10 per cent., or at the same rate as in 1909-10. The sum of £125,000 has been set aside to form a new reserve fund; £65,000 has been devoted to bonuses to staff and workmen, as against £50,000 in 1909-10; £17,500 has been placed to the disposition fund as in the preceding year; and £14,000 has been carried forward, as against £12,600 in 1909-10.

The accounts of the Elektrizitäts Gesellschaft vorm Schuckert and Co., of Nuremberg, exhibit gross profit of £362,000 for 1910-11, as compared with £326,000 in 1909-10, these being exclusive of the amounts of £61,000 and £60,000 brought forward in the two years respectively. After applying £123,000 to management expenses, interest charges, taxes, and the usual provision for depreciation, as contrasted with £119,000 in 1909-10, the sum of £7,500 has been placed to the coupon tax reserve fund, leaving net profits of £293,000, as against £260,000. The special reserve fund absorbs £15,000, as compared with a similar sum in 1909-10, and the directors' fees and profit share of managers and officials amount to £10,300 as against £7,470. The balance allows of the payment of a dividend of 7½ per cent. on the old share capital of £2,500,000, as contrasted with 7 per cent. in 1909-10, and at the same rate on the new shares of £500,000 for six months, leaving £62,000 to be carried forward.

The Rheinische Schuckert Gesellschaft fur Elektrische Industrie, of Mannheim, after making increased provision for depreciation and reserve funds in 1910-11, as compared with the previous year, contemplates the payment of a dividend of 7½ per cent., as contrasted with 7 per cent. in 1909-10.

British Columbia Electric Railway Co., Ltd.

Mr. R. M. Horne-Payne presided on November 30th at the Great Eastern Hotel, E.C., over the fifteenth ordinary general meeting of this company.

The Chairman, in moving the adoption of the report (see Electrica Review, page 915), said the accounts were so plain that they did not require any explanation from him. He had during the past six months received a number of inquiries regarding the general prosperity and future prospects of the company. In regard to the negotiations which were started by the Council of Vancouver City with a view to inducing the company to agree to their suggestion respecting the date when the City of Vancouver first had the right to purchase the railway, some of the representatives of the city wished to introduce into the bargain conditions which would have given to the City Council a right to unduly intervene and control the service given by the company. They were satisfied that this would have led to constant disputes, and to a thoroughly unsatisfactory and uneconomical service. They fully recognised the right of the Council to voice the interests and the complaints of the public as regarded the service they gave, but between this and actually giving the Council a share in the right and responsibility of spending their money, there was a wide difference. They wanted to meet the needs and advance the interests of the cities they served in every way possible. They had not spared either energy or money in their efforts; they had spent $25,000,000 on the task, but they could not part with the right of freely deciding for themselves how their money was to be spent, and how interest was to be earned upon it. The old City of Vancouver covered only a comparatively small part of the greater city or group of municipalities, commonly spoken of as Vancouver. Their rights to operate the railway outside the old city's limits were in some cases perpetual, and in no case for less than 36 years still to run. The Corporation of Vancouver had the right in 1919, and at the end of each successive five-year period, to buy most of the railway property within the old city limits on the conditions set forth in the report. Whether they would exercise that right or not for many years to come he did not know. If they had the right to-day, they undoubtedly would exercise it, because the advocates of municipal ownership of public utilities were just at present very numerous and very loud-voiced in Canada. Personally, he held the opinion that the city would not buy in 1919 or for many years, because he believed that by 1919 the ratepayers in some of the eastern cities of Canada, who were now experimenting in municipally-owned electric undertakings, would have had such a lesson that Vancouver ratepayers would not be anxious to follow in their footsteps. Already, he knew of at least one city in the east where the inhabitants were waking up to an unpleasant suspicion that, in consequence of municipal ownership, their rates were likely to go up by leaps and bounds, that they had already paid out huge sums, were called upon to pay double and treble the sum originally estimated, and had very little to show in return, and that, moreover, they were paying three times over for their public utilities, once in the direct charge, and twice over again in the shape of increased rates. He did not think Vancouver would want to buy out the city lines in 1919, but whether they did or not would not be a matter of vital importance to them, because he believed that, by 1919, there would be six or eight municipalities surrounding the old city, each as populous as the old city is to-day, and instead of serving a population of 250,000, the railway would be serving a population of between 450,000 and 550,000. He thought, moreover, that, in the long run, the company would be glad that the recent negotiations with the city came to nothing. They would have involved them in a large loss of revenue for seven years, in some gain of revenue for the next 14 years, and in an enormous loss for the remaining 17 years. The chairman proceeded to refer to the somewhat irregular and inadequate service given by the company during the spring and summer, which arose from the unprecedented rapidity of the city's growth, which made it utterly impossible for the management to keep pace with the work, and rearrange the organisation fast enough to meet constantly changing conditions. The increase in business was still going on at the same marvellous pace, but they were now better organised to meet the strain, and he hoped that the public would be well served in the future, and that complaints would cease. There was one other point that, perhaps, he had better mention as a matter of precaution. Just at present it seemed possible that, during the next 12 months, they might be compelled by some of their competitors to fight for some of their business by reducing some of their charges for light and power. There was no sound reason for this, as their charges were already exceedingly low, considering local conditions, and if their competitors would only show a reasonable amount of patience, there would be plenty of good business at remunerative prices for all. They would not be the aggressors, but if it pleased their competitors to try and steal their business by selling light and power below the cost of production, they would not sit still and allow them to do so, but would meet cut by cut, strong in the knowledge that it was only a small portion of their business that could be affected, that they could produce power at a lower cost than they could, and that they had large financial reserves accumulated to meet just such a contingency as this. He mentioned this matter in order that they might be forewarned. They must not be alarmed should they notice a halt in the increase of profits during the coming year. They might rest assured that this was only a passing condition which could be only temporarily of a serious nature, and that at the worst it was unlikely to cause them more injury than possibly to prevent them adding to their reserve fund for a year or two at the outside. In conclusion, the Chairman said that Canadian finance had up the present remained exceptionally sound and exceptionally clean, and comparatively few unsound enterprises had been floated on this market, but a year or two ago several utterly wild schemes were unfortunately taken up in this country, and the time was now about due for them to come to grief. He warned them that if two or three Canadian ventures failed to pay their interest and went into the Bankruptcy Court, they should not let it affect their judgment of other enterprises, and be scared into selling their securities and shares in any other Canadian companies simply because a few rotten, ill-conceived ventures came to grief.

Mr. E. M. Harvey seconded the motion, and the report was adopted.

A resolution was carried recommending dividends at the rate of 6 per cent. for the year on the preferred ordinary stock, and 8 per cent. on the deferred ordinary stock.

Mr. H. Brown proposed that the best thanks of the meeting be given to the staff for their loyal and successful efforts. He said he was in Vancouver for over two months during the year, and came into close personal touch with the general manager and the chief members of the staff, and he could say from personal knowledge they had a staff as zealous in the interests of the company as it was possible to get.

The motion was carried, and a vote of thanks was accorded the board.

Subsequently the meeting passed a resolution increasing the capital of the company to £4,000,000 by the creation of 800,000 new shares of £1 each.

Adelaide Electric Supply Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided on Monday at Finsbury Pavement House, E.C., over the seventh annual general meeting of this company.

In moving the adoption of the report (see Electrical Review, page 914), the Chairman said that the board had again a very satisfactory balance-sheet to put before the shareholders, due largely to the continuance of the load from the Tramway Trust long beyond the period which they had anticipated, and combined with that was a most gratifying increase in their own consumers in the various districts around Adelaide. The manner in which they were discharging their obligations under their Act, must, he thought, be gratifying to the South Australian Government, for they were not sparing expense, or the taking of commercial risk, in order to give a supply of electricity in any district within a comparatively easy reach of Adelaide where there was any reasonable demand at all. They were now supplying in 104 sq. miles, with a population of 176,361, and polls were being taken in other districts, and if

these were favourable the mains would be still further extended. Therefore it would be seen that they were fully carrying out their responsibilities to give an effective supply of electricity, both for lighting and power. This necessarily required a steady expenditure of capital, and during the past year they had spent a further sum of £52,553 on capital account. If they turned to the balance-sheet it would be seen how that capital had been supplied. The ordinary capital had been increased by 100,000 ordinary shares, but none of that additional capital had yet been issued, but was available for issue when required. They had, however, during the year exercised their borrowing powers to the extent of £100,000. They came to the conclusion that the most economical way to raise the capital required was to issue debentures, and this had been done, and they were now quoted on the London Stock Exchange at about 105. They had a further £50,000 of debentures available for issue when required. This issue of £100,000 debentures enabled them to meet the capital expenditure he had referred to, and leave them with £55,703 cash in hand. They had also made a commencement of the investments on behalf of the dividend equalisation account by purchasing £5,000 Metropolitan District and London Electric Railway Joint Power House 4 per cent. rent charge stock, partly paid, and £2,500 London Electric Railway 4 per cent. preference stock fully paid. These items stood at £4,643. Since the date of the balance-sheet, the Power House stock had been fully paid for, and they had also invested £2,500 in the purchase of Southern Nigeria 4 per cent. bonds, so that they had now £10,000 invested on behalf of the dividend equalisation fund. They thought it prudent to invest a portion of the fund in liquid securities, which should be available if necessary. The cost of the undertaking had naturally gone up by the amount spent on it, and now stood at £382,974, against £340,000 odd. Turning to the profit and loss account, it would be seen that they had had another very prosperous year. They received £30,841 for the supply to the Municipal Tramway Trust, but that revenue had now entirely ceased. The continuance of the supply so long was quite unexpected by them, and they were placed in very considerable difficulty in order to meet the demand. However, they were able to tide the Trust over a period of difficulty. The Chairman proceeded to read extracts of speeches by the Premier and by Mr. Goodman, the tramways manager, in which both speakers eulogised the services rendered by Mr. F. W. Clements, the local managing director, and Mr. F. W. Wheadon, the engineer of the company, which enabled the Tramways Trust to run their cars much sooner than they could otherwise have done. He added that it was gratifying to know that the connection with the Municipal Tramways Trust had ended in a friendly manner on both sides, and that the company were now able to devote their energies to meeting the demands of their own tramways. Of course, the most gratifying feature of the year was the increase in the number of consumers and in the revenue. They had received £36,476 for lighting, against £29,339, and the revenue from power had increased from £10,324 to £14,140. Public lighting was £2,405, against £1,941, and meter rents £1,520, against £1,097. The result was that they had a gross revenue of £86,347, against £75,598 last year. On the debit side, generation had cost £25,791, against £21,984, distribution £2,791, against £2,535, and repairs and renewals £5,914, against £3,374. Interest on debenture stock accrued, £1,250, was a new item, and would figure more largely in future years. It was proposed to pay the usual 6 per cent. dividend on the preference shares, and a final dividend of 6½ per cent. on the ordinary shares, making 10 per cent. for the year, together with a bonus of 2s. per ordinary share. They transferred £5,000 to the general reserve, against £1,000 last year, and added £5,000 to the equalisation of dividend fund, which brought that fund up to £20,000, which they thought was sufficient, and they would carry forward £4,385. He ought to have said that the increase in their lighting during the year had been 34,880 30-watt lamps, and in power of 885 H.P., and the increase was still going forward very rapidly. The last information they had, showed that applications were still pouring in, nor was this to be wondered at, because the introduction of the metallic-filament lamp had practically reduced the price of electric current by two-thirds. Some people might have said that that being so the company might have raised their price from 6d. to 8d., and that then the consumers would have benefited, but they felt it better policy to give the full benefit of the economy to the consumers. He thought there was every reason to suppose that as the advantages of electricity became better known they would get a constantly increasing demand, which would, of course, mean a steady increase in their revenue. As to the future, they must bear in mind that they would have no revenue from the Tramway Trust, and how far that loss of revenue would be met by an increase in their private consumers remained to be seen. They could not expect to show such a balance-sheet next year, although he hoped they would continue to show steady improvement in all their normal supplies. Of course, they would make some economies in generation expenses, owing to not having to supply the Tramway Trust, and he thought they would be able to show a satisfactory balance-sheet.

Mr. R. P. Sellon seconded the motion.

Mr. Ashton asked what amount the directors proposed to put to depreciation, or was the amount standing under the heading of repairs and renewals considered sufficient.

The Chairman said they were putting £5,000 to the general reserve. They did not car-mark it for depreciation specially.

Mr. Brookman thought the remarks of the chairman might give the impression that the company would not be able to maintain the 10 per cent. dividend, and he would like him to make the address quite clear. He gathered from the figures before them that the normal advance of the company during the year had been something like 30 per cent., and he would like to know if that progress had been maintained during the three months since the year closed. If it was being maintained, then it seemed to him there would be no difficulty in maintaining the dividend which the absence of the sale of units to the Tramway Trust might otherwise endanger.

The Chairman said Mr. Brookman was right as to the rate of increase of business during the year. He did not know that he could say much more than he had with regard to the future.

Mr. Brookman said they might have some estimate of the amount of profit made on the sale of units to the Tramways Trust.

The Chairman said it was impossible to separate the generating expenses.

Mr. Brookman pointed out that the number of units supplied to the Tramways Trust was not mentioned.

The Chairman said he had pointed out that for several years they had been putting away money to provide for the contingency of losing the tramway units. Their whole object in doing this was to maintain the 10 per cent. dividend. All he could add was that the increase of business going on now was equal to that of last year.

The report was then adopted, and Mr. Sellon re-elected a director.

On the motion of Mr. A. F. Farish, a hearty vote of thanks was accorded the staff in Australia, and a vote of thanks to the board was also passed on the motion of Mr. Parker.

Elmore's German and Austro-Hungarian Metal Co., Ltd.

A meeting of the holders of the first debenture stock of the above company was held on Monday at the offices, Finsbury House, Blomfield Street, E.C., to consider a scheme of arrangement for the future, dealing with the stock, both as to interest and repayment.

Mr. John MacFarlan, chairman of the board, who presided, proposed a resolution approving of a scheme which has been circulated among the holders. He said he sincerely hoped that no debenture-holder had been alarmed at the action of the directors in regard to the proposals which were to be submitted to them. The position was entirely due to the bankers in Germany, who were their financial advisers there, who said, and he thought with some reason—that if any interest was to be paid, it should be paid out of profits. That meant that they disapproved of the payment of interest by the company out of capital. He thought it would be well to consider the causes which brought about the present position. In 1910 the failure to come to terms by the members of the German Tube Syndicate resulted in a price war, in which they had no alternative but to participate; that war meant a big reduction in prices, and the result was that the metal company, in 1910, was only able to pay its charges, write off depreciation and repairs and maintenance, but left no profit available for dividends on its shares, which dividends were necessary to pay their full interest here. Unfortunately that price war still continued, but they had endeavoured to make up the loss in other directions, and with some success, but trouble again overtook them in the shape of drought, and from May 15th to November 15th they had practically no motive power from their turbines. It was difficult for him to explain the full extent of the loss which the want of water caused them, for the speciality which they produced, and which gave them so high a price, was produced mainly by water-power, and consequently the production of specialities was very small indeed, while they had a large amount of that class of work on their books awaiting execution. The difference between the cost of copper, and the price for which they had sold their goods, so far, had increased, while the weight of sales actually showed an increase over the amount sold in 1910 by nearly 3 per cent. These figures were, he was sure, conclusive evidence that had it not been for abnormal conditions, the result of their trading year so far would have been above the average. He hoped, therefore, it was perfectly clear to everyone that the alterations they suggested were not brought forward in any way as a policy of despair, but on the contrary, they as directors, with their friends, were the holders of over £36,000 of debenture stock, and they had no hesitation in proposing the alterations, and accepting them for themselves and friends. He felt sure that the debenture-holders realised that sooner of later a reduction in interest would be proposed, the question being whether it could be done by general consent on some such scheme as was now proposed, and they felt that now capital expenditure on a large scale had ceased, and that they had a model factory capable of producing 40 tons of finished goods per week, and actually averaging for nine months over 36 tons per week, replete with modern appliances, and which was recognised as being the very last word in copper tube making, it was desirable to put the Metall Co., which was their only asset, on the best possible basis, both as a dividend-earning and also a marketable concern. The Metall Co. had been founded 20 years, and as stated in the circular, the profits for the last seven years had averaged £11,653 per annum, and that was after deducting £29,582 during the seven years by way of depreciation and repairs and maintenance, in addition to German income-tax. The Metall Co. must, therefore, be recognised by them as it was recognised in Germany, as a sound profit-earning undertaking, and the proposal to convert the mortgage upon the Schladern property into an equivalent amount of share capital, improved its capital position very considerably, as instead of holding charges which could not be realised without a stoppage of the company, their trustees would hold shares to the value of M.2,000,000 in a company, which for the last seven years had earned profits averaging nearly £12,000 per year, and such shares would, if required, be saleable, and so

reatly facilitate the sale of the Metall Co., which they anticipated ould be the result when the present price war had ceased and ormal conditions again prevailed. From the accounts of the Ietall Co. they would have seen that during the five years ending)ecember 31st, 1910, it spent £37,000 on additions and improve- ients (of which £13,000 was out of profit earned) so that the ompany had been able to save £13,000 during the last five ears, in addition to paying its heavy charges for interest. n order that the debenture-holders should have their rights properly afe-guarded, the directors had gone to the Court with regard to he proposals, and after they had passed the resolutions, they would e submitted to the Court for confirmation. The resolutions were nore or less formal, but No. 2 was to sanction the reduction in the ate of interest from 8 per cent. to 6 per cent., and No. 3 was to anction the proposal that interest could only be paid when it was arned by way of profits. The directors believed that the latter esolution was desirable in the interests of sound finance, and it vas only proposed to obviate the necessity, should occasion arise, of aying interest out of capital. The Mertens' process had not made o much progress as they had hoped. The company owning the atents was contemplating the creation of a large International ompany, and the sale of licences to use the process was more or ess in abeyance in consequence, but they were, nevertheless, making mall deliveries regularly. He understood that an amendment ould be moved to the scheme with the view of providing:—(1) hat no moneys shall be set aside for the purpose of writing off any mount standing to the debit of profit and loss until after the nterest has been paid; (2) that while interest is reduced to 6 per ent., that in the event of profit over and above such interest being arned, the difference between 6 per cent. and 8 per cent. shall be aid to the debenture-holders before any dividends are paid upon he shares of the company; (3) that in the event of the sale of he Metall Co., should the purchase price be more than sufficient to ay off the debenture stock at par, that such additional amount hall, in the first place, be applied to the payment of any arrears of nterest at the rate of 8 per cent. per annum; and (4) that the nterest shall be cumulative. The directors had carefully considered hose amendments, and as they were not contrary to the principle hich the directors desired should be adopted, they were prepared o accept them. Before moving the resolutions, he would once nore emphasise the fact that they would virtually be the owners of business well established, well equipped, and which had earned ood profits, and which should earn even better profits in the uture.

Mr. Heal formally seconded the resolution.

Mr. Nettlefold moved the amendment as outlined by the hairman, which was seconded by Mr. E. D. Hartland, and arried as the substantive motion *nem. con.*

Stock Exchange Notices.—The Committee has appointed pecial settling days as under:—

Thursday, December 14th.—Anglo-Argentine Tramways Co., Ltd., scrip ully and partly paid for a further issue of £1,500,000 5 per cent. debenture tock.

And ordered the undermentioned securities to be quoted in the)fficial List:—

Anglo-Argentine Tramways Co., Ltd.—Scrip, partly paid, for a further issue f £1,500,000 5 per cent. debenture stock.
County of London Electric Supply Co., Ltd.—Further issue of £50,000 4½ per ent. second debenture stock.

Applications have been made to the Committee to appoint a pecial settling day in:—

Manaos Tramways and Light Co., Ltd.—300,000 ordinary shares of £1 each, ully paid (Nos. 1 to 300,000).

And to allow the following securities to be quoted in the Official ist:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 33,325 ordinary hares of £1 each, fully paid (Nos. 466,676 to 500,000).

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors' statement, as summarised in the *Times*, hows that for the year ended September 30th there was a profit of £21,785, compared with £18,242 for the previous year. The lirectors recommend a dividend of 2½ per cent. on the preference hares, and propose to place £1,500 to reserve, to appropriate £6,000 owards future maintenance of permanent way, to create a third arty insurance reserve of £2,000, and to carry forward £2,282. The traffic receipts showed an increase of £2,817. The sale of lectricity compared with the previous year increased by £1,784, or ver 32 per cent. The auditors' certificate states that no depreciа- ion has been written off, but an additional sum of £5,000 has been dded to reserve accounts from the revenue balance of Septem- er 30th, 1910.

Norwegian Electrochemistry. — The transaction etween Norwegian and German companies, to which reference was nade a few weeks ago, has now been approved at a general meeting of the Norwegian Hydro-Electric Nitrogen Co., of Christiania, which as agreed to take over the financial interests held by the German hemical works as represented by the Baden Aniline and Soda Co. n the Norwegian nitrogen industry. It has also been decided to ncrease the share capital of the Norwegian company by £714,000 o £2,340,000, whilst a debenture loan of £1,370,000 has been sub- cribed by the Banque de Paris et des Pays Bas and the Société Générale.

Globe Telegraph and Trust Co., Ltd.—An interim lividend of 2s. per share is announced.

French Electrical Companies.

The Société Industrielle des Téléphones, which has a share capital of £720,000, realised gross profits of £101,000 in 1910-11 as compared with £106,000 in the preceding year. The net profits were £59,000, as against £65,000 in 1909-10, and the dividend remains unchanged at 12s. per £12 share. The distribution absorbs £36,000 and £22,000 has been allocated to depreciation, as contrasted with £28,000 in 1909-10. According to the directors' report, the manufacture of the Loango-Libreville cable, which represents £80,000, only came partly into consideration in the financial results for 1910-11.

The Compagnie Générale d'Electricité, of Paris, earned profits on manufacturing of £142,000 in 1910-11, as compared with £139,000 in the preceding year, and extraordinary profits of £220,000, as against £83,000 in 1909-10. After meeting interest charges on debentures, there remain net profits of £320,000. A dividend has been declared at the rate of £1 12s. per share, this contrasting with £1 8s. in the previous year. The extraordinary profits were obtained from the disposal of central stations in Rouen and Nantes to non-associated companies, and the sale of the Nancy station to a subsidiary company, which promises to be of great importance through the extension of supply to the industrial district of Meurtha and Moselle.

The Compagnie Parisienne de l'Air Comprimé, of Paris, reports an increase in the proceeds both from the supply of electricity and compressed air in 1910-11. After making provision to the extent of £120,000 for depreciation as against £88,000 in 1909-10, the accounts indicate net profits of £101,000, as contrasted with £102,000 in the previous year. It has been decided to pay a dividend of £1 12s. per share, being the same rate as in 1909-10. As the electric supply business will pass into the hands of the Compagnie de Distribution Electrique at the end of 1914, the Compagnie de l'Air Comprimé is now devoting special attention to the development of the compressed air department, the concession for which extends to 1927.

Prospectus.—*Puebla Tramway, Light and Power Co.*—This company has this week been offering for subscription £616,438 prior lien 5 per cent. 50-year gold bonds to bearer, at 95 per cent. The prospectus contained, among other particulars, the following statements:—

"The company's business has outgrown the capacity of the plants installed at Portezuelo, and the concession from the City of Puebla requires a minimum continuous supply of 16,500 H.P. to be available for sale within the city limits not later than August, 1913. The directors have accordingly decided to lay down a large hydro-electric plant at Tuxpango with transmission lines to the cities of Puebla and Vera Cruz. Hitherto it has been the custom of the various manufacturers in the State of Puebla to generate power for their own consumption from small falls of water adjacent to the factories, the cost of steam coal being prohibitive. The tendency of factories is gradually to remove into or near to the city of Puebla in order to secure power from the company, and this movement is likely to increase. In Vera Cruz it is intended to supply electricity in bulk to Vera Cruz Electric Light, Power and Traction, Ltd., with whom a contract is being arranged.

"The existing installations have a continuous power of 7,500 H.P. at the switchboard, and with the masonry reservoir they have a peak load capacity of over 11,000 H.P. The directors are advised that the Tuxpango and Atoyac Falls, when fully developed, will give a continuous power of 45,000 H.P. at the turbines, and will have a peak load capacity of some 70,000 H.P.

"The full development of the Tuxpango and Atoyac Falls can be carried out most economically. At present it is only proposed to undertake sufficient work to provide 17,000 H.P. at the turbines, but the works will be so planned as to enable the complete installation to be effected when necessary without increasing the capital cost per H.P.

"The existing main distribution lines (all new) have a total length of over 112 miles, exclusive of the local distribution systems, and supply the following towns, viz: Puebla, Cholula, Atlixo, Santo Domingo, Apizaco, Santa Ana, Tlaxcala, Santa Cruz, Panzacola and San Rafael.

"The new transmission lines, 147 miles in length, will connect the new power plant at Tuxpango with Puebla (78½ miles distant) on the one hand and with Vera Cruz (68½ miles distant) on the other hand.

"Work has already been commenced on the new transmission line and plant, upon which it is proposed to expend approximately £300,000, and should be completed in about two years.

"The $3,000,000 prior lien 5 per cent. gold bonds have been sold by the company to provide the price payable for the shares and debentures of the San Agustin Co. and funds for the construction and equipment of the new works, for the repayment of moneys borrowed and used for capital purposes, and for further working capital."

The list was to close yesterday for town and to-day for country applications.

Echo Answers "Where?"—A correspondent of the *Financial Times* writes, asking what has become of the assets of the London Electrobus Co., which was handed over to the Reorganisation and Control Syndicate. Being a shareholder, he naturally wants to know whether the company is absolutely defunct. Our contemporary suggests that perhaps the liquidator will answer him.

MARKET QUOTATIONS.

Wednesday, December 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£11 10	..
a Copper Sulphate	,,	£20	..
a Lead, Nitrate	,,	£25 10	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
d Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£60	£10 dec.
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9⅝d.	⅛d. inc.
c ,, ,, (solid drawn)	,,	7⅝d.	⅛d. inc.
c ,, Wire, basis	,,	7½d.	..
c Copper Tubes (brazed)	,,	10⅛d.	⅛d. inc.
c ,, ,, (solid drawn)	,,	9⅛d.	⅛d. inc.
g ,, Bars (best selected)	per ton	£75	£2 inc.
g ,, Sheet	,,	£75	£2 inc.
g ,, Rod	,,	£75	£2 inc.
e ,, (Electrolytic) Bars	,,	£61 10	£1 inc.
e ,, ,, Sheets	,,	£77 10	£1 10 inc.
e ,, ,, Rods	,,	£65	£1 inc.
e ,, ,, H.C. Wire	per lb.	8⅜d.	⅛d. inc.
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	5/- to 7/-	..
h India-rubber, Para fine	,,	4/5¼	2¼d. inc.
i Iron Pig (Cleveland warrants)	per ton	47/10½	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£16 to £16 5	5/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 2 6	7/6 dec.
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½.	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£203 to £205	£7 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£31 2 6	10/- inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Asbby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

France.—The balance sheet of La Compagnie Electrique de la Loire for the last financial year shows a profit of £25,600, as compared with £22,250 in the preceding 12 months.

La Compagnie Limousine d'Electricité is the name of a new company which has lately been formed at Limoges (Haute Venne), with a capital of £40,000.

STOCKS AND SHARES.

Tuesday Evening.

December in the Stock Exchange is gradually achieving the reputation or the notoriety amongst the months which attaches to Saturday amongst the days of the week. The holiday feeling makes itself manifest quite early in the month, and the inclination to enter into fresh commitments is blunted. Moreover, there is generally a little host of new issues made in December, just as Saturday is a favourite day for the emission of a new prospectus. Business at the present time is quiet and continues to be somewhat patchy. There is, however, plenty doing in the section devoted to the traction, power and light issues of the Western Hemisphere.

English Electricity Supply shares are steady, with a tendency to harden, which is more particularly noticeable in the cases of City Ordinary and Notting Hill Preference, these securing rises on the week. South London Debenture improved a little, but South Metropolitan Preference at 1 middle are ⅛ lower.

The next developments on the part of the London County Council are being eagerly awaited by those interested in the market for all the Metropolitan Electricity shares. At the moment, the tide seems to be running all in favour of the companies. The bold prophet may even see in the present negotiations a future linking-up between the London County Council and the companies which probably never entered the ken of the original promoters of the latter. Still, these are early days to talk about such a rapprochement; but holders of Electricity Supply shares can possess themselves in patience, with confidence that, unless events take an unexpectedly bad turn, their interests are likely to be fortified considerably during the next 6 or 12 months.

The Railway market is in less happy case. Prices go up one day, to recede the next; and although a semblance of strength is retained on balance, the uncertainty felt with regard to the labour outlook renders Home Railway stocks anathema to many British investors at the present time. In spite of the extension of the Electricity system amongst leading lines, the mere stock market is dull. Metropolitan Ordinary and Surplus Lands are a little better, and Districts put on ⅜, reflecting the latest rise in Omnibus stock on the fine report. But the Steam stocks fail to make much headway, notwithstanding the fact that recognition of the Unions is, for all practical purposes, already granted by the companies. East London Ordinary rose to 6½, and the Debenture stocks are also rather better. Underground Electric Income bonds provided the feature of the week with a substantial rise to 68, this being a gain of 4 points. The advance is based on expectations of a dividend considerably better than that of last time, and the buying of the bonds has been fairly persistent, encouraged also by the dividend on the London General Omnibus stock, supplemented by the excellent report already mentioned.

New issues command a good following, and prices on the whole are distinctly firm. The new Mexican Light and Power Second Debenture firmed up to ¼ discount. South American Light and Power Debenture hardened to 2⅛ premium after being down to ⅛ premium. The result of the issue of Constantinople Telephone was about what might have been expected in view of the unpropitious time at which the prospectus was launched, and underwriters are understood to have been left with a good proportion of their obligations. The price of the shares is ¼ discount to par. Better success attended the issue of Preference shares by the Automatic Telephone Company. The guarantee of the British Insulated of course attracted buyers, and the subscription, we are informed unofficially, was decidedly satisfactory. The price is quoted par to ⅛ premium, and in view of the fact that the parent company's £5 Preference shares stand at 6, this result is only natural. The Automatic Telephone Ordinary shares were left, we understand, to the tune of about 50 per cent. in the hands of the underwriters, and in these there is practically no market at present.

Amongst the Manufacturing shares, Edison & Swan are ⅛ better and the 4 per cent. Debenture stock rose 1 upon a little demand last week. India-Rubber shares lost ¼, and British Insulated Ordinary fell ⅛ on the new issue of the Automatic Telephone Company, proprietors of the former apparently realising some of their shares in order to take up the latter. Castner-Kellners at 3⅛⅝ are 3s. 9d. down, of which 2s. 6d. is represented by the dividend deduction. India-Rubber Preference are lower, but the Ordinary remain at 13½. Babcock & Wilcox have gone back a trifle, sellers being tempted by the recent rapid rise.

The Telegraph market still relies for most of its business upon the dealings in Marconi shares, which are very wild and active. The ordinary rising to 55s. caused the new shares to spurt to 13s. 6d. premium. Anglo-American Telegraph 6 per cent. Preferred rose ¼, the merits of the stock as a speculative investment becoming more generally recognised. Even now the yield is still a high one, having regard to the nature of the security. American Telephone and Telegraph went back 1. The selling proceeded from London while New York has been reluctant to take the stock. Amazon Telegraphs at 7¼ are *ex* the 8s. dividend deducted last Wednesday, so that on balance the price is slightly to the good. National Telephone issues are quieter again. Incidentally, it may be remarked that the market in Consols is a little perturbed at the thought of how the Government intends to finance the National Telephone Company at the end of the year, and this is one reason why the price of the Funds has fallen again after its previous little spurt.

In the Foreign Traction Department business goes on at a merry rate, and there is more doing here than in any other market of similar size throughout the Stock Exchange. Prices, however, are not much altered on the whole. Rio Trams have begun to recover, and Sao Paulo Trams at 188 are a point higher. Anglo-Argentines are very firm, the First Preference securing a gain of ⅛. Bombay and Brisbane Trams are both better on the week. On the other hand, British Columbia issues have been sold pretty heavily, with the result that the Deferred is 3 points lower and the Preferred down 4. Quite a small demand for River Plate Ordinary had the effect of putting the price up to the extent of 10 points, but in its present unwieldly condition the stock is not easy to negotiate. Canadian General Electric has eased off, but Shawinigan Capital stock rose 1½. For the various Bond issues there is still a brisk inquiry.

Rubber is again on the rise, and prices in the Share Market have not been slow to respond to this better disposition on the part of Mincing Lane.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7⅞ — 8⅛	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅞ — 8⅜	..	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101 xd	..	3 19 3
Charing Cross, West End & City	5	5	5†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3¾ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12⅜ — 13⅛	+ ¼	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅜ — 9⅛	..	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6⅞ — 7⅛	..	6 4 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	..	1⅞ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3½ —	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	..	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	+ ¼	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅜ — 7½	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2¾ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	100 —103	+1	4 17 1
South Metropolitan, 7 % Pref.	1	7	7	1 5/16 — 1 7/16	— 1/16	6 11 9
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅝ — 8⅜	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	+ ⅛	5 4 4
Calcutta, Ord.	5	8½	7†	6½ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	112 —117	—3	5 19 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1 xd	..	3 0 0
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90½ — 92½	— ½	5 8 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/32 — 9/32	..	Nil
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 13 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	98 —100	..	5 0 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	89 — 91	..	4 7 11
Do. 7 % Cum. Pref.	$100	7	7	108 —110	..	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Montreal, Lt., H. and Power	$100	7	8	185 —190	..	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	41 — 43	..	11 12 6
River Plate, Ord.	Stock	10	..	233 —243	+10	4 2 4
Do. 6 % Non-Cum. Pref.	Do.	6	6	104 —110 xd	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	123½ —125½	+1½	3 3 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102⅔ —104½	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11 7/8d.	¾ — ⅞	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106⅓ —108⅔	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7 — 7½xd	+ ⅛	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	143 —145	—1	5 10 4
Do. Collat. Trust	$1000	4	4	95 — 97	..	4 2 6
Anglo-American Telegraph	Stock	3½	3†	66 — 68	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110⅜ —111¾	+ ¼	5 7 5
Do. Def.	Do.	30/-	..	25¾ — 26¼	..	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	7 — 7¼	+ ⅛	4 16 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Cuba Telegraph	10	6	6†	10 — 10¾	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100¾ —102¼	+ ½	4 7 10
Direct United States Cable	10	4½	..	7¾ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	137 —140	..	5 0 0
Do. 8½ % Pref. Stock	Do.	8½	3½	83¼ — 85½	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½ —102½	..	3 18 1
Eastern Extension	10	7	5†	13⅜ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	+ ½	3 19 3
Globe Telegraph and Trust	10	5⅞	6	10⅜ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 9
Great Northern Telegraph	10	18	5†	32¼ — 33¼	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	74 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	5	..	1 1/16 — 1 3/16	+ 1/16	..
Do. 7 % Cnm. Partic. Pref.	1	16	..	1 15/16 — 2 1/16	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ —105½	..	5 13 9
Do. Def.	Do.	6	6†	122 —124	..	4 16 9
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¼ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5½	..	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ —101½	..	4 8 8
Oriental Telep. and Elec.	1	8	..	1⅞ — 1⅞	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 13 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5†	8¾ — 9¼	..	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7½ — 7¾	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 15/16 — 1 7/8	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99 —101	..	3 19 3
West India and Panama Telcg.	10	1½	1½†	2 1/16 — 3 1/16 xd	..	4 8 10
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½ xd	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼ xd	..	5 17 1
Do. 5 % Debs.	100	5	5	103 —105	..	4 15 3
Western Telegraph, Ltd.	10	7	6†	13½ — 14	— ¼	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ —102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Batb Trams, Pref. Ord.	* 1	Nil	Nil	1/8 — 1/4	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1 1/8	..	Nil
Do. 6 % Pref.	10	1½	1½	3 7/8 — 4 3/8	..	3 8 7
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	..	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1¾†	30 — 31	— ½	4 16 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	105 —107	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1¼	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	5/8 — 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 14 8
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¾ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	2 7/8 — 3 3/8	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅞	2†	43 — 43½	+ ½	3 3 3
Do. Surplus Lands	100	2¾	3†	66 — 68	+1	4 0 11
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 17 0
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	30½ — 31	+ ¾	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½†	88 — 90	..	3 12 3
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	5†	3 7/8 — 4 1/8	..	5 12 4
Do. Def.	1	Nil	..	3 7/8 — 4 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3 7/8 — 4 1/8	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	100½ —102½	..	4 7 10
Do. 5 % Deb.	100	5	5	101 —103	+ ½	4 17 1
Potteries, Ord.	1	2	..	1 5/8 — 1 7/8	..	..
Do. 5 % Pref.	1	5	5	2 1/8 — 2 3/8	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87½ — 90½	..	4 17 2
Soutb Metro. Trams, 6 % Pref.	1	6	..	7/8 — 1	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 7/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1¾†	67 — 69	+4	1 3 0
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorksbire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/8 — 2 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	5 1/16 — 5 1/8	+ 1/8	4 14 1
Do. 2nd Pref.	5	5	5½†	4 13/16 — 5 1/16	+ 1/16	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
Do. 4½ % Deb.	100	4½	4½	101½ —103½	..	4 7 0
Do. 5 % Deb.	100	5	5	98½ —100½ xd	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	104 —107	..	4 13 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10 7/8 — 11 3/8	+ 1/8	5 5 6
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½ —100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	8 — 8½	+ ¼	4 17 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	103 —106	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	140 —144	—3	5 11 1
Do. Pref. Ord.	100	6	6	120 —124	—4	4 16 9
Do. 5 % Pref.	100	5	5	109 —112	— ½	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	104 —106	..	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 5/8 — 6 1/8	..	4 18 2
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	7/16 — 5/8	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 5/8 — 5 7/8	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	102 —105	+ ½	4 15 3
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6

La Plata Elec. Trms, Prf,	1	6	6	3/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 94	..	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101	+ ½	4 19 0
Mexico Trams Com.	$100	7	7†	123 —125	..	5 12 0
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	102 —104	..	5 15 3
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7½	..	6 18 0
Do. 6 % Pref.	5	6	6	5½ — 5 3/4	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	97½ — 99½ xd	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/8	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5¼ — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	115¼ —116¼	+ ¼	4 6 0
Do. 1st Mort. 5 % Bonds	..	5	5	102 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	95¾ — 96¾	..	5 3 4
Sao Paulo Tram, Lt. and P.	$100	10	10†	186 —190	+1	5 5 3
Do. 5 % 1st Deb.	$500	5	5	102 —104 xd	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Soutbern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 1/8 — 5 3/8	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	5 3/4 — 5 7/8	..	7 2 2
Babcock & Wilcox	1	26	24†	5 1/4 — 6 1/2	— 1/8	4 5 0
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 1/2 — 7 1/8	— 1/8	7 0 4
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westingbouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9¾	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. Deb	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/4 — 3 3/8 xd	— 1/16	5 10 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	60 — 70	..	7 2 10

Dick, Kerr	1	5	..	3/8 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	1 3/8 — 1 5/8	+ 1/8	Nil
Do. fully paid	5	Nil	..	1 7/8 — 2 1/8	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	+1	5 8 1
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/4 — 3/8	..	6 13 4
Do. Pref.	2	7	7	1 3/8 — 1 1/2	— 1/8	8 0 0
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8 7/8 — 9 3/8	— 1/8	5 6 8
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/8 — 5 5/8	..	4 5 11
Do. Deb.	100	4½	4½	104 —106 xd	..	4 4 11
India-Rubber, G. & T.	10	10	..	12½ — 14½	..	6 17 11
Do. Pref.	10	5	5	9 3/8 — 10 3/8	— ¼	4 17 10
Telegraph Construction	12	20	10†	35 — 37	..	6 7 5
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	62 — 63 xd	..	7 2 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

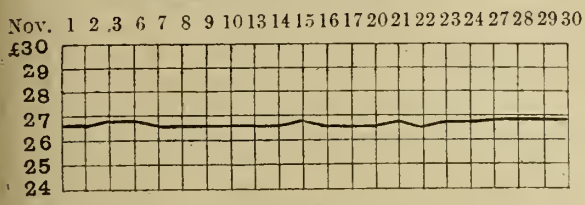
The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

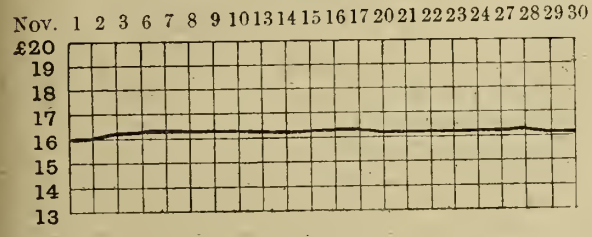
METAL MARKET.

Fluctuations in November.

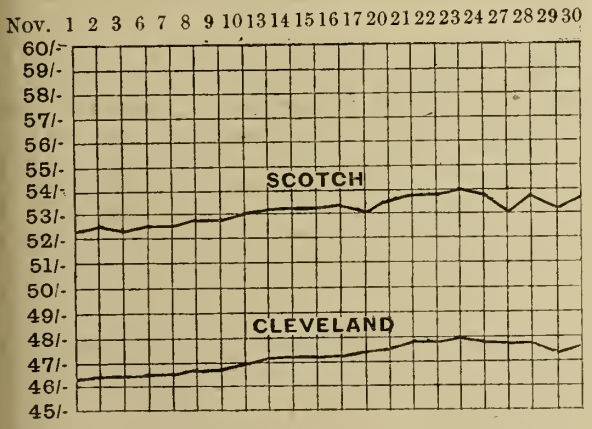
SPELTER (G.O.B's.).



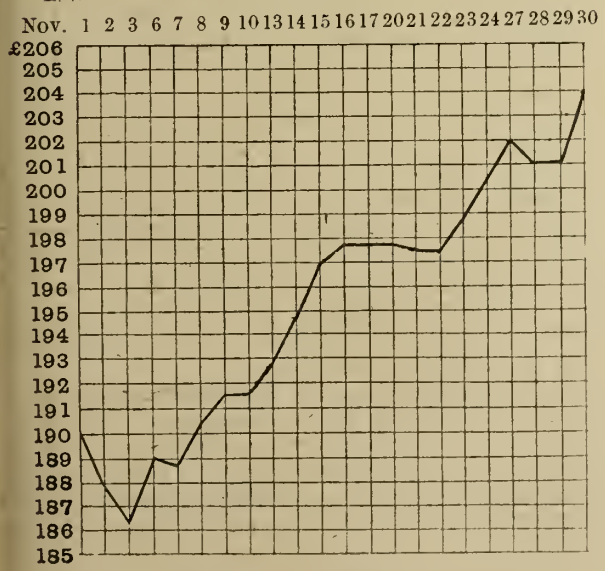
LEAD (ENGLISH).



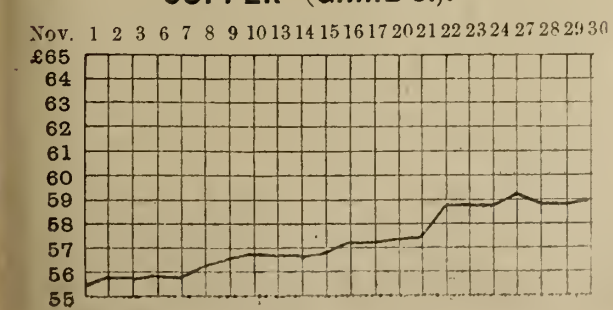
IRON.



TIN.



COPPER (G.M.B's.).



REVIEWS.

Electricity in Locomotion. By A. G. Whyte. London: Cambridge University Press. Price 1s. net.

This book may be unreservedly recommended to those desiring a popular treatment of the developments and possibilities of electricity as applied to tramways, railways, automobiles, ship propulsion, telpherage, and so on. The author commences with a pæan of praise to the unknown inventor of the wheel and axle, and details the gradual evolution of steel rails and wheels. The development of various types of locomotives is next considered, and appropriate treatment is given to dynamo-electric machinery and the means whereby large quantities of energy are electrically distributed. In tramway locomotion electrical energy offers enormous advantages over animal traction, and the exact nature and importance of these advantages are most explicitly stated. The general evolution and relative merits of trolley, conduit and surface-contact tramway systems are discussed with an entire absence of bias; but in the succeeding pages it is hardly clearly enough stated that series-parallel motor control enables cars to be run at half-speed, as at full load, without loss in regulating resistances.

Those attributing the backwardness of electric traction in this country to lack of enterprise would do well to study the unexpected direct and indirect effects of the Tramways Act of 1870 and the failure of the Light Railways Act of 1896, as explained in these pages. The possibilities of the trolley-'bus are considered with well-tempered enthusiasm, the author wisely concluding that these vehicles are best employed as tramway "feeders" and "feelers," yielding place, if local conditions are favourable, to trolley tramcars. In the chapter on regenerative control it would have been well to note that mechanical brakes are required to hold a stationary car. Dealing with accumulator traction, the author does not explain clearly the developments required (and the possibility of their realisation) to make heavy accumulator vehicles practicable, nor does he show any reason why the development of the electric vehicle in America should not be imitated in England. Many of the limitations of accumulator traction are attributable to its present restricted development. Mr. Whyte might have dealt more fully with the essential part played by electrical machinery in submarines.

In the concluding chapters, electric, suburban and tube railways, and the possibilities of electric main line operation are excellently dealt with, and we have seldom seen a better lay description of the technical features of electric railways. The chapter on "Curiosities of Electric Traction" should help to decrease the number of fatuous patents filed by variously-deluded inventors.

We note a few lax expressions, but, on the whole, the phraseology is admirable, and the author is to be congratulated on an excellent "popular" treatment of a highly technical subject.

The book is intended for lay readers, but most electrical engineers would peruse the volume with interest, and not a few with profit.—R.E.N.

Arc Lamps and Accessory Apparatus. By J. H. Johnson, A.M.I.E.E. London: Constable & Co. Price 1s. 6d. net.

The object of this book is to enable contractors, wiremen, and others, to select the best type of arc lamp for a given purpose, and to arrange it correctly for the end in view. Too much is attempted in the first chapter: the fundamental laws of illumination are treated with alarming brevity; the introduction of a few diagrams and a greater subdivision of matter into paragraphs would be an improvement. The leading features of the more important types of arc lamps are well explained, and the book forms a handy reference volume, particularly when one knows it well enough to compensate for the absence of index and paragraph headings. A considerable number of practical points are dealt with in connection with each lamp, but there is no very clearly expressed advice such as the preface leads us to expect. The illustrations are mostly familiar to readers of

the technical Press; little, if any, novel information is included, and the author seems to have drawn too freely on catalogue data, and practical advantages as claimed by the makers of the various lamps. We should prefer data and information from the author's personal experience.

The chapters on steadying and protective apparatus, suspension and switchgear, and faults, are quite good. The chapter dealing with "Applications" is useful, but the bioscope notes are not likely to be of much value, since no mention is made in the earlier chapters of special bioscope arc lamps.

Quartz mercury lamps are very summarily dismissed, but the information concerning magnetite and titanium arcs is useful. It is difficult to deal satisfactorily with transforming apparatus without a single illustration.

The arrangement of the book might be improved in numerous respects. For instance, much of the information concerning the types of lamps in use (given in Chapter I), is obviously misplaced; again, a separate chapter might well be devoted to arc lamp connecting systems, power factors, and so on.

We notice a peculiar expression on page 53—that in vertical flame arc lamps a cast-iron reflector is used, "the reflecting powers of which are *by no means impaired*" by the white fume-deposits! What, exactly, are we to understand by "there is no question but that the fumes" (in the Jandus lamp) "have the effect of regenerating the arc"?

On the whole, the author compresses a great deal of information into this treatise, and the small size of the latter may excuse that lack of explanation and justification of many statements which would be unpardonable in a larger work.—R. E. N.

Original Papers on Commercial Dynamo Design. By W. L. Waters. London: Chapman & Hall, Ltd. Price 8s. 6d. net.

This book, by one of the chief engineers to the Westinghouse Electric and Manufacturing Co., differs considerably from the vast majority of books on electrical design. In fact, the author offers it as a supplement to such treatises as a series of articles written by one who is "actively engaged in practical manufacturing."

The book consists of a series of reprints of papers presented to the American Institute of Electrical Engineers, the National Electric Light Association, and so on.

The first chapter treats of commercial alternator design, and was originally read in June, 1903; some good information is given in an interesting manner. Being written some eight years ago it is naturally not quite up to date, *e.g.*, no mention is made, in dealing with turbine-driven alternators, of rotors of the non-salient pole type.

The next chapter deals with double-current generators, and is brought up to date by a short note added in December, 1910, the paper having been written in 1904. The influence of the frequency of the alternating-current side is well and clearly given; it is noteworthy that, for periodicities of the order of 50, the most satisfactory double-current generators are those driven by steam turbines. We think, however, that attention might have been called to the fact that the output of a double-current generator is limited by the heating of the armature, and by the field distortion due to the armature reaction, in the same way as in a direct-current machine or alternator, and is consequently much less than that of a converter. The essential difference between double-current generators and converters is that in the latter the direct current and the alternating current are in opposition and not in the same direction as in the former type of machine.

Following this we have an essay dealing with the predetermination of sparking in direct-current machines. A good description is given of the endeavours of early workers to produce sparkless commutation. A new method of calculating the reactance voltage is given, but the author admits that his formula does not take into account all the conditions affecting sparkless running, and says that his result must be used with considerable discretion. It is not at all probable that a formula can be arrived at which will take everything into account, and even if it could, it would be so complex as to be useless to the practical designer. After a careful examination of this method, the reviewer prefers the well known Hobart formula.

The fourth article is devoted to rotary converters and motor-generators. The author appears to favour the installation of motor-generators where this is at all possible, in preference to rotary converters. After considerable experience, the reviewer's inclination is the other way. Absolute reliability is becoming of more and more importance and there can be little question that a rotary converter, with its necessary transformer, is more reliable than two rotating machines. Also from a mechanical point of view, the rotary has the advantage that no transfer of mechanical energy takes place, since the torque produced by the generation of direct current and the torque produced by the alternating current are applied at the same armature bars, while in a synchronous motor-driven direct-current generator, the energy must be transmitted mechanically through the shaft. A note added to this paper in December, 1910, brings this well written essay up to date, although no mention is made of the modern motor-converter.

Shunt and compound-wound rotary converters for railway work occupy the next paper, which was read in 1906. The arguments for and against compounding are well given, and it is clearly pointed out that the compounding actually takes place in the alternating-current lines leading from the rotary in which an inductance is a necessity, and not in the machine itself.

The next chapter deals with induction generators for use in central stations and for other work. A description of the general characteristics of this type of machine is given together with a considerable amount of information on the subject which is certainly not generally known. Induction generators undoubtedly suffer from the fact that they were tried in the early days of electric power stations. Their very high efficiency at high speeds, and robust character certainly seem to indicate that they might be used a great deal more than they are. Their one great disadvantage is, of course, that they are unable to carry a lagging, idle-current load. The author suggests their use, together with a rotary converter, instead of very large direct-current turbo-generators. This suggestion is backed up very effectively by some figures obtained from tests at the Baltimore Copper-Smelting and Rolling Co.'s works. The results completely outclass those from an ordinary Corliss direct-current set.

Modern developments in single-phase alternators are next treated of. The principal difficulties met with in the design of modern high-speed turbo-alternators of large pole-pitch are, neglecting mechanical considerations, the result of the pulsating armature reaction and the stresses in the ends of the armature coils where they leave the laminated core. The pulsating armature reaction causes losses throughout the machine, often resulting in dangerous heating. The stresses on the ends of the armature coils are enormous when a short circuit occurs, and this has sometimes resulted, in the reviewer's experience, in the complete destruction of the coils. Some good photographs are given in this chapter of means that have proved satisfactory in obviating or minimising these inherent difficulties.

The next chapter deals with the much-discussed subject of specifications and rating. Some original ideas are put forward which are well worth the attention of buyers and manufacturers of electrical machinery. There is no doubt that the tendency is to pay altogether too much attention to the figures stamped on the name plates of machines. The reviewer has seen machines running steadily and satisfactorily on loads exceeding by 100 per cent. the so-called rating of the machines. In the paragraphs dealing with the tests made by buyers of machinery, it is stated that certain tests cannot be made within 2 or 3 per cent., and that temperatures cannot be taken within 5°. The tests referred to are of course commercial tests on large machines and the reviewer is acquainted with the inspectors of certain consulting engineers who would do well to lay this information to heart.

The final chapter deals with direct-current turbo-generators. The author again puts forward the turbo-rotary converter installation as being the best for large units. Some good information is given as to the best speeds for given outputs and voltages, and the principles of

mmutator and brush gear design are thoroughly up to te. Mechanical construction, vibration, &c., are well tered into. It is a pity that similar information is not ven with regard to compensating windings, commutating les, &c. This chapter is the most modern, and, perhaps, e best in the book.

It is said that books may be divided into two classes, namely, ry good and very bad. If this is so, then the volume der consideration decidedly falls under the first-named ss. It is to be clearly understood that the book will be eless to beginners who wish for ideas on elementary design, t to the designer with some years of experience the book ll certainly be of interest. While some of the information quite common property, there are a considerable number original and useful hints presented in a convincing nner. The author's style is blameless, being free from e vagueness and "Americanisms," which unfortunately mar ny otherwise good American technical publications.

The book is got up in a faultless style, free from objec- nable catalogue matter and illustrations, and bearing the ove facts in mind, worth its price, despite the fact at it consists of 135 pages only.—H. G. S.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers.

Newcastle Local Section.

A special meeting was held on November 24th, with the object giving to members of the Council an opportunity of hearing the ws of local members on the proposed new Articles of Association. . J. E. Kingsbury and Mr. Rowell, the secretary, were present, presenting the Council, and Mr. Faraday Proctor was in the air. A number of suggestions and questions had been forwarded the Committee of the Council. A resolution had also been warded stating that in the opinion of the Committee it would ve been better if the Council had issued a statement showing the ole of the alterations, instead of a statement which only showed principal points in which the new Articles differed from the sting Articles. For instance, Clause 82 of the proposed new icles, relating to the publication of proceedings, affected the rking of the Local Sections, and was not included in the state- nt.

Replying to the questions, Mr. Kingsbury said that there was urgent anxiety regarding funds. The fact was that there was such a margin existing between income and expenditure as an stitution of such standing should have. Regarding a gestion that endeavours should be made to increase the member- p, he said it was the aim of the Council to strengthen the stitution in regard to the qualifications of its members. The mbership was increasing as compared with last year, but not so ch as in 1906 and 1907, and far less than in 1900. The increased t due to the change in the method of printing papers from Local tions was practically a negligible quantity, but the printing s being carried out very much better than previously. The ncil had felt that the building was of advantage to the Insti- ion as a whole, and that it was not desirable to make a distinc- n between the advantages afforded to the London members and the provincial members. In reply to a suggestion that there uld be four Associate Members and two Associates on the ncil, he reminded members that the Associate Members, ng technical men, were in a way represented by the ordinary mbers of Council, whilst the Associate class was, of course, quite inct. The amount of the examination fee had not been settled. e dissolution of a Local Section had not yet been before the ncil, and he hoped that it never would.

Mr. H. L. Riseley objected to the proposed increase in the fees, he provincial members would never get the extra value, and he ld not see what great benefit they got out of the Institution at He quoted some figures from Mr. Hammond's statement, from ich it was seen that whereas £13,000 had been expended in con- tion with London, only £1,600 had been expended on Local tions. Provincial members derived no advantage from the ary, &c., and were, in many cases, put to a great deal of expense travelling considerable distances to attend the local meetings meetings in London. When chairman of the Local Section, therefore a member of the Council, he had to pay his travelling enses to London. The members of the Council were invited to ir annual dinner, but if it should not pay the Committee had to ke it up, whereas in the balance-sheet there was a considerable n for the deficiency on the annual dinner held in London, and m of £242 in connection with the conversazione. He suggested t the *Journal* should be published while the subject matter was fh.

Mr. R. P. Sloan felt strongly on the question of increased sub- ptions, and thought that the time for raising subscriptions was ripe. Serious consideration should be given to the question ether the increase in subscriptions would be detrimental to the sent position of the Institution.

Mr. T. W. Carter said that the question of extra payments by those members who had compounded should be considered. He suggested that the invidious distinction between Licentiates and Associates could be got over by using the terms Technical Associate and Non-technical Associate. Very definite information should be given as to what form the examinations were to take; a system of confidential reports from employers would be a much better guide as to a man's fitness for membership.

Mr. Blackman (Sunderland) said that the Newcastle Local Section comprised 211 members of all classes, who, at the present rate, paid £407 8s. per annum, while the expenses of the Section amounted to £85 6s. 4d. (December, 1909). After deducting items which did not affect the Local Section, there was a balance of £126 profit made at the expense of the Newcastle Section. He was confident that there would be a heavy cessation from membership, and from mixing with the people who would be affected, he gathered that the provinces were against the proposal. The opinion appeared to be that provincial members had not sufficient opportunities to make their voice felt. At least a two-thirds majority of a public meeting should be necessary to effect the closing down of Local Sections.

Mr. C. Vernier (Newcastle E.S. Co.) thought that the incorporation of other societies should not be permissible merely at the discretion of the Council. Subscriptions should be payable at the beginning of each session, and not, as at present, at the beginning of each year. Through submitting papers to London for approval great delays occurred.

Mr. C. Turnbull (Tynemouth) asked if, in the event of the subscriptions being raised, it would be allowable for members to pass into a lower class.

Mr. G. Stoney, speaking as an ex-member of the Council, thought that the increase in the subscriptions was justified. The immediate result might be a drop in membership, but the effect was temporary only. With regard to the Licentiate class, it had long been felt that some provision should be made for switchboard attendants, shift engineers, and others, who could not be Associate Members. The effect of the examinations had been excellent in the case of the Civil Engineers, and resulted in a large increase in the membership.

Mr. W. C. Mountain could not agree with Mr. Stoney regarding the increase in subscriptions. If more money was required he thought that the London members should pay.

Many other members took part in the discussion.

Mr. Kingsbury, in reply, said that there could be no question but that the new buildings were required. It was hoped that as time went on an even closer relationship would grow up between London and the Local Sections, and that the latter would derive an increasing amount of benefit from the premises at headquarters. With regard to the new powers which were sought by the Council, legal opinion on this matter had been obtained, and they were advised that these powers were necessary in order to efficiently carry on the work of the Institution. For instance, if an overdraft at the bank were required, it was obvious that it should not be necessary to consult the body of Members. The expenses of the Local Sections should not be considered for individual cases, but should be treated as a whole. Their Institution cost less to run per member than any other Institution of equal standing. It was impossible to maintain the prestige of the Institution, and to do the work which was necessary, without keeping up or even increasing the expenditure. Under the rule regarding transfer, no technical Associate need have the slightest fear, as ample time would be given for transfer, and special facilities would also be given.

Mr. H. L. Riseley moved a motion to the effect that further consideration to the Council's proposal be deferred for one year, but this was lost by the casting vote of the chairman.

Manchester Local Section.

A meeting of this Section was held on November 21st, 1911, to discuss the revised Articles of Association. Mr. S. Z. de Ferranti, Mr. Robt. Hammond, Mr. Hugo Hirst, and Mr. P. F. Rowell, secretary, attended the meeting on behalf of the Council, and Mr. W. Cramp, chairman of the Local Section, took the chair.

Called upon by the Chairman, Mr. Hammond said it might save time if he gave the assurance that on all minor points, the Council would give the fullest consideration to the suggestions of members. For instance, the Council were quite willing to refer to the members on the question of pledging the property of the Institution (Article 66), and also on the incorporation of other societies (Articles 69). Three things, however, prominently stood out:—

Subscriptions.—The Council desired to raise these in order to provide funds for new developments, not for current expenditure.

Intermediate Class.—The Council had for years found it extremely inconvenient to have no special class for students out of their time, and who had not arrived at the age of 25, the limit placed by the Articles upon the Associate Member. The Council also foresaw that the institution of examinations would cause a delay on the part of many men in entering that class, again necessitating an intermediate class; hence the Council's suggestion of the class of Licentiate, though the actual name might now be considered as withdrawn. In Leeds, preference was expressed for the word "Graduate," with possibly a limit of age of 27, so that the Graduate I.E.E. could not come into serious competition with the A.M.I.E.E.

Associates.—The provision of an intermediary class into which non-technical men could be put would very much strengthen the Associate class, and it was felt that a number of men, upon whom

the great commercial future of the industry depended, would be attracted to that class.

Election of Council.—The proposal of the Council in Article 51 was a departure from present practice, viz., that 35 members, or preferably perhaps 10 members, were empowered to select names, but it was felt that if those names were adopted by the Council the members need not be further troubled. If, however, there was a feeling that the members should still have the right to add to the Council's final list, they had only to express their wishes, and he felt quite certain that the Council would comply with them.

Mr. H. Hirst dwelt strongly upon the dignity attaching to the titles M.I.E.E. and A.M.I.E.E., which was certainly enhanced by the building. He pointed out how greatly the Council would extend the activity of the Institution, if it received more moncy. He explained the present work of the Textile Committee, and pointed out how useful research of this character would be if extended to other trades. It was of the highest importance to electrical engineers, and especially younger members to get into contact with their market, and this could only be largely achieved by securing the attendance at their meetings of those who would become associates in the future. The want of interest betrayed by the Institution in the past in other than scientific work, had led to various organisations being formed outside. Much of the work now organised by such associations could have been done by Committees of the Institution itself.

The Chairman explained what steps the Committee had taken. Each member of Committee had been asked to send in recommendations for alterations. The recommendations had been thoroughly discussed and reduced to a very few points. The first considered was :—

Clause 15.—*Intermediate Class.*—Recommend that the name Licentiate be not adopted, but as an alternative that the term "Engineer Associate I.E.E.," be substituted, with an abbreviation to be determined by the Council. Commercial men to be termed "Associates I.E.E."

Mr. Welbourn said the Committee of the Section were in accord with the recommendation of the Council that a new intermediate class should be formed.

After further discussion, the President said the discussion showed how great was the difficulty of naming the class. The word "Associate Member" was not rational as designating a potential member. He never liked the word "Licentiate." At first his idea was to call the non-technical members "Commercial Member" and "Commercial Associate Member." It was felt, however, that no one would care to be called a commercial member. The next idea was to retain the present classification, prefixing "Hon." to the titles of the non-technical members in each class, but the hon. treasurer was afraid that hon. members would not want to pay any subscriptions. Eventually "Licentiate" was hit upon, but the Council would be greatly indebted to those who could suggest a better word.

Votes were then taken on the questions: (1) Is the new intermediate class desirable?—Carried almost unanimously. (2) Is "Eng. Assoc.I.E.E." the best title for the class?—Defeated almost unanimously.

The next proposal considered was Clause 12 (*d*), relating to the admissions as Members of persons of eminence who had rendered important services to electrical engineering in the fields of commerce, finance, law or science.

Mr. T. L. Miller said there was no need whatever to provide that non-technical men should be elected as Members. If the Associate class were strengthened, that class would only be jeopardised by the provision that superior non-technical men should become Members.

Mr. J. Frith (vice-chairman) said that the Council had definitely withdrawn Clause 12 (*d*) by its utterances on the subject of reserving the titles of Member and Associate Member as those of engineers.

The Chairman said that the Committee felt strongly that Clause 12 (*d*) should be deleted, and that any desirable names thus excluded would be better in the class of Hon. Members.

The President said he felt that there was very good ground for the opposition to Clause 12 (*d*), but pointed out that this provision had formed part of the constitution of the Institution from the very beginning, for over 40 years; the existing Article ran :—"He shall be so prominently associated with the objects of the Institution that the Council consider his admission to membership would conduce to its interests."

The Chairman put the question to the meeting whether they desired Clause 12 (*d*) deleted, and it was carried with only one dissentient.

Clause 27 referring to subscriptions of members was next taken; the resolution of the Committee of the Section was as follows :—

Members.—(1). That London Members within a radius to be fixed pay four guineas; (2) that Members within a certain radius of a Local Section pay 3½ guineas; (3) that Members outside either of the above pay 3 guineas.

Associate Members be similarly graded thus :—(1) 3 guineas; (2) 2½ guineas; (3) 2 guineas.

Associates be similarly graded thus :—(1) 2½ guineas; (2) 2½ guineas; (3) 2 guineas.

Students.—The old rule to be substituted for the Students instead of the new one.

Mr. S. J. Watson said the Committee felt that it was right to consider the question of subscriptions from the point of view of acknowledging that it was desirable to enlarge the scope of the Institution, and to use to the full extent the advantages which the Institution possessed in its excellent building. At the same time, the Committee felt strongly that a differentiation should be made between London members, members of Local Sections, and members outside these areas. It was a mistake to make a Student pay 1½ guineas at the age of 21, and as it was vital to the Institution to have a free supply of Students, they should not check in any way the admission of Students or their continuance on the roll throughout their Studentship.

Mr. Cunliffe suggested that Associates, who were presumably men of wealth, might be called upon to pay the same subscription as Members. With regard to the proposal in the revised Articles that Members should pay 4 guineas, whether resident in London or not, this was actually higher than the subscription paid by the Members of the Institution of Civil Engineers.

Mr. H. W. Wilson thought it was a great mistake to raise the subscriptions at all; the raising of Members' subscriptions from 3 to 4 guineas would lead to many resignations.

After further discussion, the questions :—

1. Is the Institution justified in asking for more money?

2. Should the subscriptions of London members be differentiated from those in the provinces? and

3. Should members residing in the area of a Local Section pay higher rates than those outside it?

Were carried by large majorities in the affirmative.

On Article 47, providing that the Vice-Presidents should be chosen from ordinary members of Council, the recommendation of the Committee was that the word "ordinary" should be deleted, in order to make it possible that the chairmen of Local Sections, now treated as *ex-officio* members of Council, should be eligible for the high offices of the Institution.

Mr. Frith said it was a distinct slur for Chairmen of Local Sections to be debarred from being made Vice-Presidents. The Council should bear in mind that there were more electrical engineers in Lancashire than in London.

Mr. Robt. Hammond explained that the revised Articles did not debar Chairmen of Local Sections from becoming Vice-Presidents, but they provided that they could only become Vice-Presidents by being chosen as ordinary members of Council by the full members, instead of by the Local Sections.

The Chairman put the recommendation to the meeting that the word "ordinary" in Article 47 be deleted, and it was carried unanimously.

On Article 58, in which it was proposed that it should not be competent for a past chairman of a Local Section to vote at Council meetings, if his chairman were present, the recommendation of the Committee was that the word "not" be deleted.

Mr. S. L. Pearce, member of Committee, thought that this was agreed to at the conferences of Local Sections last spring.

Mr. Robt. Hammond said that he was certain Mr. Pearce was under a misapprehension, and pointed out that at the present time there were 9 provincial members out of 24 members of Council, and that to add another six would give far too great a preponderance to members of Council not elected by the Institution. The proposal would give two votes to the Dublin Section, with only some 60 members resident in Ireland. A much better plan would be to agree to some form of proportional representation of the Local Sections, say one member of Council for every 500 members.

Mr. H. W. Wilson entirely agreed with the idea of proportional representation.

The Chairman welcomed Mr. Hammond's suggestion, but thought that he had better put the recommendation as follows :—Failing a new method of electing the Council, that the word "not" be deleted from Clause 58. This was carred by a large majority.

The Chairman said the last resolution referred to Clause 52 the method of election of the Council should be similar to that followed by the Civils and Mechanicals, and the ballot should be made by post.

Mr. S. J. Watson said that the present manner of election was at the root of the whole difficulty. Why should the Council nominate members of its own body? The people to elect the Council should be those whose interests the Council had to serve. The Council might suggest certain names and the members certain names, and finally every corporate member should have a vote.

Mr. S. L. Pearce suggested that a method of election should be adopted which differed somewhat from that of the Civils and Mechanicals, and should be an improvement upon both. He agreed with Article 51, but suggested that the list should be supported by 10 corporate members instead of 25. The procedure would then be as follows :—

Nomination of Council.

51. Prior to the 1st day of March in any year, any *ten* Corporate Members may nominate any duly qualified person or persons to fill any vacancy or vacancies about to occur in the Council on the 30th day of September next following by delievering such nomination in writing to the secretary, together with the written consent of such person or persons to accept office if elected.

52. At an ordinary meeting, at least four weeks before the annual general meeting, the Council shall present a list of persons whom they nominate for the vacancies in the offices of President, Vice-Presidents, Honorary Treasurer and ordinary Members of Council. Thereupon a ballot list containing the names of any other person or persons who has or who have been duly nominated under the provisions of Article 51, in addition to the names of those persons who have been nominated by the Council shall be forwarded to the Corporate Members and Associates of the Institution not less than seven days before the annual general meeting; it being a condition that to ensure an election for the ordinary members of Council such ballot list must contain the names of not less than nine persons for the six vacancies created annually, whether nominated by the Council or under the provisions of Clause 51.

Each Corporate Member or Associate shall be at liberty to make a selection from such list, provided that the number of names so selected shall not in any case exceed or be less than the number requisite to fill the vacancies.

Ballot papers shall be so marked, returned, counted and recorded, as may be from time to time determined by the Council. The persons elected shall take office on the 1st day of October next following their election.

No resolution was put, but the matter was left for the method of nomination and election as put forward by Mr. Pearce to be forwarded to and considered by the Council.

The President said he highly appreciated the splendid preparation of the work that had been done by the Committee, and he congratulated the Section on the broad-minded view which they had brought to bear on each one of the knotty points presented to them.

Manchester Students' Section.

A number of resolutions and suggestions were placed before Mr. Hammond and Mr. Rowell at Manchester on November 22nd by the Students' Section of the Local Section.

The first resolution recorded a respectful protest against the action of the Council in attempting to bring into force, at such short notice, the proposed alterations to the Articles of Association without ascertaining the feeling of the Students, as in the case of such drastic changes as were proposed, the Students were more closely affected than other grades.

The Students' Committee suggested that in Article 13 (*a*) (Associate Members) the words, "in a responsible position," be inserted after the words, "for at least two years as an electrical engineer," and that grounds for exemption from examination should be (1) the holding of an engineering diploma or degree. (2) Being a Student who shall have obtained a Student Premium, or have had a paper or original communication accepted for printing in the *Journal*.

In Article 16 (*b*) it was proposed to include as a qualification for admission as a Student, pupilage or apprenticeship to any approved firm of electrical engineers, approved supply company, or municipal undertaking, and to delete the words "under agreement."

In Article 26 it was suggested that a candidate having been a Student, for three years should pay a maximum transfer fee, including examination fee, of one guinea.

In Article 27 it was proposed that the subscription of Associate Members on the register before December 31st, 1911, or Students on that day, should be 2½ guineas; also that all students pay 1½ guineas per annum, dependent on the amendments to Articles 26 and 68, no age limit being included with reference to subscriptions.

In Article 44 it was suggested that three delegates (non-voting) appointed by the Student Members be called in conference by the Council when matters pertaining to Students were to be discussed, and that these delegates might request the Council to put such matters on the agenda.

In Article 68 it was proposed that no examination fees be paid by Students except as per amendment to Article No. 26.

In connection with Article 84, it was proposed that the Students' Section should be local and under the direct control of the Local Senior Section, with a complete reorganisation of the Students' Section.

A resolution was passed, "That *Science Abstracts* be sent to every member along with the *Journal*.

Scottish Local Section.

A special general meeting of the Scottish Local Section was held at Glasgow on November 24th, 1911. Mr. Sam Mavor presided, and was supported by Mr. Ferranti, President of the Institution, and Messrs. E. G. Tidd and W. W. Lackie, past chairmen of the Section.

Mr. Sam Mavor said that a great deal of the criticism of the proposed Articles of Association had been based upon disapproval of the short interval between the issue of the new proposals and the date of the meeting at which it was proposed they should be discussed. That was an unfortunate mistake, and it was unintentional on the part of the Council, which recognised that a mistake had been made, and afforded a most ample opportunity for a full discussion of the whole matter.

Mr. Ferranti said the Council had made a mistake, and they were now asking the whole membership to give them the benefit of their ideas. Electricity had passed from the stage when it was a novelty; they had now got down to the dry, practical side of the business, and there was a danger of the Institution losing interest and popularity. Along with this development of the business there had grown up multifarious interests—some of them purely technical, some of them commercial, and many of them a combination of the two. These interests were not being properly looked after and superintended, and he thought it was the duty of their Institution to do this. This meant broadening the basis of membership, so as to include the various classes of people represented by these interests. In this way the efficiency of the Institution would be greatly increased, and the practical value and use of membership would be largely enhanced. With proper organisation, electrical interests of every kind might be thoroughly attended to and electrical progress definitely promoted. As at present constituted the Institution was not fit to overtake this work. With regard to the subscriptions, there was something to be said for a graduated scale according to geographical position, but he pressed the point that they should regard the subscription as a payment made to a central body, who were organised to look after their interests and see that they were conserved. It was for the members to say whether the subscriptions should be uniform or not. On the suggestion of the chairman it was agreed to take up the points mentioned by Mr. Ferranti, seriatim, the first point considered being the proposed broadening of the basis of membership.

Mr. McWhirter agreed that the basis should be broadened on the lines suggested.

Mr. T. C. Fulton asked if there would be any opportunity of provincial members exercising a voting power in connection with the adoption or otherwise of the amended constitution.

Mr. Ferranti was inclined to think that such voting power could not be legally granted, and that they must depend upon the Council, which included a proportion of provincial members, to carry out their recommendations.

Mr. Scott Maxwell said broadening the basis on the lines indicated would tend to lower the status of the commercial electrical engineer, who was the man they should seek to encourage.

Mr. Lackie supported the Council's proposal, which, he said, would add greatly to the usefulness of the Institution.

Mr. E. G. Tidd said the two classes mentioned by Mr. Ferranti were quite distinct. The technical business man was eligible for Associate Membership, and therefore the proposed new class of member would not affect the status of the commercial engineer.

Prof. Baily said that the technical commercial man might not be eligible as an Associate Member, because, according to Rule 13, the candidate for admission to this class must be a genuine engineer at the time of his election. He agreed, however, as to the desirability of getting both the purely commercial man and the technical commercial man into the Institution.

Mr. J. A. Robertson said the object of the proposed new class of members was to keep them distinct from the qualified technical men whose qualifications gave them a certain position in the technical world, and if they could have some guarantee that the new class would be properly distinguished, it would remove the objections of many members.

Mr. Ferranti said the only corporate members would still be Members and Associate Members. The other class would not have the word "Member" as part of their title.

Mr. Lee Murray said that many men remained in the class of Associate who should be Associate Members. Corporate members should be confined to engineers.

On a show of hands being taken, the principle of the broadening of the basis of membership was declared unanimously agreed to.

The subject of subscriptions was then discussed. Mr. McWhirter said that local provincial members did not enjoy the privileges of London members, and the proposed increase in the subscriptions would hit many of their members rather hard.

Mr. Mavor said he was at first opposed to the increased subscription, but further consideration had shown him that the increase was absolutely necessary. Provincial members forgot that they had been living for 28 years on the charity of the Civils, who granted them the use of their rooms. With a membership of 6,000 that state of affairs could not be continued. Their Institution was the only one which provided Local Sections. They knew the privileges they had as Local Section members, but they must take a wider view than that. They were members of the Institution first, and of the Local Section second. From their geographical position it was simply inevitable that the management of the Institution should be almost entirely vested in the Council in London. Provincial members, perhaps, did not quite realise the amount of work that some of the London members put in on the various committees that attended to the business of the Institution at headquarters. It was a mistake to think that the headquarters in London were used as a club by London members. As a matter of fact, the buildings were used by provincial members from Birmingham, Bristol, &c., rather more than by London members. The Council were anxious to extend the usefulness of the library by making it a lending library instead of merely a reference library. Hitherto practically every reform proposed in the organisation had had to be referred to the Finance Committee, who simply negatived it for lack of funds. This was an intolerable position, and it was absolutely necessary that they should have more money at their disposal to carry on the work of the Institution.

Mr. W. L. Spence objected to the extent of the increase.

Mr. J. S. Nicholson said they should not be too niggardly. He was against a graduated subscription. They should all be on the same footing.

Mr. Burbidge said that the proposed increase might have the effect of decreasing their funds. He thought that Associate Members living abroad should be treated on the same lines as full Members in similar circumstances.

Mr. Scott Maxwell favoured a uniform subscription.

The Chairman said that the total expenditure allocated to Local Sections amounted to 40 per cent. of their subscriptions.

Prof. Baily said they must pay for the benefits before they could get them. The proposals in the revised constitution would raise the status of Associate Membership.

Mr. Ferranti said they had calculated to lose 10 per cent. of their members by the increased subscriptions, and they had not allowed for any revenue from the proposed new grade of member. It would pay them to have a higher subscription in order to ensure a better return for their money. Unless the Institution were really to watch and protect their interests in a practical way it would cease to be of interest to many of them. His experience of the Council was that they were most conscientious in their methods of dealing with applications for admission. Their efforts in the past had always been crippled for lack of funds, and he felt that their Institution must be made really useful or it would cease to appeal to them as being worthy of their support.

A vote was then taken :—

1. As to whether some increase in the subscription should be made. This was unanimously agreed to.

2. As to whether the subscription should be uniform or graduated—26 voted for a uniform subscription, and 12 for a differential subscription

Yorkshire Local Section.

On November 15th the chairman, Mr. T. Harding Churton, delivered his inaugural address. Referring to the proposals of the Council to widen the borders of the Institution so as to embrace many persons, who, though not by profession electrical engineers, were interested in the application of electricity, he said that the Institution had been not infrequently regarded as a purely scientific and academic body ; but they should not forget that they depended upon trade. Electrical engineers carried on their business or profession for the purpose of making a living, and the Institution would flourish only if its members succeeded in that essential purpose. If, therefore, the advancement of the application of electrical science (to borrow the words of the Memorandum of Association) was hindered by economic or legislative causes that were capable of being reduced or removed, it seemed right that the Institution should do all that it fittingly could do to that end.

The state of unrest that had manifested itself in the unfortunate labour disputes of late, undoubtedly originated in the ambition on the part of "Labour" to participate in a larger share of the wealth produced.

The production of any commodity required first, and as a necessary antecedent, (1) capital, and (2) labour.

What was it that regulated the proportions of the produce of capital and labour employed which went to the owners of the capital and to the labourers respectively ? The relative value in exchange of anything, be it capital or labour, depended upon the law of supply and demand—its value in exchange varied inversely as the supply of it and directly as the demand for it.

In any particular part of the world, the supply of a commodity depended partly upon the total supply of the world and partly upon the facilities that existed for transferring it from other parts to that particular part of the world.

Any inequalities there might be in the value of either capital or labour in various parts of the world in consequence of local conditions of supply and demand, tended to produce a flow from those parts where the value was less to others where its value was greater, and thus to establish a condition of equilibrium.

Capital, labour, and the product of the capital and labour, each had its market value. If either the capital or the labour employed in the production of any commodity or in any particular place could find more profitable employment in the production of any other commodity or in any other place, there was a natural tendency for either to flow to such other employments or places. But the flow was sometimes slow, and equilibrium only partially preserved. Capital, for example, in the form of lands, buildings or machinery, could not always be readily adapted to another use. And a man who, after years of training, was skilled at one kind of work, could not always readily adapt himself to another kind of work of equal value in exchange.

What results would follow, or tend to follow, the "artificial" raising of the value of either capital or labour by means of combination among capitalists or labour respectively ? Taking labour first, whatever the extent of the combination, the object was to maintain, with relation to the rest of the world, a higher level of market value than that which it would possess if left to the free operation of the law of supply and demand.

If the commodity produced by the kind of labour in question was one that might be readily imported from other countries, the value of the labour in the combination would thereby and to that extent be kept in check. In other words, as supply depended (in part) upon facilities for import, and as market value depended upon supply (and demand), therefore market value depended (in part) upon facilities for import (and demand).

If outside competition kept down the market value of the commodity to such a level that when labour had been paid at its increased rate, there was less than the market value of the capital left, there would at once be a tendency for the capital to be diverted to more profitable uses. Thus, the employment in that industry in this country would decrease, and the foreign importation would increase.

A striking example, illustrative of this, came to light in August last, when a chainmaker was prosecuted under the Trade Boards Act for paying boys in his employ 12s. 6d. and 13s. per cwt. for making a particular class of chain, whereas the *minimum* legal rate was 17s. From the evidence it appeared that the market value of the chain was only 17s. per cwt., which therefore left nothing—after paying the legal rate of wages—for material or other expenses or profit. The result of such legislation must clearly be to drive the trade and employment away altogether.

The Judge of the Federal Arbitration Court of Australia some two years ago, while settling a dispute, said he could not dictate to the employers what work they should carry on. But he could and would prescribe the conditions under which they must employ men, if they chose to employ them ; and, if any industry could not afford to pay the "living wage" which the Court awarded, its remedy was to apply to the Federal Parliament for protective duties that would allow it to comply with the award. It seemed clear that by no other means could the free flow of competitive foreign labour be checked or prevented.

Another result that might be noted was that a rise in wages of one kind of labour was generally followed by a rise in other kinds of labour. One section after another succeeded in obtaining increased wages, which process tended to restore the original relative-values in exchange. The wage earner, having in consequence to pay more for his commodities, might be really no better off in the last stage than in the first. And here he might observe that they were all, as *consumers*, thereby indirectly *employers*. It was said that though, in recent years, rates of wages had been generally increased, the cost of living had increased in a still greater degree—which indicated that the demand for food-stuffs and other necessaries had increased more than the supply of the same. It would appear that this result was brought about by there being a smaller proportion of labour or capital—or of both—employed in the cultivation of food than hitherto.

With regard to combinations of capitalists, the principles that applied to labour applied also to capital. For that reason, in a country in such circumstances as this, having ample shipping communications with every part of the world, and no restrictions upon imports, the conditions for effective combination among capitalists were not favourable.

Thus the answer to the question—what was it that regulated the proportion of the produce of the capital and labour employed which went to the owners of the capital and to the labourers respectively ? —was the law of supply and demand. "Supply" was dependent upon the facility with which the commodity might be imported—and upon the degree of this facility depended the extent to which the value of either capital or labour might be locally forced up by combination of capitalists or of labour respectively.

If the supply of either Capital or Labour fell below the amount which the other could profitably utilise, the supply of the product must be diminished. And, conversely, if both the factors of production were proportionately increased, the product would also be increased. With a greater amount of produce to divide, the greater would be the amount received by the parties to the distribution. Therefore, he said : "Encourage Capital—it is necessary for employment ; encourage Labour—it is necessary to render Capital productive ; encourage the greatest possible efficiency in Production—the 'living wage' is measured by it."

Automatic Reversible Battery Boosters.

By R. Rankin, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, November 23rd, and Manchester, November 28th*, 1911.)

When it is considered that a saving in coal consumption of between 20 and 30 per cent. can be obtained through the installation of a battery and booster plant, in cases where the load is of a very highly fluctuating nature, and, say, 10 to 15 per cent. by the provision of a reliable automatic booster in cases where a battery is already installed without a booster, it will be seen that an exceedingly good case can be made out for this type of plant. The percentage savings given above are results obtained in actual practice.

In order to obtain the maximum economy, the battery-booster plant should equalise on the total load of the system on which it is installed. This, of course, it cannot usually do in the ordinary corporation electricity station, where the three-wire general supply system with earthed neutral has to be kept separate from the traction system with its rail return, but even when equalisation is only carried out on the traction load, which is supplied by separate main generators, striking results can be obtained. They become more marked when the traction and general supply systems can be supplied from one set of generators, being connected by a link in the form of a motor-generator. It is, however, in the case of a works generating its own electricity for lighting, and for a very highly fluctuating power load, that the economy shown by a battery-booster plant attains its maximum. An ill-regulated voltage is fatal to satisfactory illumination, and leads to short lamp lives, and a good, steady voltage is practically a necessity. There can be little doubt that proper steady illumination in a workshop makes for greater efficiency and greater output, and the general good effect on workmen of working under satisfactory conditions is a thing which very often does not receive the consideration it deserves.

The writer has had practical experience of cases where a battery has proved of immense advantage in preventing the stopping of important processes during temporary failure of the main supply. Especially where gas-driven generating plant is installed, the certainty of a standby of this sort is of great importance. Light loads at meal hours and week-ends can often be handled by a battery, when otherwise the generating plant would be kept running very inefficiently.

Seeing that the accumulators made by the leading makers have now attained a high standard of excellence, the question practically hinges on the booster, the success of this being the factor determining the success of the whole installation.

Broadly speaking, the boosters in use in this country belong to one of three classes :—

(A) Those in which the booster can be self-contained and operated by its own field windings independently of any outside controller.

(B) Those in which a so-called exciter is an absolute necessity, not merely for exciting purposes, but being an essential in the theory of the system.

(C) Those in which an external automatic regulator is used on the booster field, either indirectly or through an exciter, the latter not being an essential in the theory of the scheme.

Class (A).

Differential Booster.—The simplest type in this class is the simple differentially-wound machine shown in fig. 1. In this case a

coil A, carrying a portion of the total load current, and giving a booster voltage in the discharge direction, acts in opposition to a coil B, excited from the bus-bar voltage, and giving a field tending to produce a charge boost. The battery being assumed in a floating condition—that is, its voltage, with no current flowing

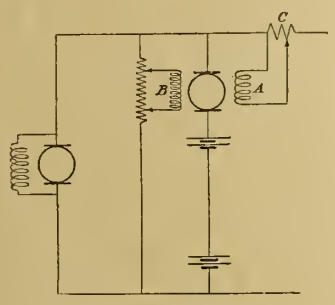


Fig. 1.

into or out of it, being just equal to the bus-bar voltage—it is evident that the battery will be idle and the generator will supply the load when the effects of coils A and B just balance each other. An increase of load will cause A to overpower B, and a resultant booster voltage in the discharge direction will be produced; the battery will accordingly come to the assistance of the generating plant, and with ideal working and the diverter C properly proportioned, the discharge current would be practically equal to the excess of line current over that at which A and B were just balanced. A decrease in line current would have an exactly opposite effect.

The battery being continually on the charge or discharge, its E.M.F. will vary considerably, as also will its resistance. For this there is no compensation, and this action renders it impossible to obtain good regulation of the load on the main generating plant.

In the Pirani booster the shunt coil B is connected across the battery. This certainly gets over the above-mentioned difficulty, but it introduces another trouble, which is quite as bad as the one eliminated, viz., that the action is unstable, and the battery tends to over-charge and over-discharge. There is no limit to this action, and the generator may be heavily overloaded, or the battery injured through getting too great a charge.

Another disadvantage which is, however, shared by other boosters of this class, is that the amount of copper in the field is excessive, since it is not the actual ampere-turns on the magnets that are effective, but the difference between the series and shunt ampere-turns.

The Crompton booster is the elementary Pirani with the addition of a shunt coil connected across the booster terminals, ostensibly to compensate for the varying state of the battery; but it is difficult to see what gain is expected by the provision of this coil, as the undesirable features of the Pirani system are always present in the system.

The Lancashire booster shown in fig. 2 is of the differential type, the booster being provided with a third coil D, connected across the booster terminals, and excited by the difference between bus-bar and battery voltages; it is designed in such a way that the field produced by it on the booster is always of such a value as to produce, in the booster armature, a voltage exactly equal to the voltage across its own terminals. Thus there is always, in the battery and booster portion of the circuit, a voltage equal to the bus-bar voltage, independent of the state of the battery. This

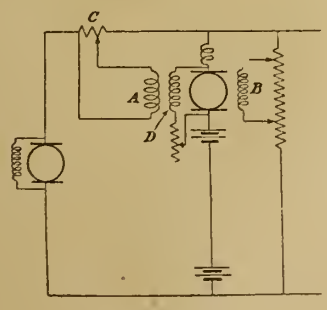


Fig. 2

leaves the coils A and B free to serve their proper purpose of regulating the booster charge and discharge, the two being balanced at normal generator load, and the total voltage in the battery-booster limb of the circuit being then equal to the floating value—*i.e.*, equal to the line voltage.

It should be observed that the diverter coil of the Lancashire booster carries a portion of the generator and not of the line current. The working of the system is as follows:—At normal desired generator load the diverter coil and the separately excited shunt coil are set to balance each other. The self-excited shunt coil supplies the difference between the battery and line voltages, enabling the battery to float without charging or discharging. An increase in line demand causes an increase in generator current, and therefore in diverter coil current, which starts the battery on discharge. The battery voltage accordingly drops, but the self-excited shunt coil compensates for this drop, the initial voltage due to the increase in generator current being available to draw current from the battery until the battery current attains the value at which the generator current returns to the normal.

In diverter boosters generally the generator current should be adjusted to the desired value by an adjustment of the shunt coil B alone. The diverter should normally not be touched, once it has been set to the proper value, although, in a Lancashire booster, both diverter and shunt regulator require to be adjusted if the best results are to be obtained.

Class (B).

The connections of the Highfield booster are shown in fig. 3. In this case the varying state of the battery is compensated for by the employment of a small exciter connected in opposition to the battery through the booster shunt coil, so that the latter is excited

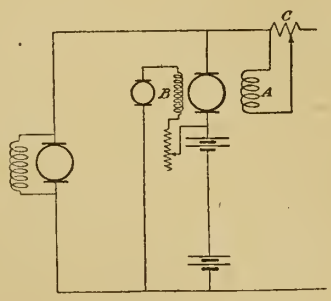


Fig. 3.

by the difference between exciter and battery voltages. The field this coil produces is of such a value as would produce a booster voltage exactly equal to the voltage across the terminals of the coil—that is, the difference between exciter and battery voltages. The diverter coil circuit being assumed open, there is, therefore, always a voltage in the battery-booster portion of the circuit equal to battery voltage plus or minus the difference between battery and exciter voltages—that is to say, a voltage equal to the exciter voltage. The state of the battery when in a normal stable working condition is therefore compensated for.

The facts that the exciter is a constant-voltage machine, and that the booster shunt coil gives a booster voltage equal to the difference between battery and exciter voltages, make it possible to run the battery and booster alone on the load, and yet have a constant line voltage automatically provided. Compounding over the steady value, if desired, can be obtained *viâ* the diverter.

With the circuit of the diverter coil closed, its additional voltage effect always tends to give a voltage in the discharge direction, since the direction of the line current is constant. With proper adjustment a rise of line current will cause an increase in diverter boost, until a discharge current is flowing approximately equal in value to the increase in line current. Similarly a decrease of line current will cause the diverter boost to decrease by an amount sufficient to allow a charging current to pass into the battery approximately equal to the fall in line current.

The scheme due to Strang, and worked by the Electric Construction Co., is another application of the principle adopted in the Highfield booster. In this, and in the Highfield system, the main point gained is that a voltage is always available and present in the battery-booster limb of the circuit, equal in value to bus-bar voltage minus diverter boost at the current which it is desired that the main generator should take.

There is one disadvantage common to all diverter boosts, viz., they will not work so satisfactorily with over-compounded generators unless arrangements can be made to over-compound simultaneously both booster and generator to the same extent—not an easy matter—and this militates against their successful employment in stations where such generators are employed.

As, however, the object of a booster is to keep a constant load on the generating plant there is little reason, provided the booster is otherwise capable of giving satisfactory results, why the generators should not be run shunt, or with some of the compounding cut out, so as to make them level-compounded while the booster is in operation. The compounding can be used, if desired, when the generator is running alone on the load. Compounding where a diverter booster is employed, if absolutely necessary, could be obtained by the use of an ordinary series line booster.

The fact that the resistance of the battery is not constant, even with the battery in a stable working condition, but varies with the varying state of the cells, is one reason why the working of line diverter boosters can never be truly accurate. Variable resistance of field coils with heating is another cause of inaccuracy of working. Besides the foregoing, the use of a diverter, itself practically non-inductive, in parallel with a highly inductive field coil, must produce a pronounced tendency to sluggishness of action in all boosters in this class.

(To be concluded.)

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We give below, in our usual form, particulars of the applications that have been lodged for the consideration of Parliament and the Board of Trade early next year. Readers who require the full details of any individual proposal will find them set out in the last few issues of the *London Gazette* :—

(*a*) Electric Light and Power.

Abercarn.—Application by U.D.C. to amend 1906 order, extend time, and provide for transfer.

Abingdon.—Corporation is applying for a prov. order. Transfer powers.

Altrincham and Bowdon.—Altrincham Electric Supply, Ltd., seeks power to supply within Hale urban district and Bucklow rural district.

Annfield Plain.—A. P. and District Gas Co. is applying for power to impose a minimum charge for gas where electricity is also supplied.

Ardsley.—Application by the Electrical Distribution of Yorkshire, Ltd., for a prov. order.

Aylesbury.—Application by U.D.C. for a prov. order. Transfer powers.

Bingley.—Application by the U.D.C. for a prov. order. Transfer powers.

Birstall.—U.D.C. is applying for amendment of 1901 prov. order, extension of time, and transfer powers.

Bognor.—Application by Mr W. Tate, of Tower House, Felpham, for a prov. order.

Bognor.—Power to Bognor Gas Light and Coke Co. to establish electricity works and supply electricity within the gas limits. Supply of electricity in bulk.

Bordon and District Gas Co.—New company to take over East Hants Gas Co., Ltd. Power to apply for electric lighting order.

Burnham.—Application by U.D.C. for prov. order for Burnham district and part of the parishes of Berrow and Brent Knoll.

Burnley.—Application by Corporation for extension of supply powers to Reedley Hallows.

Cheltenham.—Application by Corporation to extend its area of supply to include parts of the Cheltenham and Winchcombe rural districts. Sale, hire, fixing, &c., of electrical apparatus.

Darton and District.—Application by the Electrical Distribution of Yorkshire, Ltd., for a prov. order for supply in Darton and Cawthorne.

Doncaster.—Corporation seeks extension of powers so as to supply in Wheatley urban district.

Dorchester.—Application for a prov. order by Messrs. J. & W. Purves.

Glastonbury.—Corporation is applying for a prov. order.

Goole.—Application by Mr. J. W. Speight, of St. Anne's-on-the-Sea, for a prov. order.

Goole and District.—Application by the Electrical Distribution of Yorkshire, Ltd., for prov. order to supply in Goole urban district, and the townships of Rawcliffe, Airmyn and Hook, in the rural district.

Great Harwood.—Application by U.D.C. for prov. order. Transfer powers.

Greetland.—Application by U.D.C. for electric supply powers. Power to transfer to Electrical Distribution of Yorkshire, Ltd.

Houghton-le-Spring.—H.-le-S. District Gas Co. is applying for power to apply for prov. order for electric lighting.

Holmfirth.—The U.D.C. is applying for a prov. order for supply in Holmfirth, Netherong, and Honley.

Hoyland Nether and District.—Application by the Electrical Distribution of Yorkshire, Ltd., for a prov. order for supply in Hoyland Nether, Womhwell and Worshorough, in the West Riding of Yorkshire.

Ilkley.—Application by U.D.C. for prov. order to supply electricity in Ilkley District and Middleton Parish.

Launceston.—Application by Launceston and District Electric Supply Co., Ltd., for prov. order to supply in borough of Dunheved, otherwise Launceston, Cornwall,

Leatherhead Gas and Lighting Co.—Various powers including permission to make a minimum charge for gas to persons who have a separate supply of gas or electrical energy for lighting, power or other purposes, but who require continuance of the company's gas supply.

Llanelly.—Application by Llanelly and District Electric Lighting and Traction Co., Ltd., for extension of limits of supply so as to include Barry Port urban district, and portions of Pembrey Llanelly Rural and Llangennech.

Newton-in-Makerfield.—Application by the U.D.C. for a prov. order. Transfer powers.

Pontefract.—Corporation seeks amendment of 1907 order, extension of time, transfer to Yorkshire (West Riding) Electric Tramways Co., Ltd.

Radcliffe.—Lancashire Electric Supply Co. seeks powers to supply in Radcliffe.

Rothwell and District.—Prov. order applied for by Electrical Distribution of Yorkshire, Ltd.

Rushden.—Application by F. H. Thornton, B. Sampson and J. Clark for a prov. order to supply electricity in Rushden urban district, Higham Ferrars, Irthlingborough urban district, Wellingborough rural district, and Chelveston-cum-Caldecott parish.

Sherborne.—Messrs. J. and W. Purves are applying for a prov. order. Transfer powers.

Sidmouth.—Supply of gas and electricity by U.D.C. Transfer to Council of Sidmouth Gas and Electricity Co.'s undertaking. Extension of time for electricity works.

Tendring Hundred Water and Gas.—In seeking powers for extension of water and gas supply areas the Tendring Hundred Waterworks Co. is, like a number of other gas companies, applying for many provisions including one enabling them to regulate prices for gas to consumers having their own separate supply of gas or electricity.

Wath-upon-Dearne.—Prov. order applied for by Electrical Distribution of Yorkshire, Ltd.

Wimborne and District.—Application by the Bournemouth and Poole Electricity Supply Co. for amendment of Wimborne and district order of 1905. Extension of time and transfer powers.

The National Electric Construction Co., Ltd., is applying for leave to bring in a Bill confirming certain agreements relating to the supply of electric wires and fittings, made between the company or its predecessors, and a number of municipal corporations and two companies. The provisions sought will require local authorities to make a charge for electric lines and fittings supplied by the companies where no obligation to charge at present exists.

(*b*) Electric Tramway and Railless Trolley Vehicles.

Bingley.—U.D.C. is applying for tramway powers.

Birmingham.—Corporation seeks further tramway powers and authority to run trolley vehicles within and without the city. Powers respecting site in Aston and Erdington for new generating station.

Brighton.—Corporation seeks powers to run electric railless trolley vehicles within and without the borough ; also powers to Hove Corporation as to working such a system in Hove ; extension of electric supply area.

Brighton District.—Powers are sought for the B.E.T. to transfer the existing tramways between Hove and Shoreham to a new company.

Brighton, Hove and District.—Brighton, Hove and Preston United Omnibus Co., Ltd., seeks powers to provide and run electric railless trolley cars in Brighton, Hove, Worthing, Portslade, Shoreham-by-Sea, Southwick, Steyning West and East ; power to run over and use portions of the Brighton Corporation tramways system ; also to purchase the Hove, Worthing and District Tramways undertaking of the B.E.T. Co., Ltd.

Dewsbury.—Corporation is seeking tramway powers.

Dover.—Corporation. Tramways extension.

Hove.—Power to Corporation to use electric trolley vehicles within the borough, and in Portslade-by-Sea, Southwick and Shoreham-by-Sea. Extension of Hove (Aldrington) electric lighting order, 1898, to above districts.

Keighley.—Corporation seeks powers to run electric trolley vehicles. Also authority to apply to B. of T. for powers to extend to routes not now specified. Various electricity supply powers, including selling, hiring, setting up, repairing, &c., electrical apparatus on consumers' premises.

Kingston-upon-Hull.—Corporation seeks powers to run new specified tramways.

London.—The L.C.C. is applying for powers to run further tramways, and to run coupled and trailer cars, &c.

London United Tramways, Ltd.—Extension of time for authorised tramways.

Metropolitan Electric Tramways, Ltd.—New electric tramways in boroughs of Stoke Newington and Hornsey.

North Ormesby, South Bank, Normanby and Grangetown.—New company to run railless trolley cars in districts named. Supply of electricity to be taken from Cleveland and Durham County E.P. Co., Bolckow, Vaughan & Co., Ltd., or other authority.

Preston, Chorley and Horwich.—P.C. and H. Tramways Co. seeks extension of time for completion of works.

Ramsbottom.—U.D.C. is seeking powers for railless electric traction in Ramsbottom ; conversion of railless traction into tramways, and incidental provisions.

Sheffield.—Corporation. New tramways and trackless trolley system. Also various powers regarding the conduct of the electric supply department.

Southall, Hounslow and Twickenham.—New company seeks powers to run railless electric trolley vehicles in Southall-Norwood, Heston and Isleworth, and Twickenham.

Stockport.—Corporation seeks power to provide and run railless electric trolley vehicles on specified route.

Swansea.—Corporation seeks powers for several new tramways. Agreements with the Swansea Improvements and Tramways Co.

West Ham.—Power to Corporation to run tramways and trolley vehicles in Wanstead and Leyton urban districts, and trolley vehicle system in West Ham county borough. Various electricity supply provisions, including supply to consumers in Wanstead and in bulk to Wanstead U.D.C.

(*c*) Railways.

L. and N.W. Railway Co.—Powers to adapt for electrification the North London and certain portions of the North and South-Western Junction and London and South-Western Railways. Agreements with owners of those railways and Metropolitan District Railway and London Electric Railway Companies as to supply of electricity : powers to supply electricity to manufactories and works near to railway, with consent of undertakers.

Canvey Deep-Water Wharf and Railway.—New company to construct wharf, railways, &c., on the Thames at Canvey Island; powers to work railways by steam or electricity; lands for generating station; supply in bulk or otherwise to consumers whose lands abut upon lands held by the company.

Great Eastern Railway Co.—Electrification of East London Railway, and powers to various railway companies and joint committee of the East London in connection with such electrification. Powers to Metropolitan District and London Electric Railway Companies in reference to supply of electricity therefor.

London Electric Railways Co.—New railways, stairway, subways and works. Power to this company and to District Railway Co. to supply electricity to North Metropolitan E.P.S. Co. and to Richmond (Surrey) E.L. and P. Co., Ltd.

Metropolitan District Railway Co.—Widening of Wimbledon and Fulham railway, and various other works. Power to supply electricity to companies mentioned in London Electric Railway Co.'s notice above.

Metropolitan Railway Co.—Widening of existing, and construction of new, electric railways in London and Middlesex (Hammersmith, Rickmansworth, Watford).

Midland Railway Co.—Purchase of London, Tilbury and Southend Railway.

TRADE STATISTICS OF BULGARIA.

The following figures of the imports of electrical and similar goods into Bulgaria in 1910 are taken from the recently issued trade statistics; the figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1909. Francs.	1910. Francs.	Increase or decrease. Francs.
Iron wire and cable.—			
From Austria	135,000	224,000	+ 89,000
,, Great Britain ...	27,000	15,000	— 12,000
,, Germany	168,000	205,000	+ 37,000
,, Other countries ...	15,000	36,000	+ 21,000
Total ...	345,000	480,000	+ 135,000
Rails, &c.—			
From Austria	111,000	64,000	— 47,000
,, Great Britain ...	1,044,000	348,000	— 696,000
,, Belgium	1,723,000	2,497,000	+ 764,000
,, Germany	329,000	162,000	— 157,000
,, Russia	—	658,000	+ 658,000
,, Other countries ...	2,000	48,000	+ 46,000
Total ...	3,209,000	3,777,000	+ 568,000
Copper in sheets, bars, &c.—			
From Austria	351,000	475,000	+ 124,000
,, Great Britain ...	398,000	315,000	— 83,000
,, Germany	84,000	112,000	+ 28,000
,, Russia	14,000	147,000	+ 133,000
,, France	121,000	79,000	— 42,000
,, Other countries ...	—	8,000	+ 8,000
Total ...	968,000	1,136,000	+ 168,000
Railway carriages of all kinds.—			
From Austria	550,000	443,000	— 107.000
,, Belgium	34,000	634,000	+ 600,000
,, Germany	1,947,000	2,111,000	+ 164,000
Total ...	2,531,000	3,188,000	+ 657,000
Locomotives and locomobiles.—			
From Austria	377,000	667,000	+ 290,000
,, Great Britain ...	333,000	149,000	— 184,000
,, Germany	2,853,000	1,421,000	—1,432,000
,, Other countries ...	57,000	206,000	+ 149,000
Total ...	3,620,000	2,443,000	—1,177,000
Instruments: astronomical, physical, &c.—			
From Austria	95,000	77,000	— 18,000
,, Great Britain ...	1,000	27,000	+ 26,000
,, Germany	120,000	193,000	+ 73,000
,, France	27,000	27,000	—
,, Other countries ...	10,000	11,000	+ 1,000
Total ...	253,000	335,000	+ 82,000
Electrical apparatus of all kinds.—			
From Austria	98,000	119,000	+ 21,000
,, Great Britain ...	1,000	11,000	+ 10,000
,, Belgium	11,000	16,000	+ 5,000
,, Germany	81,000	141,000	+ 60,000
,, France	61,000	10,000	— 51,000
,, Switzerland ...	12,000	23,000	+ 11,000
,, Other countries ...	1,000	6,000	+ 5,000
Total ...	265,000	326,000	+ 61,000
Machinery and apparatus not mentioned (excluding agricultural, sewing, knitting, &c.).—			
From Austria	934,000	1,313,000	+ 379,000
,, Great Britain ...	1,279,000	868,000	— 411,000
,, Belgium	255,000	305,000	+ 50,000
,, Germany	2,781,000	3,709,000	+ 928,000
,, Italy	18,000	23,000	+ 5,000
,, United States ...	58,000	50,000	— 8,000
,, France	191,000	187,000	— 4,000
,, Holland	189,000	4,000	— 185,000
,, Switzerland ...	16,000	56,000	+ 40,000
,, Other countries ...	92,000	134,000	+ 42,000
Total ...	5,813,000	6,649,000	+ 836,000

Note: 25 francs = £1.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Additions and Amendments.

BULGARIA.—The British Consul in Sofia has recently reported on the necessity for complying with the Bulgarian Customs Regulations in the case of all consignments, and calls attention to the penalties for non-observance. He writes as follows :—

Frequent complaints are heard on the part of British importers against the treatment of their goods by the Bulgarian Customs authorities, and it is important that the regulations in force should be clearly understood.

Articles wrongly declared pay not only the higher duty, but are subject to a fine equal to the duty imposed.

If the importer has the slightest doubts as to what tariff number his goods will fall under, he may make matters sure beforehand by sending a sample to the Customs department of the Ministry of Finance, with a request that it should be examined by the expert Commission and its true denomination fixed for him. Where chemical analysis is required a fee of £1 is demanded.

In cases where goods are held by the Customs to be wrongly declared, a protest on behalf of the buyer may be inserted in the Customs declaration, which is submitted to the Customs department of the Ministry of Finance. The goods in the meanwhile may either be left in the Customs warehouses, or withdrawn by the buyer, who must then deposit a sealed sample of his wares, and the amount of the extra duty and fine, with the Customs authorities. If the decision of the Ministry of Finance is unfavourable to the buyer, he may, within a period of 30 days, and on depositing a sum of 5 or 10 per cent. of the fine imposed (according to the amount of the latter), make a further appeal to the Ministry of Finance for his case to be submitted to the Revisionary Commission. If the decision of the latter is again unfavourable, the deposit is forfeited and no further appeal is admitted.

It may be mentioned that the custom prevalent in commercial circles, as between buyer and seller, is that the party who is responsible for the false declaration, whether made intentionally or not, is responsible also for the resulting loss.

NEW ZEALAND.—The Supreme Court of New Zealand has recently given an important decision as to the legal valuation of goods for import duty, in a test case brought by the Dominion Government relative to the value of goods on which duty is payable when imported from the United Kingdom into the Dominion. The questions raised in the case were :—

1. Whether, if the price of goods advanced between the time at which they were purchased in England and the time they were actually shipped from there to New Zealand, the duty payable on such was to be assessed on the invoice value, or on the value as at the advanced price, and

2. Whether the Customs authorities, having assessed and collected duty on goods cleared at the invoice value, were entitled to make a further assessment of duty in respect of such goods.

The Chief Justice, in his judgment, stated that the first question turned upon the true interpretation of Sec. 55 of the Customs Laws Act, which reads as follows :—"Whereon duty on imported goods is imposed *ad valorem*, or according to the true and real value of such goods, such value shall be understood to be the fair market value thereof when sold for home consumption in the principal markets of the country whence and at the time when the same were exported."

In his opinion, the plain meaning of the words "at the time when the same were exported" was at the time when the vessel took the goods away from the place of export. He was further of opinion that there is power to sue for Customs duties as a debt due by the importer, and that, as the duties became a debt by the importer to the Crown, the acceptance of less than the amount could not be held as accord and satisfaction, because there was no power in the Collector of Customs to vary the duty by accepting less than the legal amount. The questions put in the case were, therefore, answered in favour of the Minister for Customs.

RUSSIA.—The Minister of Commerce has submitted to the Duma a series of Bills for the revision of the Russian Customs Regulations. These Bills provide, amongst other things, for the abolition of the distribution amongst Customs employés of the proceeds of fines imposed on importers for non-compliance with the Customs Regulations, &c. Another important provision is that in invoices goods may be described by their trade designation only, and the weight of the goods may be given gross or net, the quantity of the goods to be indicated in terms corresponding with those adopted in the trade. Invoices and specifications are to be accepted not only from offices of manufacturers and factories, but also from offices of commission agents and from all kinds of warehouses, and in the absence of the shipper's signature the receiver may sign.

SOUTH AFRICA.—The Customs authorities have recently decided that drain boxes of British origin for tram rails are to be admitted free of duty.

FRANCE.—The French Customs authorities have recently decided that wires of nickel, pure or alloyed, flattened and tubulated, specially prepared for incandescent electric lamps, shall be dutiable as incandescent lamps without mountings at the rate of 7 fr. per kilog. (franc = 9·6d., kilog = 2·204 lb.)

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,862. "Method and furnace for reduction or smelting of ore with electric current." Aktiebolaget Elektrometall. (Convention date, November 25th, 1910, Sweden.) November 20th. (Complete.)

25,880. "Interrupter for electric circuits." R. Bosch (firm of). (Convention date, June 13th, 1911, Germany.) November 20th. (Complete.)

25,890. "Electric furnace." G. Mettler. November 20th. (Complete.)

25,897. "Transmission of telegraphic messages." B. D. Moray. November 20th.

25,899. "Arc lamps." H. Weiss. November 20th.

25,905. "Thermo-electric piles or generators." Sir J. W. Swan. November 20th.

25,916. "Electrodes for arc lamps." H. Beck. November 20th.

25,929. "Electric switches." H. D. Thomas. November 20th.

25,947. "Sparking plug with removable electrode and central telescoping electrode." A. L. Cade. November 21st. (Complete.)

25,965. "Telephone systems." S. G. Brown. November 21st.

26,014. "Vehicle lamp for the simultaneous use of an electric light and an oil or other burner." Corry Hurford. November 21st. (Complete.)

26,021. "Fixing an electric generator in the frame of a windmill." J. A. Leeming. November 21st.

26,039. "Type printing telegraph apparatus for line-telegraphy and radio-telegraphy having an arrangement for producing secret signal characters." Aktieselskabet Hegvlands Radiotelegraf. (Convention date, November 21st, 1910, Norway.) November 21st. (Complete.)

26,061. "Automatic adjustable electrical switch." J. G. Brazendale. November 22nd.

26,087. "Electric lamp." E. A. Wilson and M. G. Wilson. November 22nd.

26,101. "Means for the electric heating of ovens and other appliances." C. W. Martin. (Convention date, December 5th, 1910, New Zealand.) November 22nd. (Complete.)

26,111. "Electric clutch for controlling railway signals." A. H. Johnson and W. J. Thorrowgood. November 22nd.

26,118. "Electric switches." British Thomson-Houston Co., Ltd., and E. Garton. November 22nd.

26,119. "Voltage regulating systems." British Thomson-Houston Co., Ltd., and E. Garton. November 22nd.

26,124. "Sparking plug." C. Lirons. November 22nd.

26,153. "Switches for high tension electrical currents." Marconi's Wireless Telegraph Co., Ltd. (W. S. Entwistle, Italy.) November 22nd.

26,168. "Electric clocks." H. W. Lake. (Electro Clock Co., United States.) November 22nd. (Complete.)

26,190. "Apparatus for electrically-starting internal explosive engines." R. F. Hall. November 23rd.

26,213. "Electric dynamos." F. B. Lodge and A. M. Lodge (trading as Lodge Bros. & Co.). November 23rd.

26,245. "Electric switches." Siemens Bros. Dynamo Works, Ltd., and J. F. Crowley. November 23rd.

26,266. "Electrodes for flame arc lamps." F. M. Lewis. November 23rd.

26,267. "Compositions or chemical mixtures for electrodes for flame arc lamps." Oliver Arc Lamp, Ltd., and C. Oliver and W. M. D. Pell. November 23rd.

26,291. "Pawls of electric controller." S. Smith, A. Fleming and T. Guerin. November 24th.

26,296. "Telephone cabinet to ensure privacy of conversation." J. J. Webb. November 24th.

26,341. "Electric locking devices and locks." G. Sahmer. (Addition to No. 15,991/09.) November 24th. (Complete.)

26,371. "Process for carrying out gas reactions in an electric furnace." A. Helfenstein. (Convention date, November 26th, 1910, Austria.) November 25th. (Complete.)

26,370. "Holders for electric lamps." I. Frankenburg & Sons, Ltd., and E. Fleming. November 25th.

26,377. "Fittings for incandescent electric lamps applicable for other purposes." F. Gunn and W. T. Nicholson and Clipper Co., Ltd. November 25th.

26,379. "Method of recarburising in electric furnaces." O. Frick. November 25th.

26,380. "Electric arc furnaces." O. Frick. November 25th.

26,381. "Method of electric reduction of oxides." O. Frick. November 25th.

26,382. "Electric reduction furnaces." O. Frick. November 25th.

26,383. "Electric lighting." I. Frankenburg & Sons, Ltd., and E. Fleming. (Addition to 28,724, 1910.) November 25th.

26,408. "Electrically-operated motor vehicles." Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. November 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Arc Lamps. Ges. für Maschinen und Metallindustrie. 22,841. October 3rd. (October 2nd, 1909.)

Electrically-Operated Time Switches or Time Mechanisms. McCaffery and C. H. Klyne. 25,506. November 8th. (Cognate application, No. 10,867 of 1911.)

Electrical Connection Devices. A. Muirhead and F. E. Wilkins. 26,077. November 9th.

Circuit and Device for Operating Selectors in Automatic Telephone Exchanges. Telephon Apparat Fabrik E. Zwietusch & Co. Ges. 26,079. November 9th.

Electric Current Generators. M. Breslauer. 26,187. November 10th. (November 26th, 1909.)

Electric Current Controlling Devices or Switches. W. K. L. Dickson. 26,248. November 11th.

Mercury Contact Breakers. Reidiger, Gebbert & Schall Akt.-Ges. 26,341. November 12th. (November 12th, 1909.)

Devices for Controlling the Speed of Electric Motors. Adams Manfg. Co. (Cutler-Hammer Madfg. Co.) 26,489. November 14th. (Addition to No. 13,406 of 1910.)

Electric Batteries especially adapted for Train Lighting. E. J. Clark. 26,542. November 15th.

Electric Incandescent Lamps. E. R. Grote. 26,667. November 16th.

Electric Ignition Apparatus of Motor Vehicles and the like. G. Forster. 27,256. November 23rd.

Apparatus for the Purification of Electrolytic Gases. A. E. Knowles. 27,264. November 23rd.

Electrically-Heated Radiators for Heating Railway Coaches and other places. A. Craved. 29,291. December 16th.

Trolley Heads for the Collectors of Electric Railway Cars. R. D. Blackstone. 30,240. December 30th.

1911.

Device for Starting Internal-Combustion Motors having Magneto Ignition. Firm of Robert Bosch. 18,082. August 9th. (October 1st, 1910.)

Electrical Transformers. E. Haefely. 20,523. September 16th.

Telephone Switchboards. W. Aitken and British Insulated and Helsby Cables, Ltd. 1,110. January 16th. (Addition to No. 1,050 of 1910. Cognate application, No. 9,492 of 1911.)

Electric Motors and Pumps. W. R. Macdonald. 4,287. February 20th. (Cognate application, No. 5,612 of 1911.)

Automatic Electric Regulators particularly applicable to Lighting Circuits. W. E. Lake. (United States Light and Heating Co.) 5,499. March 4th.

Galvanic Batteries. Elektricitäts Akt.-Ges. Hydrawerk. 6,664. March 16th. (June 23rd, 1910.)

Machines for Making the Joint between the Filament Support and the Lamp Bulb in Incandescent Electric Lamps. J. Barrollier. 7,868. March 29th. (March 29th, 1910.)

Processes and Apparatus for Magnetically-Operated Materials. S. Bruck. 11,898. May 17th. (May 17th, 1910.)

Fire Alarms. Soc. Anod. "Le Detective." 12,450. May 23rd. (May 23rd, 1910.)

Telephone and other Mouthpieces. L. Steidberger. 14,590. June 20th. (August 6th, 1910.)

Apparatus for Sterilising Liquids by Means of Ultra-Violet Rays. Soc. Anod. Française dite Banque du Radium. 14,912. June 26th. (June 27th, 1910.)

Current Distributors for Power Looms having Electrical Stopping and Signalling Devices. E. C. R. Marks. (Spidderei & Weberei Steinen Akt.-Ges.) 15,798. July 7th.

Interrupter for the Electric Ignition of Internal-Combustion Engines. Firm of Robert Bosch. 18,083. August 9th. (April 10th, 1911.)

Liberty and Property Defence League.—At a meeting of the Council of the Liberty and Property Defence League, held at Westminster, Sir Richard Temple, Bart. (deputy-chairman) in the chair, resolutions were adopted:—

1. Expressing satisfaction at the progress of the agitation for the amendment of the law relating to picketing, and urging employers to ensure the protection of themselves and their loyal workpeople by joining the Emergency Service Department of the League, and thus, in case of need, have at their command a force of special police to enable them to resist legalised aggression.

2. That Clause 64 of the National Insurance Bill should either be struck out, or amended to provide that unless a tenant gives notice to his landlord immediately he is in receipt of sick relief, the landlord shall not be restricted in the exercise of his legal rights.

3. That the League should circulate a memorandum showing that the increased cost of living is largely due to State tinkering with the conditions of life and industry, that "Social Reform" is an invention of the politician on the hunt for votes, and is a political luxury for which the lower middle and the working classes have to pay by the ever-increasing cost of all the necessities of life.

Lightning in the Transvaal.—Official statistics show that the rate of mortality from lightning in the Transvaal is far greater than in European countries or the United States, the deaths averaging over 12 whites and 40 blacks per annum. The rate works out, approximately, at 42 per million per annum for the Transvaal, while in England it is only 1 per million, in Belgium 2, in France 3, in Germany 4·5, in U.S.A. 8, and in the Austrian Tyrol 10·6.

THE

ELECTRICAL REVIEW.

VOL. LXIX. DECEMBER 15, 1911. No. 1,777.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

GUARANTEED WIRING.

IN the December issue of the *Electrical Contractor*, there is a short paper by Mr. Leonard G. Tate, the secretary to the Electrical Contractors' Association, outlining a scheme by which the E.C.A. shall guarantee the work of its members.

Such a proposition was discussed by the Central Board of the Association in June, 1910, in connection with a suggested agreement with the Birmingham Corporation. In brief, the proposal was that the Association should guarantee the work of its members on any installations carried out for the Corporation, in consideration of the Corporation placing all its installation work in the hands of E.C.A. members only.

The proposal fell through because the town clerk feared that action might possibly be taken by ratepaying contractors who were not members of the E.C.A., and who presumably did not possess the necessary qualifications for membership. Whilst fully sympathising with any movement which has for its object the maintenance of a high standard of wiring work, more particularly when such movement combines a scheme to limit that most unfair form of competition known as municipal trading, we cannot but agree that the town clerk was right.

With all due respect to the members of the Association, it does not follow that because a contractor is not a member he is incapable of carrying out good work, or that he could not find guarantors satisfactory to the Corporation for the due performance of his obligations and the integrity of his work. Mr. Tate, in his article, assumes that if any ratepayer, who is a contractor, is not a member of the Association, he is to be considered as ineligible for membership, either by reason of his carrying out bad work or because he is in a financially weak position. He even goes so far as to say that "an individual who could not obtain membership ought not to be in the business at all." Desirable as it may be that all competent contractors should join the Association, we do not think that non-membership carries with it any such stigma as is here implied, and there is no doubt that any accredited contractor who, for reasons of his own, prefers to keep outside any trade association would have a legitimate grievance against a Corporation which boycotted him on this account; and we think, in the event of an agreement being arrived at on the lines proposed—assuming it to be *intra-vires*—the E.C.A. would have to indemnify the Corporation against any actions which might be brought against it by aggrieved contractors.

Touching on the broader aspect of the question—viz., the guaranteeing of contracting work done for the public generally—Mr. Tate considers that this presents greater difficulty, as it is impossible to enter into an agreement with the public.

He therefore suggests the formation of a guarantee fund, to which members desiring a guarantee should subscribe a sum based on a percentage of their turnover; or alternatively, that all members should subscribe a definite amount to the fund. Members would then be able to inscribe on their tenders that the quality of the work estimated for was guaranteed by the Electrical Contractors' Association, who undertook to make good at their own expense any defects that might be proved. Nothing is said in the article as to the limit which is to be set on the Association's liability, but an Editorial comment suggests £50 as the limit on any one job, and £200 on any number of jobs carried out simultaneously by one contractor.

What the proposal really amounts to, so far as the customer is concerned, is a scheme of insurance against defective work, and it seems to us that the matter will have to be treated strictly on the lines of an insurance business. For a definite annual payment the Association could probably insure the whole of the members' work with some recognised insurance company, which would, no doubt, place a limit on the amount of indemnity payable in respect of any one installation. We need not pursue this point further, as the details of insurance policies have been thoroughly sifted and standardised by those companies which specialise in this class of business.

There are several questions which naturally arise out of the proposal: Who is to be the authority or Court of Appeal who shall decide whether or not the work is satisfactory or up to specification? Who is to draw up the standard specification with which the work shall comply? Will the customer be satisfied with a limited insurance? These are among the questions which suggest themselves.

As matters stand at present, all that a customer has to do before giving an order is to stipulate that the work shall meet all the requirements of his insurance company, and, on completion, the installation is insured as part of the building. This is, generally, only an insurance against fire, and not against defective work or materials, but an insurance inspector who knows his work would call attention to anything obviously defective.

We do not suggest that nothing further is needed, but we are here trying to look at the matter from the customer's point of view. On the other hand, there are many people who regard electricity as dangerous—a feeling which has been intensified by irresponsible writers to the daily Press, who attribute every fire of doubtful origin to the "fusing of an electric wire." To such people, a guarantee of good and safe work would, no doubt, carry weight, and a contractor whose work was guaranteed by a trade association would undoubtedly have a pull over a non-member whose tender did not carry the official *imprimatur*.

On the question of inspecting the work and deciding questions in dispute, Mr. Tate is silent; but the *Electrical Contractor*, in its editorial comment, suggests the appointment of a member of the Association who shall have been a member for, say, five years, the cost of the award to be borne by the party against whom the decision is given. This is a matter which will require to be regarded from more than one point of view. There is the view of the contractor who objects to a competing contractor sitting in judgment on his work, and the view of the customer who may regard a member of the E.C.A. as a biased judge and may prefer an independent expert who is not connected with any trade association. He may, and some no doubt would, desire to have a voice in the appointment of the referee. If we may venture a suggestion on this point, it is that the Association should invite a number of outside experts, that is to say, consulting engineers who are in constant touch with wiring work, to allow their names to be placed on a list of assessors from which the interested parties might choose. In the event of no preference being shown by the parties, the president for the time being of the E.C.A. might nominate a gentleman from the list.

With this suggestion we leave the matter for the present; we shall watch with much interest the further development of the idea.

ELECTRICITY AND COAL DUST: AN ECHO OF THE WEST STANLEY EXPLOSION.

One of the most important criticisms that has yet been uttered on this question was made by Mr. W. C. Blackett, an eminent mining engineer in the North of England, on Saturday last, during the discussion on Prof. Thornton's paper on "Experiments on Liquid Mixtures for Laying Coal Dust," at the meeting of the North of England Institution of Mining and Mechanical Engineers.

In this paper Dr. Thornton described the wetting action of several liquid mixtures sprinkled upon coal dust with a view to rendering it harmless, and thus preventing it from exploding or propagating an explosion of gas or coal dust which had once been ignited, and undoubtedly the paper was, from an academic point of view, a useful contribution to the subject. We say academic because, unfortunately, it would be impossible to use most of the liquid mixtures described, as they themselves were of a more or less inflammable nature, and, moreover, there is the very practical question whether "wetting" the dust is the best or the right way to deal with it. The object of the paper, however, was an honest attempt to solve a difficult problem with the idea that, if once coal dust were rendered innocuous, one very serious obstacle to the use of electricity in mines would be removed, thus further opening the way for its development, and every credit is due to the author for his effort in this respect.

The discussion was opened by Mr. Prest, who said that in his opinion it was utterly impossible to stop the formation of dust or to remove it effectively, and he thought that instead of trying to treat the dust, attempts should be made to produce an explosive that would not ignite coal dust. This is all very well, but Mr. Prest overlooked the fact that it is not always a "blown-out shot" that initiates an explosion. Frequently it is a (so-called) "safety" lamp.

Mr. Blackett—who was one of the experts engaged in investigating the West Stanley explosion—followed, and pointed out that it was not always the "explosive" that caused an explosion in the pit, but sometimes a lamp, and sometimes, although such a statement seemed very ridiculous, sparks from falling stones. In fact, an explosion occurred in a mine—a very serious explosion—when there was no-one in it, and further, it was not caused by electricity. He thought too much was being made of the danger of electricity, and, indeed, "he was becoming afraid of Dr. Thornton, who had struck the most staggering blow electricity in mines had ever received," and who undoubtedly was the cause of the restriction about to be passed into law, regarding the use of electricity in mines where more than 1¼ per cent. of gas was present. It was all very well to carry out experiments in a laboratory, and derive certain data therefrom, but as he had only recently proved with the Holmes-Ralph gas-detecting apparatus, which, while it worked perfectly in "coal-gas," gave absolutely no indication whatever of "firedamp" in the mine, it was most important that before statements based on surface or laboratory experiments were made, they should be verified, where that was possible, by actual practical experience in the pit. Mr.

Blackett then referred to the West Stanley explosion, where Dr. Thornton was called in by the miners' representatives as their expert investigator. The former described how he first of all suspected electricity, and made an expensive and exhaustive search to see if he could find any indication of an initial disruption of any electrical apparatus or cable likely to cause the explosion, but found none, and he gave it as his opinion that the explosion was started by a heated roller spindle causing smouldering of the wood carriage or coal dust, in conjunction with the accident to the train of tubs and the raising of a cloud of dust—dust, moreover, of a highly susceptible and inflammable nature. This opinion was supported by his *confrères*, and no one except Dr. Thornton ever suggested that the explosion was caused by electricity. It may be remembered by those who followed the investigations that Dr. Thornton gave as his theory, which he attempted to prove by experimental demonstration, that coal dust flashed or short-circuited across a pair of electrical terminals, thus starting the explosion; this theory was afterwards followed up by a series of experiments, the results of which were communicated to the Institution of Mining Engineers in another paper. All of this has undoubtedly largely contributed to the present legislation. As was pointed out by Mr. Blackett, the danger of such a theory propounded by a man of Dr. Thornton's standing was that it was appreciated by outsiders as coming from one who was wholly unbiased, whereas the opinions of such practical men as Mr. Blackett were looked upon as more or less prejudiced, and the whole of the objections of Sir Arthur Markham and the miners' representatives were based upon the academic evidence of Dr. Thornton.

The point of importance, however, is that hitherto it had been assumed that fire-damp was identical with ordinary coal gas, and what took place in an experiment conducted with coal gas would take place at the coal face. There is, however, a distinct difference, as fire-damp is marsh gas, and what occurred with the Holmes-Ralph gas detector may equally apply to the experiments of Dr. Thornton, and Mr. Blackett on Saturday challenged the Doctor *to prove that the West Stanley explosion was initiated in the way he had suggested in his evidence.*

We are in complete agreement with Mr. Blackett. It has yet to be proved that electricity—even at the face of a fiery mine—constitutes a danger. We can admire the work done by Dr. Thornton, as undoubtedly he was prompted by the highest of motives, and the unfortunate part is that the results of his work have been seized by a pack of faddists, and distorted by them in order to gain their own ends. The miners' representatives are wrong, Sir Arthur Markham is wrong, the Departmental Committee was also wrong in assuming that there were some parts of a mine where electricity would be dangerous. The whole question ought to be carefully and fully reinvestigated, but by men who have a thorough practical knowledge of electricity and mining. By all means let us have theory propounded, and demonstrated by experiments, but where the well-being of an industry is in question, and especially such a basic industry as coal-mining, let us not forget practical considerations, or, in attempting to protect the individual from a *supposed* danger, cause unnecessary suffering to thousands.

An old saw informs us that "an ounce of practice is worth a pound of theory," which is truer as regards mining than any other industry, and it will be a bad day for the world at large when the mining industry is to be regulated by legislation based on theory alone. We sincerely trust that the remarks of Mr. Blackett will receive the attention they deserve, that the powers that be will seriously reflect as to whether the evidence before them is sufficiently conclusive and positive to warrant the very drastic measure about to be put into force, and that they will at least leave open the door for advancement and prosperity.

The City Lighting.

In our last issue we briefly reported the proceedings of the Court of Common Council of the City in connection with the illumination of the City streets. The City Fathers have been sitting on this important matter for some years, and we confess to a certain amount of disappointment with the commonplace result of their labours.

The situation as regards the rival illuminants, gas and electricity, remains much as it was; of the 56 miles of main streets, the City of London Electric Lighting Co. will continue to light 12, and the Gas Light and Coke Co. the other 44, but greatly improved illumination will be given, and at less cost.

It is a thousand pities that the Corporation in dealing with a matter of such vital interest to the community did not exercise some of that exquisite discrimination and free-handedness which has earned for them unstinted regard in far less praiseworthy directions; and that they could not rise above mere £ s. d. when considering the lighting of the exceedingly congested streets of London City, of all places.

The adequate lighting of main thoroughfares is of such far-reaching importance that such items as mere candle-power and cost are really only secondary matters as compared with the result to be obtained, and only the best is really good enough, especially in the City.

For once in a way we can endorse the opinion of our contemporary, the *Gas World*, that "the guiding principle in arriving at a decision has not been the relative merits of the rival lights, but expediency." Had it been otherwise we cannot conceive of any sane body of councillors agreeing to saddle the ratepayers for ten years ahead with an antique system of lighting in which a large proportion of the lighting points require individual lighting and extinguishing every 24 hours.

Such a system is obviously far too inflexible for the variable climatic conditions of the City, where, owing to the traffic conditions, adequate lighting, either by natural or artificial means, at all times, is a *sine qua non*, and if, as the *Gas World* assures us, gas people would have preferred to have the contest decided on merit, we imagine that the electrical people would have jumped at the chance of repeating their Holborn tender.

Single-phase Railway Electrification.

There is an unusual fascination in the spectacle of the eloquent consulting electrical engineer leading on the half-reluctant railway director to higher things, which it is difficult to resist. Thus, Mr. Philip Dawson, in a recent paper before the Royal Automobile Club, after invoking the good example of our American and Continental friends in railway electrification, concluded by outlining a definite scheme of single-phase traction between London and Brighton—the full details of which, and possibly its adoption, may be matters of public interest in a few months' time.

Apparently it is proposed to inaugurate a frequent high-speed electrical shuttle service on the London-Brighton route, which will be fed by frequent motor-coach services on branch lines, and will take over the steam-hauled trains from important centres such as Eastbourne, Portsmouth, &c., at convenient points. With non-stop journeys of 45 minutes, and journeys, with intermediate stops, of 60 minutes, as forecasted, the sceptic with a past knowledge of this company's little ways may be pardoned for rubbing his eyes. But the presence of Lord Bessborough, the chairman of the company concerned, and of several of its leading officials, stamps the proposition as other than the chimera of an electrical enthusiast.

Mr. Dawson describes the scheme—if it matures—as epoch making; after a study of the company's time-tables and a liberal allowance for their non-observance in practice, we are inclined to agree with him whole-heartedly.

The Brighton Co.'s prospective doings, of course, closely affect us, but it is interesting also to turn to Australian railway matters, in connection with which we note that the Victorian Government has instructed Messrs. Merz and McLellan to prepare alternative specifications for direct and single-phase working of the Melbourne suburban system, involving possibly 200 miles of railway. It is understood that this electrification has been definitely decided on.

D

SUCTION GAS AND LOW INSULATION.

By LEONARD HARDING.

There have recently been communications to this paper dealing with low-insulation troubles on dynamos driven by gas engines supplied with suction gas. The question has also been mentioned in the 1910 report of Mr. Michael Longridge, who, as chief engineer to the British Engine, Boiler and Electrical Insurance Co., Ltd., has had a very large number of these cases brought to his notice. As the trouble, therefore, is an urgent one, it has become necessary to investigate the cause.

The general experience, and that of the above company, seems to be that conducting surfaces are formed at the back of the commutator, causing "grounding," but very seldom complete breakdown. There have, however, been cases of breakdown which were attributable to this cause. In one case a deposit was taken from the back of the commutator, which, on analysis, was found to consist of 70 per cent. of free and combined copper, together with 19 per cent. of free oil, the remainder being oxidised oil, cotton, mica and dirt. Some of the copper was combined as sulphide and sulphate, and there was also a quantity of sulphur in combination with the organic matter. No doubt a considerable amount of this deposit was due to dust from the wear of the commutator, carried to the back by windage, but the interesting feature to notice is the presence of sulphur.

It has been thought that if these troubles were due to the gas plant, then valuable information might be obtained by chemical investigation of the atmosphere. The result of such investigation has shown that where these low-insulation troubles are experienced there are comparatively large quantities of sulphuretted hydrogen (H_2S) present in the engine room and gas-plant house; this may account for the sulphur in the deposit mentioned. Water dissolves four times its own volume of sulphuretted hydrogen (H_2S), and this gas, when moist, is oxidised to sulphuric acid (H_2SO_4) on warming. This reaction may be the secret of all these low-insulation troubles, as the oxygen in the air is sufficient to cause the oxidation.

In one case it was found that the machine which always showed the lowest insulation was the one that was idle the most. This may be due to the fact that it had a better chance of taking up moisture, and, consequently, the absorption and subsequent oxidation of the gas would be aided.

The deleterious effect of this gas is accentuated by the poor arrangement for ventilation which usually exists in the majority of such engine rooms. The gas-plant house is generally next to the engine house, and communicates with it by a door. In some cases the engines are directly opposite this door, and, when running, the air is drawn from the gas-plant house by the fan action of the fly-wheel over the machines, and may be dispersed out of the windows or doors, or up the rope race. In a few cases the engine room depends entirely on the gas-plant house for its ventilation. The result is that any impure air in the latter is drawn into the former, especially as the outside door of the gas-plant house is usually kept often. In addition to this, there is more often than not a leak on the engine cylinder, from which gases and oily vapour escape into the room.

Wherever these troubles are experienced the switchboard is also affected. The unvarnished copper bolts and fittings become blackened, and the brass becomes coloured with spots of white powder and chocolate-coloured patches. Upon analysis, all these deposits and patches have been found to be sulphides and sulphates of copper and zinc. Bright strips of copper left in different parts of the engine and gas-plant houses, when examined after a week's time, were found to have become very dark with copper sulphide, the strip from the gas-plant house being very much worse than the others.

In cases where a paint containing lead has been used for painting the gas plant, the peculiar fluorescence associated with lead sulphide can be seen over large areas, and owing to blackening, it has become necessary in some cases to repaint the plant very soon after its installation.

Although the low insulation of machines has been the predominant question with engineers, there is another aspect which is very much more important—that is, the question of injury to the health of the people working in these atmospheres. Sulphuretted hydrogen is a poisonous gas, a very small quantity of which will produce a feeling of sickness and headache. According to Thorpe, $\frac{1}{200}$th of the volume of this gas in any room is sufficient to kill a horse, this quantity having no effect on cold-blooded animals. The writer has been affected with the gases in various engine rooms, leaving the place, as a rule, with a slight feeling of sickness and headache.

It would appear, then, that stringent legislation is required in connection with the use of suction-gas plants. Although the factory inspectors insist upon efficient ventilation in a gas-plant house, they do not appear to have considered the possibility of injurious fumes being present in the engine room. There can be no doubt that efficient ventilation would remove the trouble, but it is important to remember that the fresh air should be drawn in from the top and the foul air drawn out by fans or other efficient means from the bottom. This would be, however, an expensive and second-rate remedy, the real remedy being the removal of the injurious gases before leaving the scrubber. Unless this is done, it is essential to fill up all spaces between copper and iron with several coatings of a reliable "anti-sulphuric" enamel. This, combined with efficient downward ventilation, should go far to remove the deteriorating effects hitherto experienced.

As mentioned above, the necessity arises for the more perfect scrubbing of the gases before passing to the engine, whereby all injurious impurities may be removed. It might be a possible and an effectual remedy to insert a layer of ferric oxide or lime inside the existing scrubber, which would very likely remove the cause of low insulation and impaired health. The use of ferric oxide would not be expensive, as the ferric sulphide formed could be revivified upon exposure to the air according to the following equation—

$$2\ Fe_2S_3 + 3\ O_2 = 2\ Fe_2O_3 + S_3.$$

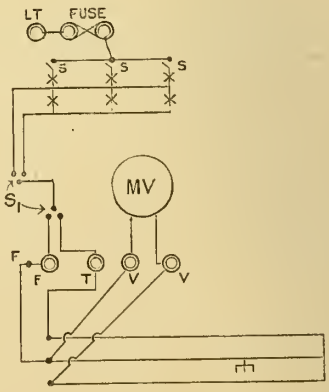
Thus a great evil might be removed at a small expense.

SIMPLE FAULT LOCALISATION.

By H. H. JOWERS.

Simplicity should be the keynote of fault localising, and the writer here describes a few simple methods which have been found to give very satisfactory results. The methods given are for direct-current networks.

The first point a mains engineer has to decide is which section of the network is faulty; the method to be



used for this depends chiefly upon two points, the magnitude of the fault current and the equipment of the switchboard. Should the fault current be large enough to give a clear indication on the feeder ammeter above the ordinary fluctuation of the load, then it is an easy matter quickly to divide the distribution fed by that particular feeder on to other feeders, and then localise the section; but when the current is only small, say under 10 amperes, it becomes a more difficult matter. If the switchboard is equipped with a test bar, &c., as described in the writer's article in the Elec

trical Review, Vol. LXIX, No. 1,768, page 598, it is not a very difficult matter to localise the section, but should the switchboard not be so equipped, the following method has been found to be successful in finding the district in which the fault lies.

Take, for example, a fault of 8 amperes; this is too small to be noticed on the feeder ammeters. Take a portable low-reading ammeter reading to about 10 amperes, put this between the neutral and "earth" at the station "earth," and take a note of the readings of the two ammeters, that is, the portable ammeter and the ammeter permanently in the "earth" circuit; this is done to obtain the relative readings of the instruments. The leads of the portable ammeter can then be adjusted so that the readings on the two instruments are equal, that is, half the leakage current will flow through each. The portable instrument is then taken out and connected between the neutral and earth at the feeder points or disconnecting boxes; the leakage current will divide into two paths, one returning to the permanent "earth" and the other to the temporary "earth." When this temporary "earth" is nearest to the fault, the maximum reading is obtained on the portable instrument, thus giving the district in which to seek for the fault.

The same method can be applied for localising neutral faults, but in this case a resistance is placed in circuit with the portable instrument to give, say, a current of 10 amperes when connected between an outer and "earth"; then, when the minimum reading is obtained on the earth ammeter at the works, the portable instrument is nearest the fault.

Having found the faulty section by one of the above methods, we next proceed to localise the exact point of the fault. For this purpose the writer has made a small portable board, as shown in the sketch diagrammatically connected up to the faulty main. The three mains are short-circuited at the far end, the faulty main always being connected as the centre wire of the three, in order to save any calculation for the short-circuiting strip. A connection is next made from a live main to L.T.; the current then flows through the fuse and resistance, the latter being composed of six lamps—two 8-c.p., two 16-c.p. and two 32-c.p.; these, as is seen by reference to the diagram, can be used either as three in parallel or three sets in series, or one in series with three: it is found that by moving the lamps a very varying resistance can be obtained. The current passes through F, and a reading is obtained on the millivoltmeter; the current is then switched over by the change-over switch S_1 and passed through T; then if the readings on the voltmeter are V_1 and V_2 respectively and the length L, the distance of fault from testing end is $\frac{L}{V_1 + V_2} \times V_1$.

Should the main only be a two-wire distributor, the same board applies, but in this case to obtain reading V_2, the short-circuit must be removed to the testing end and the test panel taken to the other end of the main. The whole apparatus is very simple and conveniently handled, the board only measuring 28 in. × 14 in.

NOTES FROM INDIA.

[from our special correspondent.]

November 23rd, 1911.

Delhi Durbar Lighting.—The King is almost with us now, and the camp lighting is all but ready. It is estimated that there are about 40,000 lamps connected in all. Arc lighting was a feature of the 1903 Durbar, but this time arcs are conspicuous by their absence: there are only a few camps lighted with flame arcs.

The most remarkable electrical feature is, perhaps, the high candle-power metal lamps: these range from 1,000 down to 16 c.p., and, from a lighting distribution point of view, are a complete success.

As was anticipated, the view of the 16 square miles of camps with their lights all ablaze at night is truly magnificent, and probably unique in the history of electric lighting.

From the Flagstaff Tower one can see the whole camp, from the King's quarters at the foot of the Ridge to the military camps five miles off, all the area between for a breadth of over three miles being brilliantly lighted. Any lighting other than electric is prohibited in camps on account of the danger of fire. The insides of tents being very inflammable, the utmost precautions are necessary; even then, there is an ever-present danger of fire through the carelessness of native servants and others.

Mr. G. E. Barlow, Messrs. Belliss & Morcom's Indian agent, has been temporarily appointed as mechanical engineer in charge of the power-house steam plant during the Delhi Durbar. Mr. K. Preston, of Messrs. Siemens Bros., has been temporarily appointed as electrical engineer in charge of the power-house electric plant during the event. Mr. J. S. Pitkeathly, electrical inspector to the United Provinces, is in supreme charge; his assistants are Captain Barker, R.E., Lieutenant Trench, R.E., and Mr. J. Francis Scott.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Two-Wattmeter Method of Measuring Power in Three-Phase Circuits.

In Mr. Ogley's article a balanced three-phase system has been assumed. The two-wattmeter method is also suitable for measuring power in three-phase circuits where the phases are unequally loaded. This may be proved as follows:—

Assuming a star connection, let $i_1\ i_2\ i_3$ be the currents and $v_1\ v_2\ v_3$ the volts in each leg of the star at any instant. The voltage impressed on meter "A" is $v_1 - v_2$, and the voltage impressed on meter "B" is $v_3 - v_2$.

The reading of wattmeter A $= i_1 (v_1 - v_2)$,

The reading of wattmeter B $= i_3 (v_3 - v_2)$,

The sum of the readings $= i_1 v_1 + i_3 v_3 - v_2 (i_1 + i_3)$.

As at any instant the sum of the currents is zero, $i_1 + i_2 + i_3 = 0$, so that $i_1 + i_3 = -i_2$.

Substituting $-i_2$ for $(i_1 + i_3)$ in the above, the sum of the readings becomes $i_1 v_1 + i_2 v_2 + i_3 v_3$, which is, of course, the total power in the circuit.

It follows from the calculations in Mr. Ogley's article that, if two separate single-phase watt-hour meters are used to measure the energy supplied to a balanced three-phase circuit, one of the meters will run backward when the power factor of the whole circuit is less than ·5 (cos 60°). It is generally more convenient to use a polyphase watt-hour meter, consisting of two single-phase elements connected to a common spindle and integrating on a common dial or set of dials. When this arrangement is used, one element tends to run backward when the power factor of the circuit is less than ·5, but as it is connected to the same spindle as the other element, the effect is to retard the other element, which, otherwise, would run too fast and record more than the total energy of the circuit.

With regard to the method of obtaining the power factor from the ratio of the readings of the two wattmeters, it may be pointed out that this method is used in power-factor meters of the "Weston" type. In these instruments the movable system carrying the pointer consists of two circular pressure coils fixed on the same staff, and in planes at right angles to each other. There is a fixed coil carrying the current of one of the leads (say No. 1). One of the pressure coils is connected across leads 1 and 2, and the other is connected across 1 and 3.

A convenient equation for obtaining the power factor from the ratio of the wattmeter readings is—

$$\cos \phi = \frac{R + 1}{2\sqrt{R^2 - R + 1}}$$

where R is the ratio W_1/W_2 or W_2/W_1. This is derived as follows :—

$$W_2/W_1 = R = \frac{\cos(30^\circ + \phi)}{\cos(30^\circ - \phi)},$$

$$R\cos(30^\circ - \phi) = \cos(30^\circ + \phi),$$

$$R(\cos 30^\circ.\cos\phi + \sin 30^\circ.\sin\phi) = \cos 30^\circ.\cos\phi - \sin 30^\circ.\sin\phi,$$

$$(R - 1)(\sqrt{3}\cos\phi) = (R + 1)(-\sin\phi).$$

Squaring :

$$(R^2 - 2R + 1)(3\cos^2\phi) = (R^2 + 2R + 1)(1 - \cos^2\phi),$$

$$4R^2\cos^2\phi - 4R\cos^2\phi + 4\cos^2\phi = R^2 + 2R + 1,$$

$$\cos^2\phi = \frac{R^2 + 2R + 1}{4(R^2 - R + 1)} \therefore \cos\phi = \frac{R + 1}{2\sqrt{R^2 - R + 1}}.$$

It should be noted that the ratio may be either W_1/W_2 or W_2/W_1. For example, let the readings of the two meters be 10 and 5 ; R may be taken as $10/5 = 2$, or $5/10 = \cdot5$. Substituting either $\cdot5$ or 2 in the above equation gives the power factor as $\sqrt{3}/2$, or cos 30°.

The power factor may also be obtained with a fair degree of accuracy from the readings of two watt-hour meters. The energy recorded by each meter over a short period when the load is steady, is noted, and from the ratio of the readings, the power factor is calculated as above.

John W. Black.

Glasgow, *December 11th*, 1911.

The Institution of Electrical Engineers.

I desire, through the medium of your columns, to express what I am unable to state, either directly or by representation, at any Institution meeting, local or otherwise, viz., my strong disagreement with the proposals now being considered by the Institution of Electrical Engineers, which vitally affect the whole of its members. In doing so, it is well to bear in mind the sound advice given in the last issue of the *Engineer*, and to refrain from mere abuse of members who have voluntarily given much time and thought to the thankless task they have undertaken. Of the criticisms which have appeared, many may be dismissed as mere abuse, but of the rest none express more clearly the situation as regards provincial members than that of Mr. T. Roles, of Bradford. I have been for the last 8½ years, since I left a London station, out of reach of any Institution centre, and have often asked myself, What do I obtain in return for my annual subscription ? I obtain the Institution *Proceedings* (whose value I fully appreciate), and the right to put the mystic letters A.M.I.E.E. after my name. As regards this, there is nothing to prevent me from using the letters E.E., after the style of many civil engineers, who, unable to belong to their own Institution, style themselves C.E., and I venture to say that 99 out of 100 of the general public will not appreciate the difference, as I know to be the case with the civil engineer C.E. Many engineers have expressed in your columns, from time to time, their desire that the Institution should afford them some protection in cases of illegal and unfair treatment by employers, and that there should be some attempt to get a minimum salary basis, especially for central station posts. If this were done, there would be some real value in membership of the Institution.

It is now, and always has been, my feeling, and that of many other provincial members, that the Institution is managed by London members mainly as a club for the benefit of London members only, whilst mainly supported by provincial members, as Mr. Roles's figures conclusively show. I, for one, cannot easily afford any increased subscription, but should be willing to pay more if I were able to attend London meetings, and have the use of the London premises and library, now denied to me, and so get value for my outlay.

It is most desirable that the representation of London and district members within 50 miles of London, and of provincial members outside that area, should always be in strict proportion to their numbers or the value of their subscriptions, these members being elected by provincial or London votes as vacancies occurred.

If the Council of the Institution would first apply themselves to the ways and means of enhancing the value of the Institution to approach that of the Medical, Teachers, Organists, or other Associations, then members would not be so unwilling to contribute more.

In conclusion, I beg to say that in my case (as doubtless in many others) if provincial subscriptions are raised it will be a matter for consideration whether, in the future, I shall not be well advised to sign myself M.I.Mech.E. and E.E., as I am qualified (but not yet entitled) to do, instead of as at present.

B. Sankey, A.M.I.E.E. A.M.I.Mech.E.,
Borough Electrical Engineer.

Whitehaven Corporation
Electricity Works,
December 5th, 1911.

THE DEVELOPMENT OF SYNTONIC AND DIRECTIVE WIRELESS TELEGRAPHY.*

By S. M. POWELL.

Syntony and its Limitations.—As the number of wireless telegraph stations has increased, the unconfused exchange of messages has become more and more difficult. All stations necessarily employing the same transmission medium, wireless telegraphy amounts to telegraphy over a single line common to all. Efforts have therefore been concentrated on the development and improvement of syntonic working, *i.e.*, means by which the waves emitted by any desired station may be received to the exclusion of all others. Immunity from "external" interruption has been sought for and obtained by the application of the phenomena of resonance, while interesting results, but only partial solutions of the problem, have been obtained by the use of "musical" sparks and by "sustained" trains of waves (particularly such as are emitted by the Poulsen arc).

Whatever the degree of syntony or sharpness of resonance, it is always possible for any station within the effective radius of the waves to tune its apparatus to receive the signals, and if it so wishes then to send out "blocking" signals," of the same wave length, to destroy effective communication between the two stations originally conversing.

The best syntony obtainable can never ensure secrecy or prevent deliberate interruption of signals.

By a suitable arrangement of lenses and mirrors, it is possible so to conduct optical telegraphy that the signal beams cross each other in any manner and degree, and yet each message can only be received by the appropriate station. That such working is not possible with Hertzian oscillations, is entirely due to the long wave length of the latter employed. Whereas a mirror only a few mm. square produces regular reflection of light, a mirror several km. square would be required to produce regular reflection of electrical waves (for the wave length of luminous radiations is a fraction of a micron, but that of Hertzian waves is at least several hundreds of metres). Oscillations of less than 300 metres wave length are seldom employed in radio-telegraphy, and for such the phenomena of "diffraction" become of prime importance.

It is by totally different means that the problem of "directive" wireless has been partially solved, and the results of the researches on this subject are interesting in themselves, and doubly interesting because of their importance in navigation.

Directive Wireless Telegraphy. Fleming and Marconi.—The first experiments on "directive" wireless telegraphy were carried out by Marconi and Fleming, and originated in a fortuitous observation, by Marconi, that asymmetric radiations were obtained from a bent aerial—arranged as in fig. 1—with a short vertical and long horizontal arm. The maximum effect is observable in direction BA, opposite to that in which the horizontal arm points.

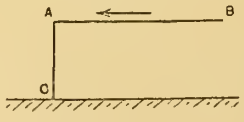


FIG. 1.

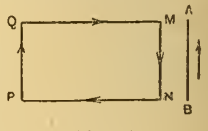


FIG. 2.

It may be understood how such asymmetric action is set up by regarding CAB (fig. 1) as equivalent to a closed rectangular oscillator (fig. 2), together with an open oscillator BA. If the currents flow as shown at any particular moment, and if the strengths of these currents be equal, and their oscillations always in phase, the effects of NM and AB will clearly cancel, and the system as a whole will radiate most strongly in the direction MQ.

* Abstract compiled from paper read by Lieut. Tissot at the Conf. de la Technique Moderne.

Just as a body, which is a good radiator of heat, is also a good absorber, so an aerial, which emits radiations freely, receives them readily, and a directive aerial (fig. 1) is also a directive or asymmetric receiver—*i.e.*, receives radiations coming in the direction A B more readily than those coming from any other direction. The most selective and the most powerful working with bent aerials is, therefore, obtained when the sender and receiver are arranged as in fig. 3.

By using a thermo-electric detector in the receiving aerial, Fleming obtained diagrams showing the energy received by a



Fig. 3.

straight vertical aerial disposed in various positions relative to a bent aerial. These diagrams have always the general form shown in fig. 4; maximum radiation occurs in a direction 00°, opposite to that in which the bent aerial points. A minimum, about one quarter as great as the maximum, occurs in the direction 180°, and two absolute minima occur in directions 110° and 250°. The asymmetry of this radiation curve is the more marked the greater the ratio of the horizontal to the vertical length of the antenna.

With a bent aerial (vertical height 3 m., horizontal arm 50 m.) at Mullion, Cornwall, signals were only received from the Scilly station—85 km. away—when the horizontal arm of the receiver made an angle of less than 20° with the direction of that of the transmitter. This limited range, though too great to enable bent aerials to be regarded as truly "directive" in action, still proves that their use concentrates the emitted radiations to a marked extent. It is for this reason that the large trans-Atlantic stations at Clifden and Glace Bay have bent aerials composed of 60 parallel horizontal wires 330 m. long, suspended 100 m. above ground. The concentration obtained is far from complete; indeed, the trans-Atlantic signals may be received in very different directions from that connecting the two stations directly concerned, and, moreover, at quite long distances from the latter—*e.g.*, in the Mediterranean.

"*Interference*" *Methods.*—An alternative means of securing directive working employs the phenomena of "interference." Suppose two vertical aerials be arranged as in fig. 5, if these be made to oscillate electrically and in phase, there will be "interference" of their magnetic fields in the plane of antennæ and addition thereof in the perpendicular median plane. If, however, the oscillations

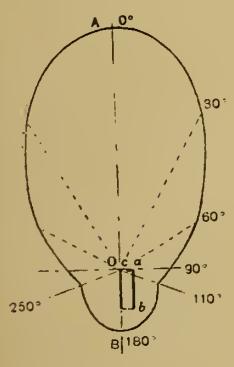


Fig. 4.

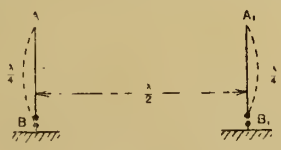


Fig. 5.

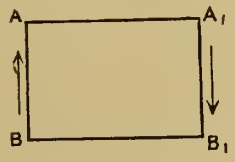


Fig. 6.

are in anti-phase, interference is obtained in the perpendicular median plane and addition in the plane of the antennæ. Such a system would have no effect on a receiving station in the median plane and a maximum effect on one in the plane of the antennæ. This arrangement—first proposed by Brown and later by Blondel (under the name of "champ de concentration")—may legitimately be regarded as a happy application of the principle of Turpain's "interfering fields."

However valuable the system may eventually prove, the excitation of the antennæ, at the required difference of phase, clearly offers practical difficulties.

In order that there may be maximum concentration of Hertzian waves in the plane of the antennæ, the length of the latter should be λ/4 (λ = wave-length of the oscillations employed) and their distance apart should be λ/2. At any other distance between the aerials a less sharp concentration of radiation results. A closed vertical rectangular circuit (see fig. 6), in which the current at any given moment is in antiphase in A B, A′ B′, also behaves in the above manner, giving a concentration of field in the plane of the radiating framework.

Bellini and Tosi "*Directive*" *Aerials.*—The special form of aerial, invented by Bellini and Tosi, greatly facilitates the directive emanation and reception of Hertzian waves. Instead of adopting a completely closed rectangular circuit (as in fig. 6), a triangular aerial (fig. 7), almost closed at its apex, is employed. This variation enables considerable simplifications in the system, and the antennæ may now be supported by a single mast. A Braun oscillating circuit induces suitable oscillations in the aerial system through the Tesla transformer S S′ and tuning between the primary and secondary circuits is effected by inductance coils in B C, B′ C′, which also enable a symmetrical adjustment of the two branches.

The variation of the field from a closed rectangular aerial, in different azimuths, follows a sinusoidal law, and the same law naturally expresses the variation of induced E.M.F. in a simple

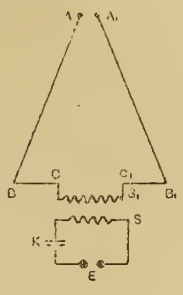


Fig. 7.

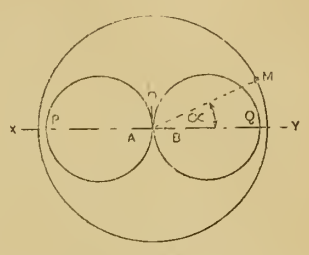


Fig. 8.

vertical aerial placed in various azimuths, but at a constant distance from the sending station. Referring to fig. 8, let A B represent, in plan, the sending aerial, and M the receiving aerial. Then the current induced in M is given by $I = I_0 \cdot \cos \alpha$—*i.e.*, may be represented by a polar vector figure P O Q (two tangent circles, touching at the origin O). It thence follows that the energy

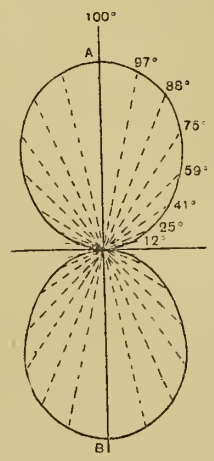


Fig. 9.

received by M (α C²) follows the law, $E = I_0^2 \cdot \cos^2 \alpha$, the corresponding polar energy curve being two symmetrical tangent ovals (see fig. 9). Such a diagram was obtained by Bellini and Tosi on measuring—by means of a thermo-galvanometer—the energy received by a vertical aerial situated at a constant distance from one of their triangular directive aerials—the latter being rotated about its vertical axis between readings.

Similarly, if a uniformly radiating transmitting aerial be employed in conjunction with a closed vertical rectangular receiving aerial, the E.M.F. and current induced in the latter will precisely follow the law of fig. 8 and the energy induced, the law of fig. 9 being maximum in each case when the plane of the receiving frame includes the sending station. Whether fig. 8 or fig. 9 represents the actual efficacy of reception in such a system depends on whether the detector employed is operated by the maximum or the total effect received.

Though the employment of closed circuits as "directive aerials" ensures minimum interference among a group of stations thus equipped, there are great practical difficulties in the way of their use. It is seldom that two stations desire only to intercommunicate between themselves, and the large rectangular or triangular aerial frameworks, with sides 50 m. or so in length, cannot easily be swung round to establish communication with other stations. In any case this shape of aerial is very inconvenient.

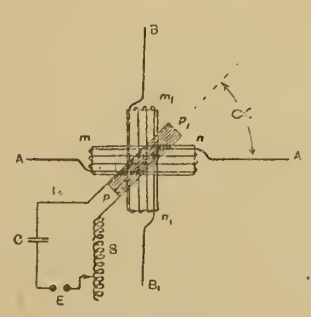


Fig. 10.

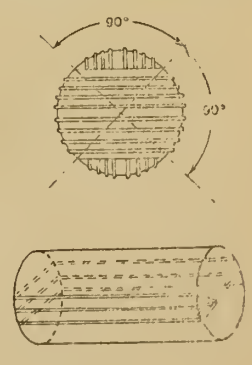


Fig. 11.

The Radio-Goniometer.—By a later arrangement, Bellini and Tosi enabled the emission of variously directed radiations from a fixed aerial.* Two identical aerial frames are arranged per-

* "La Technique Moderne," Vol. II, No. I, p. 1.

pendicularly to each other, as shown in fig. 10 ; on exciting both simultaneously, a resultant asymmetric radiation of energy is obtained, which has a maximum in a direction dependent on the relative excitation of the two circuits. If the latter be excited according to a sinusoidal law, the excitation of A A′ following the law—I . sin α and that of B B′, the law—I . cos α, the resultant field may be directed to any part of the horizon and is always of constant strength.

The requisite sinusoidal excitation may be obtained as follows :—Two rectangular frameworks—*m n*, *m′ n′*—are inserted in the aerial circuits and are tuned to the same frequency by suitable inductance coils. They form, with the primary *p p′*, a Tesla transformer, the initial osillations being derived from the Braun condenser circuit shown. The primary circuit is syntonic with the tuned aerials and the winding *p p′* may be rotated about the axis of intersection of the planes of *m n*, *m′ n′*. If the exciting coil be relatively very small (the coupling between it and the secondary being then, however, very weak), the aerial currents rigorously follow a sine law and the net radiation is in the plane of the primary coil *p p′*.

To obtain a closer coupling, *i.e.*, a higher coefficient of mutual induction between primary and secondary — it has been found desirable to wind the several bobbins in cylindrical form. The secondary windings consist of a number of turns wound round a hollow bobbin, as in fig. 11, and occupying half the available surface ; and an internal primary winding, arranged on a concentric cylinder, which may be rotated about an axis coincident with that of the outer cylinder. By rotating the inner winding, the direction of the emitted radiations may be controlled as above, and, by a similar arrangement, directive reception of signals may be secured.

The radio-goniometer appears likely to be of great value to vessels at sea, and, among the ships already equipped with this apparatus, may be noted the packet steamer *La Provence*. The exact arrangement of aerials on the latter vesssel is indicated in fig. 12. Four similar aerials are employed, each being composed of three or four strands (parallel or slightly divergent towards the top). The lower extremities of these aerials are fixed to the corners of a square (whose diagonals make an angle of 45° with the longitudinal plane of the vessel), and are connected to the radio-goniometer by horizontal conductors. A square frame, carried by a span rope between the masts, supports and separates the upper extremities of the aerials. (The latter thus occupy a fixed position with regard to the vessel—though, what this position is, is immaterial.) The two fixed bobbins of the radio-goniometer are each connected to two diagonally opposite aerials and constitute the primary coils of a Tesla transformer, the secondary of which is formed by the inner movable coil connected to the receiving apparatus.

Then, when the vessel receives signals from a station in any particular direction, the fixed primary coils of the radio-goniometer are appropriately excited by their aerials, and the inner coil lies in a resultant field, whose direction is perpendicular to the direction of propagation. Maximum sensitivity of reception is obtained when the movable coil is perpendicular to the field by which it is excited ; its direction is then clearly coincident with that from which the signals originate. (More accurate working is obtained by observing the two angular displacements of the movable coil at which the signals just become incapable of detection ; the direction bisecting these two extremes is that from which the signals emanate.) In the commercial form of the radio-goniometer, the position of the inner bobbin is indicated by an attached needle moving over a compass card mounted above the windings (the Bellini-Tosi "Compas Azimuthal Hertzien").

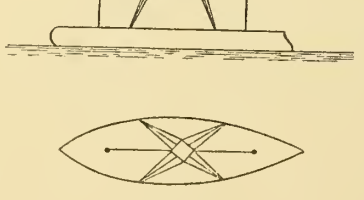


Fig. 12.

The secondary (moving) coil of the apparatus is connected to the detector circuit (fig. 13). The latter resonant circuit comprises the radio-goniometer coil, an invariable condenser C (or two invariable condensers C C′, symmetrically arranged), and a variable condenser C_1. The receiving telephone is shunted across C, and the detector (of the "solid contact" type, a metal point and pyrites crystal) is shunted across C_1. It is, of course, essential that the aerials and the detector circuit be in tune with the signals received, before any attempt is made to localise the latter. Tuning is effected by varying the number of turns employed in the primary coils of the goniometer, and by adjusting the variable condenser C_1.

Practical Tests of the Radio-Goniometer in Navigation.—(1) The land station of Boulogne-sur-Mer was equipped with the above apparatus, and the ironclad *Le Bouvines* having on board an ordinary non-directive radio-system, cruised about 10 miles away in the Channel, giving predetermined signals, from time to time, and simultaneously noting her position. The Boulogne station took the bearing of the vessel at these moments by aid of the radio-goniometer, thus obtaining values which were found to be witnin 2° or 3° of the actual bearings (average results).

2. The ironclad *Le Carnot* was equipped with a radio-goniometer and cruising about 12 miles from the Kerlaer station (Brest), endeavoured to locate the latter. Again, bearings were obtained with an average error of from 2° to 3° and a maximum error of less than 5°.

3. Perfectly analogous results were obtained, over much greater distances, during experiments conducted by the Cie. Générale trans-Atlantique vessel *La Louisiane*.

The above combination of aerials and radio-goniometer, thus constitutes a Hertzian, or radio, compass, enabling as accurate determinations of direction as can be attained (with visible objects) by the use of the magnetic compass.

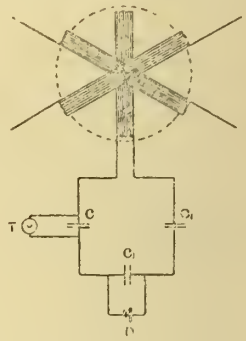


Fig. 13.

Although the partial substitution of submarine bells and microphones for the old siren signals has largely reduced the dangers of navigation in fogs, the radio-goniometer seems likely to be of yet greater value in this respect. Radio-telegraphy is perfectly unimpeded by a foggy atmospheric condition, and, as it is probable that all vessels will be fitted with wireless telegraph apparatus in the near future, the danger of collisions in fog will be practically eliminated. The establishment of coast stations, emitting code signals, similar to those now used by lighthouses, ships, and buoys, will go far to remove the perils of dangerous shores.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Oil-Electric Set.

The accompanying illustration shows a combined paraffin engine and dynamo set, which has recently been supplied by Mr. J. E. Weyman, of Newcastle, for the North-East Coast branch of the British Arc Welding Co. The dynamo is by Messrs. J. H. Holmes and Co., and the engine by the Parsons Motor Co., Ltd., of Southampton. It is a portable set generating direct current for electric welding, and is used for repairs to castings and rudder posts, but principally for boiler repairs and machine work. In one case a repair was effected within two days, while the estimate by boiler repairers for doing the work in the ordinary way meant a matter of two or three weeks, at a cost of £250.

The weight is kept down as far as consistent with strength in all parts. The bed of cast-steel is well ribbed, and the metal cut down as much as possible. As the set is intended to be used in all sorts of positions, often in the holds of vessels, there would be a difficulty in getting water for the engine circulation ; consequently the set

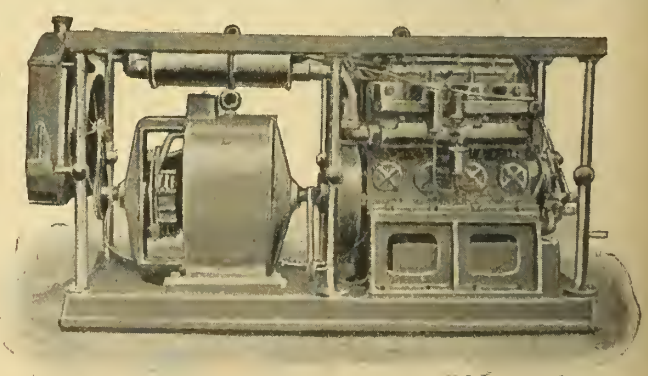


Fig. 1.—28-h.p. Parsons Engine and Holmes Dynamo on Bed-Plate.

is self-contained, with a radiator for cooling the circulation water. As it is all open, the radiator had to be of special construction and size. Strong wrought-iron standards are used, with angle-iron framing, which not only acts as a guard but helps materially in stiffening the bed. In the framework at the top, hooks are formed with permanent slings for lifting purposes. The oil tank is fitted between the standards carrying the engine. As the engine has float feed, a small rotary pump is driven from the dynamo shaft

which pumps the oil up into a small receiver fitted under the frame behind the engine; from this an overflow pipe leads back to the oil tank below. The radiator is carried at the end of the machine on brackets fitted to the standards, the fan being driven by a pulley on an extension of the dynamo shaft. The switchboard, with double-pole switch and shunt regulator on the back of the board, double-pole switch, voltmeter and ammeter on the front, is fixed on the side of the framing and bed behind the dynamo.

B.T.-H. Automatic Motor Control Gear.

As is probably well known, the British Thomson-Houston Co., Ltd., of Rugby, have for many years specialised in switchgear for all purposes, and as a result of their experience the firm are

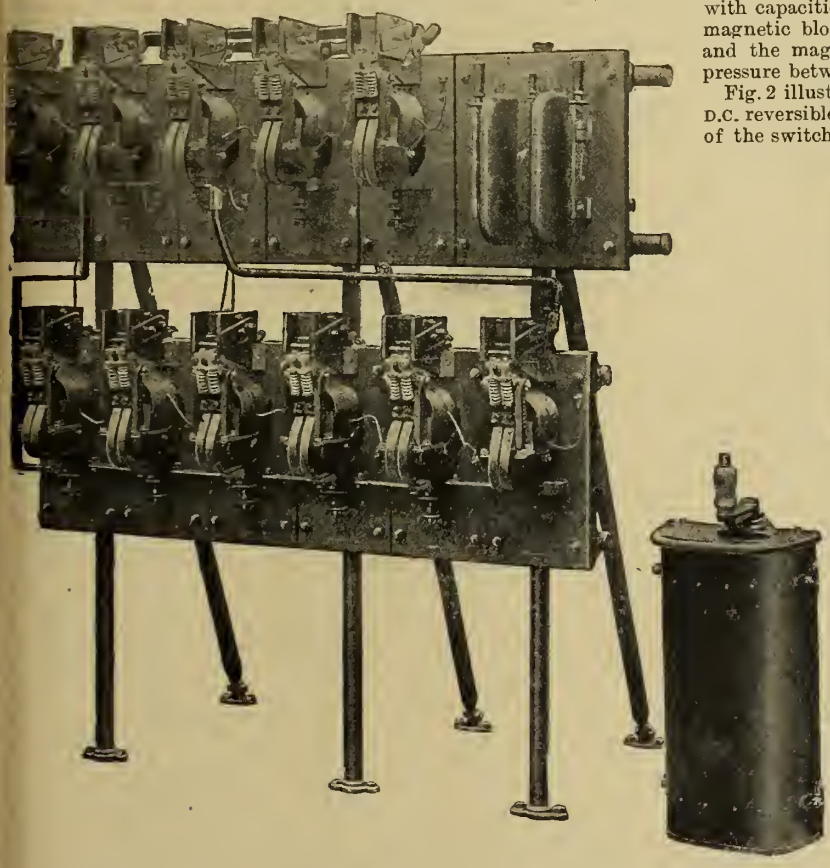


Fig. 2.—B.T.-H. Contactor Equipment, with Master Controller for 300-h.p. Motor.

naturally in a unique position to advise and supply switches which embody the requisite features to ensure success in various applications.

Amongst other types, the B.T.-H. Co. have developed in a high degree automatic control gears for various purposes. In the

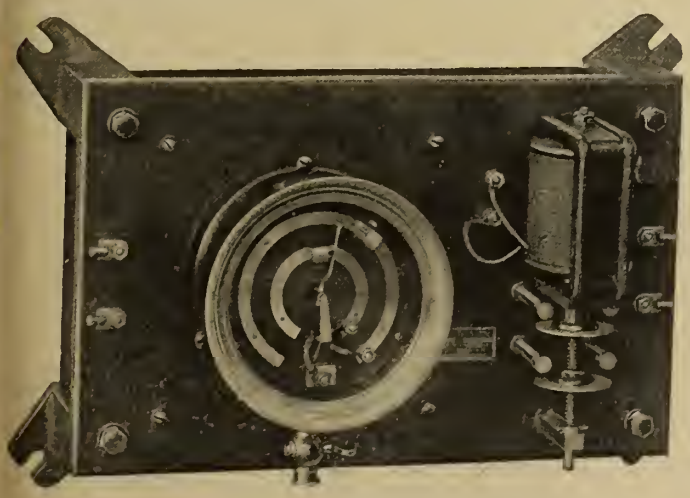


Fig. 4.—Starting Rheostat with Pressure Control.

B.T.-H. apparatus, the essential feature is control by current limitation, this method being most satisfactory where a motor has, say, to be started and accelerated or reversed against widely varying loads.

For motors of small capacity, the above system is more expensive than a time control arrangement, and our illustration, fig. 3, shows a cheap starting rheostat for non-reversing d.c. motors of 15 h.p. or less, with automatic time-limit control. The solenoid and resistances are designed for starting under normal full load at intervals of 4 minutes with a 15-second starting period, which may, however, be regulated by the dashpot.

The motor circuit is opened and closed by a contactor, and the solenoid circuit may be remote controlled by tumbler switches. For motors connected to air compressors, the rheostat is used in conjunction with the pressure governor shown in fig. 4, consisting of a dial-type pressure gauge with adjustable contacts and a small relay for closing the solenoid circuit.

A motor float switch, or a pedal-operated switch, such as is used in capstan work, can equally well be used in conjunction with this (type C R 120) rheostat.

For larger size motors, contactor equipments are recommended as being better able to deal with the currents involved.

These equipments are built up of magnetically operated switches, with capacities up to 2,500 amps., each provided with a powerful magnetic blow-out device. The working contacts are renewable, and the magnet coils are powerful enough to ensure adequate pressure between contacts.

Fig. 2 illustrates an equipment for controlling a 300-h.p., 500-volt, d.c. reversible motor for driving a main haulage gear. The whole of the switches are operated through the small master controller

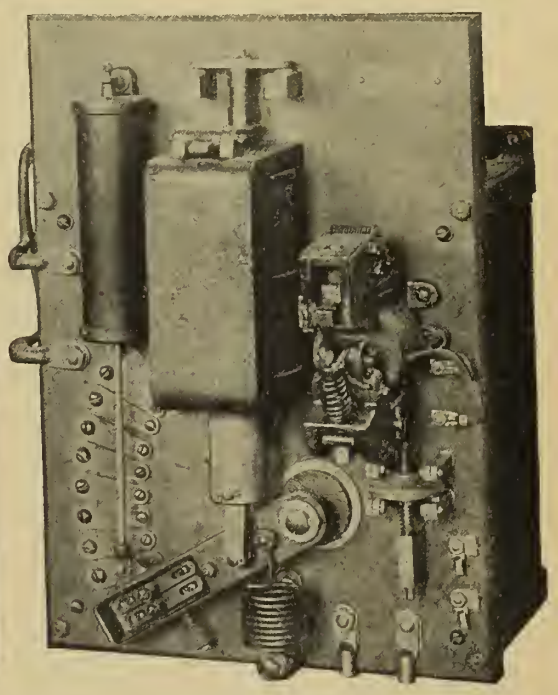


Fig. 3.—Starting Rheostat, with Time-Limit Control.

shown on the right, and as the equipment is arranged for current control, slow and careful manipulation of the handle such as would be required with an ordinary drum controller is unnecessary. Such an equipment possesses great durability under adverse conditions, and is such as should be adopted for controlling motor drives for heavy roller trains in rolling mills.

A similar type of apparatus is supplied for use on a.c. circuits, and is largely in use for controlling large induction motor drives for rolling mills, an example of which are the 6,000-h.p. motor drives at the new mills of the U.S. Steel Corporation, at Gary.

Reflectors for Industrial Lighting.

In a new catalogue and price list that is being issued by Messrs. Benjamin Electric, Ltd., of 117, Victoria Street, S.W., there are shown the "Holophane-Benjamin steel line of reflectors" for



Fig. 5.—Holophane-Benjamin Steel Reflector.

industrial lighting, which are designed for the lighting of mills, factories, workshops, dockyards and railway stations. They consist of five types of reflectors, four of which are for pendant use, in four different sizes, with lamps of from 17 to 300 watts, while the

fifth type, which is parabolic in three styles, is designed for local lighting, with small lamps, of, say, from 17 to 35 watts. These reflectors are for use with the ordinary shade carrier lampholder, and no gallery is required, or they can be supplied equipped with the "Benco" weatherproof lampholder for outdoor work. They are entirely British made, and are covered by patents and registrations. The illustration shows the Holophane-Benjamin steel reflector, focusing type.

The King's Indian Visit.

In fig. 6 we illustrate the Aster B 7 trolley electric generating set, supplied by the Aster Engineering Co., Ltd., which is being

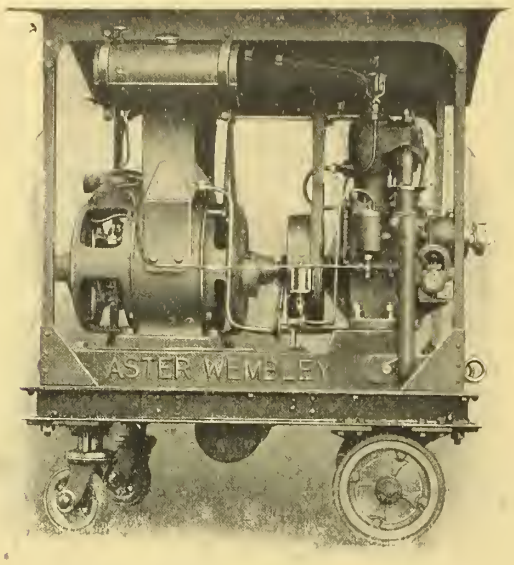


Fig. 6.—Portable Aster Generating Set.

used by the Indian Government for the temporary lighting of the Royal Amphitheatre, used by H.M. the King during his visit to Calcutta.

Petrol Motor and Dynamo.

Side by side with the development of the crude-oil engine for heavy duty, the use of petrol motors for small and medium powers is steadily increasing. This feature is exemplified by the illustration, fig. 7, showing a 25-b.h.p. six-cylinder petrol engine, made by Messrs. J. W. Brooke & Co., Ltd., of Lowestoft, coupled to a "Zone" dynamo, having an output of 17 kw. at 110 to 135 volts, with a speed of 840 r.p.m. The engine is of the four-stroke type, and the equipment includes a rotary cooling-water pump, a throttle

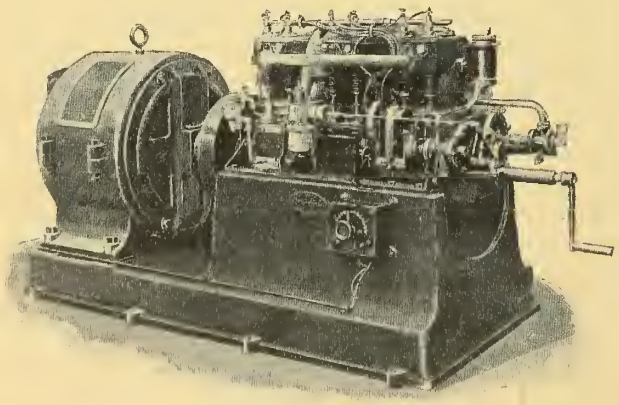


Fig. 7.—Brooke Petrol Electric Set for Brazil.

governor and a Bosch magneto with an accumulator for dual high-tension ignition. Very great care is taken in the manufacture of these motors, all parts being interchangeable and made to limit gauges, whilst grinding is resorted to for the cylinders, piston rings, gudgeon pins and bushes. The material also is of a very special quality, forged nickel steel being used for the crankshafts and cams, which latter, with their spindles, are cut from the solid bar.

This engine is of Messrs. Brooke's standard marine type, of which thousands are in use all over the world, and as the conditions afloat are more severe than for electric lighting purposes, reliability should be a strong feature. The set in question is for shipment to Brazil.

Simplex "Unit" Fittings.

The Simplex Conduits, Ltd., of Birmingham, have recently introduced a new departure in their fittings business. A system of adjustable parts has been devised to meet the demand which exists amongst contractors in outlying districts and abroad, for some

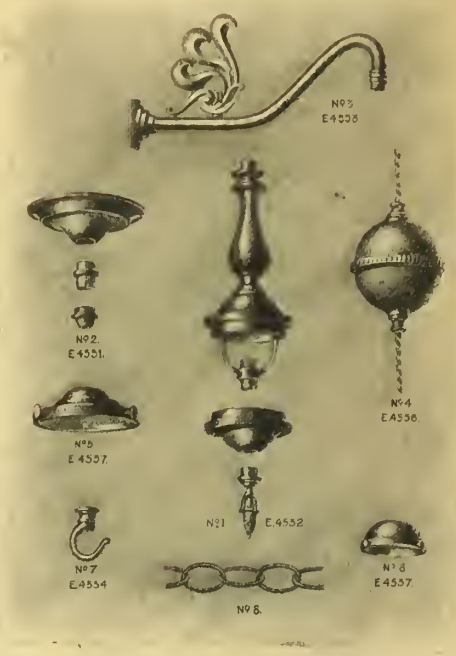


Fig. 8.—Parts of the Simplex "Unit" Fittings.

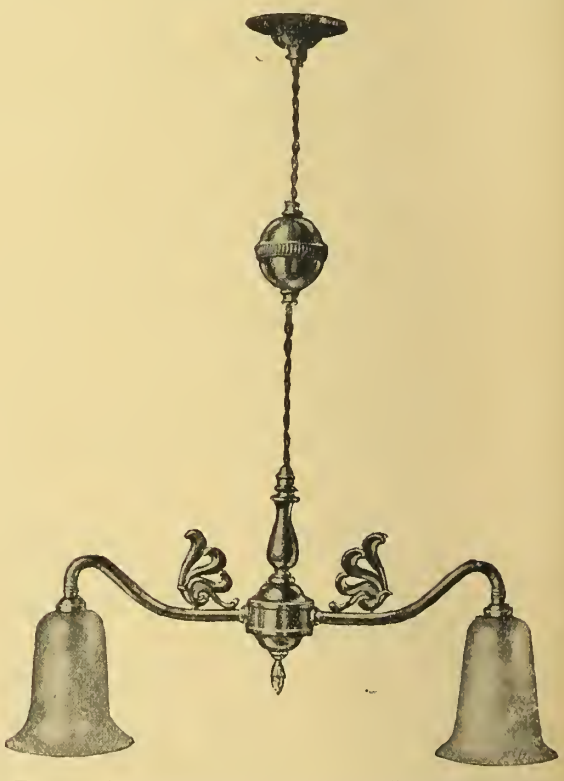


Fig. 9.—Adjustable Fitting from "Unit" Parts.

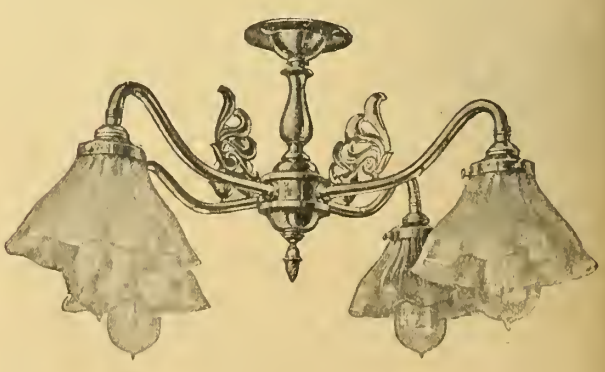


Fig. 10.—Ceiling Fixture from "Unit" Parts

arrangement which will enable them to fill orders without delay. The Simplex "unit" system embraces half a dozen parts, as shown in fig. 8, which can be assembled in numerous ways, to produce several different fittings.

It will be noted that the parts include—(1) A stem with cord grip cap; (2) Ceiling plate; (3) Tubular arm with ornament; (4) Spring cord absorber; (5 and 6) Galleries for silk shades and Holophane reflectors; (7 and 8) Hook and chain. These can be assembled in a variety of ways for pendants, brackets, table lamps, &c. Figs. 9 and 10 show a two-light adjustable dressing-table fitting and a ceiling fixture built up from these parts.

LEGAL.

Young *v.* Cleveley's Hydro Co.

George Young, formerly secretary in a South African Mining Co., claimed £100 for alleged personal injuries sustained whilst taking an electric bath from the Cleveley's Hydro Co., Ltd., and the action was resumed at Blackpool on Friday, at the County Court, before his Honour Judge Hamilton. The plaintiff's case was that after spending 15 years in South Africa, he returned to England broken down in health. In June last, on the advice of his medical attendant, he visited Blackpool. At the Cleveley's Hydro he took a radiant heat or electric light bath, during which he complained that his left leg was badly burned, which incapacitated him for some considerable time. His Honour said he knew something about electric burns, as a member of his family was the first person in England to be burned by electric light treatment, and, singularly enough, it was on the same part of the body as in the present case. The recovery took about nine months. Mr. Read, solicitor to the company, intimated to the Judge that the parties had arrived at a settlement, although his clients denied liability, and were not responsible for the burns which plaintiff alleged he had received. They wished to take that opportunity of pointing out that the bath attendant was a skilled man with 10 years' experience in the leading baths in England, but having regard to what the Judge said, his clients felt there might be some moral obligation, and terms had been come to.

His Honour entered judgment for the plaintiff in accordance with the terms of agreement, which were not disclosed.

Ross, Stevenson & Co. *v.* Wright.

An action was raised in the Perth Sheriff Court at the instance of J. Ross, Stevenson & Co., electrical engineers, Edinburgh, against Mr. J. M. Wright, Kinmouth, Bridge of Earn, for delivery of designs for an electric light installation at Kinmouth, and failing delivery for £50, the value put upon the designs by pursuers. It was intimated to Sheriff Sym that the designs had been found at Kinmouth House, and that they had been returned to pursuers. The Sheriff ordained the defender to pay expenses to pursuers on the higher scale.

General Electric Co., Ltd., *v.* Great Western Railway Co.

The Railway and Canal Commission, on Monday, December 11th, composed of Mr. Justice A. T. Lawrence (president), the Hon. A. E. Gathorne Hardy and Sir James Woodhouse, sitting in the King's Bench Division, heard this case on an appeal from the Registrar. Mr. Disturnal and Mr. Tangye were for the plaintiffs, and Mr. Macassie appeared for the appellants, the railway company.

In opening the case for the railway company, Mr. Macassie stated that plaintiffs had brought an application before the Registrar in respect of what they alleged to be undue preference allowed by the railway company to Messrs. Belliss & Morcom, Ltd., in the carriage of electrical machinery from Birmingham, where factories for both firms are situated. Messrs. Belliss & Morcom were manufacturers of engines and agricultural machinery whose goods, being heavy and bulky, were carried under Class 4 of the Railway Rates Act at no prescribed rate, but at a "reasonable sum." The goods of the plaintiff company were carried under Class 4 as machinery in cases with a provision that if the weight exceeded 10 tons an addition of 25 per cent. might be made to the rates. The plaintiffs applied to the Registrar for an order of discovery, alleging that the Great Western Co. was carrying electrical appliances for Belliss & Morcom, Ltd., at the rate of vertical engines, and so giving that firm an undue preference over them. The Registrar, he said, without having a single case presented to him of undue preference, made an order of discovery of three years of the goods carried by the defendant company from Birmingham. He contended that that order was oppressive, and that, in any case, the Court would not allow an order for discovery to be used as a "fishing" order to procure evidence for the plaintiffs without any grounds shown. Moreover, he said he was instructed that Messrs. Belliss & Morcom did not manufacture electrical machinery at all.

Mr. Disturnal, for the plaintiffs in the case, stated that the same application was made by his clients against the L. & N.W. Railway Co., the Midland Railway Co. and the Great Western. The two first-named companies had agreed to supply his clients with 12 typical cases, and he was quite willing to accept an assurance from the Great Western that they would do the same, which would save them from the overhauling of three years' work at Birmingham.

Mr. Macassie declined to give the assurance, and said that if it was true that his clients had been carrying electric machinery at the rate of vertical engines, they had no means of discovering which was which.

Mr. Justice A. D. Lawrence, in giving judgment, said that, in any application of this kind, the ground of the undue preference must be shown, and that had not been done in this case. An order of this kind for a discovery of three years would, he said, be oppressive to the railway companies, and, if it were pursued, would make the conduct of railway business impossible. At the same time, he told the railway companies that the Commission would give every assistance in cases where undue preference was charged, and would put no obstacles in the way of allowing applicants to prove their cases. In this case, however, they thought the order was too wide, and disallowed it, giving plaintiffs 10 days in which to produce six instances upon which their case could be based and their application renewed.

United Lighting Co. *v.* Liescgang.

In this action plaintiffs claimed for breach of contract and for the value of broken electric lamps supplied to the plaintiff company. Mr. Inskip, on behalf of the company, applied to Mr. Justice Coleridge in the King's Bench Division on Saturday, December 9th, for judgment. The defence, said counsel, was struck out in default of discovery, and there was part of the claim, £189 15s., upon which the plaintiff was entitled to judgment at once. The action arose out of a contract for the supply of electric lamps at 1s. 9½d. each, and there was a stipulation that if the breakages exceeded 5 per cent. the defendant should allow the plaintiffs the price of all broken over that limit. The 5 per cent. limit would be 654 lamps, but there were over 2,000 delivered broken. The rest of the action was for damages for breach of contract in the quantity delivered, and in respect of that there would be damages to be assessed by the Official Referee.

His Lordship entered judgment for the £189 15s. and for the amount of damages to be assessed as stated.

BUSINESS NOTES.

Christmas Holidays.—We shall be glad if our friends will take notice of a slight variation in certain of our arrangements for our issue of December 29th. The holidays will this year make no difference in the day of publication, but as our offices will be closed on Monday and Tuesday, December 25th and 26th, the last day for the receipt of "Correspondence" to appear on 29th inst. will be Saturday, December 23rd. Other matters may be sent in by the following Wednesday morning, as usual. Advertisers are advised that new copy and alterations to existing displayed advertisements should reach our offices not later than Friday morning next, December 22nd.

Catalogues and Lists.—Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—Catalogue illustrating and pricing all kinds of Christmas, New Year and other presents, included among them being electric fires and radiators and pocket flash lamps.

The British L.M. Ericsson Manufacturing Co., Ltd., 82-85, Fleet Street, London, E.C.—Two sections have been issued of a new catalogue, and others are to follow. Special binders are also being prepared in two sizes, one to take three sections only, and the other for the complete set when ready. We have received sections "M" and "S," which can now be obtained by interested members of the trade who have not yet received them. Section "M" contains neatly tabulated prices and beautifully executed half-tone illustrations of portable instruments, including combined telegraph and telephone instruments, portable telephone instruments, portable switchboards for metallic circuits, wire and cable reels, contact rods, micro-telephones, cells, and battery test instruments. Section "S" is devoted to protectors, including heat coils, fuses, serrated protectors, discharge coils, terminal boxes, apparatus on porcelain bases, junction-boxes, carbon protectors, protectors with carbons, fuses and heat coils mounted in wooden boxes with glass cover or on special frames. We have nothing but praise for the excellent style in which this catalogue is being issued.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—New catalogue (No. 239) containing 234 pages of illustrations, prices, code words, and brief particulars of a whole host of electrical fixtures. These include, first, a variety of brackets ranging from the plain and simple to the beautifully shaded fitting of choice design, including those of various periods, Dutch candle fittings, and iron brackets; ceiling fittings also progress through a range from simplicity to ornateness, and in corridor and hall pendants and iron lanterns there are designs to please almost every conceivable taste. This remark applies equally well to the very impressive collection of electroliers, adjustable pendants, and silk shade pendants, which occupies many pages. Fittings for indirect lighting, portable and adjustable standards, floor standards, statuettes, some charming fancy figure suspensions, church fittings,

wireless multiple light fittings follow, and after them comes a collection of cardboard, silk, glass, bead and other shades, also "Aureola" luminous radiators, out-door lanterns, brackets, signs, and Efesca lamps. It may be thought that we have named a list of ordinary lines, and could have compressed all that we have said into a couple of sentences, but the catalogue is no ordinary one of its kind, and we are afraid that our words will hardly convey a correct idea of how full and complete is the collection of fixtures here shown, some of which are to us quite new. We have no doubt that the book will be required by most electrical contractors and traders.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—Pamphlet containing a reprint of an article on the power and telephone equipment of the Llanharran Colliery, which was carried out by the firm.

Messrs. Pritchetts & Gold, Ltd., 58, Victoria Street, London, S.W.—Leaflet containing an illustrated description of the Pritchett "B1" accumulators which they are supplying both at home and abroad for working large bell, telephone, and signalling systems in country houses, hotels, factories, mines, and the like. The cells can be charged either like ignition accumulators or from lighting circuits by means of the firm's charging switch. Contractors are invited to apply for the list.

Messrs. S. J. Howland & Co., 110, Cannon Street, London, E.C.—Leaflet giving particulars of the "Oro" metallic-filament lamps and a list of prices for lamps ranging from 20-30 to 200-260 volts, and in candle-powers from 8 to 1,000. A small table of comparative costs of the "Oro" and carbon lamps in current consumption per 1,000 hours is given.

Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, London, S.W.—We have received a copy of the firm's new lantern-slide list. This, we understand, has been revised and considerably increased by the addition of many interesting and up-to-date slides. The set now consists of 180 different views, and they are kept in stock at Caxton House in readiness for lending, free of charge, to lecturers, schools, &c.

The Diesel Engine Co,, Ltd., 179, Queen Victoria Street, London, E.C.—Two publications ; one a pamphlet giving information regarding the Diesel engine, its economy with figures as to costs, and a list of plants installed abroad, the other containing a number of half-tone views of various sizes of the engines for electrical and other service, up to 1,000 b.h.p. size. The pictures include views of electrical plants at Vera Cruz, Bombay, Calcutta, and several home stations for electric light and power, tramway, cotton mill and other works. Copies of these pamphlets can be obtained on application.

Endolithic Manufacturing Co , Ltd., Pomona Buildings, Fore Street, London, E.C.—Leaflet showing a number of designs of labels in ivory, bone, brass, &c., for affixing to electrical apparatus, machinery, &c.

The Detroit Engine Works, 77, Gamage Building, Holborn, London, E.C.—Circular containing a description, illustrated, also a list of prices of the Detroit portable stationary oil engines for small electric light plants. Sizes ranging from 2 to 20-b.h p. are included.

The Dowsing Radiant Heat Co , Ltd., 105, Great Portland Street, London, W.—Leaflet illustrating and stating prices of some new designs in the shape of "Redglow" radiators (Bastian heaters).

Canadian Enterprise in Spain.—A fresh instance of Canadian enterprise through Belgian and French circles is represented by the announcement made from Brussels that the Pearson group has in preparation an issue of bonds of the Barcelona Traction, Light and Power Co., which is to be made in Paris and Brussels. The question was also referred to at a meeting of the Electric Light and Power Investment Co. held in Berlin, on December 7th, when the chairman stated that the Compania Barcelonesa de Electricidad, in which the former is largely interested, is confronted with the prospect of competition, although negotiations are proceeding with the object of arriving at an understanding. Since then the Compania Barcelonesa has issued a notice intimating that Canadian promoters have acquired large water powers in the Pyrenees, and raised capital in America and Europe for the purpose of utilising the power for the electrical transmission of energy to Barcelona, it being intended to largely underbid the present company in prices. Although it would have remained to be seen how far this proposal would have been carried out by the Barcelona Traction, Light and Power Co., which has been formed in Toronto, there is no doubt that the Compania Barcelonesa would have been faced with severe competition and probably a decline in prosperity. These considerations induced the directors of the latter company not to refuse to negotiate in regard to the offer of purchase made by the Canadian promoters, who have proposed a price for the shares at the rate of 140 per cent. The negotiations have not yet been concluded, although a decision is expected at the end of the year. The Compania Barcelonesa, it should be explained, is substantially a German undertaking, which was formed in 1895 by the A E G., the Deutsche Bank, the Bank for Electrical Enterprises of Zurich and other financial institutions. After paying dividends of 7½ per cent. for five years in succession, the distribution was raised to 8 per cent. in 1910, and a similar rate is expected for the present year.

Annual Dinner.—The annual dinner of Messrs. T. W. Vaughan & Co., Ltd., of Islington, N., took place last Saturday evening, at the Builders' Arms, Lynton Street, N., Mr. Vaughan taking the chair, and Mr. Tappenden, foreman of the Art Metal Works, acting as vice-chairman. The chairman referred to the large increase in the staff and business generally during the year. A number of visitors were present, also the following heads of departments . Mr. A. J. Mister, electrical department , Mr. A. W Crapper, brass finishers' department ; Mr. T. Tappenden, ironwork department ; Mr. J. Cook, heating and gas department ; Mr. Dickinson and Mr. Morris representing the office ; Mr. Jordan, outside representative. Toasts were given and responded to, and the musical honours were given by Messrs. Good, Nutting, Strudwick and Bolding.

Electro-Galvanising Plant. — An electro-galvanising plant for coating boiler tubes and special fittings is being erected in accordance with Mr. Sherard Cowper-Coles's designs and specifications for the Las Sociedad Espanola de Construccion Naval, Ferrol, Spain, which company is entrusted with the building of the new Spanish Navy.

Liquidation.—Automatic Trolley Head Co., Ltd.—A meeting is called for January 23rd, at 82, Victoria Street, London, S.W., to hear an account of the winding up from the liquidator, Mr. H. S. Foster.

Bankruptcy Proceedings. — Oswald Carr, Oak Works, Headingley, and 31, Estcourt Terrace, Headingley, Leeds, York, electrical engineer.—The public examination of this debtor took place last Tuesday at the County Court House, Albion Place, Leeds, on accounts showing a deficiency of £59. It transpired that the debtor started business in 1890. Last September a meeting of his creditors was held when an offer of 5s. in the £ was made, and declined. The debtor's turnover during the past three years had averaged £1,000 a year, leaving a net profit of between £150 and £200. His present position had been brought about by bad debts. Debtor stated that all his assets had been sold to his father for £150, and the business registered as a limited company, he being the manager, and holding one share. The issued capital was £90, of which his (debtor's) wife held £77. The causes of his failure were want of capital, bad debts, and losses on contracts. An adjournment was ordered.

A. P. Parker, electrical engineer, of May Street, Burnley.—At the Burnley Bankruptcy Court, on December 7th, this bankrupt appeared to undergo his first public examination. Debtor formerly carried on business in Yorkshire Street, and he attributed his position to "sickness of myself and family, and loss on contracts." The liabilities were £174, and the deficiency amounted to £139. Debtor commenced business in October, 1910, without capital. Previously he had been a journeyman electrician, earning an average wage of £1 per week. There had been no profit from the concern. The examination was adjourned.

Thomas Topping, electrical and mechanical engineer, Southport.—Receiving order made at Liverpool on December 8th, on debtor's own petition.

Book Notices.—"Hazell's Annual for 1912." London : Hazell, Watson & Viney, Ltd. Price 3s. 6d. net.

"The Rubber Industry." By Dr. Joseph Torrey and A. Staines Manders. 1911. London : The International Rubber and Allied Trades Exhibition, Ltd. Price 15s. 6d. net.

"Science Abstracts." Sections A and B. Vol. XIV, Part 2. November 25th, 1911. London : E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"How to do Business by Letter and Advertising." By Sherwin Cody. 1911. London : Constable & Co. Price 5s net.

"The Induction Motor." By B. F. Bailey. 1911. London : Hill Publishing Co., Ltd. Price 10s 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVI, No. 8. October, 1911. Chicago : The Society. Price 50 c.

Trade Announcements.—Consequent upon increased business and the necessity for holding larger stocks, the Hart Manufacturing Co. have taken over premises next door to their existing address, doubling their former accommodation. Their address is now 76 and 77, Rochester Row, Westminster, S.W.

Mr. T. A. Nunwick has now commenced business on his own account as manufacturers' agent, and has opened offices and stores at Ayton Buildings, King Street West, Manchester. He will represent the Wandsworth Electrical Manufacturing Co., Ltd., and the Standard Cable Manufacturing Co., Ltd., in Lancashire, Yorkshire, and Cheshire ; the Light Alloy Co., and Oliver Arc Lamps, Ltd., in Lancashire and Cheshire ; and the Hart Accumulator Co., Ltd., in Lancashire only.

Messrs. Herbert G. Richardson & Co., of Walsall, have, owing to increase of business, moved into larger premises, and have acquired the mill on the "Old Wharf." They can now give quicker deliveries of their standard lines in switchgear, magnetic separators, electric cranes and haulage gears, and have put down a plant for the production of turned work for the trade in brass and steel. Their address after to-day will be Magnet Works, Wolverhampton Street, Walsall ; Telephone No. 400, Walsall.

Messrs. J. Hopkinson & Co., Ltd., announce that their works will close for the holidays on Saturday noon, December 23rd, and will resume on Thursday morning, December 28th.

Catalogues Wanted.—The Wolseley Sheep Shearing Machine Co., Ltd., of Sydney Works, Alma Street, Aston, Birmingham, want catalogues in duplicate from makers of material instruments, and apparatus necessary for installations for electrically lighting country houses, and the general equipment o electrical plants for agricultural purposes at home and abroad.

Belgium.—Works for the manufacture of electri motors are about to be established at Liége by La Société de l Fabrique Belge d'Outillage.

"Tantalum."—Messrs. Siemens Bros. Dynamo Works, Ltd., announce that in future all tantalum lamps supplied from their works and stores at Tyssen Street, Dalston, will be marked on the bulb with the word "Tantalum," and in a short time all deliveries of these lamps from their branches will bear the same mark.

"Zed" Fuses and "The Miracle."—Messrs. Siemens Bros. Dynamo Works, Ltd., inform us that they have received the order to supply the whole of the fuse distribution boxes and iron-clad switch and fuse gear required in connection with the forthcoming production at Olympia of the wordless play entitled, "The Miracle." The "Zed" distribution boards will, of course, have to comply with the Theatre Regulations of the L.C.C., and the supply of these boards in record time (the order has to be completed in 10 days) was only made possible by the firm's extensive experience of theatre installations, enabling them to standardise boards of suitable design. The whole of the iron-clad switches will be of their standard "S W" type manufactured at Stafford works. The firm has been obliged to adopt special arrangements to keep pace with the demand for these fuse boxes.

LIGHTING and POWER NOTES.

Accrington.—The T.C. has confirmed the scheme for the substitution of gas for steam in the generation of electricity. The estimated cost is about £27,000. It is hoped by this means to cheapen the price of current and to solve the difficulty of extensions. The present electricity works are being run to the fullest capacity, and with the contemplated supply of current to Haslingden, Clayton-le-Moors, and Church, considerably more generating plant will be required. To extend the steam power system would necessitate a new site on a large scale and the duplication of buildings, plant and staff. For the present it is intended to install a complete unit of 2,000 B.H.P. of power gas plant, with by-product recovery, arranged in such a way that additional units can be installed to the ultimate extent of five, or a total of 10,000 B.H.P. It is estimated that for a 60 per cent. load factor on 2,000 B.H.P. there is a saving in favour of gas of £1,100 per annum, allowing 12½ per cent. for interest and repairs, and taking coal at 10s. per ton. It is also estimated that a further sum of £1,250 per year will be forthcoming from by-products. Tenders have been received and the L.G.B. is being asked to grant borrowing powers.

Mr. John Newton, employed by Messrs. Howard & Bullough, has gained some distinction by the erection of six working class cottages in Pilot Street, Accrington, which will contain no gas pipes at all. As an experiment—the first of its kind in the district—nothing but electricity will be provided for lighting and all other purposes.

Ascot.—For some months the original electrical plant laid down by the Ascot District Gas and Electricity Co., four years ago, has been inadequate. Now, by the installation of a Mirrlees-Diesel oil engine of 150 H.P. working a 100-KW. generator, the plant capacity has been practically doubled.

Ashburton.—The U.D.C. has decided to oppose the application of Messrs. Purves, of Exeter, for a prov. order for E.L.

Barking.—The U.D.C. has decided to support the Bill of the I.M.E.A., and to contribute up to £7 10s. towards the cost.

Blackpool.—The T.C. dealt with several interesting matters at the meeting on December 7th. The electrical engineer was authorised to lay a new H.T. lighting feeder and a new tramway feeder from the electrical works to the western end of Chapel Street, where a new transformer kiosk is to be erected. Mr. Furness and a deputation of councillors have visited several towns for the purpose of inspecting electrical machinery with a view to recommending the most approved type for the contemplated extension of the electricity works.

Bridlington.—The T.C. has revised the tariff for current for general lighting to 4d. per unit for exceeding 750 units per quarter, and up to 1,000, and to 3¾d. per unit for over 1,000 units, up to 1,500.

Burton-on-Trent.—The electrical engineer (Mr. Thos. Hall) has submitted a report upon the extension of the electricity works, at a total estimated expenditure of £17,150. He stated that he proposed to replace the No. 1 generator with a three-phase machine of the turbine class, which would be capable of generating 1,250 KW. on full load, as against 80 KW. of the No. 1 generator. The Council would then have two systems of generating, and as it would take some time to complete the change over, it would be necessary to give a supply on both systems for some time to come, and for a considerable time to supply the outlying districts, principally for lighting purposes, from the single-phase mains. To obtain the advantages due to the turbine, he proposed putting in a motor-generator from three-phase to one-phase, which could be run inverted to give either three-phase or one-phase supply. The tramways would be supplied in the same manner from the turbine, by means of a second motor-generator. With regard to switchboards, he proposed erecting a new switchboard on a gallery. The steaming capacity of the boilers in the boiler house was quite sufficient as long as the turbine condensers were working efficiently, but to provide against an emergency, a water-tube boiler should be erected. The economisers, main flues and main stack being too small, it would be necessary for economical working to have new economisers and a new stack of larger dimensions. The proposed boiler would allow the Council to take a maximum load equivalent to that of the turbine, after which it would have to extend the boiler house. Dealing with mains, the engineer stated that those in the central part of the towns were already overloaded and would have to be duplicated. They also required extending from the works to the Shobnall Road district. It was proposed to put down a new H.T. three-phase main, and at first to connect on to this the largest power consumers. Any further applications would then be dealt with on this system, and as the mains in the centre of the town required renewing, this could be done from year to year until the whole system was converted to three-phase. New offices and stores would be required owing to the new plant occupying the space now taken up by them. The approximate expenditure the engineer puts as follows: One 1,250-KW. turbo-alternator and condenser, £4,750; foundations, £400; pipework, £200; one 500-KW. motor-generator (three-phase to one-phase), £1,200; one 300-KW. motor-generator (three-phase to D.C.), £800; foundations and connections, £200; one switchboard and gallery, £600; one water-tube boiler and pipework, £1,800; six superheaters for old boilers, £800; new stack and economisers and extension to main flue, £2,500; new H.T. main and alteration to existing motors, £2,400; new offices and stores, £600; alteration to existing screens, &c., £500; contingencies, £400. In conclusion, the engineer expressed the desire to proceed at once with the erection of the superheaters, to get the benefit of the economy in working; also, if possible, one of the motor-generators and the mains in readiness for any new motors in the coming summer. The Electricity Committee, after considering these proposals, recommended that they be approved, and application is to made to the L.G.B. to the borrowing of the £17,150 for executing the work. The work of extending mains to Shobnall Road is to be proceeded with at an estimated cost of £528, and the work of converting 19 gas lamps into electrical lamps is also to be carried out. Mains are also to be extended from Station Bridge to Moor Street at an estimated cost of £150.

Canterbury.—The T.C. has decided not to support the Bill of the I.M.E.A. In Committee it had been decided to support the Association, and to contribute up to £10 towards the cost. The Council considered it inadvisable to state the reasons for the withdrawal of the suggested support.

The Council has decided to jointly oppose the Bill of the National Electric Construction Co., Ltd., confirming free wiring agreements with several Corporations, including Canterbury.

As the result of an opposing petition on the part of the T.C., the Kent Electric Power Co. has cut out Canterbury from its area, and the city is now an island in the centre of the area of the company.

Chile.—Don Carlos Alberto Gohannsen has obtained a concession for providing the Town of Coquimbo with electric light; and a similar concession has been granted to Don Ignacio Fernández for an electric light installation in the Town of Calama. In each case 12 months are allowed for the carrying out of the work. The Department of the Interior has approved the project for the installation of an electric lighting and power plant at Bulnes.—*Board of Trade Journal.*

Continental Notes.—Germany.—The recent death of Dr. Kallmann, electrical engineer to the Municipal Council of Berlin, has brought forward not only the question of a successor, but also that of the municipal purchase of the undertaking of the Berlin Electricity Works Co., which has a monopoly of supply in the German capital. According to the agreement between the city and the company, the former is empowered, but is not under the obligation, to acquire the company's works, rights, patents and patent rights on October 1st, 1915. The purchase price is to be on the basis of the book value or a valuation, at the option of the city. The existing renewal fund is not to be considered in fixing the price, but will devolve upon the city. Two years at the least before October 1st, 1915, the city has to inform the company if it is intended to exercise the right of acquisition. If notice is not given the agreement will automatically continue for a further period of three years. If the undertaking is purchased after the date in question, the book or valuation price, excepting for sites and buildings, will become reduced by 10 per cent. for each period of three years after October 1st, 1915. A Berlin newspaper, in discussing the situation of affairs, states that it is scarcely to be doubted that the city will make use of its rights in 1915. Although the agreement with the Grand Berlin Tramways Co. was recently prolonged for 20 to 30 years, special difficulties were in the way of carrying out a transfer, but these were removed by way of compromise. Similar obstacles do not stand in the way of the taking over of the Berlin Electricity Works, and it is, therefore, thought probable that the right of municipalisation will be exercised.

The Essen electricity works is installing an 18,000-KW. Zoelly turbine coupled to a Siemens-Schuckert generator, speed 1,000 R.P.M. Two 6,000-KW. steam turbines by the same makers, Escher-Wyss, are at present in use at this station.

Belgium.—La Société des Charbonnages de la Haye has decided to establish electricity generating plants at its collieries at Tilleur and Saint-Nicolas-lez-Liége.

Norway.—The Kykkelsrud Electrical Works, which for years have been the greatest factor in electric supply to Christiania, are now about to largely extend their field of operations. The transmission pressure will be increased from 20,000 volts to 50,000, by means of which alteration the works will be enabled to supply the surrounding districts in a more effective manner with power and

light. The new transmission plant will be completed in the spring.

The new municipal electrical works at Bergen are expected to be completed at the end of March, 1912, and the large generators are now under installation. The consumers are waiting with great impatience, having in the meantime to console themselves with the prospect of a reduction of the price—viz., from 4d. to 3½d. per unit.

Bartford.—The U.D.C. has decided to support the Bill of the I.M.E.A.

Darwen.—It is proposed to run a new cotton mill at Highfield by electricity, and the Electricity Committee has been asked for its terms for supplying energy.

Dublin.—At the last meeting of the South Dublin Union a discussion took place with reference to a dispute with the contractors for the electric lighting of the Workhouse. Mr. Nicholl, secretary to the Electrical Trades Union, wrote stating that the contractors for the electric lighting were employing non-union workmen, contrary to the terms of the advertisement inviting tenders for the contract. Mr. Crimmins moved that the letter be sent to the manager of the A.E.G. Electrical Co., the contractors, for his explanation with reference to the matter complained of. Mr. Lawler moved, as an amendment, that the contract be carried out in accordance with the agreement and conditions specified, and that, in carrying it out, union labour only be employed. The amendment was carried, on a division, by 24 votes to 3. Mr. Crimmins said, in fair play to the contractors, they should be supplied with a copy of the letter. The contractors did good work, and they should receive fair treatment. A letter was subsequently read from a solicitor, on behalf of the contractors, making the following proposal: "To take opinion of an independent electrical engineer accustomed to the inspection of this class of work, whose appointment should be mutually agreeable, as to whether the work has been carried out in accordance with the specification, and the alterations made by order of the engineer during construction, and if he decided that the work has not been so performed, my clients will pay his fees, which might, perhaps, be from 15 to 30 guineas; and if he should decide to the contrary, the Guardians are to pay the fees and to pass a resolution acknowledging that the work has been done satisfactorily." Mr. Ganly suggested that the reports of their engineer and clerk of works showed that the proposal should be accepted. The chairman said that these reports showed that the work was being carried out properly and satisfactorily—in a high-class manner, and the best material was being used. He accordingly suggested that they should wait, without taking further action, until the work was completed, and they could get a report from the engineer, and decide what course should be taken. He moved that as an amendment, and it was adopted.

Dundee.—An action has been raised against the Corporation, at the instance of a local electrical engineer, craving to interdict it from continuing the sale of lamps to consumers. It is alleged that the Corporation electricity department has no authority to trade in this way, and that its action is injurious to the business of the local engineers.

East Ham.—It has been decided to amend the existing scale of charges for the supply of current for power so as to provide that when the total consumption exceeds 1,000 units per quarter, the charge should be 1½d. per unit, as against 2d. per unit for not exceeding 150 units per quarter under the existing scale. It has further been decided to supply and maintain, on hire, high candle-power flame arc lamps at inclusive rates from £6 10s. per annum.

Eton.—Speaking at the last meeting of the Board of Guardians, one of the members (Mr. Howlett) spoke of the difference in the cost of the electric supply and the cost of gas during the half-year. He said the cost of lighting the infirmary with electricity and supplying electric power for pumping water and the laundry was £79 6s. 3d,, whereas the cost of gas for one stove and lighting, including mantles and burners, during the same period was £163 7s. 8d., the cost of gas being about twice as much as electric light.

Farnham.—At a meeting of the Council, the Public Works Committee reported having considered the application by the Farnham Gas and Electricity Co. for the Council's consent to the supply of electric current by means of cables affixed to the fronts of houses, and recommended the Council to inform the company that it was not prepared to give a general consent for the whole of the district, but would be prepared to consider special cases, as they might from time to time arise. The recommendation was adopted.

Farnworth.—Owing to the extravagant use of electricity in houses supplied on the fixed sum of 6d. per week, the U.D.C. has decided to increase the charge for the winter to 9d. per week. If there is a decrease in the energy used, the price will probably be reduced again. It was reported that the price received per unit had not amounted to more than 2d.

Gillingham (Kent).—The T.C. has decided to include in the extension of the offices, stores and workshops at the electricity works, provision for a showroom.

The Bill of the I.M.E.A. is to be supported, and up to £10 contributed towards the costs.

Greenock.—Port-Glasgow power users (shipyards an engineering works) are stated to have indicated their willingness t meet the conditions laid down by the Greenock Corporation for th supply of electricity. Arrangements will accordingly be made a an early date to carry out extensions which will involve the tow in an additional capital outlay for plant of about £25,000. One o the conditions laid down was that Port-Glasgow power users shoul guarantee to take a minimum amount sufficient to pay interest an sinking fund charges on the capital employed on the extensio The negotiations, which now promise to have such a pleasan ending, have been protracted.

Guildford.—The T.C. has appointed a Committee t consider the advisability of having the E.L. installed in the Counc Chamber.

Hereford.—The T.C. has adopted the telephone syste of charging for current for lighting, heating and other domesti purposes, doing away with the need for a separate heating circuit an meter. The charges are a flat-rate of 7s. per lamp, in general use, c 50 watts per annum, and in addition 1½d. per unit, less 5 per cen discount. The flat-rate of 7s. per lamp is to be paid in advance.

Herne Bay.—A report is to be prepared for the U.D.C on a scheme for carrying out the electric lighting order submitte by the Pier electrical engineer.

Heston and Isleworth.—Application is to be made t the L.G.B. for sanction to borrow the following amounts: £1,20 for mains, £800 for house services, and £5,000 for the provision c additional machinery and plant at the generating station. At th meeting of the Council a letter was read from the Heston-Hounslo Ratepayers' Association deprecating the expenditure of the £5,00 and an amendment was moved to postpone the application for month. In answer to a question, Mr. Gentry said that the Com mittee could go on with its present provision for 750 KW., if it coul be sure of immunity from accident. Extra plant was certain to l wanted in October next, and it would take quite six months to g sanction to the loan and another six before the machinery could b obtained. In the result the amendment was negatived.

Higham Ferrers.—The T.C. has decided to invite th local authorities interested to discuss the E.L. scheme being pr moted by Messrs. J. Thornton, Brooke Sampson and J. Clark f Rushden, Higham Ferrers, Irthlingborough, part of the area of th Wellingborough R.D.C., and Chelveston. The promoters are to b invited to meet the Council and to discuss the scheme.

Keighley.—The Electricity Committee of the T.C. ha decided to apply to the L.G.B. for a loan of £6,576 for electricit purposes, viz., mains and services, direct current, £2,000 ; service alternating current, £600 ; coal-handling plant and foundation £536 ; water tower, piping and excavation, £1,100 ; economise additional tubes, £150 ; motors on hire, £600 ; motor-generato £550 ; over expenditure, £840 ; contingencies, £200.

Killeshandra.—At the last meeting of the Rur Council, a letter was read from the L.G.B. with reference to th recent inquiry held into the application of the Cavan R.D.C. to invested with the powers of an urban authority for the purpose having the town lighted by electricity. The Board stated tha although there was some opposition to the scheme, if the Counc desired to proceed with it, the L.G.B. would give sanction an directions for the issue of the necessary order. After discussio the Council decided to at once apply for the necessary order, th area of charge to be Portaliffe.

Linlithgow.—At a meeting of the T.C. a letter wa read from the agents for the promoters of a scheme of electr lighting which it is proposed to introduce in an area embracin certain districts of Linlithgowshire and Stirlingshire. Explanatio having been given as to why the promoters had scheduled only part of the burgh of Linlithgow, in the meantime the Counc agreed to consider the whole proposal at an early date.

Liverpool.—The Tramways and Electricity Committee a its meeting on December 8th, adopted a resolution to take into co sideration the question of cheapening the charge for electric curren and the electrical engineer has been instructed to draw up a repo on the subject. It is stated in some quarters that the cost of elec tricity in Liverpool, as compared with other centres, is such tha it militates against the increased use of energy for industrial pow purposes.

London.—A conference of representatives of the Boroug Councils of Poplar, Stepney, Hackney, Shoreditch and Bethn Green is to be convened for the purpose of formulating a definit policy of linking up the electricity undertakings of the eastern are of London.

HAMMERSMITH.—The Electricity Committee recommends, an advertisements are to be issued inviting offers for the disposal of quantity of disused plant, which has accumulated from time t time, and certain materials, such as arc lamps, globes, &c., the us of which has been dispensed with owing to the recent change fro arc to metal-filament lamps for street lighting. The original co of the superheater, condensers and economiser included in the lis was £2,232, on which there is a balance of £1,485 loan outstandin The Committee says that it may be necessary to consider later th question of repaying this outstanding balance of loan, towar which the sum realised on the proposed sale would go. In no cas where there is a balance of loan outstanding will the plant have t be replaced.

Marylebone.—A flat rate of 1½d. per unit is to be given as an ernative cooking tariff to the maximum demand rate of 2d. and . for consumers on the telephone system of charge, owing to the ficulty experienced by manufacturers' canvassers in attempting introduce cooking apparatus without being able to inform con- mers precisely what rate they were going to pay for current ısumed.

Hammersmith.—The Electricity Committee has approved a ıeme for supplying, fixing and maintaining flame arc lamps on e to consumers, with wiring and fittings necessary, at the fol- ving annual rentals, including the charge for current supplied :— Minimum hours of lighting, 500 per annum ; (*b*) hire per pair arc lamps per annum, £11 ; (*c*) hire of single arc lamp, £6 10s. ; 600 hours per annum ; (*b*) £12 ; (*c*) £7 ; (*a*) 700 hours per ıum ; (*b*) £13 ; (*c*) £7 10s. ; (*a*) 800 hours per annum ; (*b*) £14 ; £8. The rate per hour over the minimum period per pair, the e per hour over the minimum period per single lamp, and the litional extra charge for wiring where necessary, is put at 3d., l, and £1 respectively in each case.

Hackney.—Owing to the Hackney Wick network becoming con- erably overloaded, distributing mains are to be laid to strengthen at an estimated cost of £900. The Electricity Committee orts that it has been advised by the electrical engineer that the e load which the generating machinery at the works was capable sustaining had been reached, and that it would be necessary to e immediate steps in order to supplement the existing plant. The nmittee had had under consideration details and estimates of a eme prepared by the engineer for dealing with the future ıands, but before reporting on the matter to the Council it ired to take independent expert opinion, and an engineer is to be cted to report at a fee of 50 guineas.

tepney.—The Finance Committee has received a reference n the Electricity Supply Committee to the effect that it was rable that steps should be taken with a view to the provision motor converter, switchgear, and new feeder with a view to ting the increasing demand for current, and asking the Com- tee to recommend the Council that it should be empowered ake the necessary steps for the provision of the machinery, and carrying out of the work, and that application be made to the C. for sanction to the borrowing of a loan of £10,000, the cost he work, £5,500 of which is for converters, switchboards, and ıdations, and £4,500 for feeder cables. The Finance Committee agreed.

t a recent Joint Conference of London electric supply authorities esenting the following boroughs—Battersea, Fulham, Ham- smith, Hampstead, Islington, Poplar, St. Marylebone, Shore- h and Stepney, and the Charing Cross, Chelsea, City of London, nty of London, Metropolitan, and South Metropolitan Com- es—the Chairman gave a forecast of the future programme, cially with regard to the important question of linking up supply undertakings of London under the powers conferred by London Electric Supply Act, 1908.

ytham.—Mr. P. J. S. Tiddeman visited Lytham last to interview the local Traders' Association, on behalf ıe Lytham Electric Lighting Co., and spoke of the importance ectricity to Lytham. He said that an initial outlay of £10,000 necessary before they could proceed with the scheme. Up to present they could count on £4,000 ; if the subscription of capital favourable the works could be ready by May next, and he ved the investment would be a sound one in every respect. At Lytham Council meeting on December 7th, the clerk admitted negotiations were proceeding.

iddleton.—With a view to supplying electricity to a y large number of prospective customers in Middleton Junction, Electricity Committee has decided to lay a cable to the ict.

ewport (Mon.).—The T.C. is applying for power to ly current to houses at Christchurch, which is outside the ugh.

ewton-le-Willows.—The U.D.C. has decided to apply e B. of T. for a prov. order for E.L. with power to transfer it, with powers for the Council to purchase, deal in, and fix rs and other apparatus and fittings.

enmaenmawr.—The U.D.C. has decided to apply to .G.B. for sanction to borrow a further £196 for the purpose of ional lighting of the promenade, this sum being the expendi- incurred over and above what was contemplated in the ıal application for £550.

erth.—At its next meeting the County Council is to be l by the Finance Committee to pass a resolution opposing the cation which is to be made to the Secretary for Scotland for a sional order to incorporate a company for the purpose of ding a hydro-electrical generating station at Loch Ericht. It is sed to use the water of the loch river, and to distribute elec- energy for all purposes in the county of Perth. The Finance nittee states that until the order itself is lodged, it will not be ble to judge exactly the effect of the proposals as affecting the y, and the Committee thinks it advisable that the matter d be kept open so that the order may be opposed should this nd necessary.

ettigo.—A movement is at present on foot here to have own lighted by electricity. Various experts have been con- l, and there seems to be a general consensus of opinion that wer obtainable from the local river would be insufficient in er. Under the circumstances, it will probably be necessary to install an engine of about 20 H.P., and this will cost approximately £400.

Pontefract.—The Electrical Distribution of Yorkshire, Ltd., has decided to withdraw its application for a prov. order for the borough.

Queensbury.—The U.D.C. has appointed a deputation to discuss with the Bradford City electrical engineer the terms for a supply of electricity for the district.

Redditch.—The U.D.C. has decided that application be made to the L.G.B. for sanction to borrow a further £341 for electric lighting purposes, in addition to the sum of £5,850 already applied for, making a total of £6,191, for extensions in connection with the undertaking.

Sheffield.—The general manager of the electricity department is to submit a list of thoroughfares which he is prepared to light experimentally with electricity.

South Africa.—The electric light plant of the Greytown Local Board is being removed to a more suitable site near the railway station, where siding accommodation will be arranged for the delivery of coals. A 360-ampere-hour Tudor battery with booster is being added which will make the supply of current available through the 24 hours.

Stockport.—The T.C. has fixed a special rate for current for arcs for photographic purposes. Subject to the payment of a meter rent of 5s. per quarter, current will be supplied at a flat rate of ¼d. per unit, except during November, December, January and February, when the charge will be 3½d. per unit for current consumed between 4 p.m. and 10 p.m.

Stoke-on-Trent.—The T.C. has decided to give a trial with electric cookers for hiring out, and some of these are to be obtained at a cost of not exceeding £50.

Stroud.—A complete electric plant for power and lighting is being installed by Messrs. Apperly, Curtis & Co., Ltd., at Dudbridge Mills.

Taunton.—The Council has just obtained a 200-K.V.A. alternator from Messrs. Crompton & Co. Arrangements are being made with the Great Western Railway Co. for a supply of current to be used for track signalling. This is the first introduction of electric supply in the extensive stations and yards at Taunton.

Teignmouth.—Dr. J. A. Purves, of Exeter, has informed the U.D.C. that as the Council does not see its way to agree to his proposals, he does not feel disposed to prosecute his application for a prov. order for electric light.

Tonbridge.—The U.D.C. has adopted a bonus scheme for the employés at the electricity works by which a sum equal to 10 per cent. of the net profit each year will be distributed, the bonus not to exceed three weeks' pay.

Topsham (Exeter).—Damage to the extent of £2,000 which is covered by insurance, was done on Sunday night by fire to the Topsham electricity works, which, with the exception of the accumulator room, were destroyed. It is thought that the outbreak was occasioned by the ignition of the roof of the building by a spark. As a result of the destruction of the works, the town was in darkness.

Torquay.—At the last meeting of the Torquay T.C., a recommendation of the Electricity Committee was approved to the effect that it should be allowed to incur a cost not exceeding £75 in preparing plans for the erection of a new generating station, it being understood that such authority should not carry with it the approval of the Council to the erection thereof. Mr. Langdon, chairman of the Committee, said that they could not go beyond 18 months or two years under the present conditions, and it was absolutely necessary that the matter should be taken seriously in hand.

Tottenham.—At the last meeting of the Education Committee it was decided to wire one of the new schools for electric lighting in the event of favourable terms being received from the North Metropolitan Electric Light Co.

Tunbridge Wells.—The T.C. has decided not to support in any way the I.M.E.A. Bill to give local authorities power to wire consumers' premises, and to supply fittings, &c. The Lighting Committee recommended the Council not to support the proposal.

Turton.—A L.G.B. inquiry was held on December 6th into the application of the U.D.C. for a loan of £4,500 for electricity purposes. There was no opposition. The Council purchases its current from the Lancashire Electric Power Co., and it is intended to light Bradshaw Road, where there is no gas supply, by means of overhead wires.

Wakefield.—The city electrical engineer having prepared a scheme for the supply of electricity to the Sandal and Belle Vue districts, a sub-committee has been deputed to confer with the Street Lighting Committee as to the public lighting of Sandal.

Wardle (near Rochdale).—The U.D.C. is in correspondence with the B. of T. with respect to the supply of electricity within the district.

West Ham.—The Electric Lighting and Tramways Committee reports that in May last the Council decided to apply for a loan of £52,000 for extensions to plant, &c., at the generating

station. Since then, however, the demand on the generating station has considerably increased, and as a result, after having given careful consideration to reports supplied by the electrical engineer, it is of opinion that in lieu of £59,000, £87,825 should be borrowed, made up as follows: River service pipe and strainer, £9,950; buildings, £19,000; engine room plant, £14,520; boiler house plant, £28,240; coal plant, £7,400; contingencies, £1,640; general mains, £6,000, &c.

Westhampnett.—A prov. order for E.L. in the area of the R.D.C. is being applied for by the Bognor Gas Co.

Wimbledon.—The Electric Lighting Committee has appointed a sub-committee to consider the desirability of the Council entering into an arrangement with the Fixed Price Light Co., Ltd., for the supply of energy to private houses for lighting purposes at a fixed price per annum. A specification is to be prepared by Mr. Jas. Swinburne and the superintendent of the Fire Brigade for the installation of a new fire alarm system in the borough, and a copy is to be forwarded to Siemens Bros. and Co., Ltd., and the Gamewell Fire Alarm and Police Telegraphs, inviting them to submit revised tenders in accordance therewith. A charge of 2¾d. per unit is to be made for energy supplied to existing consumers for the purpose of Christmas decorations, provided their premises are wholly lighted by current supplied by the Corporation.

TRAMWAY and RAILWAY NOTES.

Australia.—According to the *Standard*, it is understood that Mr. Merz, who has been engaged by the Victorian Government in connection with the scheme for the electrification of the suburban railway lines, will shortly call for tenders for the carrying out of the proposals. A railway official, who has had much experience in connection with the Victorian railways, will proceed to London at an early date to assist in the formulation of the scheme.

Birmingham.—A meeting of the ratepayers of the city, convened under the Consolidation Act, has approved of the proposed Corporation Tramway Bill.

Continental.—Austria.—It is reported that an American syndicate is in negotiation with the Austrian and Hungarian Governments with reference to the construction of an electric railway between Vienna and Budapest.

Portugal.—A serious and unusual tramway accident occurred at Oporto on Sunday last, when two tramway-cars, after being derailed, ran down a steep hill into the river. Fourteen bodies were subsequently recovered, but many more are feared to have perished in the river. The injured number 37. Feeling against the tramway company is reported to be very high.

Germany.—The Bavarian Traffic Ministry has placed the order for the whole of the transmission equipment of the Garmisch-Partenkirch-Landesgrenze electric main line now building, with the Bergmann Co. The working pressure for this railway will be 15,000 volts, and in the transmission pressure 50,000 volts.—*E.T.Z.*

It is proposed to convert the suburban light railways in the vicinity of Darmstadt to electric traction, and to extend the network of electric tramways under a scheme of co-operation between private enterprise and the Municipal Council. For this purpose the city authorities and the South German Railway Co. intend to form a new company with a share capital of £200,000 and bond capital of £250,000, and 50 per cent. of the share capital will be issued to the city, 1 per cent. to the provincial authorities and 49 per cent. to the company. Five representatives of the city will be on the board of directors, five of the present company and one for the province, and the period of the concession is to be 30 years.

Sweden.—The Swedish railway authorities have now taken the first decisive step toward the future, involving the electrifying of all the Swedish railways. The electrification of two different suburban lines between Stockholm-Märsta and Gothenburg-Alingsaas has now been decided on. The total capital expenditure for both lines is estimated at nearly £200,000, and the Government has been asked to put forward a proposition to the Riksdag next year for the granting of the necessary money. According to the estimate, £100,000 will be wanted for transmission cables and transformer stations, while £88,000 is required for the purchase of rolling stock and materials. As, however, the present rolling stock can be utilised elsewhere, the expenditure will be of a nominal character.

Halesowen.—At the meeting of the R.D.C. on Wednesday last week, the clerk submitted lengthy correspondence with respect to the Halesowen Light Railways Extension Order, 1911, as provisionally settled by the Commissioners. It included a letter from the Commissioners to Mr. Kennedy of November 8th, drawing attention to the limitation of purchasing powers of the Halesowen District Council under the Draft Order with regard to the line in Quainton, and refusing to alter the provision in the Order that the railways may be commenced within 12 months from the date. A further letter has since been received from the Railway Commissioners, stating that the amendments made to the Draft Order as regarded the purchase of the original railway were purely consequential on the change of boundary of the Halesowen Council since the Transfer Order of 1909 was made by the Commissioners, and that such amendments would not seem to affect the District Council prejudicially, having regard to the present boundary of the district. It was also stated that representations might be made to the Commissioners. It was decided to instruct the clerk to write to the Commissioners, and to strongly press them to reinstate the Council in the Halesowen Order to the same position that it held with regard to purchase under the Transfer Order of 1909.

Leeds.—Since the settlement of the Leeds tramway strike in July last, when, with the assistance of Sir George Askwith, of the B. of T., an agreement was drawn up and assented to by the Corporation and the tramwaymen, there has been growing dissatisfaction among the men, who allege that the terms of the agreement have been contravened by the Corporation in certain particulars. They complain that the average hours per week are below 54, that no payment is allowed for meal times on duties under hours, that the "spread over" duties have increased in number and that the previous notice of the shed staffs and day labourers has not in all cases been considered as a qualification for increased pay. Protracted negotiations have failed to effect a settlement of the men's alleged grievances, and it was resolved that an appeal should be made to Sir George Askwith to act as arbitrator on the points in dispute, in accordance with the July agreement. On Friday last a Leeds deputation met Sir George Askwith at the Chief Commissioner's Rooms in Whitehall, and placed its views before him. The Corporation were represented by Alderman Brown, Alderman Tetley and Alderman Kinder, and Mr. J. B. Hamilton (tramways manager), and the men's case was presented by Alderman G. T. Jackson (Amalgamated Association of Tramway and Vehicle Workers), Mr. G. H. Pearson (Secretary of the Leeds branch) and two employés. The conference lasted some time, and all the points having been fully discussed, it was arranged that Mr. Hamilton should meet Mr. Pearson in Leeds on Monday and discuss the accuracy of certain figures regarding wages which were presented by Mr Pearson. The result of those deliberations will be communicated to Sir Geo. Askwith, who will give his decision in due course.

London.—Hammersmith.—A letter has been received from the solicitor of the L.C.C. stating, in connection with the arbitration proceedings for the sale of the London United Tramways Company's undertaking within the County of London to the County Council, that the £1,000 deposited by the company with the B.C., as security for the completion and maintenance of the tramways, had been included in the claim, and asking whether, as the tramways were now about to pass to the L.C.C., the B.C. would agree to repay to the company the sum in question, as if that is repayed the company would withdraw the amount from the claim. The Law and Parliamentary Committee has decided to inform the solicitor of the L.C.C. that, notwithstanding the change of ownership, it does not see its way to agree to the proposal.

The recent report of the London Traffic Branch of the B. of T. refers to the proposals of the G.P.O. Committee as to the carriage of mails in London by electric railway. A 7½-ft. deep-level tube containing two 2-ft. gauge tracks, and running in the first instance 6½ miles—between Whitechapel, the G.P.O., and Paddington—is proposed, which would accommodate motor wagons capable of a maximum speed of some 35 miles an hour. The cost is estimated at about half a million, and considerable extensions linking up the chief offices in the north, north-west, west, and south-west, and principal railway termini, are suggested if the first section of the scheme proves satisfactory.

Middlesex.—The Light Railways and Tramways Committee of the County Council has decided to support the Metropolitan Electric Tramways, Ltd., in the promotion of a Bill in the ensuing session of Parliament for the purpose of obtaining power for the construction of an independent line of tramways from Finsbury Park terminus to the Manor House, subject to the County Council having the option of taking over the powers of the company in connection with the construction of the line. The local authorities affected are to be asked to support the scheme.

Morecambe.—On the Heysham tramways, which are worked by the Morecambe Tramways Co., petrol-driven motor tram cars, supplied by the Leyland Motors, Ltd., Preston, are being substituted for horse traction.

Newcastle-upon-Tyne.—The Corporation has decided, on the recommendation of the Tramways Committee, to purchase four motor-omnibuses for use in the city and between the city and North Walbottle.

New Zealand.—The Nelson B.C. has appointed a special committee to prepare, with the city engineer, a report on the question of tramways for the borough. The Palmerston North B.C. has decided to obtain a report from Mr. F. Black, electric engineer, Wellington, as to the installation at Palmerston of a Edison battery or overhead trolley tramway.

Oldham.—At the meeting of the T.C. last week Alderman Wild asked whether tramway rails to be put down in West Street came from Germany or America, or whether they were made in England?—Councillor Dunderley said he had examined some of the rails, and found they had been made in Germany.—Councillor Middleton, chairman of the Tramways Committee, replied that the specifications issued to the contract provided that the rails should be of British manufacture. He gave the order to an English firm on the understanding that the rails would be made in England. The firm appeared to be agent for a German firm, and as soon as the contractor found out that the rails had been made in Germany, he told the borough survey

in a straightforward manner what had taken place.—At a further special meeting the matter was again discussed, and eventually the contractor agreed to sacrifice any extra profit he might obtain in view of being allowed to go on with the work, which it was agreed should proceed.

Paisley.—Considerable damage has recently been done to cars of the District Tramway Co., and Mr. Coutts, the general manager, intimates that the service on a certain route during workers' meal hours may have to be withdrawn. Last week a double-decked car was so smashed in the upper deck that it will cost £20 to £30 to repair it.

Rotherham.—At a meeting of the T.C. a lengthy discussion took place on the proposal of the Tramways Committee to extend the Dalton tramway to the proposed terminus at Thrybergh. Councillor Thompson moved that the resolution accepted by the Council in October be rescinded, urging that they ought to investigate the circumstances before they committed themselves to an expenditure of £10,000. The motion was seconded and supported, one member expressing the view that the matter should be deferred until it was seen how far railless cars might be successful. The Tramways Committee's proposal to construct the tramway was confirmed by a large majority.

South Africa.—The Bloemfontein Town Council has, with three dissentients, adopted the recommendation of the city engineer for the railless trolley system, and has referred the matter to the Finance Committee to make arrangements for the necessary loan.

The Johannesburg tramway receipts for the past four months amount to £107,246, being an increase of £10,950 on the corresponding period of last year; while the passengers carried totalled 9,350,000, which is an increase of over 1½ millions on the corresponding period.

Stockport.—The T.C. has unanimously decided to promote a Bill authorising it to run railless cars from Mersey Square to Marple. The estimated cost of the scheme is £12,000.

Wigan.—Mr. Jas. Slevin, tramways engineer and manager, states that since the installation of car meters, at a cost of £250, there has been a saving in energy consumption of 10·86 per cent.

Wolverhampton.—The Corporation Tramways Committee has decided to fit up six tramcars with top-deck covers at an estimated cost of £600, which amount is to be met out of the tramways reserve fund.

The T.C. has received from the L.G.B. sanction to a loan of £10,400 for electricity purposes.

TELEGRAPH and TELEPHONE NOTES.

All-Night Shopping by Telephone.—A number of large firms in London have made arrangements for receiving orders for goods by telephone at all hours of the night, the articles required being dispatched by the first delivery in the morning.

Australia.—The Government proposes to spend in 1911-12 on the wireless telegraph stations at Pennant Hills and Fremantle, £16,800, and on telegraphs and telephones, £1,300,000.

On Friday last the Postmaster-General, referring to the protracted dispute that had taken place between the parties concerned in wireless telegraph systems, announced that the Government had decided to erect immediately wireless stations round Australia, adopting a system invented by the Government wireless expert.

Austria.—The Austrian Ministry of Finance has given approval to an appropriation of £833,000 for the extension of the telephone system.

Cheap Telegrams.—In answer to a question in Parliament, the Postmaster-General stated that the rate for non-urgent plain-language telegrams to Australia, to be introduced on and from January 1st next, would be 1s. 6d. a word. These telegrams would be accepted on condition that they might, if necessary, be delayed for 24 hours.

Hythe.—The T.C. has agreed to a suggestion made by the National Telephone Co., that the action brought by the company against the Council shall be stayed on the condition that each party pays its own costs.

Monument of the Telegraphic Union.—The *Journal Télégraphique* of November 25th reproduces an illustration of the design adopted for the international memorial of the foundation of the Telegraphic Union, with the detailed description furnished by the artist, Giuseppe Romagnoli.

Overhead Wires.—A deputation representing 16 Metropolitan Borough Councils was received by the Postmaster-General recently, in connection with the erection of overhead wires for telephone service. In his reply, Mr. Samuel pointed out that the action of the Post Office in treating telephone wires as telegraph wires was undoubtedly legal, and in case of dispute, the decision had been almost invariably in favour of the Post Office. At present the mileage of the Post Office wires in the metropolitan area was 1,090, of which 671 miles were underground, 330 miles overhead on private property, and only 50 miles overhead along the roads. The cost of underground wires was five to ten times as much as that of overhead wires, and if the former were adopted, the charges to subscribers must be increased. If they wanted cheap telephones, they must not insist on underground wires. After the transfer of the National Telephone Co.'s system, large numbers of overhead lines would be placed underground. Negotiations were in progress with the Association of District Councils of Middlesex, which, he hoped, would lead to an agreement by which wayleaves would be granted quickly and the question whether overhead or underground wires should be adopted would be settled by definite rules. He suggested that steps should be taken to draw up a similar agreement for the Metropolitan Borough Councils' areas.

Russia.—The State has just secured the right of acquiring the city telephone system in St. Petersburg. A committee, composed of representatives of the Ministries of Finance and Home Affairs and of the St. Petersburg Municipal Council, will settle the terms of purchase. It is said that the Administration of Posts and Telegraphs will in the near future approach the problem of the nationalisation of municipal and private telephone systems, and it is concluded from this circumstance that the intention to entrust certain interurban telephone schemes to private companies has been abandoned.

A Bill has been presented to the Duma by the Russian Minister for Home Affairs providing a credit of about £950,000 to be applied in the construction of new telegraph lines, and for the connection of existing systems.—*Board of Trade Journal.*

Telegraphists' Cramp.—A Departmental Committee which has considered the problem of "telegraphists' cramp" has issued its report. The trouble is not attributed to any single cause, and there is no royal road to a remedy. The suggestions include careful selection of workers, with particular attention to candidates who show signs suggesting permanent nervous weakness, to stiff wrists, heavy, clumsy hands, and inability to write easily. Ambidexterity, it is also recommended, should be encouraged; young telegraphists should not be employed at first on heavy and difficult circuits, nor should the seniors be kept exclusively on the heavier Morse instrument. Periodical relief from the Morse instrument is suggested, and the Committee discusses the newer inventions which are replacing the Morse apparatus; the latter, however, hold the field for the time being. Importance is attached to the use of seats of suitable height.

Telegraphists' Grievances.—As the result of agitation on the part of the Postal Telegraph clerks, the Postmaster-General has agreed to appoint a committee of inquiry in 1913.

The Telephone Transfer.—The Postmaster-General has brought in a Bill to amend the Telephone Transfer Act, 1911, so as to authorise the Government to make a payment to the National Telephone Co. of a sum on account of the telephone purchase money before the total sum payable is finally ascertained. On Wednesday it passed through Committee without amendment.

A Telephonic Farce.—This title is not, as might be supposed, an allusion to our telephonic service in this country, but to a one-act farce entitled "Tuppence, please," which is being produced at the Royalty Theatre, London, as a curtain-raiser. It is a satire on the call-box telephone service provided at a large London hotel, and of course embodies all the customary annoyances with which we are all familiar, as well as a number of additional sources of irritation. It appears to be quite amusing.

Wireless Telegraphy.—In order to maintain communication with the Mawson expedition to the Antarctic regions, arrangements are being made for the erection of an intermediate wireless station on Macquarie Island, 600 miles south of Hobart.

A Commission appointed by the Joint Wireless Board at Iloilo, in the Philippines, has recommended the erection of an extended system of wireless telegraphy in the islands. It is proposed to set up 13 chief stations, beginning with the Batan Island in the north and reaching to Jole in the south. The erection of 14 intervening stations is also proposed. The cost of the undertaking is estimated at $300,000.—*Elek. & Maschinenbau.*

The new Marconi station at Teneriffe was opened the day after the new stations at Cadiz, Barcelona, and Las Palmas.

A wireless station has been erected on the roof of the Ministry of War at Vienna. The structures supporting the antennæ are two lattice-work towers each 65 metres high.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—N.S.W. Government Railways.—January 8th, 1912.—Four 1,000-kw. rotary converter units. January 22nd, 1912.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economieers and mechanical stokers. January 29th, 1912.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

January 9th, 1912.—Accumulators, booster, switchboard and accessories, for the Subiaco Council. Town Clerk's office. Deposit of £100.

Croydon.—December 22nd. The B.C. invites tenders for 2,000-volt and 5,000-volt switchboards, and erection of the same complete (estimate £4,000). See "Official Notices" December 1st.

Dartford.—January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" to-day.

France.—January 5th, 1912. The French Post and Telegraph authorities in Paris are inviting tenders for a multiple telephone board for the Central Telephone Exchange.

Grimsby.—December 18th. Fine slack coal for the T.C. electricity works, for a year. W. A. Vignoles, electrical engineer.

Hornsey.—January 11th. One steam dynamo set (either reciprocating or turbine), for the T.C. See "Official Notices" December 8th.

London.—L.C.C.—The Main Drainage Committee is inviting tenders from six selected firms for the installation of electric light in the new engine-house at the Abbey Mills pumping station. The Highways Committee contemplates an expenditure of £4,000 on the renewal of the electrical installation in Blackwall Tunnel in 1912-13.

HAMMERSMITH.—It is recommended that the Council invite tenders for the supply of flame arc lamps in quantities of not less than 50 in one year, in connection with the proposed hiring-out scheme.

New Zealand.—March 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Sheffield.—December 21st. Two sets of 25-KW. high-speed direct-coupled vertical engines and alternators, for the City Council. See "Official Notices" December 8th.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

BANGKOK.—March 15th, 1912. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 KW. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

Swansea.—January 6th. Water-tube boilers, superheaters and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" to-day.

CLOSED.

Bexley Heath.—The U.D.C. has ordered for its car-sheds "Bennis" stokers and self-cleaning compressed-air furnaces from Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton.

Bury.—The following tenders for supply of electrical plant have been accepted by the Corporation :—

Phœnix Dynamo Manfg. Co., Ltd.—Two battery boosters combined with a motor.
A. Reyrolle & Co., Ltd.—Switchgear.
W. T. Glover & Co., Ltd.—High-tension trunk mains.
British Westinghouse Electric and Manfg. Co., Ltd.—Two 750-KW. rotating transformers.

Dewsbury.—The Electricity and Tramways Committee has decided to order a spare armature for the steam turbine at the electricity works from the British Westinghouse Co., Ltd., at the price of £285.

Rotherham.—The T.C. has accepted the following tenders :—

Steel, Peech & Tozer.—Tramway rails.
Hadfields.—Crossings and points.
Bayliss, Jones & Bayliss.—Telpers.

Sheffield.—The City Council has accepted the tender of Hulley's Industrial Motors, Ltd., at £730, for the supply of a four-cylinder 40-H.P. motor tower-wagon for the tramways department.

London.—POPLAR.—The B.C. has received the following tenders for the supply of three motor-driven centrifugal circulating water pumps with a capacity of 4,800 gallons per minute, required in connection with the extensions at the generating station :—

Gwynnes, Ltd.	£1,620
Rees Roturbo Co.	1,655
Worthington Pump Co.	2,002

The calculated maximum head submitted is 35 ft., 39 ft. and 48 ft. respectively, and the B.H.P. of the motors is 67, 90 and 110, with a maximum efficiency of 76, 80 and 81 per cent., and a minimum efficiency of 60½, 75 and 70 per cent. respectively. After considering the tenders, the Electricity Committee decided to accept that submitted by the Rees Roturbo Co., Ltd., for three 16-in. Roturbo pumps with 16-in. suction and delivery valves and pipes.

HAMMERSMITH.—The Electricity Committee received the following tenders for cables :—

Standard Cable Manufacturing Co., Ltd.	(recommended)	£277
General Electric Co., Ltd.		292
Connolly Bros., Ltd.		315
Union Cable Co., Ltd.		316
Western Electric Co., Ltd.		322
Electrical Engineering and Agency Co., Ltd.		328
Aubert, Grenier & Co.		328
Siemens Bros. & Co., Ltd.		347
Callender's Cable and Construction Co., Ltd.		348
British Insulated and Helsby Cables, Ltd.		348
Johnson & Phillips, Ltd.		348
W. T. Henley's Telegraph Works Co., Ltd.		352
Reginald Todd		354
Pirelli, Ltd.		360
W. T. Glover & Co., Ltd.		363
Craigpark Electric Cable Co., Ltd.		370
Drake & Gorham, Ltd.		393

The tenders for steel and ironwork, required in the construction of the platform around the new turbo-alternator, were as follows, the erection to be carried out by the department :—

Aston & Co.	(recommended)	£144
Cadogan Ironworks Co.		144
J. Wilson & Co.		159
Measures Bros., Ltd.		160
Dorman, Long & Co.		174
Young & Co.		196

L.C.C.—The Stores and Contracts Committee has recommended tenders from the following firms for stores for the year 1912 :—

Electric insulating materials.—L. Andrew & Co.
Electric cables and wires.—Hooper's Telegraph and India-Rubber Works, Ltd.; Yorkshire Cable Co., Ltd.
Electric lamps.—A.E.G. Electric Co. (foreign); Brimsdown Lamp Works, Ltd. (British); Brush Electrical Engineering Co., Ltd. (foreign); General Electric Co., Ltd. (British).

In its reference to the lamp tenders the Committee made the following observations :—"As regards electric lamps, we considered it desirable to obtain alternative tenders for lamps of British or foreign make. In the case of the carbon-filament lamps, we recommend acceptance of a tender for foreign-made lamps, the result of recent tests of the lamps offered having proved satisfactory. The prices are about 21 per cent. less than those quoted in the lowest tender for British-made lamps, and about 20 per cent. below the prices at present paid under contract for British lamps. In the case of the metal-filament lamps, we advise the acceptance of lamps of British make, passing over tenders for foreign lamps not of equal efficiency. As regards traction lamps, experiments are being conducted, and we consider it desirable, therefore, to accept a tender for only one-half of the estimated quality. For this a tender for foreign-made lamps is recommended, the lowest tender for British lamps being 20 per cent. higher."

South Africa.—POTCHEFSTROOM.—Our Durban correspondent writes:—"In one of your contemporaries dated October 13th, 1911, it is reported that the Potchefstroom Town Council has accepted the tenders of Messrs. Reunert & Lenz and Hubert Davies and Co. for supplying and erecting plant for the Council's electricity works, the total of the two tenders being £12,487. The lowest tender (by Messrs. Siemens) for the whole of the work is reported to have been £12,243. This report is incorrect, as the whole of the order has been placed with Messrs. Siemens, and the work is being proceeded with at present in the shops of Messrs. Siemens Bros. Dynamo Works, Ltd., and Messrs. Siemens Bros. & Co. The order includes two generating sets with booster, battery and switch plant for the power station, and an extended overhead distributing system at twice 240 volts D.C. The plant is expected to be ready for putting into service in March 1912."

Stretford.—The U.D.C. has accepted the tender of the Union Cable Co., Ltd., at £2,407, for the supply of '8 traction cable, pillars and link-boxes.

West Ham.—The tender of Mr. J. T. Halsey has been accepted by the Education Committee, at £499 18s. 6d., for the installation of electric light at the Gainsborough Road School. The tender of Messrs. Cammell, Laird & Co., Ltd. has been accepted by the T.C. for a supply of tramcar steel tires, at £1 6s. 9d. per tire, less 2½ per cent.

Wimbledon.—The tender of the Western Electric Co., Ltd., has been accepted by the T.C., at £67, for 1,200 yards of telephone cable with telephones, bells, &c.

Worksop.—The U.D.C. has placed with Messrs. E. Bennis and Co., Ltd., a contract for stokers and self-cleaning compressed-air furnaces for the electricity works.

BRAZIL: ITS PRESENT CONDITIONS AND THE POSSIBILITIES FOR FUTURE COMMERCIAL RELATIONS WITH GREAT BRITAIN.

By C. E. BEST and H. L. PARROTT.

(*Continued from page* 883.)

The Rio de Janeiro Tramway, Light and Power Co.—We will now proceed to give our readers a brief description of the undertaking of this important Canadian company, which was established in 1904 in the capital.

The company was incorporated in Toronto, under the laws of Canada, in June, 1904, to acquire and operate valuable concessions and privileges granted by the Governments of the Brazilian Republic and of the State of Rio de Janeiro, and by the Council of the City of Rio de Janeiro, to carry on an electrical business in the Federal District and in the City and State of Rio de Janeiro, and to acquire two great water-powers, construct and install the necessary hydraulic electric plants, to generate and supply electric current for purposes of traction, light and power.

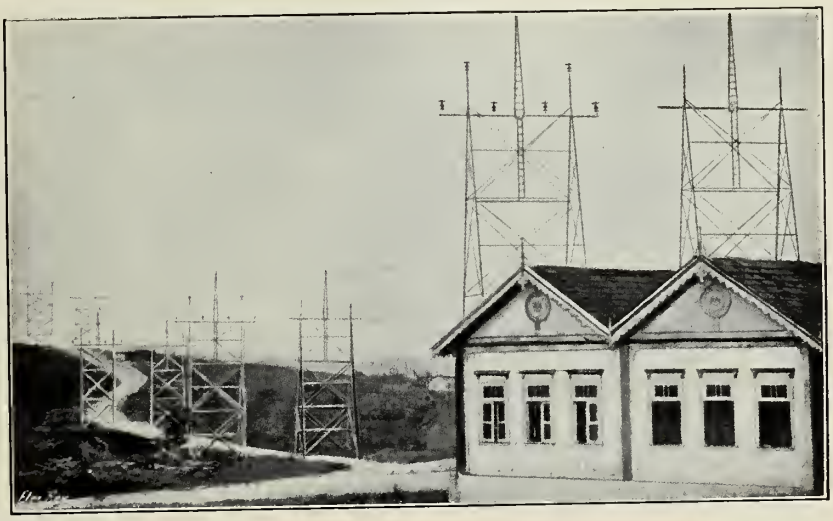


Fig. 1.—View of Transmission Line between Rio das Lages and Rio de Janeiro, showing Style of Towers.

Each line carries two 3-phase circuits. The porcelain insulators measure 17″ diameter across the top and are tested to 120,000 volts.

The water-powers are situated:—(1) On the Rio das Lages, 56 miles from Rio de Janeiro; (2) at Sapucaia on the Rio Parahyba, about 100 miles from Rio de Janeiro.

After a careful examination, it was decided to develop the former water-power first, and hold the latter in reserve, as it was believed that the Rio das Lages was only capable of developing 40,000 H.P., whilst the Sapucaia power can easily develop 100,000 H.P. in the driest season.

When the construction was commenced, the clearing of the banks of the Rio das Lages disclosed that the reservoir formed by the dam which the company built had a much larger capacity than was anticipated, and consequently a much greater power can be developed. By another concession

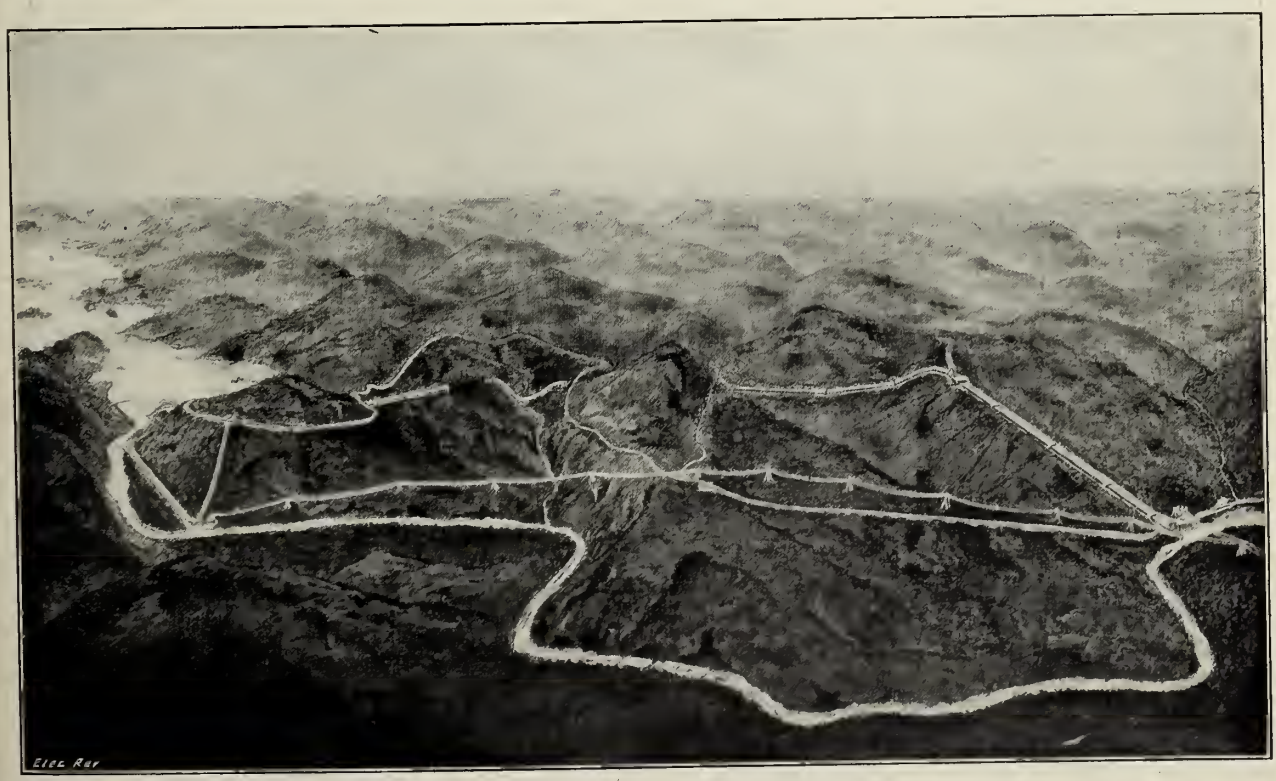


Fig. 2.—Panorama, Rio das Lages, showing Pipe Lines and Electric Transmission Lines.

obtained from the State of Rio de Janeiro, the company acquired the right, if and when desired, to tap the neighbouring watershed of the Rio Pirahy, which ensures sufficient water to develop a total of 120,000 H.P. at Rio das Lages in the driest season.

The company is the absolute owner of the banks of the Rio das Lages, from a point some distance below the power house, and extending up stream to the highest points to which the water is backed by the dam, a total distance along the river of some 22 miles. The authority to use the hydraulic force of the river is derived, not only from the common law right, as owners of the river margins, but also from a concession of the Government of the State of Rio de Janeiro, the competent authority. This concession is perpetual, and in the form of a contract, and cannot be revoked, and no additional onus or obligation can be imposed on the company.

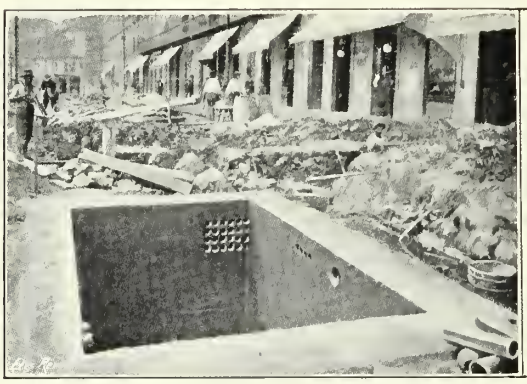


FIG. 3.—6,600-VOLT TRANSFORMER-VAULT CONNECTING UNDERGROUND CONDUITS.
These vaults are located 1,200 ft. apart, with ordinary manholes, spaced about 400 ft. apart between them.

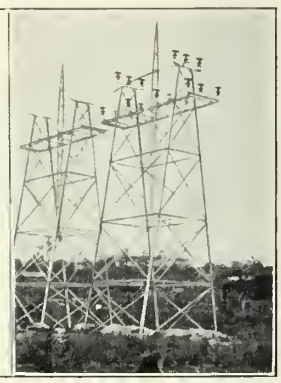


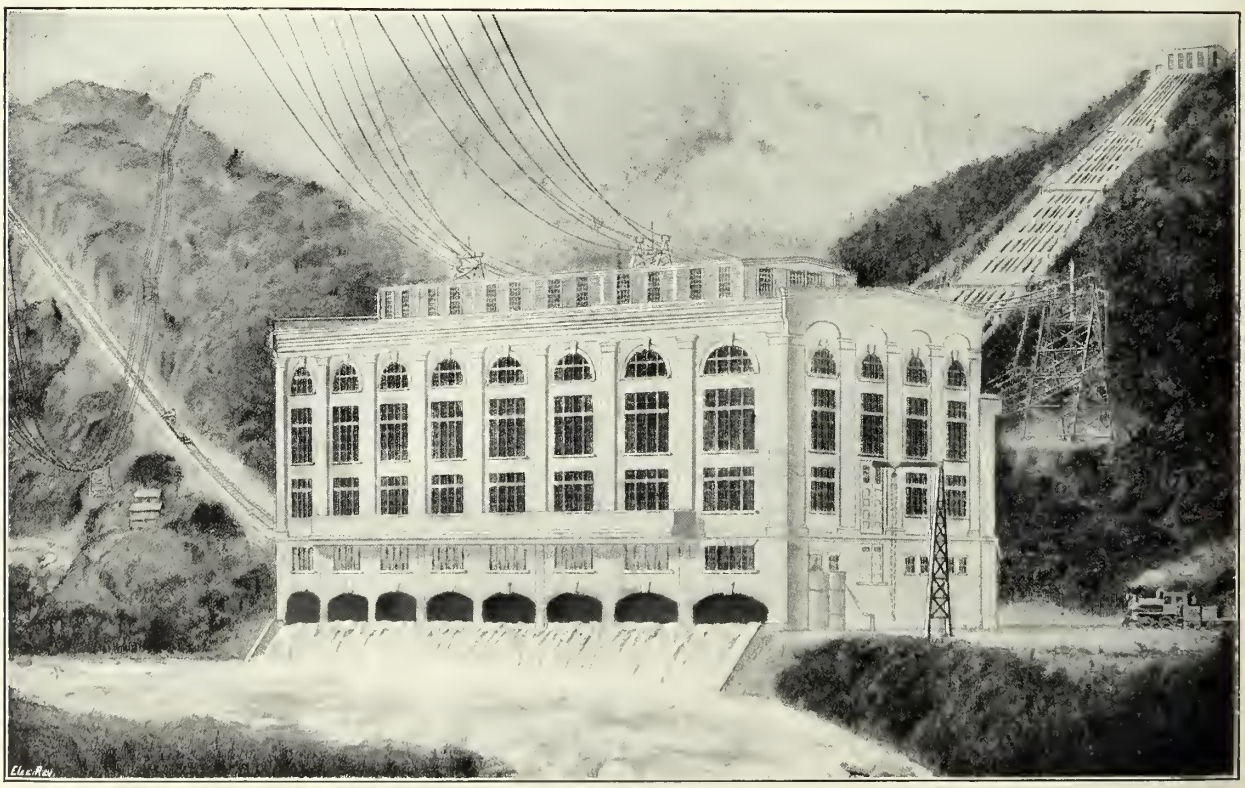
FIG. 4.—SPECIAL ANGLE TOWER ON TRANSMISSION LINE NEAR CASCADURA. These towers are erected wherever the line is diverted from a straight line more than 5 degrees.

In the Hydro-Electric Concession all State and municipal taxes in the State of Rio de Janeiro are fixed in one annual contribution for a period of 50 years; power is given to supply electricity throughout the State, and to all the cities and towns thereof, and it is clearly understood that if any new favour in the future be given by the Legislature to any hydro-electric enterprise, the same shall be extended to this company. Thus the obligations of the company in regard to construction, operation and maintenance of the works, are reasonable and free from vexatious restrictions. The company also owns all the necessary marginal land for a future development at Sapucaia, and the concession above referred to also extends to this enterprise.

The company also acquired from the Federal Government and the Municipal Council concessions giving the exclusive right to furnish electrical energy, generated by hydraulic installation, within the city and Federal district, and the right to construct and maintain an overhead and underground system of canalisation for distributing the electric energy for power and lighting, subject only to certain rights of the gas company, to which we refer later. After June, 1915, this concession continues, but without any exclusive right, until 1950, but the ownership of the extensive system of underground canalisation occupying all the principal streets practically insures the company against unreasonable competition.

By the terms of the Federal State and municipal concessions, the company enjoys the right of expropriation of the lands necessary for their enterprise. The company was also conceded the right of exemption from duty on all material imported for construction purposes.

In March, 1907, it was deemed advantageous to immediately construct a preliminary hydro-electric plant at Rio das Lages. The main upper fall of the river was used for this purpose, and a temporary power house of wooden frame and corrugated iron was built. This plant had a capacity of 3,400 H.P., and was utilised for furnishing all the light-



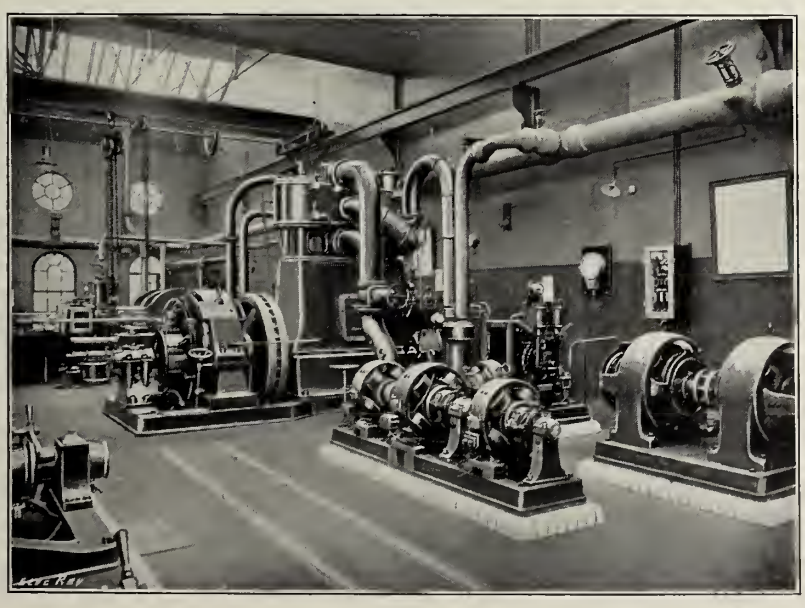
RIO DAS LAGES POWER HOUSE. VIEW SHOWING PENSTOCKS, RAILROADS, AND TRANSMISSION LINES.

ing and power required for the construction work at Rio das Lages, as well as supplying light and power in Rio de Janeiro over the permanent transmission lines which were then already completed. Meanwhile, the main installation at Rio das Lages was being rapidly constructed. A concrete and masonry dam is built at the top of the falls, 115 ft. in height and 92 ft. in thickness at the base. This structure stands on a solid granite foundation, both at base and sides, and closes up the valley above, in which is impounded sufficient water to guarantee under the present development a maximum load of at least 50,000 H.P.

The total area of the lake above the dam is about 7¼ square miles. The water passes through controlling gates and riveted steel pipes 6,000 ft. in length from the reservoir to the distribution receivers immediately above the power house. From the receivers are led out six 36-in. pipes about 1,900 ft. in length, each to its own turbine. These pipes are laid on a steep grade, the receivers being located about 900 ft. above the power station. The total head with the reservoir full is about 1,030 ft. from the spillway level on the dam, the nozzles of the turbines representing a pressure of 445 lb. to the sq. in. At the power house are installed six main wheels, each developing about 9,000-H.P. maximum capacity, to which are connected generators of the stationary armature and revolving field three-phase type, designed to operate at 50 cycles, with a normal voltage of 6,000 and a maximum pressure of 6,600 volts. The voltage of current from the generators will be stepped up to 80,000 volts, with a maximum overload potential of 88,000 volts, for transmission to Rio de Janeiro over the four transmission circuits.

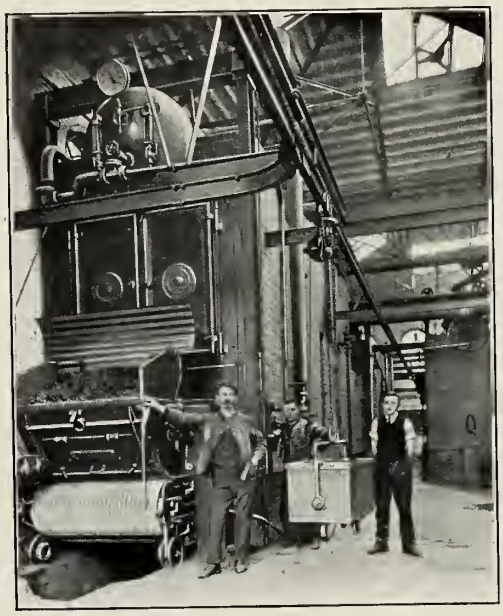
There are two separate lines of transmission to the city, each with two separate circuits, located on the private rights-of-way of the company, acquired by purchase. The company has constructed some 220 miles of underground canalisation under the streets of the city, has built 69 large transformer and distribution chambers under the pavements, and has already installed some 1,300,000 ft. of cable. We are pleased to say that the company's lighting system is believed to be one of the most perfect in the world, this probably being the first occasion on which an entirely modern electric lighting system has been installed throughout a large city, unhampered by any previous antiquated installation or plant.

The company acquired the control of the following companies :—The Companhia de Sao Christovao (Tramway) ; the Companhia de Carris Urbanos (Tramway) ; the Companhia de Villa Isabel (Tramway) ; the Companhia de Tijuca (Tramway) ; the Companhia de Corcovado (Tramway) ; the Companhia Jardim Botannico (Tramway) ; the Société Anonyme du Gas de Rio Janeiro ; the Brazilianische Elektricitats Gesellschaft (Telephone Co.).



WHITEHAVEN ELECTRICITY WORKS :—BROWETT, LINDLEY-P.D.M. CO. STEAM DYNAMO, BOOSTER-BALANCER AND MOTOR-GENERATOR. (See p. 990.)

Telephone Service.—This service is operated under a concession granted by the Municipality of Rio de Janeiro to Brazilianische Elektricitats Gesellschaft, a German Company, the entire capital stock of which was owned by the Rio de Janeiro Telephone Co. (A Maine, U.S.A., Corporation) with a capital stock of $1,000,000, but which is now owned by the Rio de Janeiro Tramway, Light and Power Co. This company has reconstructed the old telephone service, the greater part of the lines having been rebuilt, and a large amount of new work has been done to meet the growing demands in the suburban districts. The central substations in the Villa Isabel and Jardin Botanico districts have been completed, bringing up the total switchboard capacity to 8,700 lines, which shows a very large increase on the previous years.



WHITEHAVEN : BABCOCK & WILCOX BOILER, WITH CHAIN-GRATE STOKER AND OVERHEAD RUNWAY.

The Gas Service.—This company controls the gas service of Rio de Janeiro through the ownership of the entire capital stock of the Rio de Janeiro Gas Co. (also a Maine corporation), which, in turn, owns over 90 per cent. of the securities of the Société Anonyme du Gaz de Rio de Janeiro, which is a Belgian corporation and the owner of the concession and plant in Rio de Janeiro.

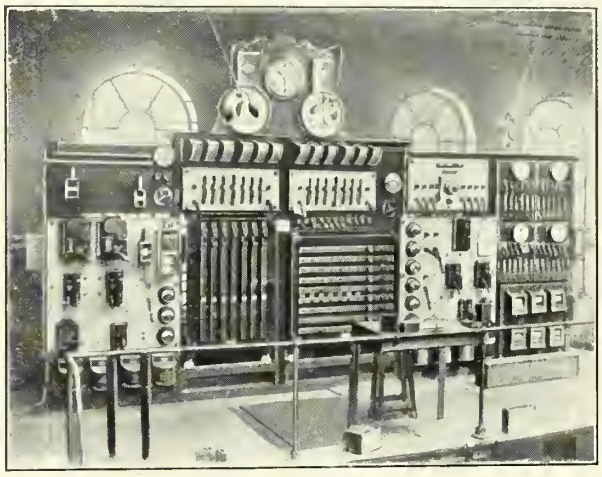
The concession gives the company the exclusive right to supply gas for all purposes until 1945, including the lighting of the streets of the city during this period. The concession also gives the company the right to supply electric energy for public and private lighting, with a monopoly for public lighting until 1945 and for private lighting until 1915, after which the concession for private electric lighting continues without exclusive rights until 1945. Under this concession the company is supplying some 5,200 arc lamps for street lighting.

A new concession was granted the company for gas service : it included a large area of land, comprising about 20 acres, which is very favourably located for the delivery of coal, adjacent to the water front. The new plant which the company has constructed, is of the most modern design, advantage having been taken in its construction to utilise the most advanced practice in gas engineering in every department. Particular attention has been paid to the use of machinery in place of manual labour wherever possible, in order to reduce to a minimum the cost of the latter, which in undertakings of this character, in a tropical country, is necessarily high. The new works have a capacity equal to

twice the present consumption, and can be further extended as the demand requires at a moderate cost, so that the future requirements of the city are fully provided for. The use of gas for fuel purposes is being developed in a systematic manner, and it is expected that the consumption for this purpose will considerably increase within a short time.

Our readers will now have an idea, more or less, of the important undertakings which have been, and are being, carried out in Brazil. We reproduce some illustrations, to give our readers a better idea of the Rio Company's works, and to show some of the difficulties which were encountered.

This will also give our readers an idea of the character of the electrical opportunities that are available in Brazil. We



Whitehaven: Original Main Switchboard.

may venture to state that there are many towns in Brazil without electric tramways and electric lighting, and also without a good telephone service.

(To be continued.)

THE WHITEHAVEN CORPORATION ELECTRICITY WORKS.

The Whitehaven Corporation Electricity Works is amongst the oldest of the municipal electrical undertakings in this country, the public supply of electricity having commenced on September 2nd, 1893, almost exactly two months after the opening of the Manchester electricity works. The first instalment of plant, to the designs of the late Dr. Hopkinson, consisted of six Willans-Crompton 35-kw. d.c. sets, supplying the outers of the three-wire system, at declared pressures of 210 and 105 volts respectively. The balancing was for some time carried out by means of a bank of lamps on the switchboard, and change-over switches on the premises of the large consumers, an arrangement which would hardly commend itself to the engineers of to-day. Whitehaven is said to have been the first town in the United Kingdom to have been electrically lighted throughout, every gas lamp in the town, and on the harbour, to the number of about 400, having been changed over to electric lighting during the summer of 1893.

The mains were supplied by Messrs. Siemens Bros. & Co., the public lighting mains, which are entirely separate from the private mains, consisting of rubber cables laid bare in brick troughs. The supply for this purpose was at 220 volts, two-wire, divided into five districts, and the mains were arranged on the tree system with the lamp-posts or brackets arranged two in series, a third or series wire connecting each pair of posts or brackets ; in the case of an odd post a two-light fitting was used. The lamp voltages varied according to the distance from the works, there being a drop of some 40 volts between the switchboard and the outer ends of the system.

It is interesting to note that this system and pressure are in use at the present moment, and have been found most adaptable for the use of the tungsten-filament lamps working two in series, an interesting testimony to the value of the work done by Dr. Hopkinson nearly 20 years ago.

The three-wire private mains consisted of three single rubber-insulated cables, drawn into earthernware drain pipes, services to consumers being apparently made by breaking into the pipes and making a rough brick-work box, covered by a flagstone and buried.

As might be expected in the light of modern experience, these mains did not have a very long life, and before long it became necessary to relay the whole of them, and to provide further extensions of the plant at the electricity works.

For this purpose two loans were raised, one in 1899 of £9,858 for 20 years for plant extension, and another in 1901 of £9,900 for 10 years, with which the whole of the mains were relaid. The private mains consisted of Callender's bitumen cable in wood troughs filled in with bitumen, and the public mains of Siemens lead-covered rubber-insulated cable drawn into the existing brick troughs. At the same time the works were extended by two Willans-E.C.C. 83-kw. generating sets, and two Babcock & Wilcox double-drum water-tube boilers were installed, whilst the switchboard was enlarged and reconstructed on a wooden framework. It should be noted that no boiler house accessories were provided such as economisers, mechanical stokers, superheaters, or even feed pumps. Saddled with the very heavy capital charges of the above loans, it is hardly to be wondered at that the electricity undertaking was unable to make both ends meet.

In 1909 further loans were raised to provide a surface condensing plant, taking the place of the old ejector condensing plant using town's water, and to provide a new battery with switchboard and battery-charging booster, the old batteries being worn out and there being no satisfactory charging arrangements. In spite of these improvements, it became evident that by reason of the steady increase of the output the supply could not much longer be economically or safely maintained with a number of small engines, six out of eight of which had been in regular use since 1893, and with two water-tube boilers only, with no boiler-house accessories.

After careful and prolonged consideration, the Corporation therefore decided in May, 1910, to proceed with the scheme laid before it by the borough electrical engineer, Mr. B.



New Main Switchboard.

Sankey, and the following plant was installed to his specification, and under his supervision :—

Water-tube boiler, complete with chain-grate stoker and superheater	Babcock & Wilcox, Ltd.
Two superheaters fitted to existing Babcock & Wilcox boilers	„ „
Green economiser	E. Green & Son, per Vulcan Engineering Co., Whitehaven.
Boiler house runway	Vaughan & Sons, Manchester.
Stokers for existing boilers	E. Bennis & Co., Ltd.
Pipework and Weir feed pump	J. F. Stout & Sons, Whitehaven.
New main switchboard	Whipp & Bourne, Castleton.
Motor-generator	Electric Construction Co.
250-kw. generating set	Browett, Lindley & Co., with Phœnix Dynamo Co.'s dynamo.
Balancer	Phœnix Dynamo Co.
Cables	Callender's Cable and Construction Co.

The whole of the building and foundation work, as well he laying of the cable extensions to two new districts, e undertaken by direct labour, a temporary assistant ng employed to prepare detail plans, make plans of the ins, and give general assistance with the new work. The tor-generator was installed to convert the private lighting ssure of 420 volts 3-wire to 220 volts 2-wire for public ıting purposes, the pressure being once more reduced from) volts to 220 volts by the installation of metallic-filament ıps throughout the town. This machine consists of an er-pole motor taking current off the private lighting s-bars at 420 to 440 volts, and coupled through a flexible ıpling to an inter-pole dynamo supplying the public ıting at 220 volts, both machines being fitted with ball ırings. The efficiency of the combination at full load is 8 per cent.

The balancer, as seen in the illustration of the new generat- set on p. 989, is equipped with an automatic regulating r, supplied by Messrs. Bertram Thomas. This arrange- nt has now been in successful use for over 12 months hout giving the slightest trouble, and has made a great provement in the steadiness of the supply pressure, the gineer-in-charge having mercly to attend to the main ıamo regulator, whilst the balancer equally divides the s-bar pressure under all conditions of load. Of the old -kw. Willans-Crompton sets, three have been disposed of make way for a workshop, containing a 6½-in. Selson he and a Selson drilling machine.

The new mains consist of some two miles of bitumen and d-covered distributor cables supplying two important idential districts, in which a considerable number of idents have already availed themselves of the supply. The ginal network has also been improved by the fixing of ıe feeder and distribution pillars in place of a large number old-fashioned disconnecting pits and boxes, thus enabling : network to be divided into districts interconnected by es, which can quickly and easily be examined or changed any time and in any weather.

Now that the whole of this new plant is installed and at rk, it is hoped that with a more vigorous and progressive icy the undertaking may soon be established on a sound l paying basis. After the completion of the present ancial year, the capital payments will also be relieved of : annual charge of £1,200 on the £9,900 10-year loan, l Whitehaven will be relieved of the unpleasant position of ving the highest percentage of capital repayments of any dertaking in the United Kingdom, viz., 5·53 per cent.

CONTROL OF CENTRIFUGAL PUMP MOTORS.

By JOHN S. LEESE.

IE control of the discharge of centrifugal pumps may be ɔmplished in two ways : either by the throttling of the charge pipe by the manipulation of a valve therein, or by ying the revolutions per minute of the impeller. The mer method needs no further elucidation here, but some ınts connected with the speed control may be dealt with.

A centrifugal pump will operate at its highest efficiency the speed for which it is designed, and with its normal : and discharge. The efficiency curve of a typical centri- gal pump brings this fact out very clearly. Unfortunately ɔed control cannot be applied to all and sundry centrifugal mps, since the lift does not vary directly as, but as the ıare of, the speed. In services in which the centrifugal mp is applied to circulate a fluid, however, the head against : pump will be for the most part due to pipe friction, and, this friction varies as the square of the velocity of the id, it is evident that this proportion will eliminate the ficulties of speed control to a large extent. A common ıtance of such a service may be found in cases of surface ɔdensers whose circulating water is supplied by a centri- gal pump.

The majority of the centrifugal pumps installed, and being talled, are direct driven by electric motors. Dealing first with cases in which a variable speed is desirable, two classes of motor may be applied ; first, direct-current shunt motors controlled as to speed by shunt field control, and, secondly, variable-speed induction motors controlled by varying the frequency. The first type of motor will be extremely efficient in the service under discussion, but, since the motor will have to operate at its normal output at high speed, it will necessarily be somewhat large. All variations in the speed of the set will be to speeds below the normal, since it is impracticable to "force" a centrifugal pump discharging into long or tortuous piping systems. Another method of speed control may be accomplished by using armature control, the speed varying almost inversely as the cube root of the power. The result of this will be that only a small resistance will be necessary, which will reduce the size of the motor required below that of the shunt-field controlled type first mentioned. The relative costs of the two systems of control will be in favour of the armature-control system unless the speed variation is small—say, not exceeding 20 per cent. In this case the shunt-field control system will be but little—if any—more costly, and the superior efficiency available with this type of control will counterbalance any small difference existing in the prices. The results obtained with the second class of motor, namely, the variable-speed induction motor, are very similar to those due to direct-current motors with armature control, but they can only be accomplished by frequency variation.

There are three classes of electric motor which are used in ordinary centrifugal pumping work ; first, the constant-speed alternating-current induction motor ; secondly, the variable-speed induction motor ; and thirdly, the direct-current shunt-wound motor. The starting-up method employed with the second type is sufficiently self-evident and needs no description. The starting-up of the first type of motor may be accomplished on about 55 to 65 per cent. of the normal voltage, since the torque required with the discharge valve closed will not greatly exceed half-load. When the motor-driven set is being brought up to speed, the maximum current required will never exceed twice the normal full-load current under these conditions. When the set has been brought up to speed, the normal voltage may be thrown on, the resulting change in the ammeter reading being very small. The opening of the throttle valve will introduce normal conditions. There are two methods of starting up alternating-current induction motors, neither of which possesses any very great advantages over the other sufficient to justify its exclusive adoption. Either a double-throw switch or a single point auto-starter may be beneficially used. The starting-up of direct-current shunt-wound motors necessitates a greater number of starting notches on the controller.

The Midland Electrical Engineers' Ball.—Arrangements have been made for the holding of a Midland Electrical Engineers' Ball at Birmingham, on Friday, January 12th, 1912, in the Grosvenor Suite, Grand Hotel. It is under the care of a strong and representative local committee, with Mr. R. A. Chattock as its chairman, and the Lord Mayor of Birmingham and the Lady Mayoress are patrons. Mr. Howard Foulds, 14, Dale End, Birmingham, is the hon. treasurer, and Mr. H. B. Matthews, of Winchester House, Victoria Square, Birmingham, is the hon. secretary. The tickets are one guinea each, inclusive of everything. We understand that the best band in the city has been secured, and that excellent arrangements have been made with the Grand Hotel for catering and decoration. It is believed that there are a goodly number of electrical engineers in London, Manchester and elsewhere who will desire to avail themselves of an opportunity of meeting their Birmingham friends under such conditions, and we can assure them of a hearty welcome and a really enjoyable time.

The Physical Society's Annual Exhibition.—This exhibition, which is to be held on Tuesday, the 19th inst., at the Imperial College of Science, South Kensington, will be open from 3 to 6 p.m. and from 7 to 10 p.m. Prof. The Hon. R. J. Strutt, F.R.S., will give a discourse at 4.30 and again at 8 p.m. on "Electric Discharge and the Luminosity which Survives It." Some 30 firms will be exhibiting. Invitations have been given to the Institution of Electrical Engineers, the Faraday Society, the Optical Society and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the Societies just mentioned (including also the Physical Society) desiring to attend the exhibition should apply to the secretary of the Society to which they belong.

FORTHCOMING EVENTS.

Electro-Harmonic Society—Friday, December 15th. At 8 p m. At the Holborn Restaurant. Smoking concert.

Institution of Mechanical Engineers.—Friday, December 15th. At 8 p.m. Discussion on paper on "Double-cutting and High-speed Planing Machines," by Mr. J. H. Wicksteed.

Manchester Association of Engineers and Manchester Local Section of Institution of Electrical Engineers.—Friday, December 15th. At 7.30 p.m. At the Whitworth Institute, Manchester. Conversazione.

Institution of Municipal Engineers.—Saturday, December 16th. At 3 p.m. At 4, Southampton Row, W.C. Paper on "The Electric Trolley Omnibus System," by Mr. Horace Boot.

Physical Society of London.—Tuesday, December 19th. 3 to 6 and 7 to 10 p.m. At the Imperial College of Science. Annual Exhibition of Apparatus.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, December 19th. At 8 p.m. At the Heriot Watt College, Edinburgh. Paper on "The Heriot Watt College Laboratories," by Prof. F. G. Baily.

Illuminating Engineering Society.—Tuesday, December 19th. At 8 p.m. At the Royal Society of Arts. Paper on "Some Aspects of Railway Station and Goods Yards Illumination," by Mr. H. T. Harrison.

Finsbury Technical College Engineering Society—Tuesday, December 19th. At .m. At the Holborn Restaurant. Smoking concer .

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders are issued :—

Monday, December 18th.—"A" Company. Technical work and musketry instruction (standard tests), 7 to 10 p.m.

Tuesday, December 19th.—"B" Company. Technical work and musketry instruction (standard tests), 7 to 10 p m.

Wednesday, December 20th, 1911, to January 2nd, 1912.—Headquarters will be closed.

Urgent.—All members of the corps are requested to attend headquarters on their company night to sign Association Form 20, recently received from the County of London Association.

(Signed) P. H. Campbell, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

NOTES.

More About the Donuts.—On Thursday last we went down to Rugby to see what the "Donuts" could do—and incidentally to settle the mystery of the derivation of their curious title. To settle the latter first, we found that they were defined in the programme as "merely the organised D.O. nuts"—the nuts, that is, mostly employed in the drawing offices. Apparently the Donuts are prepared to tackle any branch of science, art or literature, and if they are always as successful as they have been in this their first undertaking, they will undoubtedly be entitled to the award of what, after their fashion, we may call the B-th bun. As the bulk of the properties, the whole of the scenery and the admirable stage effects were the work of the performers themselves, and the play extended over six acts with as many different scenes, which were admirably staged, it will readily be seen that an immense amount of labour had to be accomplished by the worthy nuts. Their sign is a bright hexagon nut, which we hope is not supposed to be screwed, and their motto is the defiantly aggressive one "Ride, si sapis."

The play "The Adventures of Eddie Currant" was written by Mr. T. H. Relton, who is also the Donuts' hon. sec. and treasurer, as well as publicity manager. It covers the life-history of the hero from his abduction at a tender age to his attainment of worldly success and restoration to his rightful position; the intermediate stages are represented by scenes in a technical school, in a drawing office at the P.I.P. works, in the engineers' office of the same, and in a grocery store, the final scene being laid in the verandah of West Hyng House, where Eddie has just returned from his honeymoon. The career of a smart young engineer, armed with a sufficiently "guid conceit" of himself and plenty of bluff, through the technical departments to the sales department, and thus to fame and fortune, is cleverly satirised, and great credit is due to the performers, who obviously devoted their whole attention to the play and did their very best. While we cannot enlarge at length upon the various *rôles*, we have pleasure in complimenting Mr. B. Shepherd upon his excellent singing, and in congratulating Mr. A. G. Worth on his life-like impersonation of the scheming typist, Miss Teresia Loupe. Honourable mention must also be accorded to Messrs. H. C. Heath as Bill Miker, a coster; W. E. Elkins as Mother Goose, a witch; F. G. Ketelbey as Mr. Winkle, the old draughtsman; and W. B. Cornes as Higgins, the office boy, as well as in other parts. Mr. A. King, as Snatcher, was the most realistic sneak-thief that we have ever seen, and must have seriously jeopardised his reputation for honesty by his life-like get-up. The title *rôle* was very conscientiously filled by Mr. C. W. Peyton.

Circumstances, we believe, prevented a complete dress rehearsal from being held, and all the more credit is therefore due to the actors for their successful *début*; the same reason probably accounts for the fact that some of the monologues were not cut down to more manageable proportions. Apart from this, we have nothing but praise for the efforts of the D.O. staff of the B.T.H. Co. to entertain their colleagues and the public, and admiration for their pluck in starting with so bold an enterprise.

Copper.—Messrs. Merton's statistical circular for the end of November, 1911, shows a drop of 3,154 tons in the visible supplies for the month. This is made up of 3,560 tons withdrawn from stocks in English ports and 219 tons less at Havre, balanced against an increase of 625 tons more afloat. This drop is about 1,000 tons above average. Supplies from North America to England are low, though fairly strong to other European countries. From Spain, also, they are below the average, while shipments from Chile and Australia are both rather low. Total deliveries, however, keep fairly high at 39,416 tons. Stocks in Rotterdam have fallen off 1,200 tons, and in Hamburg (estimated) 1,300. Stocks in American producers' hands at the end of October were 2,632 tons lower than for end of September. The world's supplies at the same date are at 122,103 tons, some 8,136 tons lower than for end of September. These are lower now than they have been since January, 1909.

Tuned Cablegraphy and Wireless Telegraphy.—On Monday last we attended a demonstration of the systems propounded by Messrs. A. T. M. Johnson and F. H. Varley for "cheap cable messages and secret wireless telegrams," at 37A, Finsbury Square, E.C. The apparatus was arranged round the sides of a small room, and consisted mainly of instruments used to demonstrate the principles employed by the inventors, being of a more or less experimental character.

The idea at the base of both systems is that of syntony obtained by means of tuned reeds; each letter or numeral is represented by a sending and a receiving reed of identical pitch, and it is claimed that the tuning is so sharp and the system is so free from interference between signals of only slightly different pitches, that 49 differently tuned signals can be obtained within the range of one semitone. Obviously, in theory at least, each letter or other signal could be transmitted by depressing a given key on a suitable keyboard which would actuate the corresponding sending reed, and the signal would be picked up at the receiving station by a similar reed connected to a recording device. Thus a message could be transmitted as fast as it could be written on a type-writer.

But while this is very pretty and plausible, it fails to take due account of practical conditions. And this is, perhaps, not surprising in view of the fact that the chief inventor appears to be Mr Johnson, who was formerly a Professor of Music in Victoria, and therefore could hardly be expected to be fully conversant with the working of submarine cables. That Mr. F. H. Varley, who is associated with Mr. Johnson in the matter, did not enlighten his colleague is less easily explained.

The demonstration consisted for the most part of elementary explanations of the behaviour of tuned and untuned reeds, with which our readers need not be troubled. Unfortunately, even on a subject so closely related to his own profession, Mr. Johnson's views are unreliable, for one of the essential features of the system is that the rate of vibration of reeds is uninfluenced by variation of temperature. He essayed to explain the statement by pointing out that change of temperature would cause change of all the dimensions of the reed in the same proportion, and claimed to prove it by an experiment with a pair of tuned reeds and a saucepan of hot water, which carried conviction to no engineer's mind. But the professor appeared to be unaware that the frequency of vibration of a reed varies as the thickness, and inversely as the square of the length, so that proportionate variation of dimensions with temperature *must* cause change of pitch, while the decrease of elasticity with increase of temperature aggravates the error.

As a matter of fact, reeds do change their pitch with change of temperature, though to a less extent than stretched wires, no doubt. It is difficult to see why the inventors did not propose to keep the pitch of the reeds invariable by keeping the temperature constant, as can easily be done, instead of going out of their way to introduce a fallacy at the start. Let us assume that this is done. Can oscillatory currents be transmitted through long submarine cables? It is common knowledge that this is impossible, except at a slow rate, depending upon the length and capacity, &c., of the cable. In the case of the Atlantic cable, to which Mr. Johnson referred, the highest speed attainable is in the neighbourhood of 12 or 13 signals per second (50 words per minute). To make an indicator responsive to the excessively attenuated signals received across the Atlantic, its control would have to be reduced to the minimum, and in order to accumulate by resonance sufficient motion to actuate a relay, however sensitive, the signal would have to be maintained for an appreciable fraction of a second for several waves to arrive; moreover, with so short a train of waves close tuning could not be possible. Hence, not only would the time taken in transmitting a single letter by resonance be comparable with that at present required to transmit the Morse signals making up a letter, but that accuracy of tuning claimed by the inventor would be utterly lost. How then could the 49 different tuned signals be compassed within a semitone? To raise the frequency to a pitch at which sharp tuning would be feasible is rendered impossible by the physical characteristics of the cable.

Experiments such as that shown, in which audible signals were transmitted through 53,000 ohms, are utterly meaningless, as the all-important element of static capacity was absent

The only test that is worth consideration is that of transmission through a long cable actually laid at the bottom of the sea, or its equivalent, and in reply to a question, Mr. Johnson admitted to our representative that this had never been done with his apparatus.

The wireless part of the affair was more directly in Mr. Varley's hands. While utilising the same principle, it is claimed to be an untappable system. A stream of waves is emitted under the control of a reed slightly out of tune with the receiving reed, which is therefore unaffected: the signals are transmitted by the aid of a key which modifies the sending reed, so as to bring it precisely into tune with the receiver, which is, therefore, affected when the key is depressed. It is claimed that an outsider would not be able to distinguish the very slight change of pitch which marked the sending of each signal. We doubt this, under practical conditions. But even if it be true, the fact that a station thus sending out a continuous train of waves seriously interferes with all other stations within range is a very grave objection. That it does so we know from the mouth of Mr. Johnson, who informed our representative that a certain English coast station was, to use his own expression, "paralysed" and unable to receive any signals while the Johnson-Varley apparatus was at work. A "continuously decohering coherer" using iron filings was exhibited for use in connection with the system; this is surely a "back number."

The reed tuning system, Mr. Johnson said, could be used to send and receive several messages simultaneously through one cable or wire; no doubt this is true within the limits prescribed by the conditions to which we have referred.

We have said enough to show that, in our opinion, the inventors are dealing with matters with which they are not at all conversant, and we fear there is a painful disillusionment awaiting them. Fortunately, as one of the promoters informed the audience, they "are not out for money," as they claim to have a financial backing. Appearances belied the statement; but, at all events, they are unlikely to obtain support in electrical circles.

Faraday House Students' Society.—Dr. Alexander Russell has been appointed president of this Society; Mr. E. B. Ritson, vice-president; Mr. F. T. Chapman, B.Sc., treasurer; and Mr. B. P. K. Walsh, secretary. The next meeting will be held on January 17th, 1912, at 4.45 p.m., when Mr. E. B. Ritson will give an account of his personal experiences as an engineer with the High-Tension Hydro-Electric Power Co. at Necaxa, Mexico.

Northampton Institute.—On Friday evening last the annual prize distribution and students' conversazione took place at this Institute. Sir Wm. H. White was present to distribute the prizes and certificates to successful students, but before that item in the programme was reached, a more than usually interesting report was read by the Principal, Dr. R. Mullineux Walmsley, on the work of the 1910-11 session. It appeared therefrom that once again the necessity for enlarging the buildings to provide increased accommodation was being realised. He said that the total number of individual students diminished from 2,163 to 2,035. The diminution, however, was confined practically to a single department, and was due to a specific reason beyond the control of the Polytechnic. The department referred to was that of telegraphy and telephony, where the educational work was still disturbed by the near approach of the date for the taking-over of the work of the National Telephone Co. by the Post Office. The percentage of apprentices attending the evening classes increased to 40 per cent., as against 39 per cent. in the preceding session. The day classes and courses were well maintained, and for the seventh year in succession the Principal was able to place, without any payment of premiums, the whole of the second and third-year students in commercial workshops during the summer. The reports received from these workshops continued to testify in many ways to the appreciation with which the students trained in the day courses at the Polytechnic were regarded by the firms which had an opportunity of testing their attainments. New firms were added to the list during the session, so much so that more vacancies were offered to the Principal than he had students available for. As a further mark of the success of the day courses in engineering, some of the fourth-year men were engaged for permanent employment as early as Easter, although they were not at liberty until July, and on the electrical side the number of vacancies in July available for students completing their course was fully double the number of students qualified to fill them. The appreciation of employers was not confined to the day courses, but extended to the evening classes. Letters were frequently received testifying to the influence which the work done in the classes had upon the commercial work in the industries dealt with. After alluding to the laboratory and workshop classes in aeronautics, the Principal said that with regard to the Board of Education's examinations, although the whole of the work done in the classes was recognised by the Board of Education, only the examination in the subject of magnetism and electricity was prepared for in the Polytechnic, and that only in the classes which were confined to Post Office telegraphists and telephonists. The bulk of the work of the Polytechnic was appraised by the Board of Education by inspection and not by examination, and exceedingly favourable reports had been received during the session upon that work, the appraisement taking the form of a substantial increase in the block grant on the work of the evening classes, which was revised triennially by the Board.

Sir Wm. White, before distributing the prizes, delivered a brief speech, in which he said that as a result of his visits to educational institutions in this and other countries, he was much impressed and greatly delighted with the arrangements made at the Northampton Institute for the instruction of students. Any manufacture or industry must have a greater chance of success if all the workers were intelligent and well-informed. Rule-of-thumb would not prevail in these days of strenuous competition. It had been the fashion to talk about the special training for captains of industry—he did not know what that meant. His experience was that captains of industry did not get to their position by mere heredity; they were not people who could be picked out at the beginning of their lives as "future captains of industry." He had known some who had everything in their favour, and were picked out in that way, but who never attained the real position indicated. There was a selective process going on in all those matters, and they might put a man in a big position, and give him a title wonderful to read; but if he could not carry on the responsible duties of that position he would not be there long. We lived in a country where a career was open to any man or woman who would make the effort and deserve success. Sir William later referred to the question of examinations, and approved of the object of the Institute to train students to be thinkers in the careers that they had chosen rather than to fit them to pass examination tests. Some of the best and ablest men and women were utterly at sea when they sat down to an examination.

Explosion on a Battleship.—An explosion occurred on the new battleship *Orion* at Portsmouth on Tuesday last, under unique circumstances and resulted in severe burns to a large number of men. The electrical equipment was being put through its trials, and one of the generators had satisfactorily passed the tests. A second dynamo was then started, and ran for a short period, when there was a violent explosion, and some 20 men who were present in the compartment were more or less severely burnt. The accident is attributed to the ignition of vapour from the oil wells of the armature bearings, but no definite information is available, and the compartment has been closed pending official inquiry. Those injured included several officers and men belonging to the *Orion* and others. Among them were Messrs. James Pringle (electrical engineer, Admiralty), A. Franklin (assistant electrical engineer), W. Green (inspector of electrical fitters), T. Metcalfe (chargeman of electrical fitters), H. Driver, W. Richards and J. Willis (electrical fitters), W. Rycroft and W. Ward (apprentices). It is believed that the injuries are not dangerous. Most of the sufferers were removed to Haslar, the rest being treated in the dockyard surgery.

It will be remembered that, some years ago, an explosion took place at Southport electricity works, due to the oil in the crank chamber of a vertical engine having a low flash-point. This is the only similar accident that we can call to mind.

Glasgow Electricity Department.—The officials of the above department held an "At home" on December 8th in St. Andrew's Halls. The *Glasgow Daily Herald* says that there was a large attendance of members of the electrical and engineering professions in Glasgow and the neighbourhood. The guests were received by Councillor Willock, convener of the Electricity Committee of the Corporation, and Bailie W. B. Smith, sub-convener. An enjoyable programme of music, whist and dancing was carried through. The secretarial arrangements were in the hands of Mr. R. B. MacCall.

The Electro-Harmonic Society.—At the smoking concert which is to be held at the Holborn Restaurant (King's Hall) to-night (Friday) at 8 o'clock, Mr. Hugo Hirst will preside. The artists are as follows:—Vocalists, Mr. Joseph Reed (tenor), Mr. Albert Garcia (bass-baritone), the Fransella Wind Quartett. Solo flute, Mr. Albert Fransella; solo banjo, Mr. Olly Oakley; sketches at the piano, Mr. Kenna Lawson: humorist, Mr. Fred Curtis; magician, Mr. Louis Nikola; solo pianist and accompanist, Mr. Bernard Flanders, A.R.A.M.

Educational. — University of London, King's College.—A course of advanced lectures on "The Application of Electric Power to Mines and Heavy Industries" will be delivered by Mr. W. H. Patchell, commencing on Monday, January 15th, 1912. Further particulars are given in our advertisement pages to-day.

Northampton Polytechnic Institute.—Notice is given in our advertisement pages of a course of 10 advanced lectures in "Illuminating Engineering," to be commenced on Tuesday, January 16th.

Appointments Vacant.—Dynamo-attendants for the Birmingham Electric Supply Department (25s. 9d.); assistant in the mains department of the Derby Corporation; shift engineer for the Stockton-on-Tees electricity works (30s. 6d.); mains assistant engineer for Kilmarnock (45s.). See our advertisement pages to-day.

Institution and Lecture Notes. — Association of Mining Electrical Engineers (Inc.) (South Wales Branch).—The ordinary meeting of this branch will be held at 5 p.m. on Saturday, December 30th, at the offices of Messrs. Haslam and Schontheil, Ltd., Windsor Place, Cardiff. The discussion on Mr. Chris. Jones's paper on "Earthing, Earth Plates and Earth Detectors" will be resumed, and a paper on "Shaft Signalling" will be read by Mr. E. E. Beadsmore. On December 16th, at 6 p.m., a lecture will be delivered by the president, Mr. Sydney F. Walker, at the Lesser Town Hall, Pontypridd, his subject being the "Threatened Shortage of Coal: What Engineers are Doing to Meet it, and what Electricity has Done, and is Doing."

Institution of Electrical Engineers (Newcastle Local Section).—At last Monday's meeting the presidential address by Mr. C. S. Vesey Brown, was delivered. The annual dinner is to be held on Wednesday, December 20th.

South African Institute of Electrical Engineers.—At the meeting held at Johannesburg on September 21st, Mr. W. H. Perrow (Member of Council), electrical engineer of the Nourse Mines, Ltd., was presented with the Institute's gold medal for his paper read last season, the subject being "Notes on the Application of Electricity to Medicine and Surgery, with Special Reference to X Rays and High Frequency Currents."

A paper was then read by Mr. A. H. O. Renner on "A Comparison of Costs between the Ward-Leonard and Three-Phase Winding Systems."

Physical Society of London.—At the meeting on November 24th, a paper on "The Maximum Value of the Electric Stress between Two Unequal Spherical Electrodes," was read by Dr. A. Russell. With equal spherical electrodes, the electric stress between them can easily be computed from known tables. When, however, they are unequal the calculation becomes so laborious that it is prohibitive to nearly every experimenter. The author develops formulæ for this case, by means of which, and of the formulæ for the capacity coefficients given in a recent paper to the Society, the calculation is very appreciably shortened.

Royal Institution.—On December 4th, at a general meeting, a resolution was passed returning thanks to Sir James Dewar, Fullerian Professor of Chemistry, who had redecorated and furnished the lecture room at his own cost, in commemoration of his having, on October 22nd, 1911, occupied the Chair of Chemistry as long as it was held by Faraday.

Association of Engineers-in-Charge.—On Wednesday a paper was read by Messrs. G. and J. R. Wilkinson on methods of dealing with losses in steam plant due to condensation. The authors emphasised the importance of removing the water of condensation regularly as it was formed, and of passing it back immediately at its highest temperature through insulated pipes to the boilers.

Institution of Civil Engineers (Students).—At the meeting held on December 1st, Messrs. J. and W. Legg read a paper entitled "Brake-Lining Coefficients of Friction," giving detailed results of their experiments on the relative values of several brake-lining materials, and the variation of the coefficient of friction between cast-iron and the material with the intensity of pressure and the relative velocity of the two substances.

Imports and Exports in November.—During last month there were increases in both imports and exports. The former advanced in value by £1,343,083, and the latter by £4,088,966, re-exports increasing by £375,623. The electrical goods and apparatus exported amounted to £320,184, an increase of £88,526; machinery advanced to £2,882,123 by £333,805.

Fatality.—An inquest was held on the 6th inst. into the cause of death of Walter Ernest Holliday, which occurred on the previous Monday at Messrs. Hall & Co.'s cement works at Beddington. The works are equipped with their own electrical installation which generates three-phase 220-volt current, and deceased was in the firm's employ as a boiler maker and labourer. On the day of the accident, according to the evidence of the manager, he was repairing a set of cement clinker elevators, and tried to come up from the elevator pit by stepping on a bucket and then between two girders, instead of going up the steps. He was holding an electric lamp, and when he fell it was smashed, so that, as his hand was in contact with it, the current must have entered his body. As soon as witness saw this he pulled the wire away, though he got a slight shock when he touched the body. Witness produced the length of wire, and an electric lamp similar to the one deceased was using, and explained how it was broken. He also showed the jury a plan of the pit, pointing out where the body was lying. Witness thought that when he touched the body he got quite as much electricity through him as deceased could have done. Questioned by Mr. W. E. Harding (Home Office), witness did not think the deceased fell as the result of a shock, as the lamp and the lead were under the body. Another witness stated that he tried artificial respiration until the arrival of the doctor.

Alfred Wilkinson said he saw Holliday go down into the pit with a light and a few minutes after noticed him lying at the bottom. The lamp was broken, and a blue flame was round the terminals.

Dr. O'Hagan said he found that there were burns on the back of the right hand and on the left, and between the thumb and index finger of each hand and under the chin. The heart was very fatty and its condition abnormal. He did not notice any bruising, though there was a wound on the head, and could not say from the appearance of the body whether he had fallen or not. In his opinion death was due to an electric shock, and was probably accelerated by the condition of the heart.

The jury returned a verdict of "Accidental death."

It seems to us that the inquiry was unsatisfactory from an electrical point of view, for apparently no properly qualified electrical engineer had anything to do with the matter either with regard to examination or evidence. It seems not at all improbable that deceased got a shock from the flexible lead which he was carrying which caused him to let go his hold in climbing, and that he struck one of the girders in falling. Alternatively it seems possible considering the medical evidence as to Holliday's health, that in climbing he over exerted himself and fainted; in falling it would be possible for him to damage the lead, and in this way also to produce the effect of death from electric shock.

The Electrical Treatment of Tobacco.—Referring to the note on this subject in our last issue, to avoid misapprehension, we wish to make it clear that our criticism was directed only to the description of the process invented by Mr. E. J. Lusby. That the process actually does improve the flavour and keeping qualities of the tobacco was not denied, nor have we any reason to doubt it.

National Insurance Bill.—The following letter came to hand too late for our "Correspondence" columns:—

"Subject to the above becoming law, it is proposed to formulate an Association of Electrical Works Sick Clubs. The undersigned need hardly point out the advantages of such a society to keep our sick clubs together, especially amongst those who do not at present belong to any friendly society. There are too many details to go into which would interest all sick fund men, and cannot be discussed by correspondence. May we, therefore, through your columns appeal to all sick club secretaries connected with the trade (or others interested) to communicate with us, with a view of having a round table conference and getting the society formed. The promises we have received from several large firms in the country lead us to believe that such a society would be welcome.

"W. Mead, General Electric Co., Ltd., Witton, Birmingham.
"J. J. Scrivener, British Thomson-Houston, Rugby.
"G. T. Broad, General Electric Co., Ltd., Witton, Hon. Sec., *pro tem.*

"Witton Birmingham, *December 11th*, 1911."

Plating on China.—An interesting departure in electro-deposition work has been introduced into this country by the Harvey Electro-Chemical Co., of Laurence Pountney Hill, E.C. By means of a new process, based on the Marino patent, the company are now plating glass and earthenware, or even wood and other substances, and in such a way that the deposit forms a molecular union with the article being treated. The actual process is, of course, not disclosed, but so far as we could gather, it consists of treating the surface of the object to be plated—which must be unglazed—with a solution which permeates the skin and practically transforms it into a metallic base, on which by means of the ordinary electrolytic deposition process, but with a modified electrolyte, any of the usual metals, such as silver, gold, copper, bronze, or aluminium, can be deposited. The simplest application is appears to be for electro-plating earthenware teapots, jugs, &c., for providing silvered rims and handles, &c.; the metal sheaths which the process provides greatly strengthen articles of earthenware, which need not be discarded though cracked internally. The process is an inexpensive one, and the results appear to be decidedly effective. The company also undertake electro-galvanising, and we are given to understand that their process is a considerable improvement on the ordinary one.

Finsbury Technical College, O.S.A.—The sixth annual dinner was held at the Trocadero Restaurant on Saturday last, the chair being taken by the President, Mr. R. J. Wallis-Jones, M.Inst.C.E., M.I.E.E. A large gathering of the members of the Association attended. Excellent speeches were given by Sir John Wolfe Barry, K.C.B. (who proposed the toast of the O.S.A.), Dr. Silvanus P. Thompson, F.R.S., Dr. R. Meldola, F.R.S., Dr. G. T. Moody, and Mr. W. J. Tennant, M.I.M.E., F.C.I.P.A. An enjoyable musical programme was provided under the direction of Mr. Chas. B. Nadaud.

Parliamentary.—The Coal Mines Bill.—This Bill was considered in the House of Lords on Wednesday, and after amendment it was reported to the House.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At a meeting of the South Shields T.C. on the 7th inst., Ald. Rennoldson moved the adoption of a recommendation of the Electricity Committee as follows:—

That the Town Council, on the occasion of Mr. J. H. Cawthra relinquishing his appointment of Borough electrical engineer to take up his appointment in South Africa, place on record its high appreciation of the services rendered during the past 10½ years by Mr. J. H. Cawthra in his capacity as Borough electrical engineer of this Corporation, and its testimony to the skill and ability shown by him as chief engineer of the electricity undertaking of the Corporation, and to the assiduous attention which he has devoted to the undertaking during the period before mentioned, and that a copy of this resolution be engrossed and presented to Mr. Cawthra with the corporate seal affixed thereto, that it be signed by the Mayor and countersigned by the Town Clerk.

Ald. Rennoldson said he had the greatest pleasure in moving the adoption of the report, although there was a little unpleasantness at the meeting. He did not wonder at it so far as Mr. Cawthra was concerned, and he thought that anyone who was treated so unkindly and ungraciously as was Mr. Cawthra could be excused for allowing his feelings to get the better of him. Councillor Bootiman seconded the motion. Councillor Sykes said he took it that the dignity of the Council must be paramount. The unpleasantness arose on the question as to whether Mr. Cawthra should have something in lieu of the holiday he had missed. While the position was being discussed, it was suggested that Mr. Cawthra should leave the room for the time being. He thereupon flew into a tantrum, snapped his fingers, turned up his lips in scorn, and said, "You can keep your testimonial, your money and your holiday." What he (Mr. Sykes) asked the Council to do that night was to "keep their testimonial." He moved that failing the receipt of a reasonable apology, the testimonial be not granted.

Councillor Dunlop seconded. Alderman Rennoldson said he would like to make one thing clear, and that was that Mr. Cawthra neither asked nor hinted at receiving any monetary compensation in lieu of his holiday. Mr. Cawthra wrote that he would like to have a little holiday before he went away. He (Alderman Rennoldson) told the Committee that he thought a holiday during the present month was out of the question, but it was for the Committee to say whether Mr. Cawthra should not have something in lieu thereof. What irritated Mr. Cawthra were the remarks of Mr. Dunlop, and he (the speaker) could excuse him. For any official to be humiliated in the way Mr. Cawthra was, was intolerable. On a division the Committee's report was adopted.

Mr. G. F. Nuttall has resigned his position of senior canvassing engineer to the Sheffield City Council, and, owing to this, a rearrangement of the staff is to be made, Mr. H. G. Bennett, chief motor assistant, being appointed assistant superintendent of the wiring and fittings department at his present salary; Mr. H. A. N. White, second canvassing engineer, becoming first canvassing engineer, at £140 per annum, to be increased to £150 at the end of 12 months; and Mr. F. K. Smith, wiring and fittings clerk, being appointed second canvassing engineer, at £90 per annum, to be increased to £100 at the end of 12 months.

At a meeting of the Electricity and Tramways Committee of the Newport (Mon.) T.C. on Monday, the resignation of Mr. H. Collings Bishop, general manager and electrical engineer, was received.

Mr. P. H. Buzza, senior assistant engineer at the Corporation electricity works at Colchester, has resigned. He has secured an appointment in the North of England.

Mr. Harry L. Cottam, charge engineer at the Dewsbury Corporation electricity works, has been appointed charge engineer at the Colchester Corporation electricity works. There were 138 applicants.

Mr. Percival Spiers has resigned his position as chief assistant engineer to the Stratford-on-Avon Electricity Co., Ltd., in order to take up an appointment with the Hong Kong Electric Co.

Tramway Officials.—Mr. John Fraser, motor inspector in the employment of the Glasgow Corporation, has been recommended by the Kilmarnock Tramways Committee for the traffic managership of the Corporation tramways. Mr. Fraser has had 10 years' service in Glasgow.

General.—The *Daily Telegraph* says that Mr. Henry Wallis has been appointed superintendent of the telephone department of the Central Post Office at Brighton in succession to Mr. F. Collins, who recently retired from the service.

In the list of Durbar Honours announced this week are the following:—

Henry Whitby Smith, Esq., Indo-European Telegraph Department, lately Director Persian Gulf Section, to be a C.I.E.

Ivor Cradock Thomas, Esq., Director Indian Telegraph Department, appointed M.V.O. (fourth class).

James Scott Pitkeathley, Esq., Electrical Inspector to the Government of the United Provinces of Agra and Oudh, and Electrical Engineer Delhi Coronation Durbar, appointed M.V.O. (fourth class).

To all these gentlemen we tender our hearty congratulations.

Obituary.—Mr. E. H. Tyler.—The death occurred at Southampton on December 6th of Mr. Edward Henry Tyler, M.I.E.E.

Mr. J. R. Hanson.—The death has occurred, from heart failure, of Mr John Robert Hanson, of Castle Street, Southport, who was in business in the town as an electrical engineer. He was only 33 years of age.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Jackson, McConnan & Temple, Ltd. (67,699).—A memorandum of satisfaction to the extent of £5,000 on March 28th, 1910, of debentures dated March 14th, 1901, securing £22,000, has been filed. Particulars of £20,000 debentures, created October 31st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £17,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Johnson & Phillips, Ltd. (84,968).—A memorandum of satisfaction in full on November 14th, 1911, of debentures registered June 15th, 1909, securing £50,000, has been filed.

Everett, Edgcumbe & Co., Ltd. (84,764).—A memorandum of satisfaction to the extent of £300 on September 1st, 1911, of debentures dated June 9th, 1905, securing £10,000, has been filed.

Foote & Milne, Ltd. (73,923).—Deed of charge on the company's undertaking and property, present and future, including uncalled capital, dated November 23rd, 1911, to secure £1,040. Holders: London County and Westminster Bank, Ltd., 41, Lothbury, and 21, Lombard Street, E.C.

Universal Light and Sign Co., Ltd. (115,336).—Issue on November 28th, 1911, of £185 debentures, part of a series of which particulars have already been filed.

Companie de Electricidad de la Provincia de Buenos Aires, Ltd. (117,118).—Particulars of £900,000 debentures, created November 6th, and secured by trust deed dated November 24th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, power distributing and transforming stations in Argentine Republic, and all existing and future concessions and contracts relating to the supply of electricity. Trustees: City Safe Deposit and Agency Co., Ltd.

CITY NOTES.

British Electric Traction Co., Ltd.

Mr. E. Garcke presided on December 7th at the offices, 1, Kingsway, W.C., over an extraordinary general meeting of this company for the purpose of considering and, if thought fit, confirming the resolution recently passed for rearranging the capital of the company.

The Chairman said that, in view of the full discussion which had taken place on the scheme of arrangement, they would not wish him to say anything further in support of the resolution which he would content himself with moving. On the motion being confirmed, the scheme of arrangement would be complete except for the formal issue of the new stock certificates in place of the existing certificates, in regard to which notice would be issued to the shareholders.

Mr. Raworth seconded the resolution, and it was adopted without discussion.

Mr. Ward asked if it was a fact, as stated in the Press, that the company contemplated promoting a motor-bus company in opposition to the London General Omnibus Co. As a considerable shareholder in the company and a former shareholder in the Omnibus Co., he would like to know if there was any truth in the statement.

The Chairman: I may say at once it would be exceedingly inconvenient to discuss questions of policy of that kind at this stage. The statement to which you have referred is not entirely incorrect, but it certainly is quite premature, and it is impossible for me to make any public statement with regard to the matter at present.

Prospectuses.—*Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.*—On Tuesday last the list was to close in an issue of £750,000 5 per cent. first mortgage gold bonds to bearer in bonds of £20 each, at the price of 95 per cent., or £19 per bond. The issue was made by the Credit Mobilier Francais through the London and Brazilian Bank, Ltd. The nominal capital of the company is £1,000,000 in 250,000 shares of £4 each. The business of the company is stated to be steadily increasing, and the working capital which will be provided by the present issue will enable further extensions to be made. The company acquired the undertakings and assets of another company of the same name (the Argentine company). In the suburbs of Buenos Ayres current is obtained in bulk from the Compania Alemana Transatlantica under contracts having an average period of about 26 years to run, and is distributed through the company's own substations. Under these contracts the Argentine Co. has the exclusive right from the Compania Alemana Transatlantica of supplying and distributing electric current in the following suburbs of Buenos Ayres, viz., Lomas, Temperley, Banfield, Adrogue, Quilmes, Bernal, Burzaco, Ballester, Hue and Klein. The Argentine Co. have their own generating stations in the following towns, viz., Tres Arroyos, San Nicolas, Pergamino, San Pedro, Azul, Junin, Mar del Plata and San Martin in the province of Buenos Ayres, and in San Luis, the capital of the province of the same name. The Argentine Co. is also the owner of several concessions for public lighting granted by the various municipalities in the towns served. The profits of the Argentine Co. for the past three years have been £27,485, £29,696 and £54,060, before charging interest, depreciation and administration. It is estimated that for 1911 they will be £80,000.

Mexican Fuel and Power Co., Ltd.—The list closed on 9th inst., in an issue of 50,000 7 per cent. £1 cumulative participating preference shares at par.

Eastern Extension, &c., Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended September 30th last of 2s. 6d. per share free of income-tax.

Stock Exchange Notices.—The Committee have appointed a special settling day as under:—

Wednesday, December 20th.—Manaos Tramways and Light Co., Ltd.—300,000 ordinary shares of £1 each, fully paid (Nos. 1 to 300,000).

And ordered the undermentioned to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co., of Baltimore.—$1,000,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each (Nos. 11,565 to 12,564).

United Electric Tramways of Monte Video, Ltd.—The directors have announced an interim dividend of 3s. per share, less tax, on the ordinary shares.

Western Telegraph Co., Ltd.—The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1912, being at the rate of 6 per cent. per annum. The transfer books will be closed from December 14th to 20th inclusive.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended October 27th, 1911, were 916,552, compared with 736,085 units in the corresponding four weeks of 1910.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

In the directors' report for the year ended September 30th, 1911, it is stated that the accounts show, after provision for doubtful debts, a net loss of £55,457. Transferring £50,000 from the reserve fund, adding £22,614 brought forward, and deducting £9,375, the dividend on the preference shares paid in January and July, there remains, after providing for the preference dividend accrued to September 30th, a balance of £4,657 which the directors propose to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share or at the rate of 5 per cent. per annum be made to the preference shareholders on January 1st prox., but find themselves unable to recommend any distribution of a dividend to the holders of ordinary shares. The general business of the company has been fully maintained, but it has unfortunately been absolutely impossible during the last 18 months to vary the selling prices in step with the enormous fluctuations in the costs of raw material, both in the form of stock and purchases. The effect has been exceptionally severe in the case of the French works. A diagram clearly demonstrating the fluctuations referred to is circulated with the report. Taken as a whole our foreign agencies have done a fairly profitable business. The electrical industry shows a slight improvement. The volume of the submarine cable work is much the same as last year, and the steamers *Dacia* and *Buccaneer* have had fair employment. The works at Silvertown and Persan have been maintained in the usual state of efficiency. Mr. C. H. Moore, the retiring director, offers himself for re-election.

The general meeting will be held at 106, Cannon Street, E.C., on Tuesday, December 19th, at 12 o'clock noon.

The diagram which accompanies the report is the Para Market Chart issued by the *India Rubber Journal*, showing the violent fluctuations in prices of rubber in 1910 and 1911. The price of fine hard Para which, in January, 1911, was 5s. 1½d. per lb., rose by the beginning of March to 7s. 1d., dropping gradually to as low as 3s. 10d. early in June, rising to 5s. 0½d. in September, since when it has gone down to 4s. 4d. The 1910 chart shows the following fluctuations:—January, 7s. 7d.; April, 12s. 8½d.; June, 8s. 9d.; October, 6s. 2½d.; December, 5s. 5d.

We have brought together below the figures given in the accounts for this year and last:—

Year ended—Sept., 1910.	September, 1911.
Brought forward, £55,012	£22,614
Net profit, £55,414	Net loss, £55,457
Ordinary dividend—10 per cent. £12,500 interim £37,500 final	Nil
Put to reserve against stocks—£30,000	Taken from reserve, £50,000. The preference dividend is to be paid and £4,657 carried forward.

Profit and Loss Account.

	Sept., 1910.	Sept., 1911.
Salaries, commission, rent and general expenses	£72,534	£79,001
Mortgage deben. interest ...	16,000	16,000
Bad debts	1,122	1,245
Income-tax	1,790	2,478
Depreciation, buildings and machinery	24,892	24,977
Directors' remuneration ...	2,400	2,400
Gross profit after making provision for doubtful debts, &c.	180,619	64,178
Balance	Profit 55,414	Loss 55,457

"The prices of some raw materials attained an abnormally high level, but the advances the company were able to make in selling prices . . . . have, except in the case of the French works, sufficiently met the situation. The stocks, however, are highly priced, and the board have thought it desirable to make the provision mentioned above."—*Directors' report issued December*, 1910.

"It has, unfortunately, been absolutely impossible during the last 18 months to vary the selling prices in step with the enormous fluctuations in the costs of raw material, both in the form of stock and purchases. The effect has been exceptionally severe in the case of the French works."—*Directors' report issued December*, 1911.

Melbourne Electric Supply Co., Ltd.

The directors' report for the year ended August 31st, 1911, states that in view of the increasing capital requirements of the Melbourne and Geelong undertakings, an extraordinary general meeting in July adopted a resolution raising the unexercised borrowing powers from £150,000 to £250,000. In pursuance of these powers, the directors have created £250,000 second debenture stock, which they propose to issue as and when required, and of which £100,000 has been lodged with the company's bankers as collateral security for a temporary loan. Since the close of the financial year the directors have sold and allotted the unissued balance of 10,000 7 per cent. first cumulative preference shares at a price equal to par net to the company; and they have also sold a further 4,475 Adelaide ordinary shares at a substantial profit. During the year capital expenditure in Australia on additional land, buildings, plant, mains, &c., has been incurred as follows:—On the Melbourne undertaking, £69,015; Geelong, £8,891: Geelong tramways, £24,243=£102,149.

The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings was £36,433. Adding the dividend received on the company's holding of ordinary shares in the Adelaide Electric Supply Co., Ltd., together with discounts, transfer fees, &c., the total gross profit for the year amounts to £16,334.

After payment of management and general expenses at the London head office, and interest on debenture stock and temporary loans, and after making the following allocations, viz.:—To extinguish suspense account, £5,861; to depreciation and general reserve account, £7,000; to writing down head office furniture, £50; there remains a credit balance of £16,675, to which must be added £3,353 brought forward, making a total credit balance of £20,028. Deducting from this sum the dividend on the 7 per cent. first cumulative preference shares for the half-year ended February 28th, 1911, there remains an available balance of £16,528, which the directors recommend should be applied as follows:—

Dividend on 20,000 7 per cent. first cumulative preference shares to August 31st, 1911 (paid on September 1st, 1911), £3,500; dividend on 2½ per cent. on £174,170 consolidated ordinary stock, free of income-tax, £4,354; debenture stock sinking fund, being the proportion accrued from January 1st to August 31st, 1911, of the annual amount of £2,500, £1,667; income certificate service fund, £1,800; leaving to carry forward, £5,207.

The directors recommend the setting aside of the full amount of the annual income certificate service fund of £1,800, and the application of such sum first in the payment of 3 per cent. interest on, and the balance towards the redemption of, the outstanding certificates.

The Melbourne undertaking has shown satisfactory growth during the past year; the total connections having increased by 41 per cent., the total units sold by 50 per cent., and the gross profit by 72 per cent., as compared with the previous year.

The negotiations with the Town Council of Hawthorn, an important suburb of Melbourne, for a lease of their Order-in-Council have recently been concluded, the order has been transferred to the company, and mains are now being laid in the district.

The construction of the small system of electric tramways at Geelong has been steadily proceeded with during the year; and it is expected that the lines will be opened for traffic in the course of next month.

The following tables show the progress made by the Melbourne and Geelong undertakings during the past four years:—

	Lighting in 30-watt lamps.	Motors in rated H.P.	Total equiv. connections in 30-watt lamps.	Total units sold.	Gross profit.
Melbourne.					
August 31, 1908..	90,088	2,150 H.P.	157,412	2,326,807	£16,053
August 31, 1909..	104,900	2,434 H.P.	182,788	2,716,174	£20,573
August 31, 1910..	136,562	3,688 H.P.	252,538	3,394,525	£19,279
August 31, 1911..	189,324	5,196 H.P.	355,596	5,0.9,162	£33,2:6
Geelong.					
August 31, 1908..	26,942	818 H.P.	51,864	312,661	£1,623
August 31, 1909..	28,336	893 H.P.	56,920	364,770	£2,439
August 31, 1910..	33,756	994 H.P.	63,938	413,101	£2,022
August 31, 1911..	37,938	1,133 H.P.	74,186	506,267	£3,206

Further illustration of the increasing development of the Melbourne business is afforded by some graphic curves which accompany the report.

The Adelaide Electric Supply Co., Ltd., has continued to make good progress during the year; and a dividend of 10 per cent. on the ordinary shares, together with a bonus of 2s. per share, has been paid in respect of the year ended August 31st, 1911, credit for which has been taken in this company's profit and loss account.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

Lord Arthur Butler (Chairman) presided at Winchester House, E.C., on December 7th, over the ordinary general meeting of this company.

In moving the adoption of the report, the Chairman said they were presenting a statement of accounts which they considered very satisfactory. The gross revenue showed an increase of £4,628. The traffic receipts increased by the very satisfactory figure of £2,817. The weather of 1910 was very unfavourable for traffic, but that of 1911 had been all that they could desire from a traffic point of view. The electric lighting had again shown a large increase, viz., £1,784, or over 32 per cent., a very gratifying rate of expansion which promised to continue. Turning to the expenditure side of the revenue account, the figures bore favourable comparison with the corresponding items of last year's account. Coal and coke showed an increase of £813, owing to the larger output of electric current, the units generated being 2,120,791 this year, against 1,790,923 last year, an increase of nearly 18 per cent.; and to a scarcity and higher price of coke, of which they used all they could get from the local gasworks. The scarcity of coke had involved the use of a larger quantity of the more costly coal. They had a balance being profit of £21,785 against £18,242, an increase of no less than £3,542, which was nearly 80 per cent. of the increase in gross receipts, viz., £4,628, so that it cost them only £1,086, or little more than 20 per cent. of the increase to earn the additional profit. The improvement in the net earnings of the company had been steady and continuous in recent years. During the last four years he found that the profits earned by the business were:—In 1908, £13,390; in 1909, £15,053; in 1910, £18,242; and in 1911, £21,785, which was very satisfactory progress. The profit for the past year was carried down to the appropriation account, and after debiting the debenture interest and interest on loans, income-tax, &c., the amount of net profit transferred to the revenue account in the balance-sheet was £13,255 against £9,550, an increase of £3,705. If they turned to the balance-sheet they would see on the debit side

nat their loans were £42,000 against £44,000, a decrease of £2,000, which had been paid off in the year; the creditors were £3,868 against £1,909, an increase of £1,959, and this increase represented the sum due to the contractors for the supply of additional machinery. The item "contractor for unpaid balance" was £1,000 against £1,750 last year, a reduction of £750, being the amount they had paid Mr. Murphy in the year. Then the reserve account had been increased from £8,500 to £11,000, the permanent way reserve from £1,500 to £4,000, the increase in each case of £2,500, being the amounts set aside to these purposes out of last year's revenue balance. On the credit side of the balance sheet there was considerable alteration in the figures. They had had to provide, in order to meet their growing business, a new high-tension cable (£3,541), additional plant and machinery (£2,077), and they had had to spend on electric light installation £2,705. All these sums had been paid with the exception of the balance due to contractors, about £2,300, which would be paid in due course. In electric lighting, as in gas undertakings, the expenditure on capital account never ceased as long as the business continued to grow. They could not secure new customers without sufficient cable and generating capacity to supply them, and they had to face, in the immediate future, the provision of an additional generator at their power house in anticipation of the increased load which they expected next autumn. No money could, however, be better invested than capital expenditure to meet a growing demand for electric current when it could be sold at a reasonable price. The final result was that they had at the credit of revenue account in the balance-sheet £15,532 against £11,026 last year, and their recommendation was that they should pay the preference shareholders half their year's dividend, £3,750, place £1,500 to reserve account, place £6,000 towards future maintenance of permanent way, raising that fund to £10,000 for special maintenance expenditure or reconstruction of line when the time came, and they proposed to start a new reserve for third-party insurance with £2,000, and carry forward to next year £2,282, against £2,276 brought into the account. With reference to the appropriation of £2,000 to a third party insurance reserve, he might explain that it was becoming increasingly difficult not only for them, but for other tramway companies, to place their third party risks with solvent insurance companies on reasonable terms. As long as they could get covered at reasonable rates, they proposed to continue insuring, but in case they should find it advisable to take the risks themselves, they could do so with much more confidence if they had a reserve specially earmarked for the purpose of meeting any exceptional claims. With regard to the other appropriations, £1,500 was not a large amount to put to general reserve, and though £6,000 might seem a large sum to place to renewal of permanent way, they were warned, by the experience of the older electric tramway companies, that this became a very heavy charge, after a certain period in the life of the rails and paving. With this survey of the figures, he would anticipate that some preference shareholder might say with all this prosperity, "Why don't you pay us a larger dividend?" Well, the reply to that was that although the financial position of the company had been immensely improved during the past four or five years, they were unable to pay shareholders their full dividend without borrowing. They could pay the 2½ per cent. out of their cash resources, but if they gave anything more than that, they should have to borrow, and that they were anxious to avoid. They looked forward, however, to the time when they would be able to increase the distribution. In conclusion, the chairman said he would like to express their appreciation of their manager, Mr. Forde, for his work and energy during a very arduous summer season, and also for the ability and care with which he had dealt not only with the traffic, but also with the electric lighting part of the business.

Mr. A. R. Monks seconded the motion.

Mr. P. Sharp said he agreed with conservatism in business, but £6,000 was a large sum to set aside for the maintenance of the permanent way, and he would like to know if there was any special reason for putting away such a large sum.

Mr. Lea Smith said he took it that the speaker had not been over the permanent way.

Mr. Sharp: I have never seen it.

Mr. Lea Smith: "Ah!" He considered it was the wisest thing the directors could possibly have done to set aside this sum of money. No doubt the past summer had been a good one, except that, in his opinion, it was too hot for the traffic. He motored several times to Margate, and generally found the whole of the population in the water.

Mr. Holman asked for a further explanation of the sum set aside for third-party risks.

Mr. Trubshaw pointed out that nothing was allowed for depreciation, and seeing that there must be a great deal of wear and tear on the tramways, asked the reason for this omission.

The Chairman explained that they had set aside £10,000 for the permanent way, and their general reserve would now stand at £12,500, and this was really the same thing as a depreciation fund. In fact, the auditors qualified their remarks by referring to the general reserve.

Mr. Sharp asked if it was the intention to allow the permanent way to get into a worse condition and then take it in hand.

Mr. W. M. Murphy explained that the ordinary maintenance for the year included such things as a renewal of points and crossings, the packing up of rails, and the application of various remedies for prolonging the life of the rails. Eventually, however, the time came when the rail became dead and had to be replaced, and it was for that that such a fund was required. They would not have to replace the rails for some years, and they hoped the provisions they would be able to make would be amply sufficient. With regard to third-party risks, they found it difficult to place such risks with the insurance companies except at unreasonable premiums, and in another company with which he was connected, they did form a small fund, which came in very fortunately when one of the insurance companies in which they were insured went into liquidation. It was to meet these peculiar and uncertain claims which were made on tramway companies that they proposed to establish this fund, which he did not think need exceed £5,000 or £6,000.

Mr. Lock, as a former critic of the board, complimented them on the improved state of affairs.

The report was then adopted, and the retiring directors and auditors were re-elected

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Power-Gas Corporation, Ltd.—The directors' report for the year to September 30th last states that the results of the year's trading of Ashmore, Benson, Pease & Co., Ltd., show a total profit of £14,257, plus the balance brought forward, £2,352, making £16,609. Of this £4,000 has been transferred to reserve, £9,000 to the accounts of the Power-Gas Corporation, Ltd., for dividend, and the balance, £3,609, carried forward. The results of the year's trading of the Corporation show a total profit of £13,906, plus £2,122 brought forward, making £16,029, which the directors propose to apply as follows:—To reserve fund, £2,780; to dividend at 4 per cent. per annum upon the ordinary shares, £9,984: balance to be carried forward, £3,264.

Manx Electric Railway Co.—The directors' report for the year ended September 30th, 1911, states that the gross receipts amounted to £36,013, and the gross expenditure to £17,214, leaving a balance of £18,799, making, with balance forward, a total of £19,036. Debenture interest has absorbed £9,000, and the interim dividend of 2¾ per cent. on the preference shares, £3,580, leaving a balance of £6,455. Out of this it is proposed to pay the balance of preference dividend due in respect of the year, £3,580, and to reserve for special renewals £1,500, leaving £1,375 to be carried forward. There has been no capital expenditure during the year. Passenger receipts increased by £3,255; and goods and other receipts by £176, making a total increase of £3,431. The working expenses amount to £17,214, which is nearly £100 less than last year. The ratio of working expenses to receipts was 47·78 per cent. in 1911, as compared with 53·12 per cent. in 1910.

British Electromobile Co., Ltd.—The directors' report, says the *Financier*, shows a profit of £1,800 on the past 18 months, and the deficit is turned into a small surplus, besides providing for depreciation and for debenture interest and creating a reserve.

United River Plate Telephone Co., Ltd.—The directors have declared an interim dividend of 3 per cent. on the ordinary share capital, free of income-tax, for the half-year ending September 30th.

Douglas Electric Tramways, Ltd.—At the sixteenth annual meeting held in Manchester last week, it was reported that the receipts were £5,644, against £4,812. Passengers carried numbered 230,653, an increase of 34,565. Net profit was £2,125, against £1,482. The directors recommended a dividend at the rate of 7 per cent. on the preference shares, and 1¼ per cent. on the ordinary shares, leaving £301 to carry forward.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The directors have declared a dividend of 1¼ per cent., being at the rate of 5 per cent. per annum on the Common shares for the quarter ending December 31st.

Manila Electric Railroad and Lighting Corporation, Ltd.—The directors announce that a dividend of 1½ per cent. for the quarter ending December 30th has been declared on the capital stock, being an increase of ¼ per cent. on the previous quarterly payment. According to the *Financial News*, the Corporation's financial year ends on December 31st, and the following figures show the results for the 11 months:—Gross earnings, $1,325,500; same period last year, $1,183,692; increase, $141,808. Net earnings, $697,100: same period last year, $598,403; increase, $98,697.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is finishing up the year in a state of mind of subdued cheerfulness. The Railway outlook has become much more promising, with the result that prices moved up swiftly. Amongst Industrials, a forward movement in rubber is an outstanding feature. The elevation in Foreign Electrical issues shows no sign of slackening. Business is still described as patchy, but it is certainly on a broader basis, and it looks as though prices will end the year with a good deal of firmness.

Consols and their satellites were unfavourably affected by the idea that a fairly substantial issue will be required in the New Year for the purchase of the National Telephone Company's undertaking; but, on the motion in the House of Commons for making a payment on account, the price of the premier security recovered. National Telephone stocks themselves are, comparatively speaking, quiet, and the Deferred has slipped back a couple of points. Further discussion has arisen with regard to the actual position of the company's 3½ per cent. Debenture stock and the point as to

whether it is entitled to be paid off at 103 or not. The current quotation of par, middle, reflects the market view of the possible outcome.

English Electricity Supply descriptions keep steady on the whole, but there is no feature calling for particular mention. The Joint Conference of London Electric Supply Authorities which sat last week had no influence upon the market, so far as prices were concerned, although the proceedings evoked satisfaction. St. James' are a little easier at 8 middle, and London Electric Ordinary fell 5s. On the other hand, South Metropolitan Preference picked up $\frac{1}{32}$ after its decline of last week, and several of the Debenture stocks advanced, the principal rise being secured by Kensington and Knightsbridge stock, a small inquiry for which sufficed to raise the price 3 points to 95 middle.

The Home Railway market, as already noticed, gained very substantially on the idea that the recent conferences between masters and men will make for eventual peace. Prophets, moreover, ventured upon the forecast that the men's ballot would show a big majority against a general strike. Upon this, prices of steam stocks rose materially, and those of the Tube lines participated in the improvement. Metropolitan Ordinary went up 1½. Districts continued to go ahead, and the price hardened to 31½ upon the latest acceleration of the company's already rapid service. All the same, the trains continue to be uncomfortably crowded during rush hours, and conductors have been overheard to grumble numerously that they are now expected to think in seconds instead of in minutes in consequence of the alteration of the time-tables. Central Londons have not moved.

British Electric Traction shares are unchanged, but the 5 per cent. Debenture shows a loss of 1 on the highly-interesting rumour that the company—perhaps in consort with some other undertaking—contemplates an excursion into the motor-omnibus business of the metropolis. The holders of London General Omnibus stock are not greatly perturbed by this prospect is evidenced by the fact that the latter company's stock continues to rise merrily. It is worth noticing that Potteries 4½ per cent. Debenture show a rise of 3½ points on the week. The Preference shares, however, are $\frac{1}{32}$ easier. Underground Electric Railways issues hold their improvements, and there is big business being done daily in the company's 6 per cent. Income bonds on the basis of 68 middle. The restless energy of the group inspires confidence amongst stockholders of the various classes of securities connected with the concern, and District stocks are being bought again as speculative investments. Metropolitan Electric Trams 4½ per cent. Debenture stock is 1½ higher at 103; though, on the other hand, London United Tramways 4 per cent. Debenture at 72 is down on the week.

New issues have not been going any too happily for the underwriters during the past few days. It is, therefore, all the more noticeable that the premium on the new South American Light and Power Debentures should have risen 2¾. On Tuesday £750,000 5 per cent. First Mortgage Gold Bonds of £20 each were offered by the Compagnia de Electricidad de la Provincia de Buenos Ayres, at 95 per cent. In spite of the fact that 20 per cent. was payable on application, and 75 per cent. becomes due a month hence, the bonds, it is reported, were rapidly subscribed, and a premium of ½ established in the market. The bonds appealed, of course, principally to Paris, and the issue, some said, was covered in that city even before they were offered here. There was no underwriting. The Puebla Tramway issue was left in the hands of underwriters to the extent of 64 per cent., and the scrip is quoted at a discount of about 1½.

Nevertheless, the group as a whole maintains its prices with considerable strength, having regard to the number of fresh applicants with inviting offers. Montreal Light, Heat and Power rose no less than 6 points, and the shares now stand at a premium of 93½ per cent. Shawinigan gained ½, Melbourne Debenture 2, and Cordova Light Debenture 1. Manaos First Debenture put on 1½, and various other bonds of this group strengthened ½ to 1½. The report of the Melbourne Electric Supply Company shows a dividend of 2½ per cent. on the Ordinary, which is about one-third of what was earned. This explains the remarkable rise which has taken place in the stock this year, and the 5 per cent. bonds themselves are 2 higher at 101. The Mexican shares and bonds are a trifle irregular, movements amounting to very little on balance. Rio shares reacted ½, but the bonds are better.

In the Telegraph market investors are buying Eastern Ordinary and Eastern Extension shares on the yields obtainable from securities that keep so steady as these two do, and, as a consequence, the prices of both show slight improvements. The feature, however, continues to be the very lively dealings in Marconi shares, which forced the price up at one time to 5⅛s. 6d. There is, in Stock Exchange parlance, a big account open for the rise, and it might not take very much bad news to bring about a smart relapse. The Preference shares at 2 are a shade easier. West India and Panama, which appear to be an excellent speculative investment of their class, braced up to 2¾, with a good many cheap buyers about. Anglo-American Preferred has been sold, but the Ordinary at 67½ is ½ higher. American Telephone and Telegraph lost a point at 143. The bond market is firm, with more buyers than sellers for the soundest varieties.

For the India-Rubber, Gutta-Percha and Telegraph Works Company to pass its ordinary dividend altogether, after paying 10 per cent. regularly since 1904, caused something of a sensation in the market. Both Ordinary and Preference fell heavily. The tremendous fluctuations in the price of the raw stuff are responsible for the company's loss of £55,000 for the year just ended. Rubber goes on rising day by day, and the fortnightly sales at Mincing Lane this week have shown good prices. Telegraph Constructions are 10s. up. Edison & Swan again rose $\frac{1}{16}$, and Electric Constructions of both classes are a good market at advanced prices.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	In
Aberdeen	Dec. 6	2,723	+ 84	27	41,592	+ 2,277	..	..
Ayr	„ 9	374	+ 29	30	10,419	+ 89	8	..
†Bath..	Nov. 25	649	+ 16	48	40,218	+ 1,243	..	..
Birkenhead.. ..	Dec. 10	2,231	+ 58	36	41,690	+ 1,476	13·7	..
Birmingham Corp.	„ 2	18,565	+4,710	35	298,542	+58,489	56·4	..
†Blackburn	„ 6	1,001	+ 52	36½	42,818	+ 3,623	14·6	..
Blackpool Corp.	„ 7	861	+ 127	..	56,938	+ 7,862	..	..
Blackpool-Fleetw'd	„ 9	480	+ 44	23	25,020	+ 2,072	..	..
†Bolton	„ 2	2,412	+ 172	36	90,575	+ 6,040	26	..
Bournemouth ..	„ 6	2,729	+ 105	36	66,716	— 856	22	..
Bradford	„ 2	9,833	+ 657	35	195,0·2	+ 18,433	56	1·2
Brigbton	„ 10	1,503	+ 49	36½	39,421	+ 2,259	9·5	..
Bristol	„ 8	11,559	+ 503	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdric	Dec. 1	534	+ 122	48	10,895	+ 424	3·65	..
Barnsley	„ 1	354	+ 28	„	8,908	+ 662	..	..
Barrow	„ 1	559	+ 138	„	14,850	+ 2,146	5·87	..
Devonport ..	„ 1	917	+ 132	„	23,982	+ 3,561	8·85	..
Gateshead ..	„ 1	2,064	+ 143	„	50,2·5	+ 2,7·8	11·25	..
Gravesend ..	„ 1	378	— 2	„	10,277	+ 861	6·5	..
Greenock.. ..	„ 1	1,340	+ 446	„	34,879	+ 5,804	7·25	..
Hartlepool ..	„ 1	505	+ 125	„	13,149	+ 1,359	6·72	..
Kidderminster ..	„ 1	173	+ 5	„	5,612	+ 314	..	..
‡Leamington ..	„ 1	304	+ 45	„	8,561	+ 436	..	..
Merthyr	„ 1	187	+ 37	„	10,058	+ 193	2·9	..
Metropolitan ..	„ 1	15,836	+2,555	„	422,263	+63,555	22	..
Middleton ..	„ 1	685	+ 52	„	16,380	+ 1,303	8·5	..
Mid.Joint Com'tee	„ 1	8,227	—3,005	„	211,214	—27,080	..	..
Oldham—Ashton	„ 1	1,090	+ 78	„	27,686	+ 1,116	9·13	..
Peterborough ..	„ 1	211	+ 21	„	6,186	+ 624	5·31	..
Potteries	„ 1	4,112	+ 327	„	94,426	+ 8,683	29	..
Rothesay	„ 1	76	+ 2	„	10,033	+ 59	2·75	..
Southport ..	„ 1	454	+ 18	„	14,593	+ 566	8·17	..
S. Metropolitan..	„ 1	1,509	+ 70	„	41,388	+ 2,165	..	..
Swansea	„ 1	2,1·6	+ 197	„	55,0·4	+ 3,252	12·5	..
Tynemouth ..	„ 1	279	+ 16	„	12 5·1	+ 402	3·75	..
Weston-s-Mare ..	„ 1	49	+ 3	„	8,138	+ 1,054	3	..
‡Worcester ..	„ 1	463	— 1	„	14,200	+ 629	5·75	..
Wrexham ..	„ 1	204	+ 32	„	4,930	+ 288	..	..
Yorks. Wool. Dist.	„ 1	1,9·0	+ 186	„	50,764	+ 3,441	17	..
Miscellaneous ..	„ 1	576	+ 43	„	10,895	+ 712	..	..
Burnley	„ 9	2,643	+ 233	..	..	..	11·73	..
Burton-on-Trent ..	„ 10	508	— 43	36	10,566	+ 572	6·6	..
Bury	„ 10	2,251	+ 88	36	47,065	+ 3,975	22·5	..
Cardiff	„ 9	4,453	+ 31	36	89,·09	+ 6,696	..	..
Chatham and Dist.	„ 7	1,488	— 81	49	41,780	— 19	15	..
Cork	„ 7	867	+ 1	49	24,433	+ 563	9·9	..
Croydon	„ 1	2,991	+ 210	35	64,048	+ 4,651	11·4	..
Darlington	„ 25	448	+ 56	35	7,788	+ 746	..	..
Darwen	„ 8	489	+ 2	36	9,759	+ 709	4·36	..
Dover	„ 2	358	+ 16	35	9,466	+ 1,347	4·75	..
†Dublin	„ 1	5,173	+ 287	..	136,799	+11,657	54·2	..
Dundee	„ 22	2,212	+ 57	27	52,513	— 760	15	..
East Ham	„ 9	2,088	+ 198	36	39,904	+ 2,169	7·87	1
Exeter	„ 8	530	— 19	36	12,698	+ 842	5·5	..
Glasgow	„ 9	37,881	+3,054	..	527,227	+37,991	98	..
Hastings	„ 7	1,372	+ 22	..	..	+ 666	..	..
†Huddersfield ..	„ 2	1,875	+ 148	35	67,911	+ 7,123	29·5	1
Hull	„ 9	5,958	+ 213	36	105,453	+ 5,616	14·5	..
Ilkeston	„ 7	288	— 4	36	4,811	+ 88	..	..
Ipswich	„ 10	667	— 27	36	16,691	+ 892	10·5	..
Kilmarnock.. ..	„ 9	300	+ 21	30	4,995	+ 399	4·25	..
Lancashire United	„ 6	2,464	+ 199	49	66,·66	+ 2,468	39	..
Leeds	„ 2	14,117	+ 921	35	266,996	+18,679	50·75	2
Leicester	„ 9	4,928	+ 213	..	..	..	..	..
†Leith	„ 2	582	+ 72	28⅔	19,245	+ 1,457	8·7	..
Liverpool	„ 2	22,139	+1,0·6	48	549,847	+17,836	116	2·5
‡L.C.C.	Nov. 29	82,997	+5,908	..	1,539,245	+84,276	140	6
London United ..	Dec. 9	10,665	+ 776	..	317,706	+11,636	..	..
Lowestoft	„ 9	301	— 21	10	1,770	+ 13	3·5	..
Manchester ..	„ 9	31,535	+1,652	36	589,781	+82,203	183	..
Newcastle	„ 9	8,402	+ 780	..	155,789	+12,099	14·5	..
†Newport	„ 2	665	+ 27	35	25,127	+ 991	14·5	..
Oldham	„ 10	3,681	+ 154	37	72,0 5	+ 3,263	23·75	·5
Pontypridd	„ 9	725	— 5	36	15,109	+ 9	5 5	..
†Portsmouth ..	„ 2	1,617	+ 16	35	81,697	+ 6,708	15·25	..
Preston	„ 6	1,4·9	— 40	36	28,543	+ 2,059	..	..
Rotherham	„ 7	1,330	+ 113	36⅔	24,771	+ 2,026	12	..
Salford	„ 4	9,702	+ 681	35	174,205	+ 8,0·4	..	..
Sheffield	„ 12	12,996	+ 726	37	238,962	+15,849	40	..
Southampton ..	„ 6	2,135	+ 96	36	45,327	+ 5,507	22	..
Southend-on-Sea ..	„ 6	873	+ 142	36	26,486	+ 4,012	..	..
†South Shields ..	„ 2	506	+ 84	31	22,374	+ 2,434	..	..
Swindon	„ 6	283	+ 22	..	5,834	+ 636	..	..
Tyneside	„ 6	854	+ 206	23	11,780	+ 1,826	..	..
Wallasey	„ 9	1,951	+ 147	36½	40,673	+ 5,584	..	..
Walthamstow ..	„ 9	1,261	+ 64	36	27,721	+ 1,7·4	9	..
West Ham	Nov. 30	5,144	+ 648	35	95,925	+ 8,947	15·25	..
Wolverhampton ..	Dec. 6	1,837	— 7	36	35,738	+ 2,0·0	25	..
Cen. London Rly...	„ 9	10,739	— 571	23	109,124	—16,166	6·32	..
City & S. Lon. Rly.	„ 10	6,979	— 255	23	73,128	— 423	7·26	..
Dublin-Lucan Rly.	„ 8	216	+ 11	23	3,4·6	— 40	7	..
G.N. and City Rly.	„ 12	3,425	+ 358	23	33,272	+ 1,017	3·5	..
L'pool Overh'd Rly.	„ 10	2,842	+ 202	..	34,483	+ 2,003	6·8	4·3
Llandudno-Col. Bay	„ 8	221	+ 33	..	..	..	..	..
London Elec. Ry. Co.	„ 9	29,4·0	+1,170	23	296,795	+10,195	21·25	..
Mersey Railway ..	„ 9	4 311	+ 141	23	44,748	— 1,073	4·5	..
Metropolitao Rly.	„ 10	37,2 8	+ 341	23	385,·72	— 4,549	24·5	..
Met. District Rly.	„ 9	24,065	+ 835	23	257,624	+11,454	24	..
Anglo-Argentine ..	„ 9	102,491	+2,784	..	2,402,·8s	+195 950	..	..
§Auckland	Nov.	16 594	+1,168	20	81,451	+ 6,196	23·3	·6
Bombay (B.E.T.) ..	Nov. 10	6,625	+ 118	45	130,932	+ 8,337	..	..
§Brisbane	Nov.	21,890	+3,1·0	48	227,870	+27,450	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Dec. 9	7.720	+ 313	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Nov.	3,165	..	48	37,944	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Nov. 15	1 421	+ 118	..	31,067	+ 2,688	..	..
§Montevideo ..	Nov.	26 614	+2 528	..	..	..	..	..
Perth (W.A.) ..	Dec. 8	3,444	+ 501	49	79,803	+16,947	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 12th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅛ — 8⅜	..	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101 xd	..	3 19 3
Charing Cross, West End & City	5	5	5†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	99 —102	+1½	4 8 3
City of London, Ord.	10	7	6†	12⅜ — 13½	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅝ — 9⅜	..	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11⅞	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅝	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	94 — 96	+3	4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7
London Electric, Ord.	3	2	..	1 — 1⅜	— ¼	3 8
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 3
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7
Metropolitan	5	5	4†	3⅝ — 4	..	6 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	..	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3½ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	7⅜ — 8½	— ½	6 1 3
Do. 7 % Pref.	5	7	7	6¾ — 7½	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	..	2⅜ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	100—103	..	4 17 1
Soutb Metropolitan, 7 % Pref.	1	7	7	3⅛ — 1 3/32	+ 1/32	6 8 0
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	⅛ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅞ — 8⅜	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8½	7†	6½ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	112 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1 xd	..	3 0 0
Do. 5 % Deb.	100	5	..	94 — 97	+1	5 3 1
Eleo. Lt. and P. of Cocbabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Eleo. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90½ — 92½	..	5 8 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	— 1/32	Nil
Do. 6 % Pref.	1	6	6–	21/32 — 25/32	..	7 13 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅝ — 3⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	100—102	+2	4 18 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	88 — 90	—1	4 8 11
Do. 7 % Cum. Pref.	$100	7	7	107½ — 109½	— ½	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Montreal, Lt., H. and Power	$100	7	8	191 —196	+6	3 11 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	41 — 43	..	11 12 6
River Plate, Ord.	Stock	10	..	233 —243	+10	4 2 4
Do. 6 % Non-Cum. Pref.	Do.	6	6	104 —110 xd	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	124 —126	+ ½	3 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11⅞d.	¾ — ⅞	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ —108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7 — 7½xd	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	142 —144	—1	5 11 1
Do. Collat. Trnst	$1000	4	4	95 — 97	..	4 2 6
Anglo-American Telegrapb	Stock	3¾	3†	66½ — 68½	+ ½	5 9 6
Do. 6 % Pref.	Do.	6	6	110½ — 111½	— ¼	5 7 7
Do. Def.	Do.	30/-	..	25¾ — 26¼	..	5 14 3
Anglo-Portuguese Tel., 5 % Reg. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	7 — 7½	..	4 16 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	— ½	4 10 11
Cuba Telegraph	10	6	6†	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100¼ — 102½	..	4 7 10
Direct United States Cable	10	4½	..	7¾ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Eastern Telegraph, Ord. Stock	Stock	7	5†	137½ — 140½	+ ½	4 19 8
Do. 3½ % Pref. Stock	Do.	3½	3½	83¼ — 85½	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100¾ — 102½	..	3 18 1
Eastern Extension	10	7	5†	13¼ — 13⅝	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ — 102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6	10⅜ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	12¼ — 13½	..	4 10 9
Great Northern Telegraph	10	18	5†	32¼ — 33½	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	74 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	5	..	2⅝ — 2⅞	..	..
Do. 7 % Cum. Partic. Pref.	1	16	..	1⅞ — 2⅛	— 1/16	..
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1⅜ — 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ — 105½	..	5 13 9
Do. Def.	Do.	6	6†	120 —122	— 2	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	9⅜ — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¼ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5½	..	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ — 101½	..	4 8 8
Oriental Telep. and Elec.	1	8	..	1⅛ — 1⅜	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 5/32 — 1 9/32	..	4 13 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacifio and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5†	8⅜ — 9¼	..	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	+ 1	4 8 3
United River Plate Telepbone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99 —101	..	3 19 3
West India and Panama Teleg.	10	1¼	1½	2⅞ — 3 xd	+ 1/16	4 3 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½ xd	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼ xd	..	5 17 1
Do. 5 % Debs.	100	5	5	103 —105	..	4 15 3
Western Telegraph, Ltd.	10	7	6†	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	+ ½	4 7 5

* Unless otherwise stated, all sbares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Batb Trams, Pref. Ord.	1	Nil	Nil	1/10 — 1/4	..	Nil
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1 1/4	..	Nil
Do. 6 % Pref.	10	1½	1½	3 7/8 — 4 1/8	..	3 8 7
Do. 5 % Deb.	100	5	5	92 — 95	—1	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	..	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	.	50 — 52	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1¾†	30 — 31	..	4 16 9
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —104	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Nortbern & City, Pr'f. Ord	10	Nil	..	1 — 1½	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	5/8 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 14 8
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 3/8 — 2 5/8	— 1/8	4 6 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	+1	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	2 7/8 — 3 3/8	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	—1	5 8 1

NAME.	Stock or Sbare.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Metropolitan Railway Consol.	100	1 3/8	2†	44 — 44½	+1½	3 1 10
Do. Surplus Lands	100	2 1/4	3†	66 — 68	+1	4 0 11
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 17 0
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	31 1/4 — 31 3/4	+ 3/4	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4 1/4†	88 — 90	..	3 12 3
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	5†	2 7/32 — 2 9/32	..	5 12 4
Do. Def.	1	Nil	..	5/32 — 7/32	..	Nil
Do. 5 % Pref.	1	5	5	2 7/32 — 2 9/32	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	102 —104	+ 1½	4 6 7
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Potteries, Ord.	1	2	..	1/8 — 7/16	..	..
Do. 5 % Pref.	1	5	5	3/32 — 5/32	— 1/32	6 19 3
Do. 4½ % Deb.	100	4½	4½	91 — 94	+3½	4 15 9
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 3/4 — 2 1/4	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1 1/4†	67 — 69	..	1 9 0
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorksbire (West Riding), Ord.	5	Nil	..	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/8 — 2 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5¼†	5 1/16 — 5 5/16	..	4 14 1
Do. 2nd Pref.	5	5	5¼†	4 1/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4½ % Deb.	100	4½	4½	101½—103½	..	4 7 0
Do. 5 % Deb.	100	5	5	98½—100½ xd	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	104 —107	..	4 13 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10 7/8 — 11 3/8	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	98 —100	+1	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98½—100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	8 — 8½	..	4 17 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	103 —106	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	138 —142	—2	5 12 8
Do. Pref. Ord.	100	6	6	118 —122	—2	4 18 4
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	104 —106	..	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 3/8 — 6 1/8	..	4 18 2
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2 3/4†	7/16 — 5/8	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 1/8 — 5 7/8	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	102 —105	..	4 15 3
Kalgoorlie Elec. Trams	1	Nil	..	1/4 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	60 — 64	—2	7 16 3

La Plata Elec. Trms, Prf,	1	6	6	28/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93½ — 95½	+1½	5 4 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101	..	4 19 0
Mexico Trams Com.	$100	7	7†	123 —125	..	5 12 0
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	102½—104½	+ ½	5 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7 1/8	..	6 18 0
Do. 6 % Pref.	5	6	6	5 3/4 — 5 7/8	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	97½ — 99½ xd	..	5 0 6
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	1 3/8 — 1	..	2 10 0
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 1/2	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	114 1/4—115 3/4	— ½	4 6 5
Do. 1st Mort. 5 % Bonds	..	5	5	102½—103½	+ ½	4 16 7
Do. 5 % Mort. Bonds	100	5	5	96 — 97	+ ¼	5 3 1
Sao Paulo Tram, Lt. and P.	$100	10	10†	187 —191	+1	5 4 9
Do. 5 % 1st Deb.	$500	5	5	102 —104 xd	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 3/8 — 5 5/8	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	2 3/4 — 2 7/8	..	7 2 2
Babcock & Wilcox	1	26	24†	5 3/4 — 6 1/8	..	4 5 0
Do. Pref.	1	6	6	1 1/8 — 1 1/4	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/4 — 7 1/8	..	7 0 4
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
Britisb Westingbouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	55 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/8	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/2 — 3 5/8 xd	..	5 10 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	60 — 70	..	7 2 10

Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	7/16 — 1	+ 1/16	Nil
Do. fully paid	5	Nil	..	1 3/8 — 2 3/8	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	5/16 — 7/16	+ 1/16	..
Do. Pref.	2	7	7	1 5/8 — 1 7/8	+ 1/8	7 9 4
Greenwood & Batley, Pref.	10	7	7	7 1/4 — 8 1/4	..	8 5 3
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8 7/8 — 9 3/8	..	5 6 8
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/2 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	104 —106 xd	..	4 4 11
India-Rubber, G. & T.	10	10	..	9 — 11	— 3/8	..
Do. Pref.	10	5	5	9 — 10	— 3/8	5 0 0
Telegrapb Construction	12	20	10†	35 — 37	..	6 7 5
Do. Deb.	100	4	4	100½—102 3/4	+ ½	3 18 1
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	53 — 63 xd	..	7 2 10

* Unless otberwise stated, all sbares are fully paid. † Interim dividend.

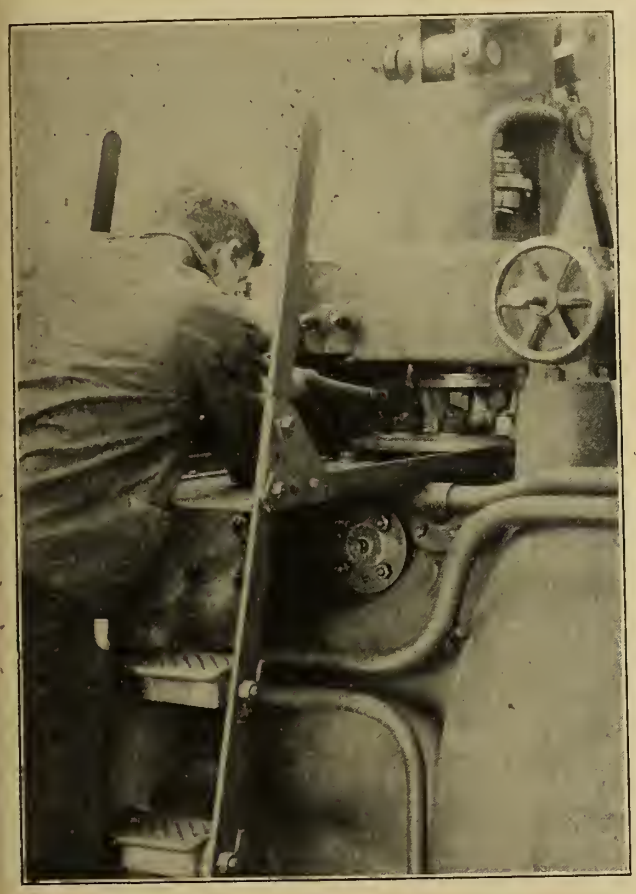
The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

THE B.H.P. GAS ENGINE.

The introduction of producer plants for generating gas from cheap bituminous slack or all kinds of low grade fuel for gas engine purposes, stands to the credit of British scientists and manufacturers.

Very efficient producer plants have been installed for gasifying ordinary bituminous coal slack and converting the energy into electricity by means of gas engines.



Valve Arrangement, B.H.P. Gas Engine.

The valuable contents of the coal are not exhausted to waste as in the case of the existing steam plants of to-day, but are treated for the recovery of valuable by-products.

The chief by-product obtained, viz., sulphate of ammonia, represents a value of about 12s. per cwt., and with native coals from 80 lb. to 110 lb. can be extracted from each ton of coal gasified, so that the utilisation of coal for producing power, and the recovery of valuable by-products at one and the same time offers, in some cases, a most economical solution of the power plant problem.

It is known that bituminous gas is apt to contain traces of tar, which tend to clog up the pistons and valves of the engines, unless special care is taken to avoid this.

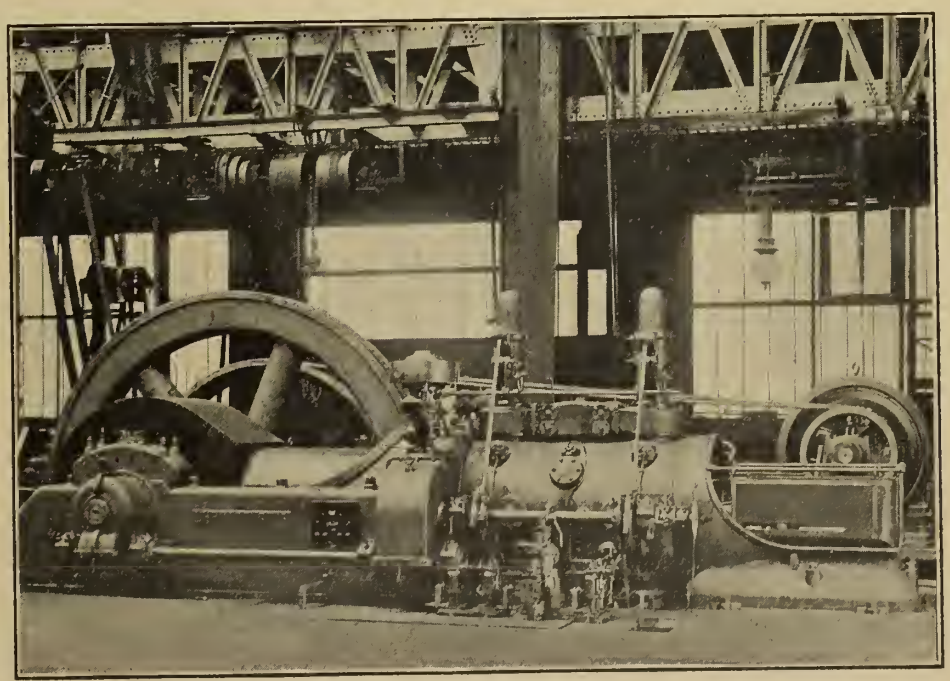
We illustrate an interesting gas-engine valve arrangement where special care has been taken in the design, in order to avoid any clogging due to tarry deposit, and from this it will be seen that the design provides special facilities for the removal of such deposits in the course of a few minutes. The illustration clearly shows how this is effected, and it is claimed that the operation could even be performed without stopping the engine, by merely shutting off the gas on that side of the cylinder, the valve of which has to be cleaned.

The arrangement is a departure from present-day practice, as it is generally known that gas engine valves can usually only be cleaned by dismantling the whole of the valve gear, and withdrawing the valves and valve cases. This is a source of great inconvenience on account of the time taken up, and also because of the necessary readjustments to the valve gear after the valves have been cleaned.

The valve is one of the improvements introduced by the British High Power Gas Engine Co., Ltd., and is a special feature of their engine known as the "B.H.P." gas engine. This engine is of the slow-speed horizontal type, which is claimed to be the most adaptable of all types for working with unclean gas. If tar should deposit in the cylinders of this type of engine, it would collect on the bottom of the cylinders, and would be swept out to the exhaust ports, which are arranged at the bottom of the cylinders, without adhering to the piston and piston rings.

It is probably on account of this and other advantages that engines of the slow-speed horizontal type have also, as is known, the best record for use in collieries with coke-oven waste gases, these gases frequently containing a fair percentage of tar.

The engines of the British High Power Gas Engine Co., Ltd., are built under licence by Messrs. Fraser & Chalmers, Ltd., of London and Erith, Kent.



The B.H.P. Gas Engine.

PROCEEDINGS OF INSTITUTIONS.

Automatic Reversible Battery Boosters.

By R. Rankin, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, November 23rd, and Manchester, November 28th*, 1911.)

(*Concluded from page* 965.)

Class (C).

In this class of booster control is usually made to depend on small variations in the generator current which it is desired to regulate, these small variations being turned to account to prevent the occurrence of larger variations. The regulation does not depend on exact design, but on the rapidity with which the regulator can act, and arrangements can be made to ensure very rapid action indeed.

Most makers of diverter boosters consider it necessary to laminate the entire booster field system; with boosters controlled by a quick-acting regulator there is no necessity whatever to have such a refinement as this.

The simplest system is that invented by Entz, the prominent feature of which is the carbon regulator.*

A notable feature of the Entz system is its simplicity. There is no complicated system of field windings to be designed in accordance with exact theory, and requiring patient adjustment on site, and consequently, exceedingly little trouble is experienced in putting it to work.

An important property claimed for this regulator is that when

* See Electrical Review, July 8th, 1910.

the balance between solenoid pull and spring tension is disturbed the result, due to the sensitiveness of the carbon piles to change in pressure, is an exciting voltage for the exciter field, and hence an exciter armature voltage in excess of that actually required. This compels the booster field to build up to the required value very rapidly.

As instant reversibility is what is aimed at in every automatic battery booster, it will be seen that the possession of this property is an exceedingly strong argument in favour of the Entz and similar systems.

Since the Entz system was invented various other systems have been introduced employing the same principle.

The well-known Tirrill regulator has been employed in this way. Originally this regulator was used for voltage regulation, its operation being responsive to small variations in the voltage which it was employed to steady. Its application to the control of battery-booster plant is shown in skeleton form in fig. 4. The scheme of connections is the same as that of Entz, the two sets of carbon piles being replaced by two resistances, and the large solenoid by a diverter and a small solenoid. Variation of the

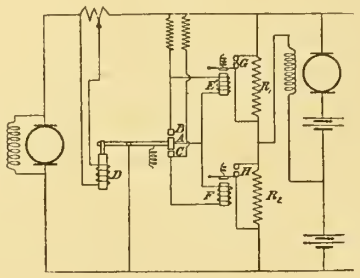


Fig. 4.

potential of the junction of the resistances, relative to that of the middle point of the battery, is obtained, not by variation of the resistances, but by their being entirely cut out by short-circuiting. Operation of the system is responsive to small variations in generator current reflected in the main solenoid. With the contact A occupying a position between contacts B and C, which will be when the spring is balanced by the pull on the magnet of the main solenoid D, the two relays E and F are energised, and both pairs of the corresponding short-circuiting contacts G and H are open. The resistances R_1 and R_2 being equal, there is therefore, under those conditions, no current in the booster field. A sufficient increase of solenoid current over that required to balance the tension in the spring causes the middle and upper contacts A and B to close. The relay coil on magnet E is therefore short-circuited and de-energised, and the contacts G close under the action of the spring shown in the figure. This, by short-circuiting the resistance R_1, throws the booster field directly across half the supply voltage, and produces a booster voltage tending to discharge the battery, but immediately the discharge exceeds the value required to bring the generator current back to its normal value, the main spring overpowers the pull on the solenoid core, and the middle and lower contacts A and C close, giving a charging tendency by means of F in a manner similar to that indicated above. Obviously the middle contact is never at rest, as, in order to get quick reversal of booster field, the complete cutting out of the resistances is designed to give an overshooting effect similar to that noted in connection with the Entz regulator.

The outline shown in fig. 4 is insufficient to give satisfactory practical results, it being necessary with the Tirrill regulator, as with most other regulators designed to give an overshooting effect, to adopt some principle of auxiliary checking control. The required checking effect is obtained by the use of what are termed "floating contacts."

It should be noticed that no type of auxiliary checking mechanism is used with the Entz regulator, this being due to the sensitiveness of the carbon piles to changes of pressure.

In the application of the Tirrill regulator, a resistance in series with a field winding is open and short-circuited alternately, but in the Taylor-Scotson scheme, the open and short-circuiting operation is performed directly on a field winding itself.* The regulator is mostly used for voltage regulation, and, so far as the author knows, has not been applied to the control of battery-booster plant in the ordinary way, but the action is made to depend on the rise and fall of line voltage at some point.

In the Tilney booster, which is classed as an externally regulated set, a potentiometer type booster field-regulating and reversing switch is operated by a small motor. The armature of this motor is connected through a resistance across the line voltage, and its field is wound differentially, one coil being excited from the bus-bars and the other carrying a portion of the generator current. The shunt coil is set so as to balance the diverter coil at the desired generator current. When the coils exactly balance each other the motor armature is stationary. An increase or decrease in generator current, due to an increase or decrease in line demand, disturbs the balance of the coils, and the armature accordingly revolves and regulates the booster field, until the battery current assumes the value necessary to bring the generator current to the correct value again.

The differential method of winding does not make for rapidity of action, and a further lag is introduced by the use of an ordinary field-regulating and reversing switch. There is no provision for over-regulation.

The Thury voltage regulator has been applied to the control of battery-booster plant. The action of the regulator is responsive to variations in bus-bar pressure, and a rise or fall of voltage from the desired value causes the regulator to act, and a booster voltage in an appropriate direction is the result.

The Thury regulator cannot be called quick-acting in the same sense, as, say, the Tirrill regulator, and it can readily be conceived that much trouble might be experienced with it should an attempt be made to make the operation dependent on the variations in generator current instead of line voltage.

Other systems which may be mentioned are those due to Lincoln and Bijur, which act on a principle similar to that of Entz. In both cases a controlling field is connected between the middle point of a number of cells and the junction of two resistances connected across those cells. In Lincoln's scheme, which is patented in connection with alternating-current systems, the torque of a small alternating-current motor, which is responsive to variations in main generator current, is balanced by a spring at the desired value of the current. An increase or decrease of generator current causes a rotation of the motor, and hence, by means of ordinary switches, a variation in the relative values of the two resistances connected across the cells, the controlling field being therefore energised in an appropriate direction.

In Bijur's system a solenoid is used, the pull on the core, which is due to the generator current, being balanced by a spring. Variation of the two regulator resistances is accomplished by means of contact points dipping into mercury cups.

In neither of those regulators is there any provision made for a back-checking action, and variation of the resistances could not conveniently be made so quick and yet so gradual as in the case of the Entz regulator.

The Brown-Boveri voltage regulator is applied as shown in outline in fig. 5. The resistances, each provided with a large number of contacts, are connected in Wheatstone bridge fashion, the booster field taking the place of the galvanometer. The terminals of the field are connected to two contact sectors A and B, which are fixed to a moving-coil system. The moving coil C moves in the gap of a differentially wound magnet D, and carries an approximately constant current. Absolute constancy of current is not indispensable. There is no spring or other control to bring the moving coil into any recognised mean position, but it can come to rest in any position which results in a balancing of the magnetic effects of the differential coils on D.

One of the differential windings is connected across the line voltage or a part of it, and the other carries a portion of the generator current to be regulated, the working of the scheme being as follows:—

The differential coils may be assumed to be balanced initially, with the sectors A and B in the mid-position shown in fig. 5, the line load being equal to the desired normal value which the generator should take, and the battery in a floating condition. The booster field will then have no current flowing in it.

An increase or decrease of line current will cause a corresponding alteration in generator current, which will upset the balance between the magnetic effects of the differential windings,

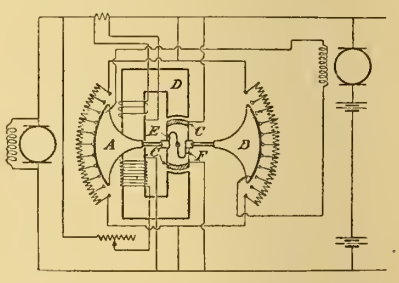


Fig. 5.

and cause the moving coil and the contact sectors to rotate in such a direction as to give the necessary discharge or charge booster voltage.

Adjustment of main generator current is effected by adjustment of the strength of the shunt winding on the magnet.

It is claimed that over-regulation is prevented by the lightness of construction of the moving parts of the regulator, and the provision of a special adjustable damping arrangement.

The springs E and F maintain the pressure between the contact sectors and the resistance contacts, and the pivoting of the sectors in coned cups as indicated in the figure, gives a rolling and practically frictionless contact between sectors and contacts, the latter being arranged on an arc, the radius of which is somewhat greater than that of the face of the sectors.

This regulator possesses the defect of all differential systems in that compounding of the main generator will affect its working. The ways in which a battery-booster plant can be used are many and varied. In three-wire systems it is quite common practice now to run the battery and booster across the outers of the system like a two-wire set. A three-wire set consists merely of two sets with a common point at the middle wire of the system. For satisfactory working the exciter field regulators have to be interlocked.

Exceedingly good results are obtained by the use of the battery and booster directly connected across the outers of the three-wire system in conjunction with a separate balancer. For example, in

* See Electrical Review, February 17th, 1911.

one station, shunt-wound generators are run directly across the outers in parallel with a battery and automatic reversible booster, and a rolling-mill motor-load is supplied from the same bars as public and general lighting without any adverse effect on the voltage. Also, in the ELECTRICAL REVIEW, Vol. LXVII, page 59, plant was described which is in operation at Blackburn Corporation Electricity Works, and which makes provision for the town traction to be supplied from the outers of the three-wire lighting and general supply system through a motor-generator. A battery and booster operate in parallel with the generator side of the set, and equalise the load so that the variations are not noticed on the three-wire system. The generator current is held steady within about 20 amperes from the mean, which is normally 600 to 800 amperes.

Arrangements such as have just been mentioned are often capable of showing large economies, but before an engineer definitely decides to supply such highly fluctuating loads from his lighting bus-bars, he should satisfy himself thoroughly that the equalising system he chooses is capable of giving the results he wants, and the best way to make sure of this is to see a similar plant in satisfactory operation.

Balancing on a three-wire system where a two-wire battery and booster are used, instead of being obtained by means of a separate rotary set, may be effected on the armature of the booster motor by means of a choking coil in the middle wire of the system connected to slip-rings on the armature. This, of course, means that the motor armature has to be larger than would otherwise be the case, the increase in size depending on the magnitude of the out-of-balance current. As an alternative to this the booster may be balancer-driven, in which case the balancer machines require to be made larger than is necessary to deal with the out-of-balance current, the increase in size being dependent on the power required to drive the booster. In all those cases a middle-wire connection should be provided for the battery, and at times of light load or in emergency, balancing can be done by means of the battery.

Colliery winding and similar work provides an opening for battery-booster plant of an instantly reversible character, provided the initial cost can be kept down. Fly-wheel sets are often employed, but the large reserve of power in a battery would be a distinct advantage in many cases. There is no necessity to limit the use of this type of winding plant to direct-current systems, as it can be equally well applied to systems in which the supply takes the form of alternating current. The system is, of course, in competition with fly-wheel equalisers on both alternating-current and direct-current systems, but a fly-wheel, although it decreases the peak power drawn from a supply, cannot flatten out the demand in the way a sensitive battery-booster plant can, and, where power is taken from a supply company and paid for on the basis of maximum demand, this is a point worthy of serious consideration.

With a good external automatic regulator the benefits of accumulator storage can be readily obtained on alternating-current systems. Very little has been done in this direction in this country, but very large installations have been put down in America operating on this principle. The most prominent name in this connection is that of Woodbridge, some of whose devices will now be described.

As in the case of the direct-current booster, perhaps the simplest arrangement is the employment of an Entz regulator operated by an alternating-current solenoid, responsive to variations in the

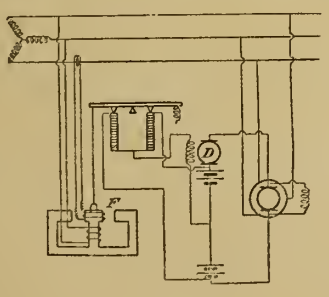


FIG. 6.

energy component of the alternating current, the regulator controlling the A.C.-D.C. transmitting plant. Such a solenoid is shown at F in fig. 6.

It consists of an iron magnetic circuit magnetised from the line potential difference on the A.C. circuit, the magnetising coil being shown wound round the middle yoke. On the enlarged end of this middle yoke there is placed a movable coil, which is suspended from one end of the lever of an Entz carbon regulator; the coil is connected across the secondary of a current transformer, the primary of which is in series with the main which has no voltage connection. The flux in the core splits and crosses two air-gaps to re-enter the centre core, and, being produced by the potential coil, connected as shown, will lag 90° in phase behind the line voltage. At unity power factor in the main A.C. circuit, the current in the movable coil will lag 90° in phase behind the voltage across the potential coil, and hence the current in the movable solenoid and the flux in the air-gaps will be in phase with each other, and a pull will be exerted by the solenoid on the lever of the regulator, the pull being proportional to the product of the flux in the air-gaps and the current in the solenoid. If the power factor is not unity the pull of the solenoid will be proportional to the product of the magnetic flux in the air-gaps and the energy component of the current, this component being, of course, in phase with the flux. The wattless component of the main alternating current will have no effect on the lever of the regulator. The effect of the pull on the lever will be to operate the Entz regulator in the usual manner. An increase in A.C. energy above the desired mean will cause the booster D to discharge the battery into the rotary circuit. If the energy in the main A.C. circuit falls below the desired mean (this mean being obtained by adjustment of the regulator spring, as usual) the booster voltage will be in the charge direction, and energy will be transmitted from the main alternating-current circuit *via* the rotary converter into the battery. Other types of external regulator may be used in a manner similar to that just described.

Either the motor-generator or the converter type of plant may be used for the transference of power, but the latter is more suitable where quick regulation is required, as the single converter machine will respond to the control somewhat more quickly than will the combination forming the motor-generator. The boosting effect necessary to cause a transference of energy between the battery and the load circuit may be obtained by the provision of a D.C. booster on the battery side of the transmitting plant, as indicated in fig. 6, or an A.C. booster on the load side.

In order that the auxiliary booster plant might be dispensed with, the split-pole rotary converter was developed. In the ordinary converter, there is, of course, a fixed ratio between A.C. and D.C. voltages, and the object of the split-pole machine is to allow of a variable ratio by causing the D.C. voltage to vary in response to load variations in the generating plant, while the A.C. voltage is maintained constant, or approximately so.

The raising and lowering of the D.C. voltage can be utilised to cause a battery connected across the D.C. terminals of the rotary to charge and discharge, alteration of the converter field being made responsive to small variations in the generator load by means of an automatic regulator.

The split-pole converter has also been used as a two-part pole machine with success, and it is found that, with a 20 per cent. variation of direct-current voltage above and below the mean—*i.e.*, 20 per cent. on each side—the variation in alternating-current voltage is about 1 per cent. on each side of the mean value. Plant of this type is in very successful operation in the Gary works of the Indiana Steel Co.

Mr. Woodbridge has described a new form of automatic exciter suitable for controlling equalising plant on alternating-current systems.

At the Gary works of the Indiana Steel Co., where the foregoing apparatus is in actual use, the rolls of the rail mill are driven by five induction motors aggregating 22,000 H.P., comprising three units of 6,000 H.P. and two units of 2,000 H.P. It has been found necessary, although the large motors have been provided with equalising fly-wheels, to install a storage battery to take care of the load fluctuations on both alternating-current and direct-current parts of the system. The battery consists of two sets of 125 cells, each set capable of giving 4,320 amperes for one hour and 8,640 amperes on the peak for regulating purposes. Regulation on the alternating-current load is affected by means of split-pole converters and Woodbridge's special exciters, and on the direct-current load, by means of boosters controlled by Entz regulators.

One of the most valuable results obtained by the use of the battery equalising plant is the increased speed and output of the rail mill, a very decided reduction in output being the result of a disconnection of the battery.

There is installed at the collieries, Hucknall Torkard, Nottinghamshire, an A.C.-D.C. plant, including a battery-booster equipment, in which the booster is of the Lancashire diverter type, and only equalises on the D.C. load.

The figures given below were obtained from a test made in a works where a battery and an Entz booster were used to equalise on the total load. The first part of the test was made with one generator working during the day, and two at night when the lighting load came on, and the second part with the battery-booster plant and one engine only in use over the whole period. Some time after the tests were carried out extensions were made which would have necessitated the running of two engines day and night, and, had a test been made then, the saving due to the equalising plant would have been even more marked. The load was of an exceedingly fluctuating nature, worse even than a traction load, and, taking into account the reduction in wear and tear of the generating plant, in addition to the coal saving, a very few years will be necessary for the battery and booster plant to entirely repay the capital initially put out on it.

It will be observed that, as the second generator was only required for about one-third of the running time of the first part of the test, the conditions of load were not the most favourable to show the maximum economy made possible by the battery and booster plant. The generator which ran through the whole of the first part of the test was the one used with the booster. The engines were of the high-speed non-condensing type.

Running plant.	Duration of test. Hours.	Total units.	Average KW.	Steam per hour. lb.	Steam per KW-hour. lb.
Two generators	138	8,536	61·85	3,735	60·43
One generator with battery and booster	136	8,330	61·25	2,649	43·25

One generator ran 48 hours and one the whole 138 hours. From the above the saving in steam per KW.-hour is 17·18 lb. or 28·4 per cent.

In the ELECTRICAL REVIEW, Vol. LIX, page 179, it is stated that at Greenock Corporation Electricity Works, where the traction load was about ⅞ths. of the total load on the station, the installation

of an Entz booster and battery reduced the coal per unit generated from 6¼ lb. to 5 lb.—that is, made a 20 per cent. saving in the total coal bill. It was estimated that the plant would pay for itself in from three to four years.

In another traction station, where the generating plant consists of Diesel oil engine sets, the installation of a Lancashire booster and a battery made a reduction of 18 per cent. in fuel consumption.

In the installation of a battery and booster on a highly fluctuating load, both the generator and battery are operated under satisfactory conditions, for it is a fact that batteries working under such circumstances usually remain in very good order indeed. For example, the battery at Greenock already referred to was not on maintenance, and was in use for six years before any money was spent on it, and then it only required cleaning out.

Discussion in London.

Mr. J. S. Highfield, in opening the discussion, said the author referred to the general use of batteries, and he agreed with his remarks, but he wished makers would devise some method of maintenance charging by which the owners of healthy batteries did not have to pay for the unhealthy ones. The difficulty in designing automatic boosters was due to the battery charge and discharge curves not being straight, especially towards the end of charging, and various devices were required to meet the curve. In his view it was not advisable to take account of the extreme end of the load curve; very few boosters would meet the full requirements, and the Thury regulator was perfectly adapted for dealing with slow fluctuations. It was essential to put a heavy fly-wheel on the booster if it were used for rapidly fluctuating currents. Laminated fields gave increased sensitiveness, and were essential with bi-polar machines. For traction loads, where a battery and booster were provided, he thought that shunt-wound machines were quite able to deal with the usual fluctuations.

Mr. A. M. Taylor said it was necessary to differentiate between time and instantaneous peaks—the automatic booster was no doubt valuable for instantaneous pressure variations, which so far as large traction loads were concerned, were negligible. A stand-by battery on a lighting system should be available for preventing a complete shut down; the battery would stand it, but not the booster. In Birmingham the sudden failure of the D.C. supply might throw a load of 20,000 amperes on the battery, which would bear this for three minutes or so. In cases of this kind it was common practice to arrange for an automatic circuit-breaker to disconnect the battery from the bus-bars; but he considered that, on the contrary, no automatic device for disconnecting should be used, but that a short-circuiting arrangement (intended only for closing the circuit) should be provided for the boosters, and thus link battery and bus-bars direct when the emergency arose. A booster to meet such conditions would cost comparatively little, and the arrangement was being adopted in Birmingham. The cost of boosters used in the ordinary way might easily be heavy, especially when the whole range of charge and discharge was dealt with by one machine, and compared unfavourably with the use of regulating cells. By adopting some such method as that indicated in his paper before this Institution (see Electrical Review, May 5th, 1911), it was possible to reduce the cost from 60 to 80 per cent. His proposed series-parallel arrangement used in conjunction with automatic boosters would effect a saving in size of boosters. The Continental combination of automatic control with regulating switches and end cells had attained a high degree of perfection, but boosters were preferable if the cost were not too high. He thought there might be scope for the use of automatic reversible boosters in conjunction with batteries on alternating-current systems, as suggested in his paper, to correct for power factor as well as to take the peak loads. In Birmingham they employed a Tirrill regulator on the A.C. supply, and in their case he did not think any economy would have resulted from the use of battery plant for the A.C. system.

Mr. H. Burge said that properly designed boosters of the Pirani type overcame the difficulties mentioned by the author, especially with machines of the interpole type. If suitable adjustments were made, the two-coil type of booster gave such good results that extra complications were not needed; they only added to the sluggishness. The colliery-winding installation with Pirani machines actually boiled down in practice to a simple three-machine set.

Mr. B. M. Jenkin dwelt on the question of time lag in the diverter type of booster. He had noticed in a railway sub-station that the power motor-generators took momentary overloads for a second or two, while the booster built up its field, and it had occurred to him that he could have saved the expense of the booster plant by frankly letting the motor-generators take the momentary overloads. The diverter type of booster involved expense, and comparison with the booster and Tirrill regulator showed the latter to be very simple indeed. If the latter was good enough it should mean a saving in the case of a large battery installation.

Mr. G. C. Allingham said boosters fell into two classes, those controlled by line current and those controlled on the relay principle by generator current. It appeared to him that the Highfield booster was unstable in exactly the same way as the three-coil type Pirani booster, while the Lancashire booster controlled by generator current was quite stable.

Mr. E. K. Scott said the differential booster did not give a straight line curve, but it knocked off a big peak and gave what was wanted in practice. The homopolar machine could easily be differentially and cumulatively compounded, and he thought its possibilities had been overlooked in booster work.

Mr. W. M. Mordey recalled the fact that the old Brush regulator was the fore-runner of all the carbon pile regulators of to-day.

The Author briefly replied to the various points raised.

Discussion at Manchester.

Mr. McKinnon said that he knew of a number of cases where the possibility of a considerable saving was entirely spoilt owing to either wrong design of booster or insufficient operating staff. Makers appeared to consider overload merely a matter of speculation. Travelling through Germany, he found many installations representing the Tirrill, Tilney and Thury methods, but unfortunately they were rarely in operation.

Mr. Cooper said that looking into the Greenock figures, there was a big saving in coal, but the maintenance charges had also increased, and this he contended was due to the battery. He had compared the Greenock figures with his own and found that his station without a battery came out very favourably.

Mr. P. P. Wheelwright said he had had an Entz booster in use for some years on traction and lighting load, and his report was reduction of coal bill, reduction in cost of repairs, and simplicity of operation. The booster handled a variation of 800-3,000 amperes very rapidly and with almost straight-line regulation. Before purchasing this booster, he inspected other types, but found them either out of operation or very sluggish. He had come to the conclusion that the Entz regulation was as good as was possible for a mechanical device.

Mr. J. Frith said that his impression of certain regulators was that they went a long way round to effect a change, but he certainly thought that the Tirrill and Entz regulators got there quickly. Had the author thought of the possibility of using a very highly inductive diverter, more inductive, in fact, than the field magnets?

Mr. C. L. E. Stewart said his experience of the Lancashire booster had been a very happy one. The machine had run for over 2½ years with very little stoppage and remarkably quick action. A number of lighting consumers were fed from the traction mains governed by the booster, and hitherto no complaint had been made, in fact the chart showed straight-line regulation.

Mr. Cyril J. Hopkins (communicated) said that the author stated that the presence of a heavy fly-wheel on the engine also affected the quality of the results with some boosters, in the same way as over-compounding on a generator, or the governor of an engine attempting to make the engine follow the load. This was true as far as the results recorded in the generator load chart were concerned; however, the fly-wheel effect was an efficient one, since it did not make an uneconomical demand upon the steam consumption, whereas over-compounding on a generator or the governor of an engine did, so that the results were not strictly comparable, and there seemed to be no question as to the desirability of a fly-wheel, even though it might appear to interfere with the evenness of the generator load.

Mr. C. C. Atchison was doubtful whether rapidity of action was always essential. He regretted that in some stations the boosters were lying idle; this did not necessarily reflect discreditably upon the booster. In connection with batteries and boosters, it was a question of time to decide whether reduction of coal costs would not be outbalanced by interest on sinking fund and capital expenditure and maintenance. It was the large undertakings that would prove the strength of the argument, and the fact that Manchester had recently installed a large battery said much for the benefits to be derived. He had obtained a distinct advantage in being able to get a very steady voltage on traction load, whereas formerly it was very irregular indeed. He appreciated the use of batteries as far as he had gone, and the Entz booster had been very satisfactory.

Mr. H. C. Crews referred to some good results which he had obtained on a lift installation using a Lancashire booster. Tests extending over an hour with variations of load from zero to maximum showed a voltage variation of only 5 in 230.

Mr. R. Rankin, in reply, said that, contrary to Mr. Cooper's contention, the battery at Greenock did not account for any increased maintenance charges. Highly inductive diverters were very clumsy and expensive articles, and he did not advocate their use. Laminated field magnets were in themselves very expensive, and it was difficult to persuade people that lamination was unnecessary. He was glad to hear of Mr. Stewart's success with the Lancashire booster, and had no intention to run down that type of machine. In reply to Mr. Wilkinson, the only reason he could suggest for the lack of development of boosters and battery regulators in this country was that there were but few openings for this class of machinery. Boosters other than the Entz could not be described as quick acting; nevertheless, they had a field of their own on, say, lighting load, and it was desirable that they should adhere to this field of operation. Any engineer desiring a constant generator load could obtain it by employing a quick-acting booster. Regarding the remarks of Mr. Crews, the author thought the generator large enough to do the requisite work without the addition of a booster.

Electricity in Mines.

At Armstrong College, Newcastle-on-Tyne, on November 15th, Prof. Thornton, President of the Newcastle branch of the Association of Mining Electrical Engineers, delivered his presidential address. He said the result of the Coal Dust Commission now sitting was of vital interest to mining electrical engineers, for with the coal dust suppressed and safe in every part of the mine, electricity could be used without the least possibility

of danger except where gas was present in large quantities and in the high percentages required for explosive ignition. Even in this case it could be made safe if one could have confidence in attention and inspection on the spot, but few would be found willing to advocate the use of electricity or any other possible source of open flame, where gas was likely to be present in bulk. With regard to cables in dusty or fiery mines, to be on the safe side armouring was advisable, but with coal dust absent or fixed, unarmoured cables would do equally well in cases where mechanical damage was not immediately possible. With regard to plant in general, and in view of the new facts which had been ascertained relating to gas and coal dust, it could not be too often said that a widening of our knowledge of the possibilities of accident was less than useless unless means were taken, by persuasion of those in authority, to face renewals or changes which made for certain safety.

Prof. Thornton spoke in terms of high appreciation of Mr. Ralph's new lamp for the detection of the presence of small quantities of gas, and said the lamp promised to give certainty where before there had only been conjecture. Mr. Ralph had lent him one of the detectors, and measurements were made on the lines of those demonstrated to the Association two years ago on the ignition of coal dust by single flashes, but now in air containing small percentages of coal gas. The speaker then described the apparatus. He said that to produce a flash a measured current from a 480-volt direct-current supply was passed through non-inductive resistances and interrupted when desired by sliding a rod back, so as to break an end-to-end contact in the middle of the box. A cloud of dust was obtained by blowing a single puff of air through a storage bottle into the explosion chamber. The air in a pressure vessel was mixed to ½ per cent. with coal gas in a reservoir, and was at a pressure of 2½ in. of mercury; the heater showing the desired percentage of gas present, a cloud of dust was made and the switch immediately opened. Below a certain current nothing happened beyond a slight dull yellow burning of dust in the arc. Sometimes this spread in the box or ran towards one side; this was called a partial ignition, the rise of pressure being negligibly small. When the ignition was so complete in the box that it travelled out of the exit tube in flame and smoke, it was called a full ignition.

In the previous series it was found that a current of 4·5 amperes just failed to ignite a cloud of the coal dust then used. In the present case, using the finest unsifted screens dust, out of 120 trials with 4·5 amperes broken and with no gas present, there were eight full ignitions, or 6·7 per cent. Gas was then admitted, and the following observations were made. Control runs with no gas present were taken from time to time, and a longer run at the end. The indicator was calibrated in measured quantities of coal gas. The following table gives percentage ignitions of coal dust in dense clouds with small percentages of coal gas present:—

Percentage of gas present ...	0	½	1	1¼	1½	2	0
Number of trials	120	130	63	50	20	15	50
Number of full ignitions ...	8	19	18	23	13	15	3
Percentage of full ignitions ...	6·7	15	27	46	65	100	6

The total number of trials was 448. The influence of gas in helping the ignition of coal dust was evident at every stage. That it should have effect down to zero was unexpected, though not, perhaps, surprising when it was considered that, however small a quantity was present, its combustion must add to the effect. It was as a carrier of the ignition beyond the arc between the separated particles of coal dust that the gas might act, for it seemed to be a point worth further investigation that when the volume of the initial ignition reached a certain limit, different, no doubt, for each kind of dust, full ignitions were more certain to occur. It was mostly a question of temperature and duration of flash so far as the dust was concerned; the exact part played by the gas was beyond the scope of the investigation.

The experiments were made with the same quality of dust throughout from a supply sent from Urpeth Pit. It was found to be very necessary to do this in order to obtain regular results. It was also necessary to keep the current exactly the same throughout, and the speed of break. In order to show in another way the influence of gas, the current was lowered until—at 3·3 amperes—no ignition occurred at break—that is, out of 50 trials there were no full ignitions. With 1½ per cent. of gas then admitted, there were 15 full ignitions out of 30 trials, giving 50 per cent., and with 2 per cent. of gas, out of 18 trials there were 14 full ignitions, or 77 per cent. The presence of a small percentage of gas was, therefore, able to cause ignition of coal dust by a flash which, by itself, would not ignite it—a point discussed by Prof. Galloway 30 years ago, and investigated by the Prussian Fire-damp Commission by an examination of the length of flame produced by a blown-out shot in a mixture of gas and dust.

The great question arose at what point should practical experience and common sense advise to cut off the electrical supply in a mine. The figures as they stood undoubtedly supported the action of the House in Committee in keeping the percentage low. Everything pointed to 1 per cent. as a reasonable limit for any possible source of ignition, electricity or naked light, to be withdrawn from the mine. Speaking with a knowledge of the consequence of coal mine explosions, he suggested that the maximum of safety with the least interference with the operation of getting coal, and with a minimum of risk, would be obtained by fixing the limit at which electricity should be withdrawn at 1 per cent. The facts brought out were of wider interest than from the electrical side of the question. They showed to what degree small quantities of gas might augment a local ignition in the workings, and the use of haulage in return airways, where both clouds of dust and small quantities of gas were likely to be present together, was once more condemned.

Electric Lighting of Railway Trains.

By Roger T. Smith, B.Sc.

(*Abstract of paper read before the* Institution of Civil Engineers, *November 28th*, 1911.)

In this paper the author deals with the method of train lighting in use on the Great Western Railway, with axle-driven dynamos and accumulators controlled by an automatic regulator, usually installed on brake vehicles only, the other coaches being supplied from them. By this means the capital cost and maintenance costs are reduced.

After a good deal of experiment, the author has decided that the illumination on a horizontal plane at the level of the eye (about 4 ft. from the floor) should never be less than 1½ ft.-candles; he aims at providing 2 ft.-candles in third-class and 2½ in first-class coaches.

The standard of illumination required in the coaches is affected by the maximum illumination given on the station platforms, for if a compartment is less brightly lighted than the platform, the entering passenger receives the impression that the lighting is poor, and this impression persists. Platform lighting should range between ¼ and 2 ft.-candles, and hence the compartment lighting should not fall below the latter figure.

Glare must be avoided; it can be greatly diminished by placing the lamps high up (never under the luggage rack) and providing a white enamel surface behind the source of light, so that the latter is always seen against an illuminated surface. Frosting the bulbs or globes diminishes glare, but collects dirt; holophane globes prevent glare and give an excellent distribution of the light.

The most satisfactory rating for tungsten lamps for train lighting is 1·3 watts per candle, giving a useful life of about 850 hours. On the Great Western Railway the lamps are only changed once in 12 months, having an average life of 900 hours. In each first-class compartment five 10-c.p. lamps in pine-shaped diffusing holophane globes are used, and in a third-class compartment three 10-c.p. lamps. The voltage at the lamps should be kept within 2½ per cent. above or below the normal, which is fixed at 22 volts on the Great Western Railway, being the terminal pressure of a battery of 12 cells when fully discharged.

It is necessary to provide a charging voltage of 2·5 volts per cell, with means to raise the voltage to 2·75 volts when necessary to cure sulphation of the plates. The best results are attained with neither constant-current nor constant-pressure charging, but a compromise whereby the current is large during the early stages of charging and diminishes, under the control of an automatic regulator, almost to zero at full charge, eventually leaving the battery practically floating on the dynamo. These conditions are ideal, and batteries examined after 12 months' use have been found in perfect condition.

The active material in the lead cell seems to be limited to a life of 5-7 years, but this may possibly be increased to 10 years. The cost of renewals and maintenance can be quite accurately determined from experience; an allowance of 10 per cent. per annum on the capital cost of the complete cell covers the whole. Chronic over-charging is much more harmful than occasional over-discharge.

The fewer the cells used the less costly is their maintenance, almost irrespective of their size. A mechanical regulator which enables a duplicate battery to be dispensed with saves initial cost, and 80 to 90 per cent. of the maintenance cost, as well as nine-tenths of the weight of the second battery, and is, therefore, preferable.

The dynamo is always driven by belt, and the casting of the belt is a difficulty calling for careful attention. The flanges of belt pulleys should be at right angles to the pulley axis. Ball-bearings save their extra cost in a few months. The dynamo must be totally enclosed in a dust proof and watertight casing, for when an engine is taking water from a trough the dynamo on the coach next the engine may be drenched, and the oil has often been washed out of oil wells.

An electromagnetic automatic cut-in and cut-out switch is recommended in preference to a centrifugal switch, as it cuts in at the right voltage irrespective of speed, and can be made to serve as a reverse current circuit-breaker. The worst thing that can happen to a train-lighting dynamo is a short-circuit in the armature, as the battery is heavily discharged before the fuse blows, just when its capacity is about to be drawn on to the utmost.

On the Great Western Railway, when the dynamo terminals were intentionally short-circuited, the cut-out opened on reverse current before the fuse could warm up. The automatic regulator must control the lamp voltage within 2½ per cent. while the battery voltage varies between 22 and 33 volts, and the lamp load between 10 and 100 per cent. of full load; it must also control the dynamo so as to charge the empty battery at full output, and to reduce the charging current as the process goes on, until the battery is full, after which, if the lamps are on, it must feed the lamps from the dynamo with the battery floating. All these conditions can be complied with.

While the working and maintenance costs of a self-contained electric lighting system do not differ much from those of oil-gas lighting for the same illumination, the capital charges of the former exceed those of the latter. But if only the brake vehicles are equipped with dynamo and battery and supply current to the other coaches, which are wired only, an economy is effected. It is sufficient for each brake vehicle to supply four other coaches at most besides itself, two such equipments being provided per ten-coach train. As each train has one or more brake vehicles, and the other coaches are provided with through cables and couplers, the trains can be made up in any order, and there is no need for block trains. Assuming the whole of the passenger rolling stock

of the Great Western Railway to be electrically lighted, 27 per cent. of the main-line stock would have to be equipped with apparatus, as well as composite and slip coaches (all brake vehicles) which leave the main-line trains *en route*, amounting to 10 per cent. of the stock. Of the local and branch-line coaches 39 per cent. must be equipped. The capital cost would thus be reduced by 35 per cent., and the running costs by 40 per cent., while the reliability of working would be increased, as all the batteries and generators on a train work in parallel. The arrangement allows of 30 per cent. of the equipments on a train being out of use without inconvenience, and the increase in reliability is of greater value to the railway than the saving in cost. When the generators thus work in parallel, it is essential that they must be rigidly limited in output, so that a dynamo cannot become overloaded. As far as could be ascertained, only one system made in England fulfilled the necessary conditions regarding the limited output of the generator and the regulator—namely, the Leitner standard apparatus.

To test the brake-vehicle method, a six-coach corridor train was equipped and started running in March, 1909. It was lighted with 142 10-C.P. tungsten lamps, taking 76·5 amperes at 22 volts. The two brake vehicles were equipped with Leitner generators rated at 45 amperes each (now rated at 50-60 amperes). There was also a self-contained coach equipped on the Leitner system in the train, the rated output of all three dynamos being 135 amperes, so that there was a margin of 58·5 amperes for charging the three batteries. The dynamo output was purposely chosen insufficient to keep the batteries healthy on daylight running, so as to test the system under limiting conditions. The train was put into traffic on March 17th, 1909, and has run continuously since then (with one break) in both fast and slow services. Several other trains running between London and Fishguard and elsewhere were also equipped in 1909 and 1910, and have run since the commencement almost without a failure. At first a looping system of connections was adopted, but it has been found preferable to substitute a simple bus-bar system, putting the whole of the coaches in parallel, with a lamp voltage regulator on each coach. The cost of equipping the experimental train (at 1910 prices) was £761 ; this could be materially reduced. The annual costs of lighting the train, averaged over 24 months, amount to £45, but under present conditions, and dealing with 500 coaches, a reduction of 29 per cent. would be made. The actual cost to the Great Western Railway of maintaining about 3,600 cells during 1909-10 represents 8½ per cent. of their initial cost. The Leitner regulator costs only three or four shillings per annum, requiring cleaning about every 14 months. For 500 coaches the average annual out-of-pocket expenses should not exceed £6 per coach on the brake-vehicle system. With all coaches self-lit the cost might be £9, while with made-up trains on suburban and local services it could be reduced to £3-£4 per coach per annum.

Attempts have been made to assess the locomotive costs due to driving the generators. The problem is a difficult one, owing to the small proportion of the power to the total output of the locomotive. Under stated conditions, with an average locomotive draw-bar power of 277 and 284 H.P., the proportion assigned to the dynamos was 3·29 per cent. in the case of the experimental train, the belt power being 9·12 to 9·34 H.P., when all the lights were on and the batteries were being charged. Averaged over the whole year, the percentage of power required for lighting is given as 1·5 per cent. Had all the coaches been self-lit, the proportion would have risen to about 2 per cent. The total weight of the electric lighting equipment was 1·7 per cent. of the weight of the train with engine and tender, but calculated on the whole of the Great Western rolling stock, the proportion would be 2·75 per cent. In the case of the experimental train, the cost of energy to drive the dynamos is worked out at £13, and the cost of haulage of the equipment at £15, making a total of £28 per annum.

Taking the working costs already given as £45, and the locomotive costs as £28. and allowing for interest on capital at 4 per cent. (£30), and sinking fund at 3 per cent. (£23), the total annual charges for the experimental train amount to £126. The author believes these figures fairly represent actual conditions on a large system to-day, and the tendency is towards cheapening the apparatus.

If the wiring is carried out with good material and protected by suitable fuses, complete immunity from fire risks can be ensured.

THE FUTURE OF RAILWAY ELECTRIFICATION.

On Friday last we were, through the courtesy of Mr. Philip Dawson, present at the reading of a paper entitled "London to Brighton in 45 minutes: The Future of Railway Electrification," by himself, before the Royal Automobile Club. The paper was profusely illustrated, both by the lantern and the cinematograph. Mr. Dawson is, of course, full of his subject, and in the short space of two hours or so he conducted his audience in semi-popular vein through the whole field of railway electrification, commencing with the earlier railway schemes in the United States, such as the Baltimore and Ohio, Long Island, West Jersey. and Seashore, N.Y.C. & H.R. Railroads, and coming down to the more recent New Haven and Pennsylvania terminal electrifications.

In connection with the latter, which is a direct-current electrification, Mr. Dawson pointed out that all the main-line trains of the system entering New York were hauled by electric locomotives, 33 of these being required, each of a total capacity of 4,000 H.P. ; 250 local trains of the Long Island electrical system, and 150 main-line trains, enter the terminal each day, and, if our memory serves us correctly, we believe that it was recently officially reported that 99 per cent. of all the trains arrived on time.

From America, Mr. Dawson led his hearers to Germany, where the experimental work of the Prussian Government with the single-phase system was briefly referred to, and the Hamburg, the Dessau-Bitterfeld, and other lines in Saxony, Baden, &c., were referred to, the recent decision as to the Berlin railways being mentioned.

Progress in Austria, Switzerland, Italy, Sweden, and Holland next came under review. How great this progress is can be gathered from the frequent references which appear in our columns.

In the Austrian, as in the German, Swiss and Swedish electrifications, the single-phase system has been adopted, many of the railways coming under the designation of "main" lines.

The French authorities, after some years of quiescence, are electrifying on a large scale in the neighbourhood of Toulouse, and this also is a single-phase scheme, connected, we believe, with another one under Spanish control on the other side of the Pyrenees.

The author then touched briefly on main-line electric railway working in this country, mentioning the Tyneside lines of the North-Eastern Co. and the Lancashire and Yorkshire Co.'s electrical routes. The Midland Co. received credit for opening the first single-phase line in this country—its Lancaster-Heysham line—and lastly, the author dealt with the work for which he has been responsible, namely, the Brighton Co.'s single-phase operated suburban routes. A good idea of the overhead work and character of the Victoria-Crystal Palace route was given by means of cinematograph films taken during a journey on one of the electrical trains.

The Brighton Co., the author pointed out, were faced not only with the problem of suburban electrification, but also with the probability of electrically working in the future the route from London to Brighton ; the distance from Victoria is under 51 miles and the service already intense, there being 40 through trains each way per day. The termini at both London and Brighton are, moreover, so congested as to render any increase in service, without impracticable enlargements, impossible under steam conditions.

Mr. Dawson referred to the well-known satisfaction derived from the electrification of the South London route ; the results, he says, as regards economy of working, are, if anything, better with the single-phase than with the continuous-current system—at any rate the Brighton Co. have been encouraged to plan further conversions from Balham *via* Thornton Heath to Croydon and other adjacent localities.

While electric tramway competition has, no doubt, been the mainspring of railway electrification in this country, the author points out that a practical limit to steam locomotive power (about 1,500 H.P.) has been reached, while no particular limit has yet been set to the haulage possibilities of the electric locomotive ; moreover, these reasons for electrification have been supplemented by the much more cogent one, that electric traction represents a saving in working costs over steam working.

The case for long-distance electrification rests on cheap electric power being available, and the cost of distribution being kept within moderate limits ; the author considers that railways will be able in this country to purchase alternating-current at ·4d to ·45d. per unit delivered, and this will be the total cost to them, if alternating current is used, while if direct current were required the cost of transformation would under favourable conditions add another 50 per cent. The importance of the latter point can be gathered from the fact that the cost of energy represents about 50 to 60 per cent. of the total locomotive charges per train-mile.

As previously mentioned, a scheme for electrically operating the whole of the London-Brighton services is being investigated. The Eastbourne and Hastings trains would be electrically hauled as far as Lewes, and the majority of the Portsmouth trains as far as Worthing, steam traction completing the journeys. Towns not on the main route would be connected to it by motor-rail car services, and, the author says, the transformation would enable a 10 to 15 minutes' service to be given to Brighton, and a 20 to 30 minutes' service to all intermediate stations, and the traffic increase would be at least correspondingly large. It is proposed that the non-stop trains shall cover the journey from London to Brighton in about 45 minutes, and the stopping trains in about 60 minutes.

The surveys and calculations in connection with the scheme are well advanced, and Lord Bessborough, who presided at the meeting, subsequently stated that a report would be presented in three or four months' time, and would be most seriously considered by the directors with a view to its adoption.

Efforts to promote a discussion on the subject met with little success, the railway men (other than Mr. Forbes, general manager of the Brighton Co.) being either absent or quiescent ; the direct-current enthusiasts, who could have put up an excellent fight from the material contained in the paper, if present, also resisted an apparently tempting opportunity.

Mr. Forbes, who gave a few details regarding the working of the company's electrical lines, mentioned that the South London line traffic dropped from 8 million passengers per annum to 3 millions, with the advent of the L.C.C. electric tramways ; electrification revived the traffic to the original 8 millions in 1910, and this year the figure would be 10 millions. On the Victoria-Crystal Palace route an increase of 70 per cent. in passengers carried had occurred.

ince the opening of the electrical service in May, and extra rolling tock was needed to cope with the growing traffic.

He had not had a single complaint from South London passengers ince the conversion, a very different state of affairs, he admitted, o that existing under steam traction. He added that the financial esults following electrification had been most satisfactory, a point vhich we hope will appeal to other railway directors more con- incingly than mere traffic facilities appear to have done.

THE MANCHESTER SMOKE ABATEMENT EXHIBITION AND CONFERENCE.

The issue of the Electrical Review for November 17th con- ained a preliminary notice of the opening of the Manchester and Salford Smoke Abatement Exhibition, with some details of the organisation and programme of the Conference to be held on November 21st and 22nd. A condensed report of the addresses and papers read at the Conference which are likely to be of interest to our readers is given below, together with a brief notice of a few of the exhibits.

The Conference was attended by the delegates of 24 municipalities and local authorities, and by representatives of eight scientific societies, and was opened by the Lord Mayor of Manchester in a brief speech of welcome.

Mr. Gordon Harvey, M.P. for Rochdale, delivered an address, as President of the Smoke Abatement League of Great Britain, in the course of which he stated that he was present as a manufacturer and a dyer, to assert that smoke from factory chimneys could be entirely stopped if three conditions were fulfilled:—

(1) There must be adequate boiler power; (2) there must be proper appliances for stoking and regulating the draught; and (3) there must be careful and constant supervision of the boiler plant by competent men. If these three conditions of work were fulfilled, his own experience enabled him to state that smoke could be suppressed on paying lines.

Mr. E. D. Simon, of Manchester, hon. secretary of the Smoke Abatement League, one of the voluntary associations already referred to, followed with a short exposition of the objects and aims of this Society, and summarised the four main lines of the League's present work as follows:—

1. To educate public opinion as to the urgency and practicability of smoke abatement.

2. To endeavour in all ways to extend the use of gas and electricity for power, heating and cooking purposes.

3. To stimulate the activity of local authorities with regard to the emission of smoke from factory chimneys, by the appointment of private smoke inspectors.

4. To help forward any legislative reforms that might be likely to render the efforts of local authorities more effective in securing smoke abatement within the areas which they controlled.

Dr. des Voeux, the representative of the London Coal Smoke Abatement Society, followed Mr. Simon with a brief paper giving some facts and figures relative to the losses due to smoke. Exact measurements proved that London's loss of sunshine varies from 15 per cent in summer to 50 per cent. in winter, and it had been estimated that the pall of smoke which hangs over the metropolis of London nearly every day in the year costs that City directly and indirectly £5,000,000 per annum.

Principal Graham, chairman of the Smoke Abatement League, followed with a speech explanatory of the main provisions of the Draft Bill for strengthening the laws against Smoke, which the Executive Committee of the League has been busy with for some months. The aim of the Bill is to simplify the procedure in smoke prosecutions, and to introduce one uniform law for the whole country; at the same time grouping the smaller local Government areas together for the purposes of the Bill, and throwing one-half of the cost of maintenance of Smoke Inspectors upon the Local Government Board.

The Bill did not meet with a very favourable reception from the Smoke Reformers present at the Manchester meeting of the League, and it has been referred back to the Executive Committee for further consideration and amendment.

The physical evils and destructive effects of smoke were emphasised at the evening session of the Conference of Tuesday, November 21st, by Prof. Cohen and by Mr. A. Ruston, a Graduate of Leeds University. Prof. Cohen in an illustrated lantern lecture upon "The Effects of Coal Smoke," gave details of the results of numerous observations carried out in Leeds and the surrounding district, relating to the composition of soot, the amount of soot emitted from domestic and factory chimneys, and the acidity and the soot suspended in and around the City of Leeds.

The Wednesday morning session of the Conference was devoted to the reading and discussion of four papers dealing with the more practical and technical side of smoke abatement.

Councillor Smith and Chief Inspector Fyfe, of the City of Glasgow, dealt with the subject of domestic smoke, and with the means taken in Glasgow to combat this evil. The solution offered by these gentlemen for the domestic smoke problem was the extended use of gas, both for heating and cooking purposes.

As no electrical engineers were present at the Conference, the gas interests had it all their own way, and no speaker dared to suggest that electrical heating and cooking apparatus could be seen in operation at the Exhibition, 10 minutes' walk away.

Two very practical papers upon "Steam Boiler Management," were then read by Mr. G. B. Storie, engineer of Mr. Gordon Harvey's works at Rochdale, and by Mr. James Bibby, engineer of Messrs. Bibby Bros.' seed-crushing works at Liverpool, where the disastrous explosion recently occurred. This explosion, it may be noted, was a dust explosion, and in no way connected with the steam-generating plant.

Mr. Storie's paper was a *résumé* of the now generally accepted scientific principles of smokeless combustion in steam boiler furnaces, and while containing nothing new, was of interest as expressing the views of an engineer in charge of an up-to-date large steam-raising plant.

Mr. Storie, while a supporter of artificial draughts, is no believer in the use of steam jets for creating a plus pressure draught in the furnaces, as is shown by the following extracts from his paper:—

"Artificial draught is independent of atmospheric conditions, and may be produced by means of steam jets or by fans. The former are generally applied in the ashpit for forcing in air, which is made to pass upwards through the grates. The steam jet has also been used to deliver air above the fires, in the form of finely divided streams, with a view to mixing it with the gases arising from the fuel bed. This system of producing draught is very costly, as a large amount of steam is used by the jets, and it also introduces a considerable quantity of water which has to be heated and carried up the chimney."

A well-known authority has been combatting the mistaken use of steam jets for supplying air to boiler furnaces for some years, and it is satisfactory to find that some practical engineers are beginning at last to hold the same opinion.

Balanced draught, the latest device for providing a sufficiency of air in the furnace and flues, is described in the following paragraph:—

"Balanced draught has only recently been introduced, and it is a combination of the two systems last named. The vacuum created by the suction fan is just sufficient to overcome the resistance due to the flues, &c., when the forcing or pressure fan is setting up the undergrate pressure to burn the required amount of coal."

Balanced draught guards against the great inrush of air which occurs with the ordinary system of hand-firing, when the furnace doors are opened for cleaning the fires or for throwing on fresh fuel, and where this system of firing is used, will prove of considerable value.

Upon the question of training stokers for their work, Mr. Storie had also a few wise things to say, and the following extracts from his paper contain some interesting facts and figures relating to this side of the subject:—

"Poking the fires is one of the principal causes of smoke production, and although the author is aware that there are times when this operation cannot be avoided, when boilers are fired by hand, it is a practice which should be discouraged as much as possible as it has become almost habitual with many firemen, who have placed at their disposal, in the stoke-hole, clumsy tools of various forms which they do not fail to use.

"The effects of good and bad stoking are often very marked. Some years ago a prize competition in hand-firing was carried out at Sheffield, and the difference between the best and the worst man made a gain of 22 per cent. in evaporation, and 18 per cent. in boiler efficiency, with conditions exactly the same in each case.

"A great deal can be done towards the diminishing of smoke from hand-fired boilers, even in the case of varying loads, if there is sufficient draught under control to meet the maximum demand for steam, and the author considers that the conditions from a smoke point of view, in many works, might be considerably improved by the exercise of care."

The final extract from Mr. Storie's paper will be one dealing with the use of heat which is too often carried up the chimney with the waste gases, for preheating the air required for combustion of the fuel, on the bars of the furnace.

"In many boiler installations, the air required for combustion is heated by the waste gases after they have left the boiler flues. The circulation of the air is effected by means of a fan placed at the outlet of the economiser chamber, which draws the gases through the tubes of a heater situated over the main flue at the back end of the boiler. The air for combustion which is drawn into the heater circulates outside the tubes through which the hot gases are passing, on their way to the economiser. From the heater the hot air is conveyed in pipes to the furnace front, which is closed, and dampers are fitted to allow of the air being admitted both above and below the fires. The providing of this hot air, which attains a temperature of about 300° F., ensures a sufficiently high temperature being maintained during combustion in conjunction with intimate inter-mixture of the gases which, as has already been seen, is of the first importance for the completion of combustion and the prevention of smoke. The author has had some years' experience with a boiler plant arranged on this system and the results have been entirely satisfactory. On a carefully conducted trial, the plant showed an overall efficiency of 77 per cent., no smoke was produced, and the fan which at present delivers the waste gases into a chimney in the mill yard, is arranged in such a manner that it can be connected up to a steel chimney. This will be necessary at some future time, as the existing chimney will have to be removed to allow of buildings being extended. Owing to the absence of smoke, the new chimney will, of course, only require to be made slightly higher than the surrounding property. At the Hammersmith Central Power Station there is a similar arrangement to the one just described, with the exception that an additional heater is placed in the flue between the feed-water economiser and the fan. From this heater the air warmed

by the waste gases after they have left the economiser, is led in ducts to the heater over the main flue, to be further heated before it enters the furnaces. It is claimed for this two-stage system of air heating that the temperature of the air entering the high temperature heater is such that the fall in temperature of the gases passing through the heater is greatly diminished, with the result that a higher feed-water temperature is obtained, and the final temperature of the gases entering the fan is reduced to about 230° F.

"The quantity of steam required to operate an induced draught plant of moderate size, would not be more than 1½ per cent. of the total steam evaporated, and with the smaller-sized plants, the consumption will seldom exceed 3 per cent. When the fan can be driven by ropes or belting through shafting from the main engine, the cost of the power absorbed becomes even less, and in many cases it is hardly appreciable in the weekly coal bill. When air and water heaters are used, and the final temperature of the gases is reduced to about 275° F., the saving effected by the adoption of the fan draught, over that created by a chimney, is very marked."

Mr. Bibby's paper covered, to some extent, the same ground, and dealt largely with the scientific principles of good combustion, and the means whereby these can be attained in actual practice. He gave the following as the points which must be satisfied by the perfect machine stoker and furnace:—

"1. A means for regulating the coal fed separately to each furnace, so that the bed of fuel is level transversely.

"2. Independent provision for both the coking and fuel combustion processes, so that the correct proportion of air is supplied at the right periods, for these processes, and perfect combustion secured without requiring too great an excess of air.

"3. The furnace should be divided into a number of sections, and each section should be supplied separately with the correct amount of air, for the quantity of fuel that it is intended to burn per section, so as to prevent short-circuiting of air.

"4. The bars should be given a horizontal motion in order to travel the fuel, and the speed should be capable of alteration to suit variations of load and classes of fuel.

"5. While the furnace is working there should be no opportunity for air to escape into the flues except through the furnace. A door should be fitted beneath the back of the furnace so as not to depend upon the ash and clinker in the back chamber preventing air being drawn in.

"6. All the reduction gear should be machine-cut and in oil-tight cases, so that the machine will work under the adverse conditions found in many boiler-houses.

"7. An automatic means should be provided for discharging the ashes which fall through the grids into the trough bars, such as a triangular slide which periodically covers and uncovers parts in the bottom of the trough, and so allows the ashes to fall through into the flue."

To these might be added an eighth clause to the effect, "the air supply required for cooling the furnace bars and for supporting the combustion of the fuel on the grate must not be obtained by blowing steam into the furnace."

The Exhibition, as already stated in the preliminary notice, was devoted chiefly to domestic heating and cooking appliances—and as at Glasgow, the electric house and the gas house proved the most popular and instructive exhibits.

The heating, lighting and cooking, appliances for the electric house were supplied by the General Electric Co., Ltd., Manchester.

A tour of the various rooms afforded a demonstration of the value of electrical time and labour-saving devices—such as electric radiators, cookers, electric lighting, plate-warmers, hot-pad heaters, cigar lighters, floor sweepers, hair curlers, electric massage treatment, &c.

In addition to this exhibit the General Electric Co. had an artistic and instructive collection of lamps, heating and cooking appliances at Stands 18 and 25 of the Exhibition, the show of low and high candle-power Osram lamps being most notable.

Messrs. E. Bennis, of Bolton, had a representative exhibit of mechanical stoking and elevating appliances, also of a CO_2 recorder and fuel calorimeter.

Messrs. Johnson & Phillips had an exhibit of arc lamps on Stand 31, and were also responsible for the lighting of the main gangway of the Exhibition.

Messrs. J. Proctor, Ltd., of Burnley, at Stand 68, showed two types of mechanical stokers, and their elevating and conveying plants.

The Exhibition was well attended during the 13 days it was open, and we are informed by the secretary, Mr. Walter Cawood, that the results will be quite equal to those attained at Glasgow in the autumn of last year. The combination of Gas, Electricity and Sanitary Corporation Committees in promoting and running Exhibitions of this character, undoubtedly tends towards their success.

Now that Glasgow and Manchester have proved that Smoke Abatement Exhibitions can be made a financial success, we shall expect to see other equally smoky towns follow their example in this latest method of combatting the smoke nuisance.

Eccles and the Bill.—The T.C. has decided to support the Bill of the I.M.E.A. There was opposition at a meeting of the Council on December 6th, on the ground of municipal trading, and a motion not to support the Bill was rejected by 12 votes to 6.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,464. "Construction of telephone cabinets and the like." W. Pickering and P. Pickering. November 27th.

26,483. "Electric incandescent lamps." S. O. Cowper-Coles. November 27th.

26,484. "Process for rendering iron surfaces non-corrosive." S. O. Cowper-Coles. November 27th.

26,485. "Electric boiler heater." J. Mann. November 27th.

26,495. "Method for generating power in primary motors." J. Esson. November 27th.

26,498. "Portable electric lamps." J. Macnab. November 27th.

26,511. "Electric arc lamps." W. Rogers and G. Rowe. November 27th. (Complete.)

26,516. "Telephone instruments." Telefon and Telegraphenbau Ges. G.m.b.H. (Convention date, June 8th, 1911, Germany.) November 27th. (Complete.)

26,520. "Plug and socket connections for electrical circuits." M. W. W. Mackie. November 27th.

26,536. "Electric lamps or the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 27th.

26,545. "Method of and combination of apparatus for operating electro-magnetic track brakes." C. B. Tutt. November 27th.

26,548. "Apparatus adapted for use with an alternating current for signalling to a distance." Hartmann & Braun Akt.-Ges. (Convention date, December 21st, 1910, Germany.) November 27th. (Complete.)

26,551. "Electric regulators." H. Leitner. November 27th.

26,556. "Accumulator plate and a process and apparatus for manufacturing the plate." B. Zyttkowski. November 27th. (Complete.)

26,599. "Electric lamp." H. C. Garment. November 28th.

26,601. "Holders for incandescent electric lamps." J. Sax & Co., Ltd., and F. H. Collis. November 28th.

26,645. "Electric welding machines." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats Ges., Germany.) November 28th.

26,661. "Magnesia or porcelain ring attachments or carriers for incandescent gas mantles." J. W. Lea. November 29th.

26,662. "Electrically driven clocks." T. T. Baker. November 29th.

26,666. "Motor-'buses and tramcars." H. J. Lawson. November 29th.

26,691. "Telephonic relays." C. H. Pritchard. November 29th.

26,717. "Telephone receivers." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt.-Ges., Germany.) November 29th. (Complete.)

26,720. "Electric secondary cells and batteries." R. Pape. November 29th.

26,732. "Method of maintaining the furnace walls of electric induction furnaces." O. Frick. November 29th.

26,735. "Protecting devices for the cords of telephone plugs." E. Borck. November 29th. (Complete.)

26,756. "Means for cooling the rotor of electric machines, especially turbo-generators." A. J. Korner. (Convention date, January 4th, 1911, Sweden.) November 29th. (Complete.)

26,775. "Galvanic boot stud." L. W. Cooper. November 30th.

26,830. "Circuit systems for operating between manual and automatic telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 30th. (Complete.)

26,842. "Primary cells with depolariser." Z. Szpor. November 30th. (Complete.)

26,854. "Processes of preparing metallic-filaments for incandescent lamps." R. H. Henderson. (Convention date, December 5th, 1910, United States.) November 30th. (Complete.)

26,857. "Cables for electric current distributing systems." C. H. Merz and P. V. Hunter. (Divided application on 4004/11, February 16th. November 30th.

26,861. "Electric conductors." W. S. Smith and W. P. Granville. November 30th.

26,862. "Generation of electric energy and apparatus therefor." W. S. Simpson. November 30th.

26,863. "Control of electric motor-generator sets." British Thomson-Houston Co., Ltd., and E. I. David. November 30th.

26,864. "Distribution of electro-motive power." G. W. Mascord. November 30th.

26,866. "Incandescent electric lamps." J. A. Scoular. November 30th.

26,874. "Method of and means for discharging electric accumulators or secondary batteries." A. M. Taylor. (Addition to 20,906, 1910). December 1st.

26,909. "Electric signalling devices and the like." T. S. Rogers. (Addition to 23,802, 1909.) December 1st.

26,913. "Electro-deposition of metals." S. O. Cowper-Coles. December 1st.

26,928. "Adjusting ring for ignition devices of internal combustion engines." R. Bosch (firm of). (Convention date, August 25th, 1911, Germany.) (Complete.)

26,929. "Interrupting devices for internal combustion engines." R. Bosch. (Firm of). (Convention date, November 7th, 1911, Germany.) December 1st. (Complete.)

26,980. "Attachment of tubular insulator carrying arms to telegraph and like poles." Bullers, Ltd., and E. H. Chambers. December 2nd.

27,006. "Trolleys for electric tramcars and the like." F. Sale. December 2nd.

27,010. "Switch apparatus for use in connection with the electric lighting and heating equipments of railway and other vehicles." Electric and Ordnance Accessories Co., Ltd., and J. Etchells. December 2nd.

27,011. "Apparatus for for measurement of electrical energy." E. T. R. Murray. December 2nd.

27,013. "Alternating current wattmeter." Callender's Cable and Construction Co., Ltd., and C. G. Watson. December 2nd.

27,034. "Electrical terminals or connections." K. D. Stevenson. December 2nd.

27,038. "Terminals for electric conductors." A. Catchpole. December 2nd.

Bootle Electricity Supply.—The electrical engineer presented to the meeting of the Corporation on December 6th a further report in regard to the provision of additional generating plant to meet the growing demand for electricity. The scheme involves an expenditure of £41,255, and it was approved by the Council.

THE

ELECTRICAL REVIEW.

VOL. LXIX. DECEMBER 22, 1911. No. 1,778.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1912 EDITION IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

MINING MATTERS.

A WEEK or two ago we expressed a doubt as to the true interpretation of the clause in the New Mines Bill, which passed through Committee in the House of Lords on Wednesday, December 13th, restricting the use of electricity in mines. In the House of Lords the *Times* reports that "On the motion of Lord Emmott, it was also agreed to substitute for the original Sub.-sec. (2) of Clause 39, the following :—(2) If at any time in any place in the mine the percentage of inflammable gas in the general body of the air in that place is found to exceed one and a quarter, the electric current shall at once be cut off from all cables and other electrical apparatus in that place, and shall not be switched on again so long as the percentage of inflammable gas exceeds that amount." We cannot from this see any *actual prohibition*, *i.e.*, any definite instructions that electricity shall not be taken into the mine, or in case the percentage of gas shall be found to exceed $1\frac{1}{4}$, any instructions that electricity shall be taken out. By electricity we mean electrical plant, and we take it that electrical plant can be installed and worked in any place of a mine so long as it is *not worked* if the percentage of gas exceeds $1\frac{1}{4}$, and the current is cut off by means of a switch on the "out-bye" side of such place. If this is so, we may congratulate those most interested in the application of electricity in mines, that the measure has not proved to be so drastic as was anticipated, and it now remains to be seen whether our colliery managers are sufficiently courageous to stick to their best friend and try to arrange matters so that the percentage of gas shall not exceed $1\frac{1}{4}$, or that the machinery shall be stopped and the current cut off until it clears. But how is the $1\frac{1}{4}$ per cent. to be measured? And what is the true meaning of "inflammable gas?" Is it coal gas or fire-damp?

By the time this issue is in the hands of our readers, the momentous meeting of the Miners' Federation of Great Britain will be over, and their decision to strike or not to strike—provided they do not again postpone, which is possible—will be known. At the time of writing it is difficult to forecast what may happen, as during the interval between their meeting in November and this one, local meetings of owners and men have taken place, but in all cases, as was to be expected, the owners have refused to consider the suggestions, and at the moment the prospects are anything but bright; although the meeting between the coal-owners' and miners' representatives in the federated areas on Monday last agreed to refer the question of abnormal places back again to the local centres for further consideration, there are still the disaffected areas of Northumberland, Durham, and South Wales to be reckoned with. The Northumberland Coal-Owners' Association, for

instance, sent the following reply after a conference with the Miners' Association: "While the coal-owners are, *as they have always been*, fully prepared to consider any application for an arrangement in respect to payment for places which are abnormal and machinery for settlement of such questions, they cannot agree to the proposal that there should be an individual minimum wage for every one working in the mines, irrespective of ability or disposition to earn such wages." Nothing can be clearer to anyone gifted with ordinary common sense than that the owners could not possibly give any other reply. They might just as well hand over their collieries to the miners and apply all their available capital to the importation of coal from countries where the coal industry is not saddled with grandmotherly legislation, because, if they did not, there would be plenty of merchants ready to try the experiment.

We are convinced, however, that the men's leaders do not take the same optimistic view of a national strike as the men themselves, and were it not for the many Socialistic foolish agitators amongst the latter, we think there would be little chance of such a strike; consequently, the meeting on the 20th inst. will really be a fight between common-sense men with good jobs, and agitators who would like to have them. The former know the strike is helpless to obtain the desired result, while the latter do not care, and will be only too ready to blame the first when the débâcle arrives. The last issue of the *Colliery Guardian* contains an interesting criticism on the effect of this Act upon wages during the year 1910, and points out that "it is easy to discern a simple sequence from cause to effect," the cause being the fact that the Act had decreased the coal-getting capacity of each individual miner on the average by 4·8 per cent., resulting, as miners were paid by piece-work, in a similar reduction in the wages earned by the men; and the effect being the present agitation for a minimum wage. The decline in efficiency was not due to any shrinkage in trade, as more coals were produced, but to the fact that more men were employed to get them. Thus in 1908 the average output per head of those employed in mines was 346 tons; in 1909, 340 tons; and in 1910 it had fallen to 328 tons; while the number of persons employed in 1908 was 987,813; in 1909, 1,013,998; and in 1910, 1,049,407; or practically 62,000 more persons were employed in 1910 than in 1908, while the coal produced in 1910 only exceeded that of 1908 by 1 per cent. Hence, while the turnover has not increased, wages have had to be paid to 1,049,407 workmen instead of 987,813. Thus, as the *Colliery Guardian* puts it, "There have been more mouths to feed, and there has been no expansion in income. The immediate result can only be lower wages; the ultimate result an increase in the price of coal. The present trouble in the mining world is purely due to an attempt on the part of the workmen to force the pace and to compel the employers to raise their prices in advance of the market." We agree with this entirely, and the position now is really this: that should this country be plunged into the turmoil of a national coal strike, the Government can only blame themselves for it; and were it not for the suffering of innocent people which would be inseparable from a national strike, we could almost welcome it, for nothing else would administer such a well-deserved lesson to the Government and the miners that the economic laws cannot with impunity be interfered with at the bidding of labour leaders any more than King Canute could command the waves to retire.

Misrepresentation in Trade.

For Truth one has to look in the well, and it is not reasonable to expect to find her on an advertisement hoarding. It is natural, inevitable, and even desirable, that each manufacturer should declare his production to be the best, and thoroughly believe it to be so. They cannot all be the best, and, therefore, 99 per cent. of them must be lying, but that hurts nobody, because they know that everybody knows that they are lying, and no harm is done.

But there is a more explicit form of statement which is not so harmless, and that is a false description of the goods; and it is this evil to which a very able and interesting Report of a Special Committee of the London Chamber of Commerce is addressed. The Committee deplores the growing tendency to misrepresentation, and gives many instances, some of which bear closely on the electrical and engineering trades. We pass over the description of wine as "port" which has never seen Oporto. Such luxuries are not for engineers. But if we buy Demerara sugar we don't wish to have beet; we would certainly like our Scotch tweeds to come from Scotland; we would like wool on our backs and not a mixture. We prefer our shoes to be hand-sewn, when so marked and priced, and that the paper on which we draw should be of the quality specified and paid for.

One of the main features of the Report is the recommendation that a department should be created to put in force the various Acts of Parliament dealing with this evil; and the splendid work done by the Irish Agricultural Department is cited. We have no hesitation in saying that the stamping out of false descriptions by vendors of butter and other commodities has had an immense effect in promoting a revival of prosperity in Ireland.

Another recommendation is that all vendors of goods should be compelled by law to furnish the correct description of such goods if requested by the purchaser, and that steps should be taken to bring all nations into line on the subject so as to promote fair international trading.

The appendices are no less valuable than the body of the Report, and give specific instances of false description, in various trades, and particulars of the existing laws at home and abroad.

The question of electric lamps is the one which bears most directly on our trade, and important evidence by Mr. Leon Gaster is quoted. The marking of the assumed voltage and the candle-power, or the current consumed, upon the lamp, is frequently a misrepresentation of a very serious character. Some lamps supplied to a specification, when tested by Mr. Gaster, were found to have a life from 40 to 70 per cent. short of that specified. He also drew attention to the quantities of lamps sold without any markings at all. He urged the adoption of some form of "hall mark" for lamps, and the establishment of some authority to see that it is genuine, in the interest of the honest trader as well as that of the user; with all of which we most cordially agree.

Labour and Rates in German Cities.

It was mentioned in the recent annual report of the A.E.G. that consideration was being given to the question as to whether the Frankfort workshops of the former Lahmeyer works should not be utilised to a greater extent than is the case at present. The A.E.G. now point out that a decision in the matter is rendered difficult owing to reflections which have arisen as a result of nine months' working in Frankfort. A variety of circumstances causes manufacturing in that town to be more unfavourable than in Berlin, where the superiority of certain classes of workmen is undisputed and where production is more economical despite the higher wages. In addition, the rates and taxes in Frankfort are 50 per cent. greater than in Berlin. The A.E.G. states that on this occasion it may remain undecided whether the complaints of the former Lahmeyer works, that the town did not always manifest towards them the goodwill which a local undertaking could claim, were justified. These considerations, taken in conjunction with the advantage of uniform manufacture in Berlin, where the company is considerately met by the city authorities, lead to the result that the A.E.G. can only resolve to separate its departments for special reasons. If the company is to take full advantage of the present position of trade, it is urgently necessary for extensions to be made more quickly than by the erection of new buildings. From this point of view, conferences have recently taken place with authoritative persons in Frankfort, which show that the town is prepared to exhibit goodwill towards the undertaking. So long as this feeling exists, the A.E.G. has nothing to gain by giving up the Frankfort works. It is added that, in addition to the present departments, which chiefly serve for the construction of machinery, the company will presumably begin the manufacture of machines and apparatus for wireless telegraphy, projectors, signalling apparatus and screws, which is already carried on in Berlin on a large scale.

The German Installation Monopoly.

A further official step in connection with the alleged German monopoly of installation work and materials, motors and accessories, against which the Prussian Government issued an order to local authorities in August, 1910, and the Baden Government last March, has now been taken by the Imperial Ministry of Alsace-Lorraine. The object in view, it will be remembered, is to prevent the establishment by any firm of a monopoly of work to be carried out on the premises of intending customers of overland central stations or stations which furnish a supply to a considerable number of small localities distributed over an extensive area. The Alsace-Lorraine Ministry has issued instructions for the guidance of the supervising authorities in forming an opinion of the contracts proposed to be concluded between the local authorities and the firms who establish overland stations, and they deal in detail with the rights and obligations of these firms. In particular, the instructions discuss the question of the right to use the roads, which can only be granted in Alsace-Lorraine under the reserve of revocation on the grounds of public interest; the obligation to supply current, the price of supply, the measurement of electrical energy, the carrying out of house installations, the duration of the agreement, and the acquisition of the station by the communal authorities. It is provided that consent must be refused under any circumstances to contract conditions whereby the firm claims for itself, or for another firm to be designated by it, the exclusive right to carry out house installations or to supply the materials, including motors. The instructions further make provision for preventing the evasion of this condition in a roundabout way.

The I.E.E.

Since the recent eruption arising out of the proposed revision of the Institution Articles, there have been many signs of a more democratic *régime* at the I.E.E., and none more noticeable or welcome than the Presidential accessibility which secured to us the continuance of the valuable discussion on Electrical Tariffs, which was inaugurated at the last meeting.

Unfortunately, much of the good resulting from a business-like procedure at the meetings may be nullified by the verbose speaker who thoughtlessly, or heedlessly, ignores the Presidential ruling as to the time available for speaking.

At the last meeting of the Institution one member, who should have known better, transgressed, occupying over 20 minutes while he imparted information which might be expected to be common knowledge to the majority of his hearers, seeing that he himself read a paper on the subject but a few years ago before the Institution.

It would be interesting to know whether this gentleman spoke as consulting engineer to the company which has adopted his proposals in practice, or as a prominent promoter of the recently formed Consulting Engineers' Association, which is supposed to hold such rigid views on professional conduct and self-advertisement; but in whatever capacity, there would be no excuse for wanton disregard of the well-known rules of debate at the I.E.E. It is evident that some drastic method of warning those who ignore the Chair and the feelings of their fellow-members is required, but nothing less than a red lamp and a fire-alarm gong will impress some people.

It is satisfactory to note, from the remarks of Mr. Ferranti at the annual dinner of the Glasgow Local Section, that there is every likelihood that the new edition of the Articles of Association will provide for voting by proxy in some form or other, thus enabling the provincial members to exercise their right to share in the government of the Institution. The question of subscriptions is less easily settled; there appears to be a satisfactory consensus of opinion to the effect that an increase is necessary, but as to the amount and proper incidence of the increase there is a strong division of opinion. Probably the outcome of the matter will be a moderate differentiation between the members in the Metropolitan area and the provincial members.

The Electrical Industry in the U.S.A. during 1909.

The preliminary report of the Department of Commerce and Labour on the output of Electrical Machinery and Apparatus, by the Census Bureau, Washington, is in the form of a review of the various divisions, with the value of the output in each. A comparative table is given, showing similar statistics for the years 1904 and 1899. In dynamos, the numbers have increased by one-half over those of 1899, and by about 7 per cent. over 1904. The value, however, has increased from £2,094,000 (1899) to £2,616,000 only, from which is deduced that, although the size of the unit has increased the price per kilowatt output has fallen. Motors have increased in value from £3,901,000 to £6,417,000, and in numbers from 159,780 to 504,730. The average capacity has declined (power motors), being 6·7 h.p., against 14·5 in 1899. Automobile motors, though 1,000 more numerous than in 1904, are slightly under the figure for 1899 (3,017). Railway motors, including motors for elevators and miscellaneous services, except fans, including also supplies and parts, are more than double in number what they were in 1899, though only showing an increase of 3 per cent. on the then value.

Storage batteries were not separately scheduled in 1899, but the weight of plates, in pounds, was 16·1 millions in 1904, and 23·1 millions in 1909. The value was £512,000 in 1899, and £935,600 in 1909, the intermediate census (1904) showing £529,000 of value.

Primary batteries were 2·6 millions in number in 1899, and 34·3 millions in 1909, or about 12 times as many. The value rose from £200,000 to £1,200,000, or only six times as much.

Arc lamps have fallen off both in number and value since 1899, though the quantity was up in 1904. The value per lamp, owing to the introduction of flame arcs, has increased.

Carbon and metallic-filament lamps are given together; these would be of considerable interest if reported separately, although, of course, prior to the present census, the output was comparatively small. The figures are:—1899, £688,000; 1904, £1,261,000; and 1909, £2,767,800, of which metallic-filaments stand for £1,536,400. All other varieties of lamps (including decorative and miniature, X-ray bulbs, vacuum tubes and vapour lamps, &c.) are valued at £663,400.

The figures for telegraph apparatus, for the three censuses, are £328,400, £222,200 and £391,400. Telephone apparatus appears at £2,102,200, £3,172,800 and £3,109,400, a slight decrease over the last five years.

Insulated wires and cables, a very important section, showed 4·25 million pounds in value for 1899, 6·9 for 1904, and 10·06 for 1909. Bare wires do not seem to have been classified separately, nor is it very apparent under which heading they are included.

Heating, cooking and welding apparatus is down for £200,600, as against £79,200 for 1904.

Magneto-ignition apparatus, spark-coils, &c., have increased considerably in value, probably owing to the automobile business, being now £1,216,000, against £135,600 in 1904.

The number of establishments engaged wholly, or (about 10 per cent.) partially in the industry was 581 in 1899, 912 in 1904, and 1,255 in 1909. The total values of outputs were:—1899, 21·16 million pounds; 1904, 31·91 million pounds; 1909, 48·79 million pounds.

THE PRESERVATION OF TELEGRAPH POLES.

[COMMUNICATED.]

Anyone taking a long railway journey through England cannot fail to note that the telegraph poles on railway slopes consist almost entirely of creosoted timber. The rare exceptions to this rule may be found at important station platforms and when the amenities of the locality would be interfered with by the presence of creosoted poles. In these special circumstances square standards of pitch pine timber are usually employed. Periodical painting is, of course, resorted to, as it preserves the wood and also renders the telegraph route less unsightly than would otherwise be the case.

Experience has shown, however, that the resinous properties of pitch pine are insufficient to prevent moisture traversing the fibre of the timber in the soil; consequently, under the influence of the warmer atmosphere above ground, disintegration sets in about the wind and water line, and after 12 years have elapsed the pole needs renewing.

Several instances could be given of wet rot having completed its destructive work at an earlier period than that specified, but the converse is equally true—indeed, some poles appear to be possessed of abnormal vitality, and for these reasons no reliable conclusion can be drawn. Perhaps the best result is obtained when the butt of a standard is charred over a slow fire and afterwards scraped and tarred prior to its erection in a sub-soil of dry sea sand.

Instead of continuing the use of pitch pine standards at tunnel ends and at the termination of underground routes, it is current British practice to install round creosoted poles of Baltic pine. The durability of these latter in murky surroundings is truly remarkable.

If it be urged that troughing for the reception of covered leading-in wires cannot be accommodated so easily on round as on square poles, but the difficulty is surely more apparent than real. Troughing ought not to be screwed directly to a round pole. Commencing from the cap downward, small pieces of 1-in. timber should be interposed and spaced about 18 in. apart. The lidding can then be easily tied in position by means of copper binders; but, what is of more importance, the arrangement ensures a free circulation of air round the troughing.

Incipient faults in covered wires are of comparatively rare occurrence, and are difficult of detection; but their number can be reduced to a minimum by boring a hole underneath the troughing where the covered wires leave the pole to enter the signal box or terminal station.

The object of the perforation is to afford an outlet for any moisture that may have percolated to the interior owing to the development of a joinering defect.

In the session of 1873-4 a paper on "The Preservation of Telegraph Poles" was read before the I.E.E., in which the various processes for the preservation of timber was discussed. Of the several methods there referred to—viz., boucherising, burnettising, kyanising, &c.—the creosoting process was most favoured.

Curiously enough the same subject came up for consideration before the I.E.E. in May, 1907. Mr. W. C. Wade, with the aid of Prof. Goodman, of Leeds, succeeded by means of an extended number of tests and experiments, in clearing away much uncertainty in relation to the subject. Among other things the paper showed unmistakably the suitability of creosoted poles for aerial transmission. It is therefore a compliment to the prevision of those early telegraph engineers who, though tempted to experiments with various local applications at the ground line of poles to prevent decay from setting in or to arrest it when once commenced, preferred using creosoted timber wherever and whenever possible. A few of these poles reduced in height are still rendering reliable service on obscure branch lines, and may be distinguished from their younger *confrères* by a roughly chiselled date mark—1870, inscribed 10 ft. from the base.

The fact may be worth recalling that poles are preserved from rot by seasoning, *e.g.*, drying out the sap under natural conditions unfavourable to fermentation. This is accomplished by stacking them in well ventilated shelters, thus protecting them from the fierce heat of summer or the snows of winter whilst exposing them to free currents of air. In due course they are ready for antiseptic treatment, and creosoting is the process that gives the most favourable results. Creosote, it may be remembered, is one of the numerous products of coal tar, and is obtained from it by distillation.

An interesting sketch (fig. 1) is given of a cylindrical creosoting tank, into which a trolley full of seasoned tele-

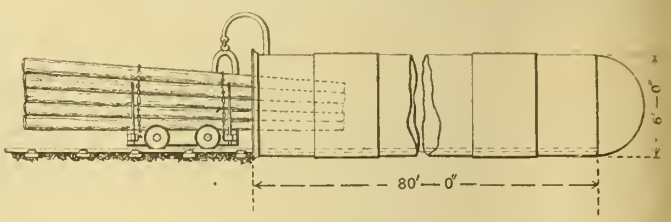


Fig. 1.—Cylindrical Creosoting Tank with Telegraph Poles to be Treated.

graph poles is being drawn. As soon as these are wholly enclosed and the cylinder end is securely fastened, the air is carefully exhausted and creosote is allowed to enter. It is forced into the timber at a pressure varying according to local circumstances and for a sufficient length of time to ensure the destruction of the germs of vegetable life. On completion of the process briefly described, the pores of the wood are filled with an oily substance which effectually checks the entrance of air and moisture, and the consequent growth of germs. The creosote is thereafter, withdrawn from the tank, the cylinder end is re-opened, and the loaded trolley removed.

Newly creosoted timber should be stored in the open air at least six months prior to its leaving the supply depôt. The importance of this detail is frequently overlooked, with the result that poles, dripping with creosote oil, are sometimes consigned by rail, and when the unskilled labourer proceeds to liberate the wagons at their destination, he incurs serious risk of slipping over the oily surface of the poles. More than one case is on record of a workman having dislocated his ankle from this cause. The clothing of construction gangmen also becomes unduly impregnated with creosote oil unless a reasonable time has been allowed to elapse before the poles are erected.

"Claims for compensation," says the postal engineer-in-chief, "have in several instances been put forward in respect of the pollution by creosote of watercress beds, ponds at which cattle drink, and well water, and substantial damages have been paid. It is, therefore, very desirable to avoid erecting creosoted poles in positions where there is danger of such contamination." In the construction of aerial telegraphs along railway cuttings, ponds, and watercress beds



Fig. 2.—Decayed Untreated Pole.



Fig. 3.—Creosoted Pole showing Destruction of Core.

are never encountered, but the warning should be of special value to those engaged in the erection of high-tension transmission lines across the country, or in the fulfilment of private contracts for telephone pole lines.

It is less difficult nowadays to assign the life of creosoted timber than was formerly the case. The reason is not far to seek. Practically every pole that has needed replacement during the past six years had previously undergone the treatment illustrated in fig. 1; hence, a wide experience has been obtained by engineers engaged upon ordinary renewal

within the period named. The writer has had occasion to take down a large number of useless creosoted poles dated 1873-4, and sell them for firewood ; a lesser quantity dated 1880 has been relegated to a similar fate, but in no instance has a creosoted pole required changing because of internal decay which bears a later date-mark than 1882. It would seem, therefore, that 30 years represents the average life of a creosoted pole.

The remarkable difference between a pole of the latter type and one that has been erected without being impregnated with creosote oil, is depicted in the accompanying views (figs. 2 and 3). With respect to the uncreosoted pole (fig. 2), decay had commenced at the ground-line and spread upward after an exposure of seven years.

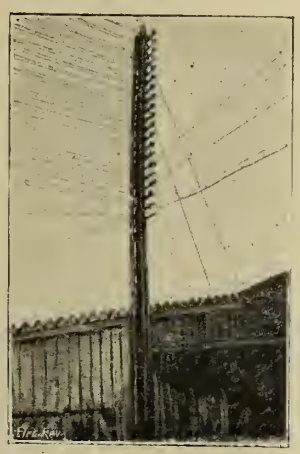


Fig. 4.—Creosoted Terminal Pole Replacing Pitch Pine Standard.

As regards fig. 3, two sections of the same cresoted pole show the destruction of the heart core from the cap downward. Wet rot had commenced where the pole was notched for the reception of arms and arm-bolts. Though decay had penetrated the interior, it will be noticed that the exterior appears impervious to moisture. After the lapse of three decades it will generally be found that a creosoted pole is soundest at and about the ground line.

From the foregoing observations, it may be conceded that a creosoted telegraph pole will continue to render efficient service until structural alterations call for its renewal.

ELECTRIC HEATING.

By PERCY GOOD.

Most people who ask for a heater for their house will say that they like their rooms warm. If they are questioned they will say that they mean the air in the room. It is doubtful if this really expresses their desire, but whatever it is, a most varied looking assortment of heaters could be seen at the Electrical Exhibition. In spite of the apparent variety they can all be conveniently classified as radiators or convectors. It is not suggested that the former do not heat that air at all by convection, or that the latter do not send out heat radiations. The classification is, in spite of that, sufficiently accurate.

All bodies radiate heat, but if everything in the neighbourhood is at the same temperature the absortion of heat is exactly equal to the radiation. If they are not at the same temperature, then the colder body absorbs more heat than it radiates, and the hotter body radiates more heat than it absorbs. This process continues until they are all at the same temperature. The rapidity with which this transference takes place depends on the difference in temperature and, to some extent, on the actual temperature, and on the surfaces of the bodies. Heat is radiated very slowly from a polished metal surface ; it must therefore be absorbed very slowly by such a surface. Heat radiations behave very much like light ; the usual laws for light, including the law of inverse squares, are true. That is to say, from a given source, the amount of radiation which reaches you varies inversely as the square of the distance between you and the source.

It should be noted that, whilst glass transmits about 50 per cent. of the radiation from a source of heat at a high temperature, it is almost opaque to radiation from a body below red heat.

Present-day radiators can be divided into two classes—those which have, and those which do not have, a combustible resistance. The former are usually called lamp radiators, and the latter, red-hot heaters.

Convectors consist of a resistance suspended in air, usually in a protecting case, through which air can pass freely. Some of these resistances are designed to reach a dull red heat, but generally they are so much enclosed as to be very little different in effect from those which do not get quite so hot.

Convectors can be easily made from a resistance net and a metal case, the whole costing less than the lamps or resistance in a radiator. They require no expert knowledge, and it is therefore not surprising to find many makers of this type of heater.

For this reason, perhaps, the statements of the representatives of these makers cannot be taken as strictly accurate, but this hardly excuses the gentleman who at the Exhibition —prefacing his remarks to the writer by stating that he was both a scientist and an engineer—claimed for the convector a much higher efficiency because, "in the radiator so much energy was lost in driving the heat from the filament across the vacuum." He triumphantly emphasised this theory by a reference to the Thermos flask. He was unable to explain further, but claimed respect for himself and his firm, because they had been at the business for 60 years.

Another explained that the reason the public left electric heating alone was the inefficiency of the lamp radiator. "You see," he said, "the makers frost the lamps so as to hide the light. If it were left very bright, everybody would realise that the electricity was being largely used for making light and not heat."

His firm employs several thousand persons. They both seemed serious.

None of them were able to claim the installation of electric heaters for the warming of large buildings, and it is very doubtful if there are many small buildings exclusively heated by electricity in this country. Probably what few there may be, are occupied by electricians.

Electric heating, it may be assumed, is at present confined to small rooms, offices, and intermittent use.

When sitting in a cold room the body soon feels cold. It is this which the heating apparatus must counteract. There are two methods of doing this, the first being to supply sufficient heat to the body to make up for the loss, and the second, to prevent the body losing an unnecessary amount of heat.

The first is the one usually adopted, and it can be done by all the known methods of heat transference. These are :—(1) conduction ; (2) convection ; (3) radiation.

The first requires actual contact, the second requires the presence of a liquid or gas as the heat is carried by the particles from the hot body to the cooler body. Radiation is, however, entirely different. It passes from the hot body to the cold body through a vacuum or intervening medium without heating that medium. Everything will not permit radiation to pass. If it does not it converts it into heat with a rise in temperature. The material then radiates again on its own account. Conduction is not very convenient or satisfactory. Few people would care to have heated chairs, &c., in which to repose.

Convection requires first the heating of the air, and, as this must be constantly changing, the efficiency of this method must be low. Warm air rises to the ceiling, so some considerable time must elapse before the body feels its effect. Further, hot air is enervating, so that the normal action of the body in making heat is reduced. All these reasons combined seem to condemn this method.

Radiation is the third method by which heat can be given to the body. As this does not heat the air, except indirectly, and as it can be directed and focussed on to the body, it seems to be the most satisfactory solution.

That it is the most satisfactory can be judged by the fact that in this country most of the heating of private houses has always been by this method. Heating of air always produces a complaint of stuffiness.

Most Englishmen find a German hotel in the winter almost suffocating, and would prefer the cold air and the radiant heat to be obtained on the mountains in sunny winter weather.

To prevent the body radiating an unnecessary amount of heat is not so usual. Sufficient clothing is one easy way, but not very convenient. The other way is to bring all the surrounding objects to such a temperature that the body does not radiate too much heat to these objects.

To keep all surrounding objects at this temperature seems difficult, but the most important objects—the floor and the walls of the room—do not offer insuperable difficulties. A wire woven into the wall covering and the carpet, both suitably heat-insulated at the back, would soon do this.

What the actual result would be is difficult to say without experiment, but it is probable that, with a suitable temperature of wall, a considerable amount of cold air could be allowed to pass through the room without feelings of discomfort.

As electric heating is likely in the future to play an important part in the improvement in the conditions under which town dwellers now live, it is desirable to have some means of comparing electric heaters. The temperature to which they will raise the air in a closed room in a given time is valueless. The readings of a thermo-couple giving mean spherical radiation are not much more useful.

A test should be taken in a room with a definite amount (not too small) of air passing through, and the result should, if possible, be expressed in the power to make people comfortable.

A method which suggests itself is to measure the amount of energy necessary to keep a defined body at 100° F., or other suitable temperature. The value of the heater is, of course, inversely proportional to the figure obtained.

A small copper vessel filled with water or oil with a resistance inside might be used. It might be covered with a woollen jacket. The vessel should be heated to, say, 100° F., and placed a suitable distance from the heater. The current it is necessary to send through the resistance in order to keep the water at this temperature must be found by trial, and, of course, the smaller the current required, the more efficient the heating apparatus.

This is a somewhat laborious method, but if the theory is accurate it could be undertaken, unless a more simple test can be devised.

In appearance the lamp radiator, in spite of the beautiful metal work, cannot be compared with the Ferranti fire or some of the Bastian heaters, but the material is at a higher temperature, and therefore radiates more heat which may, however, not all get out. Further, the red hot heater is almost black in very cold weather, just when its greatest radiation is desirable. If the resistance wire had a very much higher temperature coefficient, it would be, to some extent, automatic in its action. It may be possible to find an alloy as suitable in other respects as nickel chrome with this added advantage.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Utilisation of Crude Petroleum for Electric Power Production.

I have read the above article with considerable interest. It seems to me, however, that the endeavours which are being made to generate oil gas from crude oil for use in gas engines are rather futile, seeing that this oil can be used direct in the Diesel engine, with most satisfactory results. By so doing, the whole of the complications of the producer are done away with, resulting in a large saving of capital, attendance and repairs and maintenance.

The working results given regarding fuel consumption are also vastly inferior to those which are obtainable in every-day running with the Diesel engine. The figure of 8 B.H.P.-hours to the gallon is mentioned, whereas, with a Diesel engine, 18 B.H.P.-hours can be obtained with the same expenditure of fuel.

In view of the above, and the fact that the Diesel principle of working is so superior to gas-engine practice, there being no trouble due to pre-ignition, missfiring, back-firing, and so on, it seems very unnecessary to go to the trouble of gasifying the oil, when it can be used far more economically and easily direct in the cylinders of the Deisel engine.

Wm. J. U. Sowter.

Bray, *December 12th*, 1911.

The Governing of Water Turbines.

We have here a water turbine of the submerged type driving a 25-KW. alternator, which is usually run to supply our dayload, and, as there are no governors attached, the speed regulation is done by hand. This arrangement worked quite well while the load was purely a lighting one, but recently we have connected several small motors of 3-5 H.P. each. As these are only run intermittently, and require a considerable current to start them, the effect on the lighting is very bad. It seems that a governor on the turbine would not be particularly satisfactory, owing to the sluggish manner in which governors work and their strong tendency to hunt.

It has been suggested to me that the best way to deal with the matter would be to connect an artificial load and provide means whereby this load could be regulated automatically so that the generator always ran at a constant output, irrespective of the actual demand upon the external circuits—the energy consumed, of course, costing nothing for power to produce it.

I shall be greatly obliged if either you, or any of your readers, can inform me whether there is such a regulating device upon the market, and where it can be obtained.

Wm. J. U. Sowter,
Engineer and Manager.

Electricity Works, Bray,
December 16th, 1911.

Grouping of Underground Cable Conductors.

It is desired to improve the transmission of a long telephone trunk line by increasing the weight of copper in the underground cable connecting the aerial lines with the exchange. The cable is 2 miles long, and consists of 20-lb. conductors. It is proposed to use two cable pairs instead of one; but the correct method of connecting up is not quite clear.

The views of your readers will be esteemed, having consideration for the advantage and disadvantage of each method, with special reference to K and overhearing.

The cable in question is of the air-space dry-core type similar to a standard telephone cable.

Nodrog.

December 10th, 1911.

The Electrical Trades Benevolent Institution.

Now that winter is upon us, and calls are sure to be made on the Electrical Trades Benevolent Institution, I must beg the members of the electrical industry kindly to give it their further support.

The amount which has been invested since January 1st is £962 18s., and it is most important that this should be brought up to £1,200 before the end of the year. I therefore trust that I shall be forgiven for again begging.

Pensions must be paid only out of the interest on invested funds, and consequently it is essential that we should build up these more rapidly than has been the case.

Many questions are asked me from time to time regarding the position of the Institution in view of the National Insurance Bill. Permit me to say that the majority of

those who have benefited, or are entitled to benefit, by the funds of this Institution, are outside the scope of the Insurance Bill. Beyond this, the benefits given by the Institution differ in character and extent from those given by the Insurance Bill.

F. B. O. Hawes, *Secretary.*

18, Park Mansions, Vauxhall Park,
South Lambeth Road, London, S.W.
December 18th, 1911.

The National Telephone Co., Ltd.

My attention has been called to a circular letter headed "The National Telephone Co., Ltd., established in 1881," which purports to give recent statistics referring to the company, extracted from the half-yearly report of December 31st, 1910, and for the half-year ending June 30th, 1911.

The statements and figures in this circular contain many inaccuracies, and in particular a statement purporting to show the total sum that may be expected to be available for distribution amongst the deferred stock holders is entirely speculative and unwarranted.

From the way in which the circular is printed, more particularly the heading, and also from the fact that no address and name are given showing by whom it has been issued, the inference is probably intended to be drawn that the document has been issued by the National Telephone Co., and I shall be glad if you will allow me to give warning to any who may receive a print of the circular that it in no way emanates from the company.

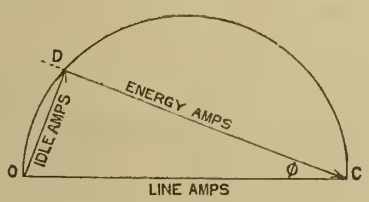
George Franklin, *President.*

London, E.C., *December 18th*, 1911.

Two-Wattmeter Method of Measuring Power in Three-phase Circuits.

A simple extension of your correspondents' methods would be to find the idle current directly by dividing the difference between the wattmeter readings by the line volts.

Also from the equation (line amperes)^2 = (idle amperes)^2 + (energy amperes)^2 obtain the energy current.



Then, by plotting the total amperes to a scale and setting off the idle current to same scale as shown in the subjoined sketch, the energy current can be shown, and the angle DCO will be the angle of lag, or the same may be calculated from the ratio $\frac{\text{energy amperes}}{\text{total amperes}}$.

F. W. Foster.

Birmingham, *December 14th*, 1911.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Large Citroën Gear Wheel.

The accompanying illustration, fig. 1, shows a large Citroën gear wheel undergoing the process of having the teeth cut in the rim. It is claimed that this wheel is the largest and heaviest machine-cut helical wheel ever made, and the figure illustrates the fact that the teeth are cut in the solid blank

The set of gearing is intended for a copper rolling mill. The pinion is direct driven by a Westinghouse motor, and is fitted on a heavy shaft which carries on each side of the pinion a fly-wheel 2·6 m. in diameter and weighing 8 tons. The wheel is fixed on a shaft between two bearings, and this shaft is fitted with a clutch enabling the gears to drive on one side the large rolling mill, and on the other side a series of minor mills in case of any of their respective motors becoming defective.

The electric motor develops normally 300 H.P. at 240 R.P.M., and is fitted with an auxiliary regulating motor enabling it to stand momentary overloads of 100 per cent. and an overload of 50 per cent. during comparative long periods.

The normal speed of the wheel is 34 R.P.M. Taking the fly-wheel effect into consideration, the instantaneous power which this system can develop (at the moment of inserting the metal in the

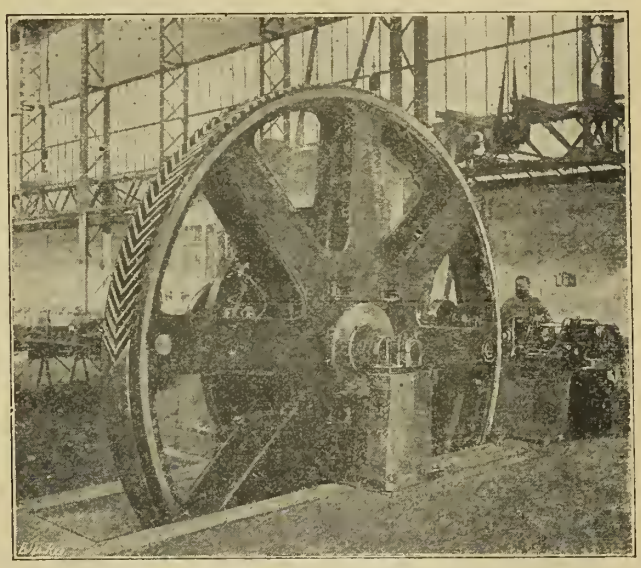


Fig. 1.—Large Citroen Gear Wheel.

rolling mill) corresponds with 1,450 H.P. The sizes of the gears are as follows: Pitch circle diameters, 644 mm. and 4,508 mm.; ratio of gearing, 7/1; number of teeth, 20 and 140; pitch, about 4 in.; width of face over teeth, 350 mm.; the teeth are shrouded to pitch line on both sides; total width over shrouds, 460 mm.; finished weight of wheel, 14,500 kg.; finished weight of pinion, 720 kg.

As will be seen from the illustration, the teeth are cut in one operation.

Adams Pressure-Controlled Speed Regulator.

One of the recent Igranic switchgear developments of the Adams Manufacturing Co., Ltd., of Bedford, is in the direction of pressure-controlled speed regulators for forced draught fans, air compressors, feed pumps, &c., in which automatic features may be introduced.

Speed regulation may be obtained by means of armature resistance only, or by shunt field and armature resistances combined; the resistance regulating lever is actuated by means of a hydraulic

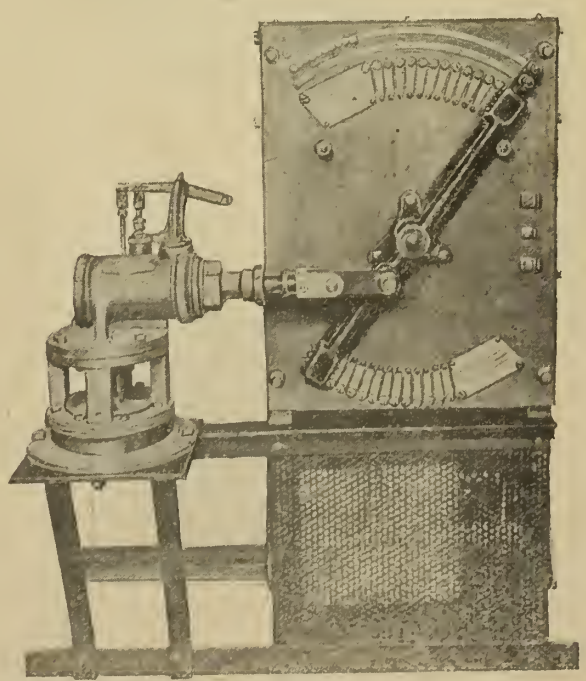


Fig. 2.—Adams Automatic Speed Regulator.

or air-pressure cylinder, the action depending on the movement of a pressure diaphragm, which is communicated in turn to a weighted lever and pilot valve, the latter controlling the actuating cylinder. Step-by-step regulation is provided, and in the event of failure of the supply or the motor being shut down, the controller automatic-

ally returns to the position of all resistance in circuit with the armature ready for another start. The system is adapted for either A.C. or D.C. motor control, and is illustrated in fig. 2.

Electrical Beer Raising Engine.

A large proportion of the publicans in Britain use compressed air to raise their beer from the cellar to the bar. Hitherto it has been necessary, as a rule, to work a small compressor by means of

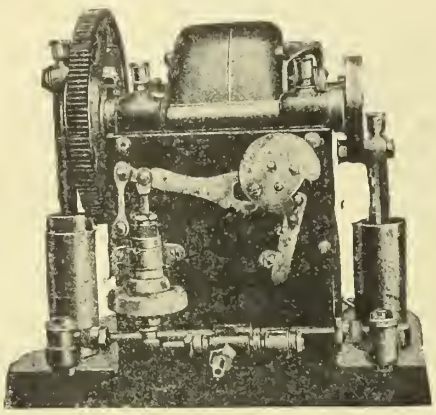


Fig. 3.—Gear-Driven Beer-Engine.

a hydraulic engine, but the cost of the water to operate the latter is somewhat high. A much cheaper arrangement is an electrically-operated engine, supplied by the Scottish Manufacturing Co., of 2, West Regent Street, Glasgow; some 200 of these machines have been supplied, and the cost of working has in no case exceeded 15s. per annum.

This device, known as the "Scottish Champion" electric auto-pneumatic beer raising engine, consists of a small motor, of $\frac{1}{6}$th to

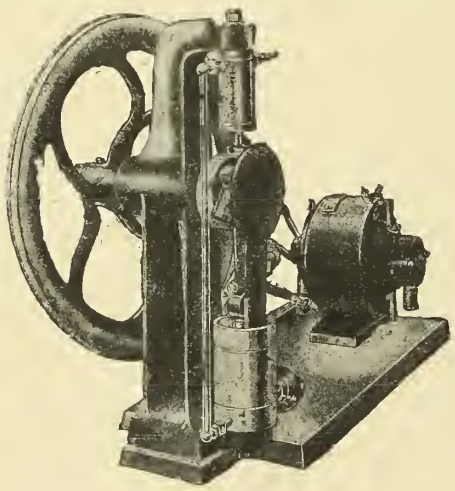


Fig. 4.—Beer-Engine Belted to Motor.

$\frac{1}{4}$ H.P., according to requirements, coupled either by gearing, as shown in fig. 3, or belt, as in fig. 4, to a small single or double-acting pump, and fitted with an adjustable automatic switch, fig. 5, which is attached to the air outlet and stops or starts the machine,

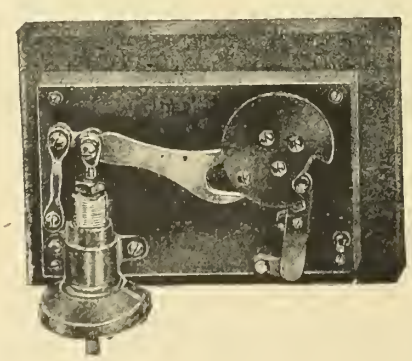


Fig. 5.—Automatic Switch.

as the air pressure varies. Fig. 6 shows a complete installation, with a gear-driven engine and automatic switch, storage tank, piping and pressure gauges behind the bar to enable the attendant to regulate the pressure to any barrel.

The air storage enables the publican to raise the beer for hours, if the motor or electric supply fails for any reason. The actual

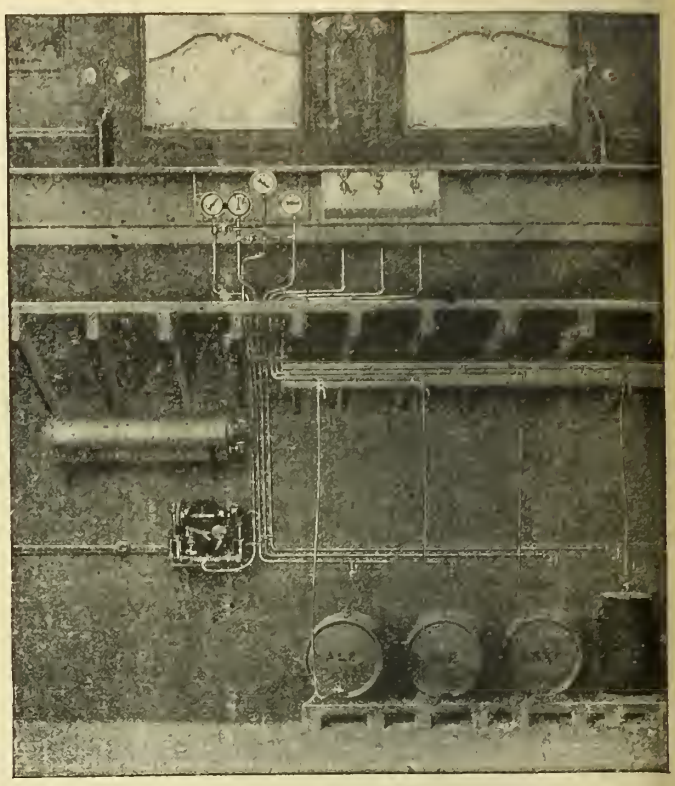


Fig. 6.—Electrical Installation for Beer Raising.

cost for electricity is about $\frac{1}{4}$d. per hogshead of beer drawn, and per annum represents a saving of from two-thirds to four-fifths of the cost of running a hydraulic engine.

"M. E." Printing Motor System.

Messrs. Marryat & Place, of 28, Hatton Garden, E.C., have introduced recently the Marryat-Elliston patent equipment for driving rotary newspaper machines. It consists of an electric motor coupled direct to the printing machine through an electric clutch of special design; the motor and clutch are controlled by an ordinary solenoid starting switch and a shunt resistance, which can be so arranged as to allow a frictionless slip upon the clutch through the complete range of speed from less than 2 per cent. of full speed up to full speed or above normal full speed. The controller can be operated by a simple lever, with various positions

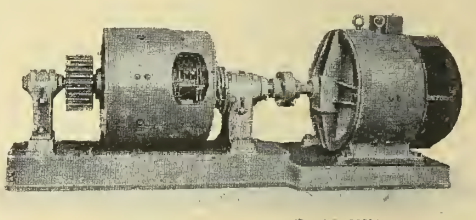


Fig. 7.—The "M.E." Electric Drive for Printing Machines.

corresponding to the different speeds, or by a series of push buttons. It is claimed that the equipment fulfils all the requirements of newspaper printing work, and in addition affords facilities for the provision of reverse motion. Very smooth acceleration from inching speed to full speed or *vice versa* is provided by the apparatus, which possesses also the merit of great simplicity. It must be borne in mind, however, that the use of a slipping clutch, of no matter what type, involves loss of energy, as the power expended is measured not by the torque × speed of the driven machine, but by the torque × speed of the motor: the difference between these quantities will appear in the form of heat in some part of the system.

Tube Station Lighting.—In our reference a fortnight ago to the "Onewatt" lighting of the Oxford Circus platforms of the Central London Railway, we stated that the uniform illumination value was "4½ candle-feet" at a height of 4 ft. above the platform throughout its entire length. We now learn from the makers of the lamps that this should read "1½ candle-feet."

Germany.—A company has just been formed at Berlin, styled the Deutsche Aero-lampen Gesellschaft m.b.H. Its object is to work the patents of the above-named lamp and improvements of the same. Its capital is 20,000 marks.—*Elekt. und Maschinenbau.*

SOUTH AFRICAN NOTES.

[FROM A SPECIAL CORRESPONDENT AT CAPE TOWN.]

Cape Town Corporation.—The British Insulated and Helsby Cables, Ltd., were awarded the contract recently for the following cables:—1,000 yds. of ·8 × ·4 × ·8; 2,340 yds. of ·5 × ·25 × ·5 with three-pilot wires; 300 yds. of ·25 × ·25 × ·25; 370 yds. of ·125 × ·0625 × ·125; 1,000 yds. of six-core 3/20 armoured and juted cable.

The report of the city electrical engineer on the running of the plant and output and distribution of current for the month of August, 1911, compared with 1910, shows the total number of private consumers in Cape Town to be 1,658, as compared with 1,459 in the same month last year. Woodstock 32, compared with 19; Green and Sea Points 152, compared with 69; and the number of lamps, equivalent to 8 C.P., 155,566, compared with 133,153. The H.P. of motors increased from 3,275 to 3,943 H.P.

Municipality of Robertson, C.C.—A scheme for electric lighting of this municipality has been talked of for some years, and a short time ago the town clerk was instructed to write to the Cape Town Corporation to ask for the services of their electrical engineer. This was agreed to, and Mr. Long has visited Robertson and is now preparing a scheme to utilise the small amount of water-power supplemented by oil engines.

Swellendam, C.C.—This Council is also considering the installation of electric lighting within the municipality.

Cape Town Electrical Exhibition.—This exhibition has been promoted by the Corporation with a view to advertising the many uses to which electricity can be put and its many advantages. The exhibition was held in a disused building, formerly in the occupation of the Railway Department, and was quite in the nature of an experiment. Apparatus was lent by the following firms: Messrs. Siemens, British General Electric Co., R. M. Ross & Co., E. A. Shaw & Co., Geo. Findlay & Co., Jac Loopuyt & Co., and Mechileys, and the furniture and pictures by "The Louvre" and Perry & Co. It included sign flashers, fans, flame arc lamps for the outside, four or five ovens, numerous kettles, radiators, hot plates, toasters, irons, vacuum cleaners, &c.; also motors electric drills, an electric floor scrubber and polisher, and a large assortment of fittings.

The two novelties were an American griller and an instantaneous hot water boiler, both of which took very large currents, but on test proved most efficient. The two views sent are of the drawing room and of the kitchen, where a Malay servant is attending to the vegetables for a luncheon, which was specially cooked by two local ladies for the Committee, to demonstrate the low cost of electricity at 2½d. per unit, compared with gas at 9s. per 1,000 cb. ft.

From the point of view of the public's interest the exhibition has been an unqualified success, and Mr. Long is to be congratulated upon his experiment.

It is proposed to have a much more representative exhibition next year to be held in the City Hall, and a considerable amount of support has been already promised by local firms.

The exhibition was open from 11 a.m. to 5 p.m., and from 7.30 to 10 p.m. The attendance during the day was always very fair, and during the evening the place was packed, the interest chiefly centring upon cooking and ironing. This can easily be accounted for with gas at 9s. per 1,000 cb. ft., coal at 42s. to 45s. per short ton (2,000 lb.), and paraffin oil at 1s. 1d. to 1s. 1½d. per imperial gallon. Paraffin easily holds the field on account of cost, and is easily understood by coloured servants. There is no doubt that such an exhibition is of great value in educating the public, and as the cost of current decreases, which it is steadily doing, there will be a large demand for cooking apparatus in the Cape peninsula.

A SUCCESSFUL IRISH PEAT-GAS PLANT.

THE peat plant here described has been working at the factory of Mr. Hamilton Robb, Portadown, since the early part of September with entirely successful results. The plant, which has a capacity of 400 B.H.P., consists of two producers, each of 200 B.H.P. capacity, with a coke scrubber, tar extractor, sawdust scrubber, exhauster, and expansion box.

The operation of the plant is extremely simple, the peat being hand fired into feeding hoppers at the top of the producer, from which it falls by gravitation into the body of the producer as combustion of the lower layers of peat takes place. The gas, as formed, passes through the coke scrubber to the tar extractor, where the tar is separated from the gas by centrifugal action, the gas thence passing to the sawdust scrubber, where the final cooling and cleaning take place. The gas is drawn through the plant by an exhauster or high-speed fan, which delivers it to a gas holder for use in the engines.

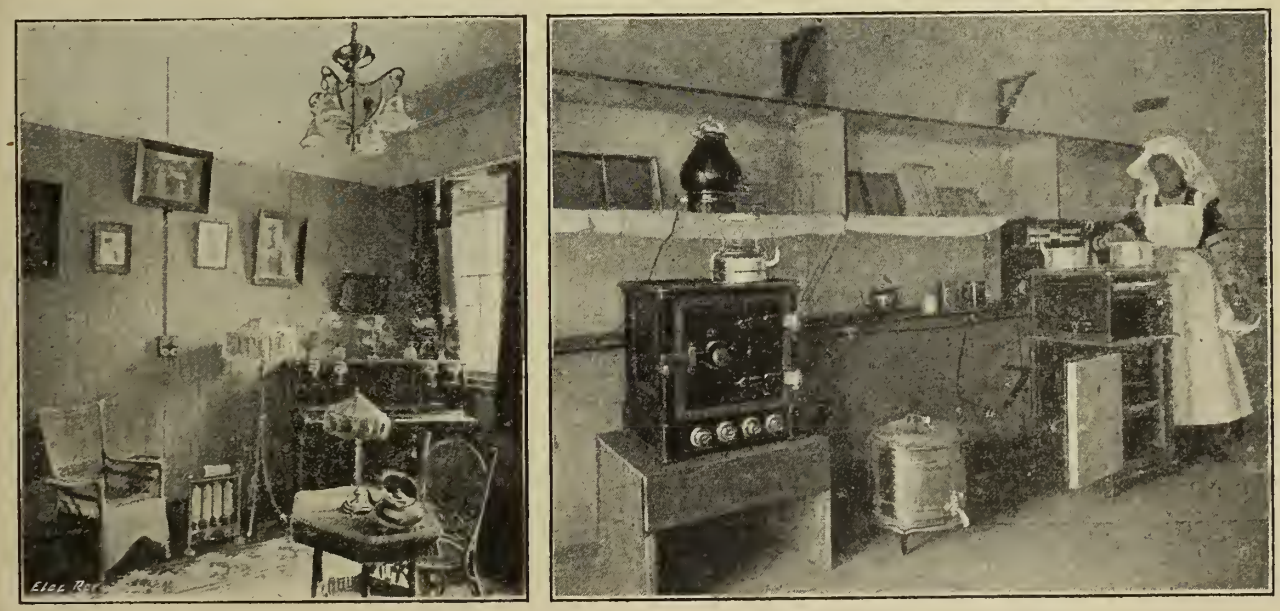
The nature of the gas produced is similar to that of suction gas from Welsh anthracite, though it contains a smaller percentage of hydrogen gas, and the thermal value is slightly more—about 140 B.TH.U.

The peat fuel is cut from the boglands at Maghery and dried by the ordinary open-air method. In this way the peat originally containing about 85 per cent. of moisture can be dried during an average drying season to contain about 26 per cent. of moisture. During the last exceptional summer the peat was actually dried in the open air to as little as 19 per cent. of moisture, as shown by chemical analysis. The plant, however, is guaranteed to work with peat up to 45 per cent. of moisture, though it is naturally not so economical to use peat in such a wet state owing to the excessive cost of carriage in proportion to the effective fuel content in the peat.

The cost of the peat delivered on site at Portadown is 6s. per ton, the amount of peat consumed per week with an average load on the plant of 275 B.H.P., being slightly under 20 tons at a cost of £6; from this must be deducted the value of the tar recovered from the plant, which averages 35s. per week, leaving a net cost in fuel of £4 5s. Previously the factory engines were driven by a Mond gas plant, using 8½ tons of anthracite per week at a cost of £13 16s. 3d. With the peat plant at present one more labourer is required, but it may be found possible to dispense with this additional labour later on. Allowing £40 for additional wages the saving effected in the cost of fuel in a factory of 500 looms, employing from 5 to 600 hands is £438 a year.

As regards the working of the plant, the Mond anthracite plant has been kept as a standby, and although it is not now ever called upon, it was found very useful in the early stages of handling the peat plant before the men had got used to it. The initial difficulty was learning how to control the amount of gas made, as sometimes this was altogether in excess of requirements, and at other times it was entirely insufficient. One of the earliest troubles was experienced from a very unexpected cause. Owing to the exceptionally dry summer, the peat which had been stacked to dry near the shores of Lough Neagh, had become considerably impregnated with sand blown from the shores of the Lough. This sand collected on the grate bars of the producer in the form of a crude black glass blocking up the bars completely and stopping the generation of gas. The trouble was quickly cured by adjusting the amount of air admitted between the bars and by introducing a certain amount of water vapour into the main air supply to the producers. No further trouble has been experienced from this cause.

When the plant was originally put down, it was arranged to cut



CAPE TOWN ELECTRICAL EXHIBITION: ELECTRICALLY EQUIPPED DRAWING-ROOM AND KITCHEN.

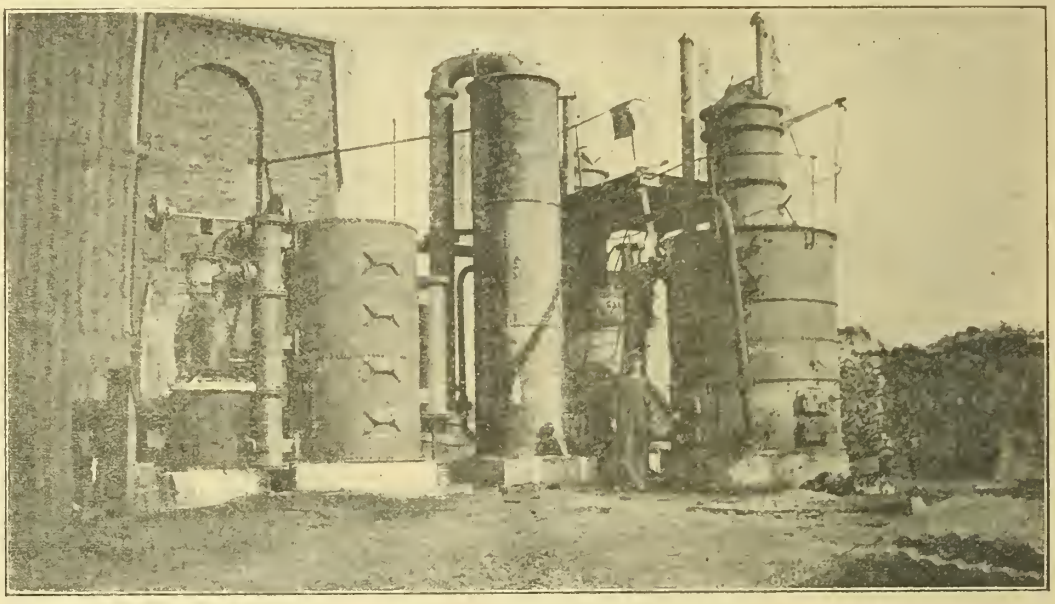
the peat fuel into blocks of about 5-in. cube before feeding it into the hoppers. This being found troublesome and expensive, the feed hoppers were altered and the peat is now fed in blocks direct as they come from the boglands.

The only other trouble experienced was in connection with the coke scrubber. As the gas passes through this before it reaches the tar extractor, a large amount of tar was thrown down on the coke, especially on the bottom layers and the scrubber rapidly became choked, requiring attention every five or six days. Eventually the scrubber was modified so as to act as a washer and cooler: the major portion of the coke was removed, the gas passing upwards against a descending shower of water. Removing the coke had a double advantage, inasmuch as not only was the initial expense of the coke saved, but more tar was thrown out by the tar extractor instead of being deposited in a worthless condition on the coke.

As regards the tar, this is being sold at a price of about 35s. per ton, the amount of tar recovered being 5 per cent. of the weight of the fuel consumed, or, say, 1 ton per week. The tar on analysis was shown to contain a slight amount of paraffin wax and a considerable proportion of heavy oils distilling above 270° C.

This plant, which is the only instance in the British Isles of the direct utilisation of peat for power purposes, is now working daily giving no trouble whatever, the only operations required are the stoking of the plant and the cleaning of the ashpits. Owing to the open nature of the fuel, it is found that no "poking" such as is necessary with coal plants is required; the operation of the plant is, therefore, very simple.

The above plant was constructed by Messrs. Crossley Bros., Ltd., Openshaw, to their designs under the specification of Mr. H. V. Pegg, Assoc.M.Inst.C.E., of the firm of Messrs. T. L. Miller, Wilson and Pegg, consulting engineers, Manchester.



Factory Peat-Gas Plant of 400 h.p., at Portadown, Ireland.

BUSINESS NOTES.

Trade Conditions in Buenos Ayres. — We have perused with great interest a report on the conditions and prospects of business in Buenos Ayres which has been drawn up by Mr. Alfred Gibbings, who, as was announced in these pages several weeks ago, is now established in business as Alfred H. Gibbings y Cia., at Cangalls 564, Buenos Ayres. The report has been endorsed by the British Consul there, and a copy is in the hands of the Board of Trade in London. The necessity for giving information as fully as possible in catalogues does not appear to be sufficiently recognised by British firms, a point in respect of which they compare unfavourably with German and other foreign firms. It is advised that catalogues should not be prepared in volume or pamphlet form, as postage of all printed matter is very expensive, and each district and client is usually interested in one speciality only. Mr. Gibbings recommends that each speciality should be contained on one leaflet or sheet, about quarto size, or four pages folded, or eight pages at the most, folded and stitched. A light weight paper should be used and ample space left for the agent to print his name and address. The Spanish language should be used in catalogues and prices must be stated in Argentine gold pesos or moneda nacional. Each catalogue should be accompanied with a detailed statement in the Spanish language of the contents (stated in the metric system), and value of the goods, with all necessary calculations worked out ready for the importer. In Buenos Ayres, it appears, owing to the buildings having few floors, rents are about double what they are in the City of London, and the costs of living are on a similar scale. In regard to clothing, ordinary felt hats cost from 20s. to 45s. each, suits to measure average £9 to £12, and boots about 25s. to 45s. the pair. A small house costing £60 per annum for rent at home is there about £250. Electric light is 10d. per unit and electric power 5d. Prices are high because nearly everything has to be imported. There are few factories of any kind, and there is no coal. The country is rich, and is gradually developing new industries, and the possibilities and prospects are excellent. There are good openings for manufacturers and factories for several articles, and such enterprise is encouraged. The largest demand is for agricultural and such like machinery, and for railway extensions. In the latter no great engineering difficulties are met with, as the country is level.

Good openings exist for every class of novelty, and in engineering for specialities of economical value. For example, windmills are used largely for irrigation and pumping, but these are unsatisfactory and irregular. Steam pumps are expensive to run owing to the cost of fuel, and electricity is only available in the vicinity of large towns. Petroleum has been found in the southern territories, and is the monopoly of the State; but carriage is costly, and the calorific value is low, yet this seems likely to be the prime mover of the future. There are openings for complete sewage schemes in many small towns. Small electric installations for towns are also possible. Mr. Gibbings does not yet know to what extent petrol gas may be employed. Many of the villages on the lines of the network of railways are rapidly growing in importance, and the railways are constantly extending into new districts. In the country around Tucuman there is enormous sugar cultivation, and further up to the north-west there is much mining development. All this vast country is served by imports through Buenos Ayres, Rosario, or Bahia Blanca, and even to the confines of Bolivia the access is easier from the Atlantic than from the Pacific owing to the barrier of the Andes. The capital invested in the Argentine railways is largely held in England, and the expenditure of any large sums for works, rolling stock and extensions is settled and carried out in England. Messrs. Livesey, Son & Henderson have considerable influence in this direction, and as regards the proposals to electrify the suburban lines of the Central Argentine and the Western Railways, Messrs. Merz and McLellan are the consulting engineers. The Central Argentine are proposing to go ahead at once, and the Western will follow later. With regard to the placing of orders, local wishes and local experience have to be considered, and those in touch in Buenos Ayres with the chief officials are in the best position to deal with the matter. Quite recently, instances have occurred in which large sums have been wasted owing to designs being made entirely in England without local references. The tramways and electric light undertakings are principally in the hands of the Germans. The new hydro-electric power scheme at Tucuman is Westinghouse, but there are some projects coming on which are in British hands. The prospects of business in some of these directions should be good.

The foreigner—*i.e.*, the British, American, German, French and Italian—is the importer into the country. The real Argentine has not taken a prominent part in the import business for two reasons: he has not the knowledge, and he is making more money out of the export business. Everybody buys land, and consequently there is little investment in industrial concerns, and now is the time to establish factories in the country. Three months' credit is the usual arrangement, but this is a matter which must be gone into carefully as each case arises. The Germans, through their banking houses, give credit to a considerable extent. All the important firms in Buenos Ayres hold stocks of the goods they sell, and the showrooms of all classes of machinery and almost of every class, size and description are fine and most extensive. This, of course, can be understood in a country where there are no manufacturers, and where goods are

often wanted urgently. There is no alternative for a manufacturer who wants to do business here but to carry large stocks of goods, where such goods have to meet the competition of others of their class. In this category must be included all standardised articles such as small gas engines, oil engines, dynamos up to 30 KW., motors, pumps, electrical instruments, electrical switchgear and accessories. In the case of specialities properly protected under registration or patents, there is not so much necessity to hold stocks, unless, of course, a large demand is likely to result immediately. It is, however, absolutely essential that a set of the complete apparatus be held for inspection, and, where necessary, to show operation. It is impossible to sell from catalogue only. These remarks do not apply to the sale of large units of generating sets, boilers, steam engines, turbines, and apparatus which has to be especially made. All models and sample apparatus must be capable of being shown in operation, and complete drawings and data are necessary. Precaution should be taken against possible infringement and copying, by German or other concerns making or offering a close imitation, if not an actual copy

In addition to the Customs duty and freight charges, there is a charge made for dock dues, and a commission has to be paid to a recognised agent to get the goods cleared at the Custom House. In some cases for small consignments, these subsidiary charges amount to as much as the duty, and in one case equalled the value of the invoiced goods.

The methods here of securing orders are quite in opposition to English ideas, and the quotation that "it is better to know the judge than the law" applies all round.

Consular Notes.—Japan.—In a recent report on the trade of Japan, the British Commercial Attaché points out that the imports under the heading of machinery in 1910 again showed a considerable decrease, amounting to some 22 per cent. compared with the total for the preceding year. In 1909, the falling off was ascribed mainly to stagnation in the industrial world. The gradual recovery witnessed in 1910 had not been in existence long enough by the end of the year to affect the amount of the annual import, but, to judge from the amount of capital invested in the formation of new and the extension of old industrial concerns during the past year, the prospects of the machinery business for the coming year are comparatively rosy. Other factors conducing to the same result were the organisation of a large hydro-electric power scheme and preparations for establishing two or three more similar undertakings, also the proposal of the Government to introduce into the 1911 session of the Diet a Bill for subsidising light railways, which was subsequently passed. The alteration of the tariff, which took place in July, also caused orders to be placed for machinery to be delivered before the new tariff came into force. An interesting feature is the increase in the use of gas engines. Small engines using gas supplied by a local gas company are employed with motors for the supply of power to small factories. Larger factories, small municipal electric light undertakings and similar enterprises have recently begun to install suction gas plants for the generation of power where water-power is unavailable, as gas is found cheaper than steam or oil. At the end of the year the Imperial Government Railway Board made a contract with a British firm for the erection of a power station, the electricity to be generated by gas engines. Speaking generally, gas engines imported are chiefly of British manufacture. The increase in the import of telephones is due to the rapidly growing demand. The imports, however, represent chiefly desk and office telephones. The telephone service is a Government undertaking, but the authorities have not been able to keep pace with the large number of applications for installations which are continually being received. At the end of the year there were 128,000 telephones in operation throughout the country, and 66,000 applicants waiting to be supplied. The Government obtains telephones from two factories in Tokio, one of which is a Japanese and the other a joint American-Japanese concern. Telephone cables are imported, but doubtless an attempt will soon be made to manufacture them in Japan. An opening would appear to exist for petrol engines. These are fitted to Japanese "sampans" and small junks. They are also required for motor-cars, the bodies of which can be made in Japan. It is feared that the alteration of the tariff from an *ad valorem* to a specific basis as regards most kinds of machinery will exercise rather an unfavourable influence. The alteration is welcomed as placing an obstacle in the way of fraudulent under-valuation of goods for Customs purposes; but the difficulty experienced in quoting a price for plant composed of various sections, many of which are liable to specific duties at varying rates, can easily be imagined. It is expected that under the new tariff the import of manufacturing machinery, such as for spinning, weaving, &c., will tend to increase. Such machinery cannot yet be manufactured in Japan, but it will be additionally required with the growth of industrial enterprises.

It is disappointing to find that although all the chief countries supplying machinery to Japan showed decreases in their total deliveries, by far the heaviest decrease was that of the United Kingdom, amounting to £454,000, or 32 per cent.

Later in his report the Commercial Attaché states that the year 1910 witnessed steady progress in the direction of extending the use of hydro-electric power for lighting and industrial purposes. In October the Kinugawa Hydro-Electric Power Co. was formed with a capital of £1,378,125, for the purpose of supplying the city of Tokio with electricity generated from the Kinu River. This company was originally projected as a joint Anglo-Japanese undertaking, but the British capitalists subsequently withdrew owing to their unwillingness to accept the conditions which the Japanese authorities attached to the issue of the charter. In April a Government Commission was appointed to examine and make a record of the water-power resources of the country. By this means the Government hope to assist the development of the use of water-power, and, at the same time, to guard against the granting of water-power concessions to persons seeking to obtain them for speculative purposes. The water-power for which charters have been granted by the authorities is estimated at some 592,000 KW. On the other hand, statistics published by the Department of Communications at the end of 1909 put the amount of water-power sanctioned at 73,507 KW., and the amount not yet sanctioned, but presumably applied for, at 176,552 KW. In addition to the use of hydro-electric power for lighting and traction purposes, there is undoubtedly a great future for it in supplying the requirements of factories and mines of all kinds. Besides the power stations already erected, a large number are in contemplation, or are in course of erection. The number of new proposals for light railways and lighting and for extensions of existing concerns has increased during 1910. In August a light railway law was put into force.

The object of this law is to enforce proper control over the promotion of schemes for constructing light railways, and also to encourage the construction of such lines in order to connect minor centres of trade and production with the existing lines of railway. The nationalisation of the railways has had the effect of checking private enterprise in this direction, while the State is unable to spare funds sufficient to meet the demands for railway extension. Consequently it is hoped that this law will attract private capital to the construction of light railways. A more powerful fillip to this industry was given by the news of the Government's intention to introduce into the 1911 session of the Diet a Bill for granting subsidies to light railways. (This Bill was passed by the Diet. The date of its coming into force is not yet determined.) It should be repeated here that, on account of the financial standing of some of these undertakings, it is advisable for British merchants to do business with them only through firms or representatives in Japan, as the latter are in a position to ascertain whether contracts can safely be accepted. Most of the light railways use electricity as their motive power and also undertake the supply of electric light. During the year a number of orders have been received for the erection of small plants for the supply of electric light, the power being generated by gas engines. In the industrial cities of Osaka and Tokio a large and growing demand exists for gas engines for use in small factories. As showing the growth of gas companies, it may be mentioned that there are 65 companies in Japan either in operation or in course of promotion. The capacity of the smallest of these companies is 35,000 cb. ft. of gas per day.

Bankruptcy Proceedings.—ARTHUR PARKER, electrical engineer, 8, Mary Street, late 57, Yorkshire Street, Burnley, Lancashire.—The liabilities herein amount to £175, to meet which there are assets of £35. The following are creditors:—

Baxendale & Co.	£42
Calverley, G. H., & Co.	26
Edison & Swan United Electric Light Co.	56
Siemens Bros., Ltd.	15

BERTRAM NEWMAN, electrician, Ilford.—First meeting, December 28th, at 14, Bedford Row, London, W.C.; public examination, January 3rd, at Shire Hall, Chelmsford.

THOMAS TOPPING, electrical and mechanical engineer, Southport.—First meeting, December 28th, at 35, Victoria Street, Liverpool; public examination, January 15th, at Court House, Victoria Street, Liverpool.

CHARLES WALLIS, electrical engineer, Great Grimsby.—First and final dividend of 1s. 9d. in the £, payable December 22nd, at St. Mary's Chambers, Great Grimsby.

EDWARD EVANS PUGH, electrical engineer, &c., Station Hill, 10, Cavendish Circus and Park Garage, Buxton.—The public examination herein was held on December 15th at the Court House, Vernon Street, Stockport. The statement of affairs disclosed gross liabilities, £1,946, of which £1,855 was expected to rank for dividend. The assets were estimated to produce £652, leaving a deficiency of £1,203. Debtor attributed his failure to a serious accident to a motor-car owned by him last March, in consequence of which he lost his trade, loss on electrical contracts, and general depression in trade. Debtor commenced business as an electrical engineer—his own trade—at Wolverhampton in 1907, with a capital of £90 and an additional £100 given by his mother-in-law, the latter amount being on loan. Subsequently he was manager for an electrical engineer at Buxton. Without capital, he commenced on his own account in May, 1910, and opened a public garage, where he repaired motor-cars. He also carried on business as a toy and fancy dealer at Victoria Arcade, Buxton. In July, 1910, he purchased a motor-car on the hire system. Of the debts, £139 were for goods supplied and services rendered, £1,451 for money borrowed from friends, and interest, £359. In respect of the motor accident, he received £44, but it did not cover the damage. He lost at least £70 over that amount. Although at one time his takings were over £2,500 per annum, he did not keep a proper cash book. Debtor was ordered to furnish an account of his losses in electrical contracts, &c., and the examination was adjourned.

Book Notices.—The *Mechanical World* Electrical Pocket Book for 1912. Manchester: Emmott & Co. Price 6d. net.—This issue has been enlarged and improved; the lighting section has been divided into "Electric Lamps" and "Electric Lighting," and sections have been added on Motor Starters, Transformers, and Construction, Rating and Testing of High-Tension Apparatus, besides a number of new tables.

"The Physical Review." Vol. XXXIII, No. 5. November, 1911 Lancaster, Pa.: The *Review* offices.

"*Journal* of the American Society of Mechanical Engineers." Vol. 33, No. 12. December, 1912. Baltimore, Md.: The Society. Price 35 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No 12. December, 1911. New York: The Institute. Price $1.

"Dynamo and Motor Attendants and their Machines." By Frank Broadbent, M.I.E.E. 1911. London: S. Rentell & Co., Ltd. Price 1s. 6d. net.

"Wechselstromversuche." By Dr. Anton Lampa. 1911. Brunswick: Friedr. Vieweg & Sohn. Price 5 m.

"*Bulletin* of the Bureau of Standards." Vol. 7, No. 3. October, 1911. Washington: Government Printing Office.

"*Transactions* of the Concrete Institute." Vol. III. 1911. London: The "Concrete Institute."

"*Résumé* of Producer Gas Investigations, October 1st, 1904—June 30th, 1910." By R. H. Fernald and C. D. Smith. "Physical and Chemical Properties of the Petroleums of the San Joaquin Valley of California." By J. C. Allen and W. A. Jacobs. "Electrical Accidents in Mines: Their Causes and Prevention." By H. H. Clark, W. D. Roberts, L. C. Ilsley and H. F. Randolph. 1911. Washington: Government Printing Office.

"Syllabuses of Science and Technology for 1911-12. Applicable to Technical Schools, &c., in England and Wales." London: Wyman & Sons. Price 3d.

"The Record of the Special Commission Formed by the British Fire Prevention Committee to Visit Paris, August, 1911." London: The Committee's Offices. Price 7s. 6d.

"*Proceedings* of the Physical Society of London." Vol. XXIV, Part 1. December 15th, 1911. London: *Electrician* Printing and Publishing Co. Price 4s. net.

Dissolutions and Liquidations.—Davis Electrical Co., Ltd.—A petition for the winding-up of this company was presented on December 8th, and is down for hearing on January 16th. The petitioners are Messrs. James McDougall, Ltd., of Mestycroft, Wednesbury, creditors.

Rugby School Electric Lighting Co., Ltd.—This company is winding up voluntarily, with Mr. A. E. Donkin as liquidator.

Edwards Air Pump Syndicate, Ltd.—A meeting of creditors is called for December 21st, at 3 and 5, Crown Court, Old Broad Street, E.C. Creditors must send particulars of debts, &c., to the liquidators (Messrs. C. Williamson, Milne and W. S. Gregg) at that address, by February 28th.

Wenham & Waters, Ltd.—Creditors must send particulars of debts, &c., to the liquidators, Messrs. F. Brown & W. Peet, at 1, High Street, Croydon, by December 31st.

Isaac Storey & Sons, Ltd.—This company is being wound up voluntarily in consequence of the amalgamation of the business with Messrs. Newman, Hender & Co., Ltd., Woodchester; Martineau, Beames & Madeley, Ltd., Birmingham; and Gaukroger, Sykes and Roberts, Ltd., Halifax, as United Brassfounders and Engineers, Ltd. Creditors should send particulars of their debts, &c., by January 20th, to Mr. A. H. Pownall, 42, Spring Gardens, Manchester, by January 20th.

Wakelin Bros., Ltd., 9, Tottenham Street, Tottenham Court Road, London.—Winding-up order made December 12th.

Tramways Extension Syndicate, Ltd.—A meeting is to be held at 5, London Wall Buildings, E.C., on January 31st, to hear an account of the winding-up from the liquidator, Mr. Edward Davis.

Davenport, Sparrow & Co., electrical contracting engineers and factors, 44, Brazennose Street, Manchester.—Messrs. J. N. Davenport and H. A. Sparrow have dissolved partnership. Mr. Davenport will attend to debts, &c.

Walters & Co., electrical engineers, Ocean Chambers, Waterloo Street, Birmingham.—Messrs. V. E. Walters and M. R. A. Hankey have dissolved partnership.

John Musgrave & Sons, Ltd., Globe Iron Works, Kay Street, Bolton.—This company has resolved to wind-up voluntarily, it being found impossible by reason of the liabilities to continue the business. Mr. Harold Mather, 10, Acresfield, Bolton, has been appointed liquidator.

Closed for the Holidays.—Messrs. Laurence, Scott and Co., Ltd., of Norwich, announce that their works will be closed from noon, December 23rd, until December 30th inclusive.

Messrs. Mawdsleys, Ltd., of Zone Works, Dursley, Glos., announce that owing to alterations and extensions to power plant necessitated by increased output, they will be closing their works from to-night, Friday, until Tuesday morning, January 2nd.

The Adams Manufacturing Co., Ltd., Bedford, announce that their works and offices will be closed from Saturday noon, December 23rd, to Monday morning, January 1st, for Christmas holidays and annual stocktaking.

White City Exhibition, 1912.—At a gathering held at the Mansion House last week, the Lord Mayor presiding, it was decided to invite France to take part in a second Franco-British Exhibition at Shepherd's Bush during next year. A second resolution urged British manufacturers and producers to take advantage of the opportunity of bringing their products and machinery before the French visitors.

Meter Approved.—On Monday last the Board of Trade signed its approval of the "E.C." type ampere-hour continuous-current meter of the Electrical Co., Ltd. This meter has self-adjusting brushes and twisted commutator,

Counting by Weight.—Messrs. W. & T. Avery, Ltd., of Birmingham, have patented a weighing machine on a new principle, obviating the necessity of counting a bulk quantity in order to arrive at the exact number. The mechanism is simple—a fixed number is placed in a small scoop which hangs from a steelyard, while the unknown quantity is in the large scoop. The small scoop is moved along the steelyard until it balances, when the markings or graduations show the exact number contained in the unknown quantity. The firm can adapt the principle to the requirements of any particular trade.

Bradford Installations.—Mr. H. Moss has recently secured the contracts for the electric lighting of part of the works and the offices of Messrs. Cresswell's Asbestos Co., Ltd., Bradford; for electric lighting throughout the new works and warehouses of Messrs. R. Beauland & Co., Ltd., at the warehouses and offices of Messrs. Paul Schmidt & Co., the warehouses and offices of Messrs. Wm. Laycock & Sons, and power and lighting installation work at Messrs. Tordoff's brewery, Bradford; also many smaller power, lighting and electric cooking installations.

Calendars and Catalogues.—Messrs. Bruce Peebles and Co., Ltd., Edinburgh.—The desk blotting pad and calendar received from this firm a year ago having nearly done its work, we welcome the 1912 copy which has just come to hand. The reference-book this time is on the right-hand side, and in addition to well illustrated abridged specifications and price lists of Bruce Peebles electrical machinery, there are many pages of squared paper, perforated postcards for use by those who require further information, and calendars for 1912 and 1913. Along the top border of the pad there are monthly date squares for the whole of 1912. A novelty appearing in a convenient position under the reference-book is a memoranda slate whereon to make hurried calculations, which can be cleaned off as desired.

Messrs. Ferranti, Ltd, Hollinwood, Lancs.—New edition of the firm's excellent catalogue, which we quite recently mentioned here, of electric heating and cooking apparatus—disk stoves, electric fires, breakfast cookers and flat-irons. Messrs. Ferranti have increased the discount to which the list prices are subject.

The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—This firm is the first to remind us by calendar that the old year is nearing its end. Its 1912 calendar, like those for previous years, contains charming views of the country in the neighbourhood of the works, but this time they are excellent half-tone pictures, five in number, showing the River Wye, the weir with fish ladder, a view above the water-wheels (including the works), the dam, and a part of the works' exterior. All of the views are taken on the company's property.

The Electrical and Engineering Supplies Co., Ltd., 36 and 37, Upper Thames Street, London, E.C.—Leaflet describing and giving illustrations and prices of several patterns of their motor-driven automatic sign switches, a feature of which is the standardisation and interchangeability of parts enabling quick delivery of spare parts from stock.

The Berry Construction Co., Ltd., 29A, Charing Cross Road, London, W.C.—Circular announcing in detail increases in prices of "Tricity" cooking apparatus, consequent upon the continued rise in the cost of raw materials.

Messrs. Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—Pamphlet No. 104, containing a brief description, with list of prices, of liquid starters for direct-current and three-phase motors. The tanks and blades are of sheet-iron, carried on substantial insulators, and the electrolyte used is a solution of soda. Worm and worm-wheel gear is provided to ensure slow and gradual starting, a sheet-iron protecting cover is fitted over the tanks and blades, and suitable short-circuiting contacts are provided. For direct-current starters field-breaking switches can be provided, and these can be mounted on the liquid starters, and can be fitted with an interlocking gear to render it impossible to start the motor up against a weak field. The starters can be supplied in various sizes from 15 up to 1,000 h.p. Copies of the list can be obtained on application.

The Mirrlees, Watson Co., Ltd., Scotland Street, Glasgow.—Two new pamphlets relating to their steam condensing plant. No. C30 (20 pages) contains a full account, with half-tone views and plans, and sectional line drawings, of the combined hydraulic and steam turbine generating station at Tuilière, Dordogne, France, for which a third set of condensing plant, with 14,000 sq. ft. cooling surface, is at present in the firm's works awaiting shipment. The other pamphlet, No. C31, contains particulars of the Mirrlees-Leblanc system of condensing plant with rotary pumps. The rotary air pump now offered is the outcome of very complete investigations extending over several years, and embodies patented improvements on the original Leblanc pump.

The Silent Electric Clock Co., 192, Goswell Road, London, E.C.—New edition of their pocket catalogue (48 pages) containing particulars of their electric clocks, with excellent half-tone pictures, showing their mechanism and different designs of dials. A lengthy list of installations carried out accompanies the catalogue.

The British Thomson-Houston Co., Ltd., Rugby.—New pamphlet No. 2,253 (12 pages art paper), containing brief descriptive matter, and a number of neat half-tone pictures illustrating methods of economically applying the electric motor (either d.c. or a.c.) drive for metal-working machines. The views included show lathe, drill presses, shapers, shears, slotters, planers, milling, and other machines.

The Cable Accessories Co., Ltd., Britannia Street Works, Tividale, Staffs.—Catalogue of 70 pages (List No. 5), containing very full information, with illustrations and prices regarding the

"Sceaco" cast-iron water-tight fittings, single-light vertical and mill fittings for various types of lamps, and for fixing to wall or ceiling, cluster-light fittings, street lighting lantern fittings, special fittings for street and other metal-filament lighting, ironclad double-pole switch and fuses, bracket arms for street and shop lighting fittings for traction columns, Britannia and other hand lamps, ships' and bulkhead lighting fittings, arc lamp winches and a number of small associated lines.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, Cannon Street, London, E.C.—New and revised edition of their pamphlet (50-60 pages in limp red cover), entitled "Electric Traction on a Main Line Railway." The contents consist of a full and admirably illustrated description of the electrical equipment of the Lancashire and Yorkshire Railway, for which, as most of our readers are aware, the firm was responsible. A map of the routes, comparative diagrams of the steam and electric time-tables of 1903 and 1911, line drawings and photographic views of the trains and parts, tabulated data showing the particulars of the electrical equipments, curves of energy consumption, the power station and sub-station plant, permanent way views, tables of mileages before and after overhaul, and of maintenance of the motive power portion of electric rolling stock, are given. As will be gathered from this brief summary, the book is of particular interest just now, when there are signs of a move forward in respect of railway electrification in this country and some of our Colonies.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E. are issuing their "Little Bill" showcard to the trade in the form of a postcard suitable for correspondence. Quantities will be overprinted free of charge for contractors and the trade, and early inquiries are invited from those requiring them.

Messrs. Siemens Bros. & Co., Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, S.W., as in previous years, have favoured us with copies of their handy pocket diary for 1912, containing, in addition to the diary, a refill note-book, and a variety of useful data, with some excellent illustrations of their many specialities.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Pamphlet entitled "The Story of a Dumb Salesman," which gives a description of the "Fortuna" shop window and counter advertising apparatus which they are placing upon the market. The device is an electrically-driven apparatus encased in a plated metal jacket and dome, around which the goods for exhibition are made to revolve without any visible means of suspension, whilst the external part of the apparatus is quite stationary.

Messrs. Richard Pape, Ltd., Belvedere Works, Belvedere, Kent.—Two pamphlets; one of 12 pages relating to hand lamps, safety lamps and portable lighting sets fitted with "Fors" accumulators; the other (12 pages) being a catalogue of the "Fors" portable accumulators (ignition, car and carriage lighting, and yacht lighting).

The Phœnix Electric Heating Co., 17, Morwell Street, Tottenham Court Road, London, W.C.—Small hanging calendar with monthly tear-off slips, above which appears in colour a charming and peaceful country scene, entitled, "Where the Old Folks Live."

Trade Announcements.—Messrs. Etchells, Congdon and Muir, Ltd., engineers, 15, Cannel Street, Ancoats, Manchester, announce that owing to increase in the business carried on by them at 42, Deansgate, Manchester, they have consolidated their business with that of Messrs. J. C. Etchells & Co., Ltd, carried on under the management of Mr. J. C. Etchells at Cannel Street, Ancoats. The name of the company has been changed to Etchells, Congdon and Muir, Ltd., and the consolidated business will henceforth be carried on under the joint management of Mr. Etchells and Messrs. Congdon and Muir at the above address.

The Lux Candle Co., Ltd., have just removed their stores and offices to 36, Whitfield Street, Tottenham Court Road, W. (telephone, Gerrard, 3151). They will now be able to carry the much larger stock rendered necessary by the success of their metal-filament lamps.

By mutual arrangement Mr. J. N. Cooper, A.M.I.E.E., is resigning at the end of the year his position as managing director of Messrs. Plutte, Scheele & Co., Ltd., of 18-19, Queenhithe, E.C., and Mr. Ernst Plutte has been appointed a direotor. Mr. Cooper is taking Mr. E. Roberts into partnership, and they will trade under the style of "Cooper & Roberts" as suppliers of electrical accessories, &c., merchants and agents, at 3, Paul's Bakehouse Court, Godliman Street, London, E.C.

We are informed that growth of business has compelled the Armorduct Manufacturing Co., Ltd., to make considerable extensions to their Witton Works. These extensions, when complete, will practically double the present capacity of the works.

The British Central Electrical Co., 84, Hatton Garden, London, E.C., have been appointed sole agents for the Canfield insulating specialities, comprising special grades of friction tape and rubber splicing strip made by the Canfield Rubber Co, Bridgeport, Conn. U.S.A.

Tests of Metal-filament Lamps.—The following results of tests carried out on four Royal Ediswan metal (tungsten) filament lamps sent to a municipal supply station will be of interest, showing as they do that the claims made for these well-known lamps are borne out by the actual experience of users. The tests were made on four 100-volt 50-c.p. B.C. lamps, and the results were as follows:—1st lamp, life 8,000 hours, still burning; 2nd lamp, burnt out at 6,319 hours; 3rd lamp, burnt out at 6,783 hours; 4th lamp, burnt out at 6,319 hours. The average life for the three burnt-out lamps was, therefore, 6,474 hours.

LIGHTING and POWER NOTES.

Abingdon.—At a special meeting of the T.C. on Tuesday last week, the Mayor moved that application be made to the B. of T. on or before December 21st for a Provisional Order for the borough. On the Mayor undertaking to defray all future expenses connected with the Provisional Order in the event of the Council being unable to dispose of it; the resolution was carried by 7 votes to 3.

Axbridge.—The R.D.C. has referred to the Cheddar P.C. the application of the Wincombe E.L. Co. for permission to erect overhead lines for the supply of current in the parish. The R.D.C. favours the scheme.

Australia.—The controversy as to the electric supply of Leichhardt is stated to have been decided in favour of the Balmain Electric Lighting Co., the Sydney Council's tender having been rejected. The working of the Newcastle (N.S.W.) municipal electrical undertaking has shown a profit of £500 on the quarter's working. The undertaking has been in low water for some time.

Ayrshire.—The Northern District Committee had under consideration at its last meeting the formation of a special lighting district for Glengarnock. There was submitted a proposal from the Glengarnock Iron and Steel Co., by which it undertook to lay the cables, do all necessary work, including upkeep, and provide the current for the sum of £50 per annum for 10 years, at the end of which time the works would become the property of the District Committee. The meeting agreed to the company's proposal, and appointed a Committee to superintend the affairs of the new district.

Bexhill.—It was reported at the Council meeting on Monday that it would be necessary at an early date to construct an electrical sub-station to supply the Little Common district, and a Committee was appointed to consider the question of acquiring the site.

The De La Warr Estate has agreed to guarantee a revenue of 10 per cent. on the cost of extension of cable for a period of five years, in order to supply electrical energy for a pumping station to be erected for the Cooden Beach drainage scheme.

The number of new consumers connected this year exceeds last year's figures.

Barnsley.—It is proposed that a new railway siding should be constructed at the electricity works at an estimated cost of £870, and that application be made for sanction to borrow the money.

Blackpool.—The Electricity Committee has now accepted the tender of the Brush Co., for a new 800-kw. traction set; and that of the B.T.-H. Co. for a new 1,500-kw. steam turbo-alternator. Tenders for new condensing plant have been left over for future consideration.

Bolton.—The electrical engineer has been instructed to submit a report to the next meeting of the Electricity Committee upon the additional plant which, in his opinion, it will be necessary to put down in order to cope with the increasing demand for electricity.

Bradford.—The chairman and deputy-chairman of the Corporation Electricity Committee have been in consultation with the chairman and deputy-chairman of the Gas and Health Committees on the subject of a proposed smoke abatement exhibition, on lines similar to that held in Glasgow during the year 1910. The Committees have decided to recommend the holding of such an exhibition, and authorised the engineers to take all the necessary steps.

The Electricity Committee has approved the proposal of the chief engineer for the installation of air-filtration plant for the turbine-driven generators, at an estimated cost of £1,080, and a turbine-driven circulating pump (estimated cost, £700) in connection with the new turbo-generator. Application is to be made to the L.G.B. for sanction to borrow those sums.

Canada.—An Electrical Commission appointed by the municipal authorities of Montreal has reported in favour of placing underground the wires at present running overhead in that city. The drafting of the conduit plans, however, has to be carried out, not as a whole but in detail for different parts of the city. Accordingly, the Commission is preparing designs for placing underground the wires in a part of Catharine Street, about 2½ miles in length.

The establishment at Montreal of a company, with a capital of about £205,000 is announced, to carry on electric light, heat and power business.

The Imperial Trade Correspondent for Ontario reports the contemplated extensions of the hydro-electric system of a town in that province, at the estimated cost of about £227,800.—*Board of Trade Journal.*

Cardiff.—The City Council has decided to make application to the L.G.B. for sanction to borrow £10,500 for laying mains in connection with the electricity undertaking.

Chile.—The *Diario Oficial* reports that it is proposed to divide the Hydraulic Works Department into the following three sub-sections:—(1) Hydraulic surveys; (2) power stations; (3) conveyance of powerful electrical currents. It is also considered expedient to expropriate as soon as possible all those hydraulic works which it may be thought more suitable for the State to work

for its own account, and to encourage the development of other hydraulic undertakings by private enterprise in the most economic and efficient manner for the needs of the country. It is proposed, firstly, to investigate the requirements of the State railways, and to see what power would be necessary for those lines which the authorities contemplate electrifying. Examination will also be made as to the possibility of using hydro-electric power for military and naval arsenals. If the energy which it is practicable to generate exceeds the immediate requirements of the State, then it may be leased for private undertakings. The first programme will comprise investigations to be carried out during a period of five years relative to the rivers Aconcagua, Maipo, Cochapoal and Bio-Bio.—*Board of Trade Journal.*

Carnarvon.—The T.C. has decided to support the Bill of the National Electric Construction Co., Ltd., to confirm the agreement for free wiring.

Co. Durham.—The County of Durham Electric Power Supply Co. has applied to the B. of T. for permission to use extra-high-tension overhead lines for the supply of energy at a pressure of 20,000 volts between the Tudhoe Ironworks, Spennymoor, and Castle Eden. The lines will be in the areas of the Auckland, Sedgefield and Easington R.D.Cs.

Continental Notes.—Austria.—The wisdom of the construction of large electricity works for the service of extensive rural districts is, in certain responsible quarters in Austria, being called in question. In purely agricultural districts such concerns are only found profitable when industrial towns or regions are included in the area of supply. Small isolated plants may, however, confer considerable benefits on rural districts, and several examples are cited. One such is that erected at Mitteltal, in the Schwarzwald valley, a village of 300 inhabitants, which straggles for 3 km. along the banks of the Murg River. Here a modest plant has been set up which has given good results. The water from an old water-mill is led along a flume at the rate of 250 metres per second, and with a head of 2½ metres is used to drive a turbine producing 20 to 30 H.P. The electric lighting of the locality requires only 18 H.P.; the rest is available for the working of a flour mill and other purposes. The turbine drives by belt a 110-volt machine which charges a battery of 400 ampere-hours capacity with a 7½-hour load during the day. In the evening, battery and dynamo work in parallel at the network, and at night the battery covers the current requirements and the water-power is available for the mill. There is a total of nine 20-H.P. motors and 100 10-C.P. glow lamps connected. The cost of installation was 28,000 kronen. Interest and sinking fund are reckoned at 2,000 kronen. The lamps are estimated at 1·20 kronen per candle per year, or 0·60 kronen per KW.-hour for light, and 0·30 kronen for power. Receipts have totalled 4,500 kronen, leaving a considerable surplus.—*Elektrotechnik und Maschinenbau.*

The Province of Steiermark is the scene of considerable activity in the construction of hydro-electric generating stations at the present time. No fewer than five schemes are in hand. That to be built on the Drau River will yield 20,000 H.P., and is for the supply of light and power to the City of Marburg, the local authorities being the promoters of the scheme. The station projected on the River Mürz will necessitate the construction of a dam across that river, and is to be carried out by Messrs. Vogel & Noob, to supply power for their iron works situated at Wartberg. Official sanction has already been secured. The station contemplated on the River Mur is mainly a municipal project of the Town of Leoban, but large industrial concerns are interested. A similar undertaking is that contemplated at Rudersdorf, but a company is to be formed to carry out the scheme. Lastly, the Imperial Railway Department purpose constructing a large power station on the Lafnitz River near Beigürtl, the current to be used for the working of the Hartberg-Aspang Railway line. The Official Commission of Experts is now inspecting the sites, &c. —*Der Elektrotechniker.*

Belgium.—An important electric lighting and power transmission plant is about to be installed at the collieries of the Société des Charbonnages du Levant du Flenn, at Cuesmes. The generating plant will comprise a 1,600-H.P. steam turbine and a 1,250-KW. alternator and two smaller sets of 1,000-KW. capacity.

An electric lighting and power transmission plant is about to be put down at the quarries of the Société des Carrieres Dumont, at Valenciennes, near Tournai.

Russia.—A proposal to establish a central electric lighting station in the town of Narwa is at present under consideration.

France.—A new company has just been formed at Monceau-sur-Oise (Aisne), with a capital of £30,000, and the title La Société de l'Energie Electrique du Nord l'Aisne, to acquire and carry on the undertaking of the Société de l'Energie Electrique de Monceau-sur-Oise.

Sweden.—The Municipality of Stockholm has now definitely settled the question of water power *versus* steam power for the production of the necessary electrical energy for light and power.

At the last meeting, on November 27th, a sum of £750,000 was voted for the erection of an electrical power station, from which the city is to be supplied with energy. This power station will be built at the Untraverkene, at the Datetven, which place is situated 82 miles from Stockholm. The waterfall in the Datetven, from which the power is going to be derived, was acquired by purchase about two years ago, at a price of about £111,000.

Croydon.—The B.C. has adopted the Electricity Committee's proposal to increase the output of the works by the installation of a 1,000-KW. mixed-flow steam turbine, driving a 750-1,000-KW. alternator, with an exciter and a 300-KW. direct-current machine, available either for traction or direct-current lighting supplies. This improvement, with certain necessary incidentals, was estimated to cost between £9,000 and £9,500. The borough electrical engineer calculates that the resultant saving will be £1,300 per annum, or over 14 per cent. on the capital outlay. According to the vice-chairman of the Committee, but for the coming of the metal-filament lamp, this expenditure would have been necessary years ago. Their load, he said, was on the up-grade again.

The B.C. has decided to pay at time and a-half all tramway employés working on Christmas Day; also to take advantage of a North-end widening to substitute a double tramway track for a portion of the interlacing lines rendered necessary in the first instance by the narrowness of the thoroughfare.

Edinburgh.—Since the introduction of electric lighting for common stairs, the arc-lamp trimmers have complained about their work being considerably increased, and in consequence the Corporation Electric Lighting Committee has agreed to put in clock switches, by which the lighting and extinguishing of the lamps will be done from the power station.

Glasgow.—Some time ago Mr. W. W. Lackie, the chief engineer of the electricity department, and Mr. S. Langlard, chief inspector of lighting, inaugurated, with the consent of the T.C., an experiment for improving the street lighting in the city. Two types of arc lamps were introduced—the Metroflam and the Angold; both have given every satisfaction, and it has been found that they could burn 80 hours with one trimming, and give three times more light for the same consumption of current as older lamps. Over 200 of the lamps are now in operation in several of the principal thoroughfares, and their numbers are being systematically augmented.

Great Harwood (near Blackburn).—The U.D.C. in Committee has passed a resolution that the scheme for the establishment of a generating station and the distribution of electricity within the urban district, prepared by Mr. J. W. Speight, electrical engineer, St. Annes, be approved, except such part as relates to the destruction of refuse, and that the estimated cost, amounting to £8,085, be also approved; and that the seal of the Council be affixed to a memorial to the B. of T. asking for a prov. order for the urban district.

Hastings.—This week the formal turning on of the light at the Union workhouse and infirmary buildings took place. The proposal to carry the mains a considerable distance in order to light the workhouse and pick up the borough sanatorium *en route* met with very strong opposition at the outset, and also on the occasion of the L.G.B. inquiry. One result of the extension of the mains will be the transference of the whole of the gas lamps on the route and the introduction of the electric light at several of the large residential properties in the St. Helen's district.

Keighley.—The Electricity Committee has recommended the T.C. to accept a tender for certain additional appliances at the electricity works, and to apply for borrowing powers to the extent of £6,576 for various purposes. In the T.C. the opinion was expressed that the expenditure on the electricity undertaking had been very heavy. The department had borrowing powers already to the extent of £75,146, apart from £9,300 for land, and it was necessary to provide over £3,700 a year for interest and sinking fund.

Lampeter.—The T.C. has granted Mr. Wm. Jones permission to fix overhead electric wires in the town for the purpose of supplying current to consumers.

Launceston.—The T.C. on Monday decided to inquire as to the cost of the installation for electric lighting for the Town Hall, Guildhall, and Free Library. The seal was placed to the supplementary agreement with the Launceston and District Electric Supply Co. for the payment of an annual acknowledgment of 6d. for each of the electric lighting poles in the borough, and the Council consented to the application proposed to be made by the company next session for a provisional order.

London.—Bermondsey.—The Electricity and Street Lighting Committee reports that since January 1st last it had connected to the Council's mains consumers with an applied demand of 570 KW., and negotiations were at present proceeding for another 288 KW. At the end of July last 101,096 more units had been generated than for the corresponding period of the previous year, being equal to an increase of 8 per cent. Owing to the late strike, however, all this lead had been lost, as the total units generated up to the end of November only amounted to 2,834,161 against 2,910,810 in the previous year. For the quarter ended December, 1910, owing to a breakdown of their own plant Messrs. Spillers & Baker had taken 102,201 units from the undertaking. During the same quarter the Dock Co. and Messrs. Peek Frean had taken 63,598 and 74,000 units respectively. 'Had it not been for the strike the Council's output would have shown an increase over last year, notwithstanding the loss of the above three consumers, whose demand amounted to 390 KW.

Fulham.—The Public Heath Committee has decided, on the suggestion of the electrical engineer, to install transformers and metal-filament lamps in the Council's five public conveniences in lieu of the existing carbon-filament lamps, at a cost of £12. By thus doing it is estimated that in the first year a saving of £61 in the cost of lighting should be effected. The Electricity and Lighting Committee has decided to modify the existing charge under the

arc lamp rental scheme of £8 16s. per lamp per annum for a minimum consumption of 800 hours, with an additional charge of 2½d. per hour above the minimum number, to £5 10s. for 500 hours, with an additional charge of 2d. for every hour in excess of the 500. Alternatively, when preferred or required, agreements are to be entered into with consumers for a fixed charge per lamp per annnm, such charge to be arrived at on the basis of the £5 10s. for a minimum of 500 hours and 2d. per hour afterwards, according to the total lighting hours per annum, calculated upon the recognised business hours of premises. The Committee has further decided to enter into a scheme similar to that in operation in Hammersmith for outside shop lighting, viz., to supply, fix and maintain one lantern for two, three or four lights, including wiring for same, at an annual charge of 16s. 9d., 20s. and 25s. respectively.

Lewisham.—The Board of Guardians has accepted an offer of the South Metropolitan Electric Light Co., at £10, to provide an installation for lighting the lunatic wards at the infirmary.

Marylebone.—Mr. A. H. Seabrook, general manager of the electricity undertaking, in a report thereon for the September qnarter, states that the total iucrease in units sold amounted to 105,878, almost equally spread over the private supply and public lighting services. The income realised from the sales to private consumers, showed an advance of £417, which, including pnblic lighting, showed a total increase of £907. The gross income from all sources was put at £30,332, as against £27,756 during the September quarter of last year, the major part of the advance being due to the extended operations of the sales branch. Mr. Seabrook further states that the total quantity estimated to be sold during the current year for both private and public supplies was put at 13,361,000 units, this being an increase of 8·3 per cent. on the actual sales in the previous year. In summing up for the six months ended September last, it was found that 4,438,020 units had been sold. This gave an increased sale of current for the past half-year of 344,649 units, equivalent to 8·4 per cent., compared with 8·3 per cent. the year's estimated increase.

Hampstead.—The B.C. sat in private and debated the question of the alleged excess of expenditure over estimates in connection with the recent conversion of the street lamps to electric lighting. It was found that 2,359 lamps had been converted, as against 2,229 which had been agreed on, and that the actual cost of the work amounted to £25,397, while the estimated cost was £15,072. The Sub-Committee which had been inquiring into the matter, reported that the estimates were prepared in a careless and slipshod manner, which amounted to culpability, by the assistant engineer, and that the chief engineer was to blame for not satisfying himself as to the accuracy of the statements he signed. In the result the Council dismissed the assistant engineer, and called on the chief engineer to resign, a course which he has since taken.

Norwich.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for a loan of £19,000 for mains and services, and for a turbine with two generators in tandem.

Nuneaton.—The T.C. has reduced the price of current for the Council offices and the depôt, from 4d. to 3d. per unit.

A loan of £7,200 for new plant and buildings at the electricity works has been applied for.

Portsmouth.—The T.C. has decided to support the Bill of the I.M.E.A.

Ramsbottom.—The U.D.C. has entered into an agreement with the Lancashire Electric Power Co. for the supply of electrical current at the sewage works.

Ramsgate.—The B. of T. has decided to have the Harbour clock lighted by electricity. Some years ago the lighting by gas was discontinued owing to the damage done to the works of the clock.

Rugeley.—On December 15th a meeting of ratepayers was held relative to the electric light question. The scheme submitted by Messrs. Drake & Gorham was estimated to cost £5,583, and it was estimated that the income during the first year would leave a surplus of £100. The meeting, by a large majority, empowered the U.D.C. to proceed with the matter.

Shanklin.—The U.D.C. has decided to enter into a fresh contract for public lighting for three years with the Isle of Wight E.L. Co.

Skegness.—The U.D.C. has decided to obtain expert opinion as to the cost, &c. of an E.L. undertaking.

South Africa.—The tender of the Cape Town Corporation has been accepted by the municipalities of Mowbray, Rondebosch and Claremont for the supply of energy to private consumers for a period of 10 years—also for the street lighting of the municipalities of Rondebosch and Claremont. This area has hitherto been electrically lighted by the Cape Peninsular Lighting Co., Ltd., whose headquarters are at Claremont. The basis of the tender for the supply to private consumers is to put them on the same terms as the Cape Town consumers with a maximum net rate of 9d. per unit for lighting, and 2½d. for power and heating; larger consumers will have the benefit of a sliding scale with increased discounts.

Stirlingshire.—The Bonnybridge Special Districts Sub-Committee reported to a meeting of the County Council that Mr. Churchward, general manager of the Scottish Central Power Co., agreed to give the necessary supply for the Greenhill district at the yearly rate of £2 5s. per lamp, providing all plant, maintaining, lighting and extinguishing the lamps, the contract to be for ten years, and the Road Board to give facilities for the erection of an overhead line. The offer was accepted, Mr. Churchward agreeing to proceed with the erection of the plant as early as possible. With regard to the lighting of High Bonnybridge, it was agreed to delay proceeding further in view of there being a possibility of the power company being able to give a supply for that part of the district also.

Sunderland.—At a meeting of the T.C. on the 13th inst. a report was submitted recommending that the Council contribute towards the expense of the promotion of the I.M.E.A. Bill. Ald. Bruce said the Bill would remove restrictions at present placed on municipal undertakings in regard to sales and wiring. They had already had two threats of injunctions to prevent them carrying on this work. He spoke of the advantage the Corporation had derived from the showroom and system of canvassers, and added that he did not think their guarantee would be for more than £50 or £60. The report was adopted.

Swansea.—The T.C. has decided to take no action with regard to the Bill of the I.M.E.A., as it already possesses some of the powers sought.

Swinton and Pendlebury.—The U.D.C. has decided to give a supply of current to the new schools at Cromwell Road and also to Messrs. Jones's foundry.

A suggestion that the Council should enter into a new agreement for a supply of current in bulk with the Lancashire Power Co., has been referred to a Committee, which was empowered to engage expert advice.

Tottenham.—A draft agreement between the Council and the North Metropolitan Electric Power Supply Co., has been approved providing for a penalty to be paid by the company to the Council of $\frac{2}{10}$d. per hour, or any part of an hour, in respect of which any arc lamps remain unlighted during the period they should be illuminated, subject to the penalty being applied to incandescent as well as arc lamps.

West Bromwich.—The T.C. has applied for a loan of £10,000 for the provision of additional generating plant.

Whitehaven.—The T.C. has under consideration a scheme for assisted wiring of consumers' premises.

The T.C. has decided to support the Bill of the I.M.EA., and to contribute up to £5 towards the cost.

Winchester.—The T.C. has decided that it cannot see its way to make any contribution towards the promotion of a Bill by the I.M.E.A. seeking to give local authorities powers to wire consumers' premises, and to supply fittings, &c.

Wombwell (near Barnsley).—The Electrical Distribution of Yorkshire, Ltd., has given formal notice to the U.D.C. of its proposed application to the B. of T. for a prov. order for the urban district.

Worcester.—The T.C. has applied for a loan of £7,250 for mains, meters and transformers for three years.

TRAMWAY and RAILWAY NOTES.

Australia.—The Perth (W.A.) Council has decided not to adopt the suggestion to promote a rival motor-'bus service in opposition to the tramways, but to continue negotiations with a view to purchasing the Tramway Co.'s undertaking.

Belfast.—At the fortnightly meeting of the Tramways and Electrical Committee on Monday, the general manager submitted a report on the question of the tramways extensions sanctioned by the new Act of Parliament, and it was arranged to deal with the matter at a special meeting. It was decided to have an alternate gas and electric lighting scheme at the Carlisle Circus for experimental purposes; it was also decided to lay mains to serve the Ulster Hospital for Women and Children at Templemore Avenue.

Bolton.—The question of extending the Corporation tramway system by linking it up with Westhoughton, which has no tramway facilities, is the subject of consideration between the T.C. and the Westhoughton Council. A deputation from the latter authority has attended before the Tramways Committee, and discussed the alternatives of an extension of the existing line from Bolton and the adoption of the railless system of traction. It was decided to have reports prepared by the officials with respect thereto. The Bolton tramway runs as far as Deane and Hulton in the Westhoughton district, leaving a gap of about 4 miles.

Bradford.—Proposals are on foot for extensions of electric tramways. The Tramways Committee has decided to ask the City Council to authorise the commencement of an extension of the track from Wyke to Bailiff Bridge, an addition of nearly two miles. On this route it is left open to future decision as to whether the service should be by the ordinary type of car or the railless system which has proved so successful in the cities of Leeds and Bradford.

The general manager has reported on the successful working of the new railless trolley system, and has been instructed to visit

the works of the Railless Electric Traction Co., at Chelmsford, to inspect the "Mercedes-Stoll" system. The general manager has also been authorised to proceed to Turin to inspect railless vehicles offered for sale by Dr. Zani, of Milan, and to visit Bremen to inspect the railless trolley system in operation there.

At the suggestion of the Amalgamated Association of Tramway and Vehicle Workers, the Corporation has decided that by way of experiment an electric tramcar be fitted with a vestibule front for protection of the driver in severe weather.

Cardigan Bay.—It is stated that a London syndicate has in hand a scheme for linking up by electric tramway the little towns of New Quay and Abergron, on the coast of Cardigan Bay. As pleasure resorts in the summer these places are yearly becoming more popular, but they are somewhat out of the way, and with the exception of the light railway, which is worked by the Great Western Co. from Lampeter to Abergron, there is no railway communication. A rough survey of the route has been made, and the installation of electric plant for lighting the towns and villages is said to form part of the scheme.

Edinburgh.—The T.C. has taken up consideration of the railless traction question again. The Tramways Committee at its next meeting will probably decide as to whether it shall adopt railless traction for all extensions or combine it with motor-bus services for its requirements. The Town Clerk is to communicate with Leith Corporation to obtain its views as to a service plying on Easter Road either by railless traction or motor-bus. The burgh engineer has been asked to report on a proposal to approach the Tramway Co. with a view to arranging for the running of double-decked cars to Georgie car terminus.

Glasgow.—Some interesting figures are provided by the tramways department in connection with the first week of the three months' experiment of doubling the ½d. journey for the same price. The experiment began on Sunday, December 10th, and the number of passengers carried for the seven days up till the evening of December 17th was 5,500,482, and the revenue was £17,595, against 5,039,307 passengers and £18,870 of revenue during the previous week, and against 4,528,789 passengers and £17,876 of revenue during the week ended Saturday, December 17th, 1910. These statistics show that last week there was an increase of 461,175 passengers, and a decrease of £1,275 in the drawings, compared with the previous week, and an increase of 971,693 passengers and a decrease of £281 in the drawings, compared with the corresponding week a year ago. A peculiar point, however, is that the drawings for Monday of this week (December 18th) were greater than they were for the Monday previous, and also for the corresponding day of last year, the total sum drawn on December 18th being £2,585, against £2,501 a week ago, and £2,583 last year. It is pointed out by the department that the pressure on the cars caused by the large increase in ½d. passengers and the difficulty of seeing that they do not over-travel their proper distances, have occasioned considerable harassment to the conductors, while it is also noted that several of the new stages give passengers practically a 1½-mile journey for ½d.

The Corporation has decided to delete from its general provisional order the proposal to link up the tramway route between Great Western Road and Gairbraid Street *via* a new bridge over the Kelvin.

The recently-reconstructed offices of the tramways department have already proved insufficient to accommodate the staff, and the Corporation has instructed the general manager to make arrangements for the tenants in the adjoining buildings, lately acquired by the T.C., vacating their premises for the purpose of immediate extension operations being begun.

The Tramway Committee, having taken back for reconsideration the proposals for the blind being permitted free travelling on the cars all over the system—reported in the REVIEW at the time—have now appointed a special committee to report to the T.C. what arrangements could be made so that all blind persons, properly authenticated, be given passes to permit them to travel free on the cars.

Lanark.—A special meeting of the County Council held last Friday, agreed by a large majority to promote a Provisional Order regarding tramways. The Council asks power to construct the lines of tramway left unfinished by the Lanarkshire Tramways Co., with certain additional small lengths of tramways which it is advised, fall naturally into the scheme. Power is also sought to enable the Council itself, or in conjunction with all, or any, of the Town Councils of the three burghs, who may so elect, to purchase the whole of the tramways.

Leeds.—Sir G. R. Askwith has forwarded his report on the matters in question at Leeds *re* the working hours of 54 per week for conductors and motormen. The arbitrator points out that the Corporation suggested, as a test, the average over the whole system, while the men suggested the average for the district routes. On both points Sir Geo. Askwith declares that he is not prepared to say that the average of 54 hours has not been as nearly as possible attained. Other matters are contained in the award which both sides have agreed to accept.

Sir Geo. Askwith's award also states that in Clause 7 the words "previous service to count" applied to car cleaners on the roster at the time of agreement. Those who had under 12 months' service were to receive 6d., those who had between one year's service and four years to receive 6½d., and after four years 6¾d. In Clause 8, he considers that the rate of the employés mentioned in this clause should be fixed in accordance with the number of months they have been in the service. The decision was received with much concern by the employés, and arrangements are to be made to hold a meeting to consider the award, though it was recognised that the three years' agreement, entered into by the men's officials and the Corporation in August last, precludes the re-opening of the dispute.

Mossley.—On Monday, Mr. J. F. Price, coroner, held an inquiry into the tramway disaster which occurred October 20th, and which resulted in the death of six people. The driver of the car, Geo. Houchin, said the car went off like a shot from a gun. The wheels of the car did not revolve. The trolley came off and left the car in darkness. He could give no explanation of the cause of the accident. Mr. R. Blackmore, engineer-in-chief to the Joint Board, said he examined the overturned car and the route immediately after the accident. The only theory he could put forward for the accident was that the rear brake was not sufficiently released. This made skidding very much easier. The jury returned a verdict of "Accidental death," and added that no one was to blame. It recommended that a loop line be made at Abney Road, near the railway bridge, and was of opinion that if such a loop had been in existence the car would have taken it instead of going through the wall.

Rothwell (near Wakefield).—The Wakefield and District Tramway Co. having applied for permission to abandon the extension of the tramways to Oulton, the B. of T. has decided that it would be inexpedient to grant the application. The Board stated, however, that it would extend the time for a further 12 months, during which period it hoped the local authority and the company would consider whether it was possible to come to an arrangement whereby money for the extension could be provided, and the line worked on terms acceptable to both parties.

South Africa.—The Transvaal *Provincial Gazette* publishes an ordinance authorising the Germiston Municipal Council to raise a loan for tramways of £106,690.

Southampton.—The Tramways Committee has received a report from the manager to the effect that, owing to extra car-shed accommodation being provided, they would be able to build about 12 cars a year as against 6 at present, and asking permission to purchase the necessary timber for the proposed work. The Committee has decided to apply to the L.G.B. for sanction to borrow £7,200, the estimated cost of building 12 new cars. The advisability of extending the tramways to the various depôts of the works department is under the consideration of the borough engineer, the general manger, and the engineer of the tramways department is to report as to the probable cost.

U.S.A.—The Chicago Railways Co., which operates the street tramways in the city, has, during the past three years, added 11 extensions of its track. Since the reconstruction period began, 447 miles of track have been rebuilt, at a cost of $50,000 per mile, and the company will soon have 600 miles of track in use. It has 1,400 pay-as-you-enter cars on the road and an additional 215 cars are being built.

U.S. Single-phase Railway Operation.—The *Journal of Electricity, Power and Gas*, referring to the 11,000-volt single-phase line of the Spokane and Inland Railway (Washington), says it has been found in the winter, when steam trains operating paralleling routes to the single-phase are unable to get through without considerable delay, that single-phase trains run closely to their time schedules. The reason given is that on a single-phase road the voltage is so high, that it holds up to almost normal, even when the train motors are drawing very heavy currents. Our contemporary adds that with an ordinary 600-volt D.C. road when the cars must buck snow, the current consumption is so great that the line voltages usually drop to a value too low for effective operation. During the worst storms, with a foot or more of snow on the ground and from 6 to 10 ft. of it in cuttings, the Spokane and Inland trains were not more than 20 minutes behind time.

TELEGRAPH and TELEPHONE NOTES.

Cross-Channel Telephony.—Starting from Christmas Day, the facilities for telephonic communication between Great Britain and France will be greatly extended, thanks to the excellent results obtained from the new loaded cable laid by the British Post Office. The range will extend as far as from Aberdeen to Paris, a distance of about 780 miles, and some 300 towns in this country will be put into communication with Paris and many provincial towns in France. The rates from English towns will remain at 8s., those over the border paying 10s., but after an additional loaded cable has been laid by the French Government, enabling an increased traffic to be dealt with, it is expected that the rates will be reduced.

Earth Antennæ for Wireless Telegraphy.—Count Georg von Arco, in the course of a lecture delivered recently in Berlin, discussed the subject of wireless telegraphy. He is reported to have stated that the question had for a long time remained undecided whether the distant effects were caused through the air or the earth, or through both media simultaneously. During the course of years experts became more of the opinion that the earth was largely concerned with the transmission. In order to obtain information on the matter, systematic experiments had been made during the past two years by Dr. Kiebitz, on behalf of the German postal authorities. It was found in this connection that electrical energy was transmitted for considerable distances through the earth, and that in the case of great distances sufficient energy could even be taken from the earth alone for the purpose of reception. Stimulated by these results, the Gesellschaft für Drahtlose Telegraphie had made numerous experiments in the past year, and had applied for various improvements in patents. The effects of the earth antennæ were sharply directed, and the antennæ in many respects showed advantages over air antennæ. In particular it was possible considerably to increase the security against interruptions by atmospheric discharges and by stations causing disturbances.

Germany.—The telegraphs of the German Empire, according to the latest statistics, comprise 210,269 km. of wire, in addition to 48,171 km. of railway telegraph lines, and 6,293 km. of wire in the Colonies and China. The number of telegraph stations is 41,276 in the Empire, and 118 in the Colonies and China. There are 51,422 telegraph instruments, 13,035 of which are Morse or sounders, 1,204 Hughes, 33,746 telephone, 9 Baudot, 14 Wheatstone or recorders, and 9 Murray instruments.—*Deutsche Postzeitung.*

Rates on Telephone Property.—In reply to a question in Parliament, Mr. McKinnon Wood stated that there was no provision in any agreement with the National Telephone Co. whereby the company made themselves liable for any payment of rates beyond December 31st. From January 1st a contribution in lieu of rates would be made by the Government on the buildings and plant to be acquired from the company. Contributions in lieu of rates had been and were being paid in respect of the telephone trunk lines acquired from the National Telephone Co. in 1896; but no contributions were made in respect of trunk lines extended or erected by the Postmaster-General since that date.

Rural Telephone Installations.—Asked whether he had yet been able to establish any £3 telephone installations for the benefit of farmers and other rural residents, the Postmaster-General recently stated that the low rate of £3 a year for rural party lines was based on the assumption that an average of three subscribers per mile of route would be obtained. A large number of localities had now been actively canvassed, and it was clear that more than two subscribers per mile could not be hoped for except in a very few special cases. To meet this condition an increase in the charge would be necessary to cover only the direct cost of the lines and operating, without allowing anything for the general expenses of the exchanges with which the lines were connected, and he hoped shortly to be able to offer a modified scheme of rates to meet the same conditions in different localities.

U.S.A.—The Postal Telegraph Cable Co. has issued instructions to its construction department to proceed with the erection of additional heavy copper wires between all important points on the system of the company, for the purpose of extending the telephonic use of the same to the independent cable companies.

Wireless Telegraphy.—It is reported that experiments with high-speed telegraphy on the Poulsen system have taken place between the Cullercoats Station, near Newcastle-on-Tyne, and a Danish steamer at a distance of 496 miles. It is said to have been found possible to transmit up to 200 words per minute.

The stations at Ingö, in Norway, and in Spitzbergen, have been completed and tested. The results have been satisfactory, and on December 2nd a regular service was opened.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—N.S.W. Government Railways.—January 8th. — Four 1,000-kw. rotary converter units. January 22nd. Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

January 9th.—Accumulators, booster, switchboard and accessories, for the Subiaco Council. Town Clerk's office. Deposit of £100.

Melbourne.—January 9th. Three tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" to-day.

Austria. — Lemberg. — January 10th. Tenders are invited by the State Railway Direction at Lemberg for the supply of a Diesel engine set of 400 h.p., for the railway power station; also light and power equipment of railway machine shop (switchgear, cable, three transformers for 5,000-volt three-phase current). Particulars supplied on receipt of postage by Bureau für Zugförderungsdienst, Lemberg.

Dartford. — January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" December 15th.

Croydon.—January 5th. The County Borough invites tenders for two Lancashire boilers. Specifications and forms of tender, £1 1s. (returnable), from the Borough Engineer's office, Town Hall, Croydon.

Edinburgh.—The Governors of George Heriot's Trust invite tenders for the electric lighting and power installation in the science laboratories now under construction at George Heriot's School. Mr. John Anderson, superintendent of works, Heriot Trust offices, York Place, Edinburgh.

France.—January 5th. The French Post and Telegraph authorities in Paris are inviting tenders for a multiple telephone board for the Central Telephone Exchange.

Hornsey.—January 11th. One steam dynamo set (either reciprocating or turbine), for the T.C. See "Official Notices" December 8th.

London.—L.C.C.—The Main Drainage Committee is inviting tenders from six selected firms for the installation of electric light in the new engine-house at the Abbey Mills pumping station. The Highways Committee contemplates an expenditure of £4,000 on the renewal of the electrical installation in Blackwall Tunnel in 1912-13.

Hampstead.—The electrical engineer has been authorised to obtain meters and other stores at an estimated cost of £354.

Hammersmith.—It is recommended that the Council invite tenders for the supply of flame arc lamps in quantities of not less than 50 in one year, in connection with the proposed hiring-out scheme.

Manchester.—January 9th. (*a*) Steel girder tramway rails; (*b*) steel tie-bars for tramway rails. For (*a*) deposit of £1 1s. required. Specifications and forms of tender from Mr. J. M. McElroy, general manager.

New Zealand. — March 7th. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Russia.—The municipal authorities of Woronege are about to invite tenders for the conversion of the horse tramway in the town to electric traction.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Bangkok.—March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

Spain. — The municipal authorities of San Pedro (province of Albarete) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Swansea. — January 6th. Water-tube boilers, superheaters and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" December 15th.

Turkey.—Tenders will be received at the "Ministère des Travaux Publics," Constantinople, up to 2 p.m. on February 20th, for a concession for the supply of electric light and power to the town of Adalia, which has a population of some 30,000. The supply of power for telegraph and telephone installations and electric traction is excluded from the concession. Power is to be generated from waterfalls. Tenderers must supply proof of technical and financial competency, and a deposit of £225 is required with each tender. Further particulars from the Commercial Intelligence Branch of the Board of Trade. Local representation is practically indispensable

West Hartlepool.—January 2nd. 191 tons steel rails, 3 tons fish plates, 11 pairs manganese cast-steel spring points (12 ft. long), 11 crossings, and reconstruction of tramway permanent way (Park route), for the T.C. Mr. N. F. Dennis, borough engineer (returnable deposit £1 1s. for each contract).

CLOSED.

Blackpool.—The Tramways and Electricity Committee of the T.C. has accepted the tender of the British Electrical Engineering Co., Ltd., for an 800-kw. traction set, and that of the British Thomson-Houston Co., Ltd., for a 1,500-kw. steam turbo alternator.

Bournemouth.—The T.C. has accepted the tender of Messrs. Goddard, Massey & Warner for rebuilding six new cells at the refuse destructor, at £1,450.

Bradford.—The Corporation has been recommended to accept the tender of the Brush Electrical Engineering Co., for the supply to the Tramways Department of six new car trucks, at £39 10s. each.

The Corporation has been recommended to accept the tender of Messrs. J. J. Griffin & Co., for the provision for the Technical College, of six electric pyrometers, arranged with the necessary switches for coupling to one direct reading instrument, at £26.

Bury.—The T.C. has accepted the tender of the British Westinghouse and Manufacturing Co., Ltd., for two 750-KW. rotatory transformers.

Crewe.—The Cheshire Education Committee has accepted the tender of Messrs. Carrington & Button, of Crewe, for electric light fittings for the new College at Crewe, at £135.

Dundalk.—Messrs. Siemens Bros. inform us that they are supplying the whole of the street-lighting material, comprising standards, cast-iron brackets, lanterns and "Onewatt" lamps, for the new street-lighting scheme which is now being carried out here.

Glasgow.—The T.C.'s Parks Committee has accepted the offer of the Electricity Department for the erection, round Richmond Park pond, of ten electric arc lamps, with overhead wires, for the lighting of the pond during skating, for a sum not exceeding £72. The Tramways Committee has accepted the following offers:—

Commutators for W.H. 49 B motors.—Alfred Clare & Co.
One 40-B.H.P. compound wound motor.—Mavor & Coulson, Ltd.
Upkeep of stokers at Pinkston.—Babcock & Wilcox, Ltd.
V.I.R. cables.—W. T. Glover & Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Switchboard and balancer in connection with the Bordon electricity supply.—Evered & Co., Ltd.
Telephone sets, &c.—British Insulated and Helsby Cables, Ltd.; Midland Electric Wire Co., Ltd.; Spagnoletti, Ltd.; West London Scientific Apparatus Co., Ltd.
Installation of electric light in Quebec Barracks, Bordon.—J. B. Saunders and Co., Ltd.

India Office Store Department.

Accumulators, &c.—Rice & Co.
Cells.—Siemens Bros. & Co.

Office of Works.

Electric lamps.—British Thomson-Houston Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; Foster Engineering Co., Ltd.; Omega Electric Lamp Co., Ltd.; Pope's Electric Lamp Co., Ltd.; The "Z" Electric Lamp Manufacturing Co., Ltd.
Electric lift at old building of the Imperial College of Science.—Otis Elevator Co., Ltd.
Collapsible lift gates, &c., Royal Courts of Justice.—Waygood & Co., Ltd.

General Post Office.—Telephonic apparatus.

Bell sets.—British Insulated and Helsby Cables, Ltd.
Silence cabinets.—M. Hunter & Sons; King & Scarborough.
Cases for retardation coils and condensers.—British L. M. Ericsson Manufacturing Co., Ltd.
Flexible cords.—London Electric Wire Co., Ltd., and Smiths, Ltd.
Plugs.—British L. M. Ericsson Manfg. Co., Ltd.
Switchboards.—British Insulated and Helsby Cables, Ltd.; British L. M. Ericsson Manfg. Co., Ltd.; Western Electric Co., Ltd.
I.-R. and C.C. cable.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Paper-core cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Fuses.—British Insulated and Helsby Cables, Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.
Keyboard perforators.—Gell Telephonic Appliances Syndicate, Ltd.
Automatic exchange equipment at G.P.O. (West), E.C.—British Insulated and Helsby Cables, Ltd.
Gamewell fire-alarm system at Hampton Court Palace.—G. Longfield-Beasley.

Keighley.—The Electricity Committee has accepted the tender of Messrs. E. Green & Son, at £182, for an additional section to existing economisers in connection with the water-tube boilers.

London.—The Korfund Co., of Westminster, have just received an order for the insulation, with "Korfund" patent cork resilient foundation plates, of the foundations of two 90-H.P. Diesel engines at Berner's Hotel, Berner Street, W.

Margate.—The T.C. received the following tenders for an eight-cell refuse destructor:—

Manlove, Alliott & Co., Ltd.	(accepted) £11,403
Goddard, Massey & Warner	9,325
Hughes & Stirling	9,954
Heenan & Froude	11,304
Horsfall Destructor Co.	11,430

Nuneaton.—The T.C. has accepted the tender of the Electrical Co., Ltd., for the maintenance of the public street lamps, at £35 per annum.

Perth.—The T.C. recently advertised for offers to supply electrical capstans for railway shunting work at the Corporation gas works. At a Council meeting held on 11th inst., it was unanimously agreed to accept the offer for the supply of Liddle patent capstans, Edinburgh. This is the third occasion within a very short time on which the Corporation gas works have adopted this patent capstan.

Southampton.—The tender of Messrs. Walter Scott and Co. has been accepted by the T.C. for the supply of 100 tons of tramway rails and 20 tons of curved rails.

Stafford.—The T.C. has accepted the tender of the Electric Construction Co., of Wolverhampton, for a booster and switchboard.

Walsall.—The following tenders have been accepted by the T.C. for the annual supply of stores to the tramway department:—

A. Womersley & Son.—Motor grease and lubricating oil.
W. H. Keys, Ltd.—Creosote, oil and pitch.
Le Carbone.—Carbon brushes.
A. G. Engholm.—P. & B. insulating paint.
Estler Bros.—Section insulators.
Electric and Ordnance Accessories Co.—Arc lamp globes and carbons.
Hoffmann Manfg. Co., Ltd.—Ball-races.
British Insulated and Helsby Cables, Ltd.—Mechanical ears.
Dyer & Young.—Armature coils.
Edison & Swan United Electric Light Co., Ltd.—Lamps.
Watlington & Co., Ltd.—P. & B. tape and Blackley tape.
National Rail and Tramway Appliances Co., Ltd.—Brake blocks.
British Hele-Shaw Patent Clutch Co., Ltd.—G.E. 58 pinion wheels.
A. Wiseman, Ltd.—Gear wheels.
Anti-attrition Metal Co., Ltd.—Trolley wheels.
Pinchin, Johnson & Co., Ltd.—Air-drying Voltalac.
British Thomson-Houston Co., Ltd.—Gear cases and controller fingers.

The T.C. has further accepted the tender of Callender's Cable and Construction Co., Ltd., at £46 15s., for laying low-tension cables to connect the new exciter with the low-tension switchboard at the generating station; and that of Messrs. Joseph Parker & Sons, at £28, for a 10-cwt. lorry for the tramways department.

Widnes.—The T.C. has accepted the tender of the Commercial Cars, Ltd., for two single-deck buses to carry 34 passengers each.

NOTES.

"A Merry Christmas."—The Editors of the Electrical Review wish all of their readers and supporters a Merry Christmas and a Prosperous New Year. 1911 will be remembered by all connected with the electrical industry as a year of great activity in which the Olympia Electrical Exhibition, and the electrical illumination features of the Coronation celebrations, called for additional concentration and entailed considerable strain. In many cases the summer vacation was spoiled by both events. With these recollections, and with the knowledge that the electrical industry is gradually improving, indeed in some parts of the country is now enjoying a record turnover, the brief Christmas respite can be entered upon with satisfaction. The few days of Christmas spent in joviality and rest in the family or social circle, should impart new energy, making all classes ready for a renewal of busy times in the early days of 1912.

Indian Business Methods.—Having read with amusement the letter published in a recent issue, the Silent Electric Clock Co. send us a similar one, which they received a few months ago—perhaps from the same source:—

"Please send us by return mail your very latest illustrated price lists of all your specialities, and quote us only your lowest rock-bottom wholesale trade prices. Kindly also be sure to add that you will allow us very tempting trade discount, together with 5 per cent. cash discount; you will please state only your highest possible trade discount. India is a most miserably cheap market, so quote lowest prices and highest discounts. If you only abide by this request we shall do a tremendous trade with you, should we find your specialities quick selling lines. We have electric lights and electric fans in our premises, but please inform if your electric clocks can be introduced in districts where there is no electric installation at all. Finally send us full details and particulars of all your specialities. Do not quote probibitive prices, and do not quote paltry discounts, else business will be out of the question.

"We established over 15 years back with merely 4s. 6d. To-day we supply to over 5,500 customers every month, and in Bombay alone. Moreover, we have quite an army of customers all over India, Burmah, Ceylon, China and Japan. Therefore, it will be for your own benefit to quote us cheapest prices and largests discounts remember:—

'He that will not when he may,
He shall not when he will.'

"We trust this small hint will be quite enough for you.

"While replying, please state that no charge will be made for packing or for wooden cases. Kindly also inform if you will pay freight and duty to India or not, and if you will appoint us your exclusive representatives and sole agents in all the East, or a specified portion thereof or not.

"Trusting this will result in good trade connections between us.—Yours faithfully, &c."

The Copper Market.—A correspondent writing in the *Financier* of December 12th states that the price of standard copper shows a tendency towards a slight rise, consequent upon purchases, mainly of a speculative character. He thinks that this cannot be altogether taken as an indication that the *bonâ fide* demand is not so strong as usual, but that it is due in a large measure to the usual slowing-down of the metal market consequent on the approach of the Christmas holidays, and for this reason the temporary falling-off in consumption is likely to be even more noticeable. The writer states that there is also at present a strongly-marked bullish movement ostensibly supported by the monthly American statistics. He is also of the opinion that, regarded from the buyers' point of view, the latest figures are certainly encouraging, and that at first sight the result might be expected to take the form of higher quotations consequent upon the lower production and decreasing stocks of copper.

The *Financial News* of December 8th gives an extract from a report of the Copper Producers' Association, stating that the copper (metal) output for November was 49,945 tons, the domestic consumption 30,375 tons and the exports 29,932 tons, leaving surplus supplies of 49,904 tons at the end of November, as compared with 60,300 tons at the end of October. The stocks of metal for November for the last two years were given as 58,209 and 54,520 tons respectively. The production for November, 1911, is given as 53,282 tons, so that from both points of view, the statistical position, on the strength of this statement, is decidedly better. The writer of the article goes on to state that the general feeling among London brokers during the past four or five months has been that the American figures have not been so reliable of late as hitherto, and that it is held by those whose information is usually correct, that the U.S. copper output during the past four months has been considerably greater than would appear to be the case, judged from the American figures, but that for some considerable time at any rate there can be no means of officially checking the figures, and that in any case it is a doubtful question whether the Washington authorities would ever be able to get at the true state of affairs.

In another part of the same article the *Financier* correspondent expresses the opinion that any effective combination among copper producers has been rendered impracticable owing to the generally prevalent feeling of uncertainty as to the attitude of the American Government and Courts on the question of trusts, and the results likely to accrue therefrom—since it is recognised that under ordinary circumstances, such a combination would be very difficult to organise on a sound basis, but when, in addition to this, the present uncertainty prevails, it is considered far too risky to attempt the project at all. The writer states that it is generally understood that the American copper market is, for this reason, quite free from any controlling influence over its prices. Whether this state of affairs has any connection with the policy of concealment adopted by the Copper Producers' Association it is difficult to say, but when an industry is in such a position that it is thought desirable to withhold its production figures, it is a matter of little difficulty for an association, which otherwise has little justification for its existence, to manipulate the figures as required.

The visible European supply (excluding Germany and Holland) at the end of November was stated to 58,682 tons, as against 36,250 in November, 1910. The world's visible supply (excluding Germany and Holland) is computed at 108,586 tons, as compared with 94,459 tons last November. The stocks at Rotterdam and Hamburg are not at present available, but for November of this year they are computed at 17,100 tons, which is probably slightly lower than those of the corresponding date last year. There is no doubt, however, that the trade both in Europe and America has been quite healthy lately, and is steadily increasing. The author of the article continues by saying that American manufacturers are steadily buying, and it is expected that this activity will continue for some time as a result of the contemplated extensions and developments of railways, public works, &c., and the opinion is expressed that this state of affairs lends additional colour to the view that the American copper output is larger than would appear to be the case according to the published statistics. It is maintained that the temptation to manufacturers to increase their output on account of rising prices, an increasing demand and decreased stock must be irresistible to many mines at least. Furthermore, he considers it fairly safe to assume that if copper quotations show any further permanent and substantial rise, the producers will certainly increase their production *pro rata*. It is generally thought that, judging from the state of affairs all over the world, any such rise in quotations would be due rather to speculative buying than to the coincidence of supply and demand in the way of trade. It is, however, fairly evident that the period of unwieldy stock and stagnation has passed, for a time at any rate, and that there is every indication of sound business being done. It is a notable fact, according to the article, that the London holders of standard copper are holding their stocks strongly and seem by no means anxious to sell.

Electricity in Horticulture.—At the Highfield nurseries, Billericay, electrical apparatus patented by Mr. T. Clark, of Bristol, has been installed in connection with a new glass-house 90 ft. in length, for the "intensified" cultivation of tomatoes, cucumbers and strawberries. An influence machine is used to supply static electricity to 1,000 ft. of wire suspended overhead in the glass-house.

The B.T.-H. Busy.—On a recent visit to Rugby we took the opportunity of having a run through the British Thomson-Houston Co.'s shops, and found them full to the doors with work. The horizontal Curtis turbo-generator has become very popular, and cannot be turned out quickly enough to meet the demand; sets of all sizes were going through the works, including two of 5,000-KW. output each. It is interesting to note that the pure Curtis turbine—perhaps the simplest type made for large powers—has been so well received in this country, though doubtless the fact that the vertical type has practically given place to the horizontal type represents the pressure of public engineering opinion or mere "fashion" in favour of the latter. In the United States, on the other hand, vertical Curtis turbines of 20,000 KW. are being installed, and the vertical type seems to have firmly established itself there. The very small floor space occupied by the Curtis turbine, even of the horizontal pattern, and the shortness of the rotor shaft, as well as the large clearances permissible and consequent freedom from stripping, are, no doubt, strong points in its favour, and when combined with its simplicity and lower cost, compensate for any small deficiency in economy.

One of the 5,000-KW. sets was on the testing bed at the time of our visit, and appeared to occupy no more floor space than a 500-KW. high-speed reciprocating set of the type that was standard but a few years ago, besides requiring far less head room.

The works have already been extended as far as possible under the present conditions: the testing and erecting shops have been greatly increased in capacity, but, nevertheless, the work has encroached upon other departments, and the coil-winding department in particular has overflowed into every available corner. In default of further space on the ground floor, the winding department is being extended skywards, a building of several storeys being in course of erection for this purpose; a new foundry is also being built, and when this is ready the present brass foundry will be removed, and new machine shops will be erected on the site thus rendered vacant.

The meter and instrument department is also full of work, and additional accommodation has had to be provided to cope with it. We may add that the engineering works at Rugby are running night and day.

Surely, under such conditions, and assuming that other works are satisfactorily employed—as we know many of them are—the time is ripe for that advance in prices which is so urgently required to enable our manufacturers to derive a reasonable return from their heavy investments. Hitherto the customer has had all the luck—he cannot logically complain if the producer claims a share in the fruits of his labour.

Ironmongers and Electric Lamps.—In our issue of December 1st, there appeared an article by Mr. H. E. Goody on "Ironmongers and the Sale of Electric Lamps." The author's comments have been criticised in some of our contemporaries, among them being the *Ironmonger*. We reproduce from the "Electrical Notes" appearing in the last issue of that journal the following observations, showing the ironmongers' views on the matter:—

"A writer in the ELECTRICAL REVIEW draws attention to the alleged straits of the local wiring contractor, and seeks to establish a claim that lamps should be purchased from tradesmen with electrical training, and not from ironmongers. The article in which this claim is made does not disclose an undue familiarity on the part of the author with the nature of the ironmongery business, and the calling of an ironmonger is one which the author apparently does not associate either with dignity or with technical competence. The expansion of the electrical industry is so comparatively modern that one might suppose that there has been no time for anyone connected with it to hold antiquated ideas. However, the writer of the article referred to proves that such a thing is possible. No useful purpose would be served by answering his two columns of misrepresentation, upon which no manufacturer or supply undertaking would for one moment rely. Arguing on a point of dignity against the absorption of the electric lamp business by ironmongers, he complains that 'the incandescent electric lamp, the complexity and technical mystery of whose manufacturing processes should have saved it from this final disgrace, has become part of a stock-in-trade which includes putty and French nails.' But the chief argument used against the supply of lamps by ironmongers is that they cannot be safely trusted to sell in any given case the right sort and size of lamp. The ironmonger, it is stated, sells a thousand things of common every-day use about which no inquiry of a technical nature is even remotely necessary; and it is not considered likely that the assistant 'who has just been doling out tin-tacks or dresser hooks in an entirely confident manner, free from all qualms or questionings, and who has probably never seen an electric lamp out of its wrapper, will be a trustworthy salesman of the last commodity.' A person who writes in this way at once shows his unfitness for the task which he has undertaken, and displays lamentable ignorance of the training and technical experience of ironmongers. The type of ironmonger which is now common is that of a man of sound technical competence and business stability who can be replied upon to carry out efficiently work entrusted to him. Thus it would not only be futile to eliminate such a man, but it would be inexpedient. It is distinctly beneficial that lamps should be generally regarded as commonplace commercial articles, like gas mantles, and made a prominent feature of shop-window displays. There are still many thousands of houses to be wired, and the local contractor cannot rely upon his supposed training to give him a monopoly in lamps."

The Lighting of London Entertainment Houses.—Including London, there are 2,900 permanent entertainment houses in the kingdom open every night. They include 300 theatres, 800 music halls and picture palaces where variety artistes are engaged, and 1,800 picturedromes; 400 of them light entirely with gas; the balance have electrical installations. 500 run their own plants. They light 375,000 incandescents and 10,000 arcs nightly

Publicity Literature.—There have been many attempts made, in the course of our experience, to issue electricity supply publicity magazines. In respect to at least three that we can remember by name, they have had their day and ceased to be. We need not speculate as to the reasons. They were very creditable productions in their way, and it may be that here and there they furnished for the use of the hesitating public an argument which clinched the matter and added a new consumer to the electric light and power mains. There are others still existing which are edited by those who have had experience concerning what is useful and convincing information and what is not. There is now being brought out a small publication of a slightly different kind, known as the *Journal of the Electric Supply Publicity Committee*, of which No. 1 (December) now lies before us. We have never been favourably impressed with the wisdom of electric supply authorities publishing journals by the aid of the advertisements of manufacturers who looked for business from those authorities. This new paper is not intended to reach the public; it is a piece of publicity effort about publicity. Its object is stated to be to furnish the supply industry with a means for "ascertaining the views and opinions of subscribers and promoting free discussion on any topics of general interest." We are told in the opening notes that it "will not be *merely* another addition to the already overloaded list of technical papers"—then it is admitted that it will be that?—but it will confine its attention wholly to the commercial side of the industry, and will be essentially a journal "written by commercial managers for commercial managers." As the organ of the Publicity Committee, "it will strongly advocate the cultivation of publicity by co-operative effort," but at present it will only exercise this strong advocacy once a quarter, so that the interchange of ideas regarding an article appearing in, say, December, will take place next March. There are several articles in this first number; one on the work of the Electric Supply Publicity Committee, by Mr. H. B. Renwick, its chairman; and a brief contribution on the Olympia Electrical Exhibition, by Mr. F. J. Walker. The latter author says that trade shows are of little use to electricity supply companies, and he tells the management of the Olympia Exhibition "that the management and scope of the Exhibition were not directed on the most favourable lines." If he had admitted that the exhibit of the supply companies was "not directed on the most favourable lines," we should have been more ready to agree with him. What Mr. Walker wants for the supply concerns is a "really popular Exhibition which amuses and interests." He forgets that the space taken by his authorities might have been so used, and the popular show have been impressively organised as a part of the whole. It is one of the objects of the new paper to advocate co-operation in publicity. If there was one thing more than another which impressed us at Olympia, it was the utter want of efficient co-operative organisation of the supply companies' exhibit. Mr. Seabrook has a short contribution on "Powder and Shot," and Mr. A. F. Harrison one on "Electric Cooking." It may be thought that we are prejudiced critics both of the idea and of the journal, but anybody who sees this first number will understand that that, at any rate, could hardly be. Nevertheless, we say frankly that we do not for a moment see that this *Journal* is going to provide any *additional* facility for the interchange of ideas, seeing that the existing electrical publications have for years shown that they regard this as one of the subjects in which their readers are interested. Indeed, we are inclined to think that it may happen that some ideas of value may occasionally be lost in these quarterly publications which, if they appeared in the weekly and widely circulated papers, might have a much larger circle of readers directly and indirectly interested in the progress of electricity supply. The work of the Publicity Committee has never received much praise, so far as we are aware, if it has merited it; whether this *Journal* will have a better experience time will prove.

Royal Society Medal.—The Hughes Medal of the Royal Society has been awarded to Mr. C. T. R. Wilson, F.R.S., in recognition of the great value of his researches in connection with the ionisation of gases.

The Municipal Tramways Association (Inc.).—Presentation to Mr. A. R. Fearnley.—The first annual general meeting of the Incorporated Association was held at the Town Hall, Sheffield, on the 15th inst. Mr. H. E. Blain (West Ham) the president of the Association, was in the chair.

The members of the Association took the opportunity of marking their appreciation of the services which Mr. A. R. Fearnley, general manager of the Sheffield Corporation Tramways, has rendered to the cause of municipal tramways during the five years he has held the office of hon. secretary and treasurer of the Municipal Tramways Association, which he recently resigned, he having been selected as vice-president. The presentation took the form of a handsome inlaid writing bureau, set of bookcases, bronze electric lamp, and a necklet for Mrs. Fearnley.

The President alluded to the growth of the Association and of municipal tramway undertakings during Mr. Fearnley's period of office. One of the greatest achievements of the Association during his secretaryship was the compilation of the exhaustive report on tramcar brakes, which, from the point of view of public safety as well as their own interest, was one of the most important works ever undertaken, and in which Mr. Fearnley took a very important part. The investigation of corrugation of tramway rails, negotiations with the Government, the Post Office, and Parliamentary work, were alluded to by the President as being important matters in which Mr. Fearnley had rendered valuable assistance.

The Lord Mayor of Sheffield (Councillor A. J. Hobson) in heartily associating himself with the references to Mr. Fearnley's capabilities, said perhaps the best testimony he could give was that throughout his long public and business career in the city he had never heard one word of complaint against the Sheffield Tramways undertaking. He was followed by Sir William Clegg (chairman of the Sheffield Tramways Committee) and others.

Mr. Fearnley, in acknowledging his appreciation of the gifts, alluded to the increasing activities and responsibilities of the Association. Municipalities were now responsible for two-thirds of the total capital expenditure on tramways in the country, and they were still spending money at the rate of two millions per annum. There were considerable extensions taking place at the present time. The largest private tramway concern in the country had just handed over its best lines to the second largest municipality in the kingdom, and was offering to sell the remainder of its undertaking before the expiration of the lease. Another large undertaking was negotiating for transfer to the London County Council, and in a couple of years the only remaining provincial company of any note would hand over its undertaking to the Bristol Corporation. In a very short time all the leading undertakings would be in the hands of the municipalities, and it was admitted that English municipal management could "give points" to the Americans. They had to-day no difficulty with the Board of Trade, and the only department from which they might expect a more reasonable attitude was the G.P.O. The problem of the congestion of traffic in city streets was one of increasing anxiety, and in the matter of fares, the action of the Glasgow Corporation in effecting such sweeping reductions as to provide a ride of a mile and a half for ½d. was likely to result in changes of tramway finance of far-reaching effect.

The International Smoke Abatement Exhibition.—We are informed that considerable progress is being made with the arrangements for the International Smoke Abatement Exhibition which is to be held at the Royal Agricultural Hall, London, from March 25th to April 4th, 1912. The Exhibition, of which the Duke of Argyll is President, is being organised under the direct auspices and supervision of the Coal Smoke Abatement Society. In addition to that Society, however, a number of distinguised bodies have extended to the Exhibition their hearty support. Electrical interests are well represented in this way, as the patrons include the Institution of Electrical Engineers—which has nominated one of its Vice-Presidents, Mr. W. H. Patchell, to the Exhibition Council—the British Electrical and Allied Manufacturers' Association, with its secretary, Mr. D. N. Dunlop, on the Council, and the Conference of chief officials of London Electric Supply Companies, represented by its chairman, Mr. Frank Bailey (joint managing director of the City of London Electric Lighting Co., Ltd.), and hon. secretary. Mr. F. J. Walker (general manager of the St. James' and Pall Mall Electric Light Co., Ltd.). Sir William Preece and Sir Oliver Lodge are Vice-Presidents of the Exhibition, and prominent members of the Advisory Council include Mr. Sydney W. Baynes (chief electrical engineer, St. Pancras Borough Council), Mr. Sydney T. Dobson (chief engineer, St. James' and Pall Mall Electric Light Co., Ltd.), Mr. R. S. Erskine (Kensington and Knightsbridge Electric Light Co., Ltd.), Mr. Claude W. Hill, Prof. Andrew Jamieson, Mr. E. L. Joseph (Ozonair, Ltd.), and Mr. J. B. Simpson (chairman, Waste Heat and Gas Electrical Generating Stations, Ltd.). Representative sub-committees, chosen from the gentlemen named, have been appointed and meet frequently to deal with the organisation of a comprehensive exhibit to demonstrate the uses of electricity for lighting, heating and other domestic purposes, as well as for commercial and motive power purposes. A block with a minimum area of 1,280 ft. super. situate near the centre of the Hall, has been reserved for this exhibit, and there will also be other shows by individual concerns. A number of the firms constituting the Manufacturers' Association are stated to be taking up the matter with enthusiasm. Conferences and lectures will be held in connection with the Exhibition, and they will be attended by delegates from all the great municipalities and from the various learned societies interested in lighting, heating or power development and distribution. Mr. Bailey has undertaken to give an illustrated lecture with special reference to electricity. A considerable proportion of the available space has been already applied for. The organising manager is Mr. F. W. Bridges, of 119, Finsbury Pavement, E.C.

Hiring Out Vacuum Cleaners.—In the *Ironmonger Weekly* there appears a spirited attack on the Stockport Corporation Electricity Committee for hiring out vacuum cleaners. We quote:—

"It has been left to the Stockport Corporation Electricity Committee to descend to the meanest of all subterfuges yet adopted for filching trade which, we say unhesitatingly, belongs to the retail trader and the retail trader alone. We should like to be quite certain that the business men composing the Stockport Corporation really know what the Electricity Committee are doing in their name, and we should also like to know how that Committee justify their action in hiring out vacuum cleaners, which, so far as we can see, have no connection with electricity supply. Possibly the vacuum cleaners in question are worked by a small electrical motor we cannot say. We simply have it before us that the Committee are hiring out vacuum cleaners, and note that, very rightly, the Stockport and District Ironmongers' Association has passed a resolution protesting against such an action.

"What is the attitude of the Stockport Council in reference to the deluded individuals called retail traders, who cheerfully (or otherwise) obey the demands, reasonable or otherwise, of that body in regard to the payment of rates? If traders are taxed, and we have never heard them complain that they were let off lightly, surely

they have a right to trade? We hear a great deal about taxation and representation, but it seems to us that the great question of the day is, taxation and the rights it should confer. We know the necessity of taxation, but surely, if a governing body tax a tradesman, they incur certain responsibilities in regard to him? For what does he pay his taxes? He pays them for his shop, and heavily are shops rated, too. The purpose of a shop is that the proprietor may trade therein. By the payment of his tax, the shopkeeper obtains a vested right in the trade to be done in that shop. He grumbles, and rightly so, if his landlord allows a competitor to open next door. Most landlords recognise their responsibility in this direction. The governing body is a kind of landlord in respect of the taxes it levies. Why, then, should it seek to obtain dues from him, and then proceed to hinder him from doing the trade, without which he cannot hope to meet those dues?

"The time has come when retail traders must insist upon this matter being fought out. The shopkeeping fraternity must make a dead set against all candidates who take part in the administration of Committees which engage in trading operations. That is the only way in which they can hit back. There must be no question of party politics with them; they must vote for the maintenance of their trading rights. Let them once show that they can hit back, and the blows dealt at them will at once be lessened in force and frequency."

Parliamentary.—Galway Tramways.—Mr. Stephen Gwynn asked the President of the Board of Trade whether in 1877 a sum of £300 was deposited in respect of the Galway and Salthill Tramways Act of that year; whether this sum had been retained ever since, and was now in the Court of Chancery; and whether, since the company had been and was now working to the satisfaction of the public, the money might be refunded to the company. Mr. Robertson said the conditions prescribed by the Act for the release of this deposit on a certificate by the Board of Trade were not complied with. The sum in question was, he understood, still lying in the Court of Chancery, and he was informed that there was no power to release it, except upon an order of the Court.

National Insurance Bill.—Mr. Clynes asked whether the attention of the Chancellor of the Exchequer had been drawn to a circular issued to employés of the British Westinghouse Electric Co., Manchester, and signed by foremen of various departments, recommending their workmen to organise a branch of an approved society, and advising them not to promise to join any other society; whether such action by large firms was contemplated under the National Insurance Bill; and whether, as such action is prejudicial to the interests of workmen, friendly societies and trade unions, he proposes to take any steps in the matter. Mr. Lloyd George replied that the interests of workmen who wish to belong to friendly societies and trade unions are sufficiently protected by Clause 24 of the Bill.

Electric Lighting Companies (Audit of Accounts).—Mr. Grant asked the President of the Board of Trade whether the Board of Trade insisted upon the appointment of separate auditors to audit the accounts of Electric Light Companies (pursuant to the Electric Light Act), and refused to appoint as their auditors under the Act, the anditors appointed by the companies; and whether he was aware that such double audits entailed double expense upon the companies concerned, who, in many cases, would be prepared to appoint the auditors selected by the Board of Trade.—Mr. Buxton said the answer to the first part of the Hon. Member's question was in the affirmative. He was aware that the double audits entailed some extra, though not necessarily double, expense on the companies concerned, but in view of the special objects of the Government audit, he considered that it should be conducted by an auditor who was quite independent of the shareholders.

Royal Assent.—The following Acts received the Royal Assent last week:—

Telegraph (Construction) Act, 1911.
Pacific Cable Act, 1911.
Coal Mines Act, 1911.
Telephone Transfer Amendment Act, 1911.
L.G.B.'s Provisional Orders Confirmation (No. 7), and No. 10 Acts, 1911.

Birmingham Corporation Tramways.—By the Bill which the Birmingham Corporation have deposited in Parliament for next session very considerable extensions of the existing tramway system are foreshadowed, as well as the running of trolley vehicles within and without the City. The estimates which have been prepared, include the following:—Tramways, £218,900; purchase of land and erection of electrical generating station, £132,500; equipment of generating station, £156,000: for the extension and development of the existing and providing new transforming substations, and laying down of electrical mains, &c., £211,500.

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Local Section).—In connection with the above Section a conversazione arranged jointly with the Manchester Association of Engineers was held in the Whitworth Institute, Manchester, on Friday, 15th inst. At the outset, the Chairman of the Local Section, Mr. W. Cramp, and Mrs Cramp, together with the President of the Manchester Association of Engineers, Mr. Michael Longridge, and Mrs. and Miss Longridge, held a reception. The company present numbered about 260, including Messrs. S. L. Pearce, Miles-Walker, M. B. Field. J. S. Peck and S. J. Watson, past Chairmen of the Manchester Section Electrical Engineers, and Messrs. W. Fox, J. H. Stubbs. and A. Saxon, past Presidents of the Manchester Association of Engineers. An excellent programme of vocal and instrumental music was afterwards well rendered. The singing of Miss Florence Webster and Mr. Fowler-Burton was especially good and was greatly enjoyed. The gathering was an even greater social success than that held last year, and judging from the many personal expressions of appreciation made, it is hoped it may become one of the items on the annual programmes of the two societies.

The Society of Engineers (Inc.).—At the second annual general meeting of the Society on December 11th, the report of the scrutineers of the postal ballot for the election of Council and officers for 1912 showed that Mr. John Kennedy had been elected president. The Bessemer Premium was awarded to Mr. R. W. A. Brewer, for his paper on "Two-stroke Cycle Engines"; the Clarke Premium to Mr. T. J. Gueritte, for his paper on "The Mechanical Installation and Upkeep of Permanent Way on Railways"; and a Society's Premium to Mr. E. Kilburn Scott, for his paper on "Nitrogen Products made with the Aid of Electric Power."

Royal Institution.—The following are included in the arrangements for the Friday evening meetings, before Easter, 1912:—

January 19th.—Prof. Sir James Dewar, F.R.S., "Heat Problems."
January 26th.—Prof. Bertram Hopkinson, F.R.S., "The Pressure of a Blow."
February 2nd.—James Mackenzie Davidson, M.B., "Vital Effects of Radium and other Rays."
February 9th.—John Allen Harker, D.Sc., F.R.S., "Very High Temperatures" (with electric furnace experiments).
February 16th.—The Rt. Hon. Sir John H. A. MacDonald, K.C.B., F.R.S., M.Inst.E.E., "The Road: Past, Present and Future."
February 23rd.—George K. B. Elphinstone, M.Inst.E.E., "The Gyrostatic Compass and Practical Applications of Gyrostats."
March 15th.—Frederick Soddy, M.A., F.R.S., "The Origin of Radium."
March 29th.—Prof. Sir J. J. Thomson, F.R.S., "Results of the Application of Positive Rays to the Study of Chemical Problems."

Other arrangements for lectures include the following:—
Two lectures (Tuesdays, February 27th, and March 5th, at 3 o'clock) by Prof. E. G. Coker, on "Optical Determination of Stress and Some Applications to Engineering Problems."
Six lectures, on Saturdays, February 24th, March 2nd, 9th, 16th, 23rd, 30th, at 3 o'clock, by Prof. Sir J. J. Thomson, F.R.S., on "Molecular Physics."

Association of Mining Electrical Engineers (Newcastle Section).—The following is the programme for the Session:—

January 15th.—Lecture by Mr. W. C. Mountain at 7.30 p.m. Subject, "Haulage in Mines."
January 20th.—Lecture by Dr. Thornton at the Mining Institute, Bishop Auckland, at 7.30 p.m. Subject, "Use of Electricity in Coal Mines."
January 27th.—Smoking Concert.
February 3rd.—Discussion on Mr. Beadsmoore's (Notts. and Derby Branch) paper, "Pit-shaft Signalling"; and Mr. Chris. Jones's (South Wales Branch) paper, "Earthing, Earth Plates, and Leakage Detectors."
February 21st.—Notes on "Electric Mining Signalling," by Mr. T. A. W. Smith (Newcastle Branch).
March 16th.—"Fault Location on Mining Cables," by Mr. G. Burrows (Newcastle Branch).
April 3rd.—"Underground Lighting with Low-Voltage Metallic-Filament Lamps," by Mr. F. Milburn (Newcastle Branch).
April 27th.—Visit to Steelworks at Middlesbro'.

Scottish Local Section.—The tenth annual dinner of the Scottish Local Section was held in the Grosvenor Restaurant, Glasgow, on December 12th, Mr. James Lowson, vice-chairman, presiding in the absence of Mr. Frank A. Newington, chairman of the Section. The company numbered over 240. The Very Rev. Ll. Deane, Provost of St. Mary's Cathedral, Glasgow, proposed "The Imperial Forces," Sir George Thomas Beatson, M.D., responding. Sir John H. A. Macdonald, the Lord Justice Clerk for Scotland, submitted "The Corporation of the City of Glasgow," and in a reference to the many activities of the Council, spoke particularly of the successful operations for the deepening and purification of the River Clyde. He did not know whether they had succeeded with their telephones or not, but it was at least to their credit that they had tried. Lord Provost D. M. Stevenson, in replying, said that with regard to the question of the Corporation's telephone venture, he had to pick a quarrel with Sir John. The Corporation had on their telephone service 12,000 subscribers, each of whom saved £5 on his subscription during the five years the Corporation owned the service; that meant a total saving of £300,000 to these subscribers. The Postmaster-General had assured him that he would not raise the rates to any of their subscribers for 18 months to come, and as compared with what new subscribers were paying, that added another £90,000 to the figure he had given. Prof. Barr submitted the toast of the I.E.E., remarking that the Institution had taken its rise in the days when electricity was mainly used for the communication of information from place to place. They could hardly think nowadays what the world would be like without the telegraph. Electricity was now in everything, however, and he only hoped that the older branch of mechanical engineering would still be left with something to do. In coupling with the toast the name of Mr. S. Z. de Ferranti, the Professor said they had seen Mr Ferranti rise to the top of his profession, and were glad to have him there in the capacity of President of the Institution. In his reply, Mr. Ferranti said they had heard a great deal from him recently with regard to the Institution. There had been a great discussion and a great conflict of opinion as to how they should frame their new rules, and what effect these would have on the future. He had come to the members of the Scottish Local

Section a fortnight ago with fear and trembling, but he left with the highest possible opinion of their views and the sound business-like way in which they looked upon the whole matter. The reason for his gratitude was that their views were exactly his own. In the new rules he was sure that voting by proxy would be carried through. At present it was illegal to do this, with the result that members at a considerable distance from London had practically no voice in the management of the Institution. That, he hoped, would be altered. The result of all this difference of opinion and discussion was going to be a great revival of interest in the I.E.E. on the part of the whole membership, and he had no doubt their Institution would develop into a far more useful instrument for the benefit of the profession than it had been hitherto. There were, however, differences of opinion which had still to be reconciled, and he hoped that what would happen in the long run would be for the greatest good of the majority. The Scottish Local Section had expressed itself in favour of a uniform increased subscription, and in favour of the broadening of the basis of membership as suggested in the new articles. Their largest Local Section—Manchester—held different views on those two points, but he hoped that with the interests of the whole Institution kept in view, these differences would be reconciled. To-day they were entering upon the age of domestic electricity which was going to do more for the people than all that electricity had done up till now. In connection with the smoke problem, the greatest sinner was the domestic chimney, but he was perfectly satisfied they were entering upon a period when no household would be able to afford to do its cooking, heating and other services with other means than by electricity. Mr. W. A. Chamen, in giving the "Scottish Local Section," suggested that some of the meetings of the Council might be held away from London. In reply, Mr. Lowson said they were looking forward to the summer meeting of the Institution in Glasgow, when they expected some 200 guests from the south. The proceedings were varied with vocal and instrumental music.

Continuous Service Passenger Transportation.—On Wednesday last week Mr. W. Y. Lewis read a paper before the Royal Society of Arts on the Adkins-Lewis system of passenger transportation, which he described at the last meeting of the British Association. As our readers may remember, in this system a stream of small cars weighing 2 tons each (loaded) is propelled by a screw along a shallow subway beneath the foot pavement; the stations are situated ¼ mile apart, and the pitch of the screw is shortened in the stations, so that the cars pass through (without stopping) at the rate of 3 miles per hour, while by varying the pitch the speed between stations is raised to 24 miles per hour. The screw is interrupted at stations to allow of the driving gear, thrust bearings, &c., being inserted, and the cars push one another across the gap in a continuous line; between the stations they are widely separated. Each car carries eight seats, giving a total seating capacity of 12,680 seats per hour, and the schedule speed is 16 miles per hour. The screw-shaft is of hollow section 24 in. in diameter, running at 264 R.P.M., and carrying a spiral rail forming the thread. The cars have flangeless wheels running on light flat rails, on which they are retained by guide rollers working in a slot. The stations need be only 50 to 75 ft. in length: a car would take 17 seconds to pass through the latter, giving passengers 8 seconds to get out and 9 seconds to get in, the two streams of passengers being divided. Curves are negotiated in the same way as stations, the pitch of the screw being closed so that the cars come together and push one another round the curve; the author suggests that wherever a curve is necessary, it would not be inconvenient to locate a station. A trial line, 40 yd. in length, has been constructed by Messrs. Ransomes & Rapier, at Ipswich, on which 2,000 to 3,000 passengers can be carried at speeds up to 10 miles per hour.

Mr. H. M. Hobart has reported in favour of the system as compared with existing systems of transportation, and in the discussion which followed the paper, Capt. Sankey, Mr. H. Stokes and Mr. Ll. B. Atkinson supported the author's proposals; Mr. R. P. Brousson, manager of the G.N. & City Railway, criticised it adversely, pointing out that the passenger traffic in London was not continuous, but came in rushes; that such a subway could not be constructed in London except at a deep level like the other tube railways, and that the system was not flexible, as the whole of the seating capacity must be kept in motion all day. In his reply, Mr. Lewis disputed the correctness of the objections raised.

While the system advocated by Mr. Lewis may prove very useful for short distances, for escalators, &c., we can hardly imagine that it will ever be adopted for the purpose which he outlines. It may be taken as axiomatic that it is impossible to construct shallow subways in London; as Mr. Lewis points out, the use of lifts to the deep-level tubes causes great loss of time, and the use of escalators is to be preferred—but he must accept one or other of these. Again, his system demands a perfectly straight line between stations, or curves which neccssitate slowing down to 3 miles an hour, and London streets and roads are rarely straight for any great distance. The thought of a screw ¼ mile long is startling. No drivers or conductors are on the cars; various sources of mishap are inevitable, and the consequences of the derailment of a car in the middle of a ¼-mile stretch are unspeakable—car after car would crash into the obstruction at 24 miles an hour, until the screw was stopped. Mr. Lewis speaks vaguely of automatic electric devices to obviate such horrors, but we cannot attach much value to the suggestion. Many other objections occur to the mind, but it is hardly worth while to elaborate them. The idea is exceedingly ingenious, but we shall look forward to the time when aeroplanes come into fashion

Horse-Power of Motor-Cars.—A Committee has been appointed by the Treasury to consider the regulations under which the horse-power of motor-cars is assessed, and to report on the question whether amendments are desirable in connection with the assessment of steam and electric cars.

Machine Tool and Engineering Association, Ltd.—The annual meeting will be held at the Midland Hotel, Manchester, on the afternoon of Thursday, January 11th.

Physical Society Exhibition.—The annual exhibition of electrical and other apparatus took place at the Imperial College of Science on Tuesday last. There were not so many exhibits as usual, but many interesting items were shown, of which we shall publish particulars in later issues.

Inquiries.—A correspondent wishes to meet with some manufacturer who will undertake to supply him with electric boilers capable of evaporating 20 to 40 gallons of water per hour at 5 to 10 lb. steam pressure.

Makers of switches for automatically short-circuiting series boosters, when the supply fails to the motor driving them, are asked for.

Names of present agents for Acheson's Aquadag and Oildag are wanted.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—As a result of the inquiry by the Hampstead Borough Council into the exceeding of the estimates for converting the public street lamps for electric lighting, by over £10,000, the Council decided that MR. G. H. COTTAM, chief electrical engineer, should be asked to resign, and that the services of MR. E. SAYER, chief assistant engineer, should be dispensed with forthwith. Mr. Cottam has since placed his resignation in the hands of the Council. The Lighting Committee recommended that Mr. Cottam and Mr. Sayer should be severely reprimanded, and that the latter should have his salary reduced by £50, but the Council decided on more drastic measures.

The King's Lynn T.C. has appointed MR. CHAS. WM. JACKSON, chief assistant engineer, as borough electrical engineer, at a salary of £150 per annum, rising by £10 a year to £200, with house, coal, rates and lighting, and with permission to take two pupils.

The Weymouth T.C. on December 14th decided to increase the salary of the borough electrical engineer by annual instalments of £50 as from March 30th, 1912, to a maximum of £400 per annum, in recognition of his withdrawal from selection for an appointment elsewhere.

At a meeting of the South Shields T.C. on 13th inst., MR. HARRY S. ELLIS, deputy city electrical engineer and manager for Bradford Corporation, was appointed borough electrical engineer in succession to MR. J. H. CAWTHRA, who has recently received an appointment in South Africa. The salary is £400 per annum. Mr. Ellis is a younger son of Ald. Sir Joseph Baxter Ellis, of Newcastle.

MR. WM. COLLIER BEXON has been appointed electrical engineer and tramway manager at Kilmarnock, in succession to MR. A. BURBIDGE, who has received a similar appointment in Mandalay, Burmah. Mr. Bexon has been assistant to Mr. Burbidge since May last, when he went to Kilmarnock from Croydon.

Tramway Officials.—MR. W. H. MUNTON has been appointed electrical and works engineer to the Bristol Tramways and Carriage Co., Ltd., and MR. SYDNEY SMITH, who has returned from Australia, has taken up his former position as assistant manager.

General.—An Australian exchange states that MR. A. G. H. MAY has commenced practice as a consulting electrical engineer at 157, Collins Street, Melbourne. He has had experience with electrical undertakings in many parts of the world, principally with the General Electric Co., of United States, and has recently supervised the erection of the electric power plant at the State coal mine, Wonthaggi, Victoria.

MR. FRANK W. SKINNER has been appointed teacher of the Electrical Engineering classes at the Barrow Technical Schools in succession to Mr. G. Mallinson, who has tendered his resignation.

At the Mersey Railway power station, on 15th inst., MR. A. H. ELY (shift engineer) was presented with a 400-day clock on the occasion of his marriage. The presentation on behalf of the staff was made by Mr. R. Somerville Bayntun. Mr. Ely leaves shortly for Melbourne, Australia.

The employés of Messrs. Siemens Bros., Ltd., Stafford, on Friday presented a piano to MR. E. O. KIEFFER, works manager, on his marriage.

Obituary.—MR. WILLIAM TRASK.—We regret to learn of the death which occurred on December 6th, at the age of 57 years, of Mr. William Trask, who was formerly in business as an electrical engineer in Upper Marylebone Street, London, for very many years

NEW COMPANIES REGISTERED.

Mexican Fuel and Power Co., Ltd. (118,962).—Registered December 6th, by Deacon & Co., 9, Great St. Helens, E.C. Capital £100,000 in £1 shares (50,000 pref.). Objects: To carry on business as manufacturers of, and dealers in, peat, peat briquettes and other patent or prepared fuel, iron-masters, steel makers and converters, manufacturers of chemicals and manures; to acquire lands and interest therein, water privileges or concessions and water and other powers, to utilise and develop the same for the generation or production of electric, steam, pnenmatic, hydraulic or other power in Mexico, and to adopt an agreement with the Peat Industry Co. The signatories (with one pref. share each) are:—W. J. Park, 7, Tabley Road, Holloway, N., gentleman; R. C. Allen, 208, Dunstan's Road, East Dulwich, gentleman; W. Eacott, 118, Addison Gardens, W., gentleman; H. C. Blackborow, 34, Elsham Road, Leytonstone, gentleman; H. J. Fisher, 9, Great St. Helens, E.C., solicitor; E. W. Bell, 9, Great St. Helens, E.C., solicitor; E. F. Medcalf, 9, Great St. Helens, E.C., solicitor. Minimum cash subscription, 40 per cent. of the share capital offered to the public. The first directors (to number not less than three or more than nine) are:—H. J. Chinnery, J.P., Fringford Manor, Bicester (director of Mexican Central Railway Securities Co., Ltd.), H. L. Stokes, 2, London Wall Buildings, E.C. (director of Wankie Colliery Co., Ltd.), F. Hurdle, Pinner's Hall, Austin Friars, E.C. (chairman of Marston, Thompson & Evershed, Com. Hon. C. A. Donison, R.N., 114, Belgrave Road, S.W.; A. L. Mills, M.A.S.C.E., Appartado 123 Bis, Mexico City; F. W. Johnstone, Mexico City (vice-president of National Iron and Steel Works) and S. W. Rider, Mexico City (vice-president of United States and Mexican Trust Co.) The three last-named are directors of the Peat Industry Co., and will join the board after allotment. The holders of pref. shares have the right to appoint a majority of directors, including the chairman; qualification (except first directors and directors appointed within the first six months of incorporation), £250; remuneration, £200 each per annum (chairman £250). Registered offices, Pinner's Hall, Austin Friars, E.C.

Holmquist Electric Co., 1910, Ltd. (118,875).—This company was registered on December 1st, with a capital of £200 in £1 shares, to carry on the business of manufacturers and hirers of and dealers in the "Holmquist" and other replacement electric heaters, electric light baths and their appliances, &c. The subscribers (with one share each) are:—C. M. Holmquist, 69, Leighton Road, West Ealing, W., electrical engineer; V. K. Gastafsson, 49, Cardington Street, Euston, N.W., electrical engineer. Private company. Table "A" mainly applies. Registered by J. McEvory, 93, Roseman Street, E.C.

Carrara-Versilia Electric Railway and Power Co., Ltd. (119,077).—Registered December 13th, by Slaughter & May, 18, Austin Friars, E.C. Capital £250,000 in £1 shares. Objects: To acquire a concession from the Italian Government, to construct, equip, work and maintain an electric railway in the district of Carrara-Versilia, Province of Lucia, to carry on the business of railway, tramway, omnibus and van proprietors, manufacturers, and dealers, carriers of passengers and goods, manufacturers of and dealers in trucks, locomotives, accumulators and dynamos, suppliers of electricity for light, heat, motive power or otherwise, &c., and to adopt an agreement with Rhys-Jones, McTaggart & Burch, Ltd. The signatories (with one share each) are:—J. M. Jolliffe, 20, Abington Villas, Kensington, W., secretary; A. G. Brown, 56, Hopedale Road, Charlton, accountant; Z. Costanz, 47, Gower Street, W.C., gentleman; D. Avory, 92, Ashworth Mansions, N.W., gentleman; A. G. Dobrantz, 54, Mazenod Avenue, West Hampstead, clerk; A Corbett, 18, Austin Friars, E.C., solicitor; W. A. Pittman, 10, Springfield Avenue, Harlesden, N.W., gentleman. Minimum cash subscription seven shares. The first directors (to number not less than three or more than seven) are Lord Vaux, Harrowden Hall, Wellingborough; W. J. Smith, J.P., Lands House, Rastrick, Brighouse, Yorks.; D. R. Davies, 5F, Montague Mansions, Portman Square, W.; M. Rhys-Jones, 87, Belsize Park Gardens, Hampstead, N.W.; and J. F. D. Bowden, 19, Rue Lafayette, Paris. Remuneration of chairman, £400 per annum; of ordinary directors, £250. Registered office, 1, Broad Street Place, E.C.

Ceara Tramway, Light and Power Co., Ltd. (119,030).—Registered December 11th, by Roney & Co., 42, New Broad Street, E.C.; capital £400,000 in £1 shares (200,000 7 per cent. preference). Objects: To construct, project, hire, lease, or acquire tramways and light railways in any part of the world; to equip, maintain, and work by electricity, steam or other power, all tramways and railways belonging to the company; to carry on the business of tramway, railway, omnibus and van proprietors, carriers of passengers and goods, manufacturers of and dealers in carriages, trucks, locomotives and rolling stock of all kinds, suppliers of electricity for light, heat, motive power, telephonic, telegraphic, industrial or other purposes, &c., and to adopt an agreement with the City Improvements Co., Ltd. The signatories (with one share each) are:—J. H. Hyland, 99, Eton Road, Ilford, cashier; H. L. Bankes, 152, Newport Road, Leytonshire, clerk; H. R. Borrowdale, 17, Quebec Avenue, Southend-on-Sea, clerk; A. G. Hulton, 17, West Square, Southwark, S.E., clerk; J. Brown, 42, New Broad Street, E.C., secretary; J. W. Ryder, 64, Windsor Road, Leyton, clerk; J. A. Roney, 42, New Broad Street, E.C., secretary. Minimum cash subscription, seven shares. The directors are to number not less than two or more than nine; J. H. Hyland and H. L. Bankes are provisional directors, pending appointment of board by the signatories; qualification (except provisional directors), £250; remuneration, £200 each per annum (chairman £250). Registered office, 42, New Broad Street, E.C.

Indicating Fuse and General Manufacturing Co., Ltd. (119,088).—This company was registered on December 13th, with a capital of £2,000 in £1 shares, to take over the business of an electrical and general engineer carried on by F. Kershaw, at 50 and 51, High Holborn, W.C., as the Indicating Fuse and General Manufacturing Co. The subscribers (with 100 shares each) are:—F. Kershaw, 77, Chandos Avenue, South Ealing, W., engineer; W. J. Seton, Bramshot Golf Club, Fleet, Hants., resident proprietor and secretary. Private company. The number of directors is not to be less than two or more than four; the first are F. Kershaw and W. J. Seton; qualification, £50: remuneration, £25 each per annum. Registered office, 50 and 51, High Holborn, W.C.

Ballinamallard Electric Light and Power Supply, Ltd. (3,761).—This company was registered in Dublin on December 14th, with a capital of £500 in 5s. shares, to carry on the business of providers of electric current for lighting, motive power, or any other uses, and especially to provide light for the village of Ballinamallard, Co. Fermanagh. The subscribers (with one share each) are:—T. Craig, Ballinamallard, mill owner; W. Campbell, Ballinamallard, grocer; T. J. Crozar, Ballinamallard, general merchant. Private company. The number of directors is not to be more than seven; the first are T. Craig, W. Campbell and T. J. Crozar; qualification, £2 10s. Registered office, Ballinamallard, Co. Fermanagh.

Worsley & Page, Ltd. (119,164).—This company was registered on December 15th, with a capital of £2,000 in £1 shares, to adopt an agreement with E. Worsley for the acquisition of the business of an electrical engineer carried on by him at Harris Street Works, Millfield, Peterborough, as E. Worsley & Co. The subscribers (with 250 shares each) are:—E. Worsley, 12, Glebe Road, Peterborough, electrical engineer; E. W. Page, 14, St. Ann's Square, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are E. W. Page and E. Worsley (managing director). Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oswald Carr, Ltd.—Particulars of £150 debentures, created November 30th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Thomassin & Co., Ltd.—Particulars of £200 debentures, created November 23rd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

"Z" Electric Lamp Manufacturing Co., Ltd.—Issue on December 1st, 1911, of £1,000 debentures, part of a series of which particulars have already been filed.

Bauxite Refining Co., Ltd. (98,531).—Issue on October 30th, 1911, of £4,000 debentures, part of a series of which particulars have already been filed.

Jackson, McConnan & Temple, Ltd. (67,699).—A memorandum of satisfaction the extent of £17,000 on November 14th, 1911, of debentures dated March 14th, 1901, securing £22,000, has been filed.

Corona Lampworks, Ltd. (116,527).—Issue on November 21st, 1911, of £400 debentures, part of a series of which particulars have already been filed.

Switchgear Co., Ltd. (85,405).—A memorandum of satisfaction in full on October 27th, 1911, of debenture dated August 2nd, 1905, securing £3,000, has been filed.

J. B. Saunders & Co., Ltd. (112,037).—Return dated December 6th, filed December 12th, 1911. Capital £20,000 in £1 shares (6,000 "A" and 14,000 "B"). 6,000 "A" and 12,000 "B" shares taken up. £18,000 considered as paid. Mortgages and charges: Nil.

Frederick Braby & Co., Ltd. (2,537C).—Return dated August 31st, filed November 1st, 1911. Capital £250,000 in £10 shares (2,500 preference). 20,000 ordinary and 2,500 preference shares taken up. £9 per share called up on 16,750 ordinary, £5 per share on 3,250 ordinary, and £10 per share on 2,500 preference. £192,020 paid (including £20 on five shares forfeited). £13,000 considered as paid on 3,250 ordinary shares (being £4 per share). Mortgages and charges: £55,000.

Ernest Scott & Mountain, Ltd. (32,760).—Return dated November 8th, filed November 16th, 1911. Capital, £150,000 in £1 shares (50,000 preferred ordinary). 97,790 ordinary and 29,800 preferred ordinary shares taken up. £1 per share called up on 75,790 ordinary and 29,800 preferred ordinary. £105,590 paid. £22,000 considered as paid on 22,000 ordinary shares. Mortgages and charges: £50,000 first debenture stock and £35,000 second debentures.

Electromobile Co., Ltd. (75,139).—Issue on November 18th of £165 5 per cent. debentures, part of a series created August 3rd, 1911, of which particulars have already been filed.

Bombay Electric Supply and Tramways Co., Ltd. (85,055).—Return dated August 2nd, filed October 19th, 1911. Capital £1,200,000 in £10 shares (60,000 preference). All shares taken up. £10 per share called up on 60,000 preference and 29,992 ordinary (excluding eight ordinary shares forfeited). £929,956 paid, including £36 on the said forfeited shares. £270,000 considered as paid on 27,000 ordinary shares. Mortgages and charges: £788,323.

Feld Bros. & Co., Ltd. (105,577).—Return dated September 29th, 1911. Capital £5,000 in £1 shares. 1,202 shares taken up. £202 paid. £1,000 considered as paid. Mortgages and charges: Nil.

Ferranti, Ltd. (83,718).—Return dated November 3rd, 1911. Capital, £130,000 in 60,000 preference, 60,000 ordinary and 10,000 deferred shares, all of £1 each. 53,374 preference, 60,000 ordinary and 10,000 deferred shares taken up. £123,574 paid. Mortgages and charges: £135,732.

Electric Reduction Co., Ltd. (54,724).—Return dated October 30th, 1911. Capital, £40,000 in £1 shares (16,200 preference and 23,800 ordinary). All shares taken up. £13,000 paid on 13,000 preference. £27,000 considered as paid on 3,200 preference and 23,800 ordinary. Mortgages and charges: £7,500.

Seale, Austen & Barnes, Ltd.—Mortgage on freehold land and outbuildings at Tonbridge, Kent, dated November 24th, 1911, to secure all moneys due or to become due from the company to Union of London and Smiths' Bank, Ltd.

Keighley Electrical Engineering Co., Ltd. (44,893).—Return dated September 22nd, filed October 16th, 1911. Capital, £10,000 in £1 shares (3,000 preference). 4,200 ordinary and 1,800 preference shares taken up. £1 per share called up on 2,580 ordinary and 1,400 preference. £3,988 paid. £2,012 considered as paid on the remainder. Mortgages and charges; £5,000.

CITY NOTES.

Nairobi Electric Power and Lighting Co., Ltd.

THE fifth ordinary general meeting of this company was held on December 12th at the offices, 8 and 9, Martin's Lane, Cannon Street, E.C., Sir Stanley Edwards, K.C.B., in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 914), said that the company's progress during the year 1910 had been quite satisfactory, and the directors were further pleased to report that this progress was well maintained up to date. A comparison of the accounts with those of the previous year showed that the revenue derived from the sale of current had increased from £1,612 to £2,718, while the working expenses showed only a very slight increase, and the adverse balance in the revenue account had now been converted into a net profit of £403, after payment of debenture interest. On the credit side of the balance-sheet would be seen the item of reserve account dealt with by resolution of the board, and requiring confirmation at that meeting of members. The explanation was that in the early stages of the company's undertaking it was impossible to estimate fairly the annual allowance to be made for depreciation of machinery and plant, and a generous

reserve account was created, chiefly to provide for this. Since then they had the experience of three years' working, and knew better the conditions prevailing and to be expected in this new country, and it was considered that the allowance made in the accounts of previous years had been too great. The machinery and plant had been efficiently maintained, and the cost of repairs and renewals charged against revenue in each year, and this would be continued. The managing director had gone very fully into this matter, and the directors were advised by those best qualified to judge, that if thus efficiently maintained, the machinery and plant should outlast the life of the company's concession, which was for about 20 years yet to come. In view also of the increasing prosperity of the company, the board had decided to adopt a new policy of setting aside out of profits a yearly sum for the redemption of capital, to commence with the next year's accounts, and in these circumstances to write back the amount of £3,364 standing to the credit of reserve account at the end of 1909, which had been done in the balance-sheet now under consideration, and was submitted for confirmation by the present meeting. It would be seen by the report that the managing director had recently returned to Nairobi, and his first reports were expected here in about 10 days. Recent advices from Nairobi showed a continued improvement, and the increasing demand for current had necessitated the installation of an auxiliary power house on the Ruera River, to enable the company to satisfy the local requirements, and this should be completed in the course of the next three or four months, and so add to their revenue-earning capacity. The cost of this new power station would be largely met out of revenue. The directors anticipated that the accounts for 1911 would show as great an advance over those of 1910, as those of 1910 did over those of the previous year.

Mr. A. W. Mayo-Robson, C.V.O., in seconding the motion, said he was out in Africa last winter, and in February he visited the company's works at Ruera, and he was pleased to say that everything was in perfect order. He saw the dam, the water-ways, and the machinery in full work. He also saw, and fully approved of, the proposed arrangement for the installation of an auxiliary power house on the Ruera River. About a quarter of a mile above the present dam and power house there was a remarkable fall, and by raising the dam it would be possible to obtain a great additional volume of water which would give them a large amount of extra power. Seeing that at the time he saw the water coming over a three years' drought had just ended, he thought they might feel quite sure that the river would give them a permanent supply of power.

The Secretary, Mr. G. A. Higlett, mentioned that that morning he had received a letter from the company's resident engineer, stating that an expenditure of £90,000 had just been sanctioned at Nairobi for new railway offices, bungalows, &c., from which the company should benefit in the future.

The report was adopted.

Melbourne Electric Supply Co., Ltd.

The annual meeting was held on Monday, at the offices, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev. last week), congratulated the shareholders upon the progress which it indicated in the prosperity of the company. He said that the profit and loss account showed a very remarkable expansion in the profit at Melbourne and also a fair expansion in the profit at Geelong. The profit at Melbourne had increased from £19,279 to £33,226, whilst the profit at Geelong had risen from £2,022 to £3,206. The profits at Adelaide had also grown, with the result that they had received in dividends from that city £9,715, as against £6,981 last year; the total result being that they had £16,433 of revenue as against £28,428. The directors recommended them to dispose of that revenue in what he hoped they would consider a somewhat conservative manner. The effect of their recommendations would be to give the company a very clean balance-sheet, with the suspense account entirely wiped out, and with a carry forward sufficient to ensure the maintenance of the dividend paid this year. When they came to look into the details of the account, it would be seen that the position, as far as revenue was concerned, was extremely satisfactory. In Melbourne their revenue from private supply had risen from £26,271 to £34,903, whilst the revenue from power supply had increased from £12,232 to £17,119, and there had also been some increase in the receipts from public lighting. Their supply to the municipal tramways had risen from £935 to £3,859, and meter rents had gone up proportionate to the increase in the number of consumers, with the result that the total revenue had been £61,719, as against £44,396, and after adding the expenses of generation, and spending £4,770 on repairs and renewals, they had a balance of £33,226 to carry to the balance-sheet, as compared with £19,379 last year. That was very satisfactory, and had been brought about by the continuous increase in the number of their consumers, which was going on year after year. They had laid on mains in no less than 75 miles of new streets last year, making the total streets in which their supply was available in Melbourne and suburbs 206 miles. They had taken on during the year 2,071 fresh consumers, and they had sold over 5 million units of electricity in Melbourne alone, as against 3,400,000 last year. At Geelong, although they regarded that as rather a sleepy little place, the total number of consumers had increased by 22 per cent., and, altogether, Geelong had earned 50 per cent. more than the previous year. The return was still not at all adequate for the capital which had been expended, but it showed a decided improvement. The tramways they were putting down there were now approaching completion, and they anticipated they would be open for traffic about the middle of next January. Since the accounts were made up they had placed the remaining 10,000 £5 7 per cent. first preference shares at par, and that had enabled them to reduce their loans considerably. As to the prospects for the future, there was no doubt that Australia had had two or three very prosperous seasons, and at the present time the company's rate of progress was going on very rapidly indeed. At the end of August, which was the end of their financial year, there were then 6,728 applications for 30-watt lamps waiting to be connected, and applications for 342 H.P. That was at Melbourne. At Geelong there were 978 lamps and 78 H.P. waiting. At the end of September those numbers had increased, and at the moment they were unable to keep pace with the demand for fresh supply. That was very gratifying, and if it continued they might see a very large increase in their revenue from Melbourne again. In conclusion, the chairman paid a tribute to the technical and commercial staff which the company possessed in Australia.

Mr. D. Finlayson seconded the motion.

Dr. Moodey said he was sure he was voicing the opinions of all the shareholders when he expressed his great satisfaction at the report. He was pleased that the board had adopted a conservative policy in dealing with the profits, for, as the chairman had pointed out, Australia had had some very good seasons recently, and a set-back might come at any moment.

Mr. Brookman also congratulated the directors upon the report, and asked whether it would not be possible for them to pay an interim dividend next year.

The Chairman, in reply to these and other observations, said it was quite impossible to say at what rate their capital expenditure would proceed this year. He should say that at Geelong, the expenditure would continue at about the same rate as last year, less, of course, the expenditure on the tramways. They expected that their generating costs would be relatively more favourable during the coming year. With regard to an interim dividend, he would not like to commit himself in any way at the present time. That must entirely depend upon the progress of the company, but if their net earnings should expand in a manner that warranted them paying an interim dividend, the matter would be considered by the board. They had received a cable that morning from Mr. Clements, their general manager in Melbourne, informing them that the supply had just been commenced in two important suburbs, Camberwell and Hawthorn, and that the order for another suburb, Moorabbin, had been granted, and that application had been made for an order for the suburb of Oakley, which was likely to be granted.

Following the re-election of the directors and auditors,

Mr. Brooker moved a vote of thanks to the chairman and directors, together with a proposal that £500 be granted them as special remuneration.

Dr. Moodey seconded the resolution.

The Chairman said that while thanking the proposer and seconder for their kindness, personally he thought it would be best for the shareholders to wait until they had received 5 per cent. before anything was done in the way of increasing the directors' fees.

Mr. Brooker said that in view of the chairman's remarks he would withdraw that part of the resolution relating to the special remuneration, but he would hope to bring it up again at a future meeting if the prosperity of the company continued.

The vote of thanks was then passed and the proceedings terminated.

Helsby Wireless Telegraph Co., Ltd.—According to the newspapers, Major B. Baden-Powell presided on Wednesday at the meeting of this company, and read the speech which Col. J. Bernard would have delivered if he could have been present. He was detained, giving evidence at the arbitration proceedings regarding the company's application for a licence to work under Sir Oliver Lodge's extended patent. A reduction of the capital from £20,498 to £10,000 was now recommended, such reduction to be effected by cancelling 10,498 shares intended to be surrendered by the company. The business had been hampered by the undecided position as regarded wireless patents in this country during the year. It is proposed to enter into a new working agreement with the B.I. & Helsby Cables, Ltd., and their subsidiary, the Automatic Telephone Manufacturing Co., Ltd.

Turkey.—The *Times* correspondent at Brussels says that the group formed at Constantinople, which includes the Deutsche Bank, other German banks, Belgian transport concerns, and a large Belgian bank, acquires the capital of the Metropolitan Railway Co. of Constantinople from Galata to Pera, becomes the principal shareholder in the Constantinople tramways concern, and obtains by agreement with the firm of Ganz, of Buda Pesth, a monopoly for the electric lighting of Constantinople. The group is to be formed into a company with a capital of 100,000,000 fr. (£4,000,000).

Callender's Cable and Construction Co., Ltd.—The preference and debenture registers will be closed from December 15th to 30th, inclusive.

Winnipeg Electric Railway Co.—A quarterly dividend at the rate of 12 per cent. per annum is announced, payable on January 2nd.

Anchor Cable Co., Ltd.—The debenture register is closed from December 15th to 30th inclusive.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The forty-eighth ordinary general meeting of the shareholders of the above company was held on Tuesday at the offices, 106, Cannon Street, E.C., Major Leonard Darwin, the chairman, presiding.

At the outset of the proceedings, the Secretary read two letters from absent shareholders—one from Mr. C. A. Flint and the other from Mr. J. E. Gwynn. Mr. Flint wrote that some explanation would be expected from him by the shareholders with regard to the resolutions he had proposed to submit to the meeting. Referring to the memorandum sent out by the directors in October, in which they criticised certain of the statements which he (Mr. Flint) had made in the circular he sent to the shareholders in July, he wrote, "it was not unreasonable to infer from the directors' memorandum that the current report would show more favourable results than had been anticipated, and that the market quotations, as given in my circular, overstated the estimated losses of the company. In view of the directors' memorandum, I gave notice of resolutions for equalising dividends, but within six weeks the directors issued the most disastrous report in the history of the company." Mr. Flint then criticised the action of the directors in issuing their memorandum, and said that the real loss on the year was £85,000, for although the accounts only showed a loss of £55,457, the special reserve of £30,000 set aside last year for possible depreciation of stocks, was not referred to in the report. In view, however, of the new situation created by the report, it was obviously inopportune to propose a resolution for forming a fund for the equalisation of dividends, and he therefore withdrew it. Mr. Gwynn, in his letter, gave it as his opinion that, with a capital of, roughly, 1½ millions, to have no dividend on the ordinary shares, showed a want of good management.

The Chairman then proceeded to move the adoption of the report. He said he wished to express the very great regret of the board that the year's trading should show such a very bad result. To judge by the accounts of previous years, the gross profit should have been in the neighbourhood of £175,000, whereas they could only lay before them on this occasion a gross profit of £64,178. He found that, in round figures during the previous 10 years, their gross profits were respectively: £155,000, £163,000, £196,000, £119,000, £169,000, £147,000, £169,000, £167,000, £177,000, £180,000. The year in which they showed £119,000 as gross profit was 1904, when the board felt that it would be unwise to recommend a distribution of more than 5 per cent. to the shareholders. Since that date the usual 10 per cent. had been paid; and he might mention in passing that the average dividend paid for the last 46 years, up to last year, was 10 per cent., whilst, with the exception of 1904 and the current year, the dividend paid during 34 years had never been less than 10 per cent. His duty towards them under the present circumstances was to try to explain as clearly as was possible how it came about that last year's trading was so unprofitable. There appeared to be two causes for this. The main cause was the enormous fluctuations which took place in the price of raw india-rubber during the past two years. The possible effects of the staple raw material varying in price from 3s. 10d. to 12s. 6½d. per lb. in the short period of 13 months, were alone sufficient to account for a complete dislocation of their trade. To deal with an assumed case; in a business consuming this raw material in its various grades to the amount of 1,000 tons per annum, the effect of a variation of 1d. per lb. would be £9,333 sterling a year. The figures he had given above, as representing the extreme variations in price of the highest grade rubber, viz., 3s. 10d. and 12s. 6½d., differed by over 104 pence. By multiplying £9,333 by 104 they saw, therefore, that about one million pounds sterling represented the extra cost of buying this amount of highest grade rubber at the higher price, over the cost at the lower price quoted. One should assume, however, that no manufacturer consumed only highest grade india-rubber, and if lower grades of rubber were included in the bulk, the average cost might be about half this amount, and the difference between the extremes would be also half, or, say, £500,000. Stated in another way, 1,000 tons at 12s. 6½d. per lb., amounted to £1,405,000, and at 3s. 10d. per lb., amounted to £430,000, or, if one assumed that the 1,000 tons used average one-half the price of the finest grade, the figures would be £702,500 and £215,000, a possible difference of £975,000 in the first case, and £487,500 in the second. No doubt the highest and the lowest prices did not last for long, and he only submitted the above figures with the object of emphasing the great difficulties encountered in the situation they had to face, although at the same time he might say that the amount of rubber mentioned was not an impossible quantity for fairly large consumers to use in a year. The second important point to be borne in mind was the fact that manufacturers were optimistic, as they ought to be, or they would never overcome the numerous obstacles they met in their everyday business life. But this optimism led them to sell at too low a profit on a rising market, when they should be preparing to meet the inevitable losses which must come later on if the price of raw material fell rapidly, and if stocks made at a high cost had to be realised at any price obtainable in order to avoid the even greater losses which would be experienced if they were held back. Under the ordinary conditions of the market they did not suffer much from irregularity in prices; but in the period of absolute folly which prevailed in what was known as the rubber boom, no prudence of conduct could possibly have avoided the trouble experienced. Some of those present doubtless had knowledge of the variations that had occurred at different times in the prices of copper, cotton, jute, coffee, sugar, or grain; but he doubted very much if any of them had in their memory a variation in prices of articles of large consumption which established a ratio of 3½ to 1 between the highest and lowest prices recorded in 13 months. In dealing with such a situation, the manufacturer might join the gamblers and take his chances, or he might stand aside. The first of these alternatives the directors could under no circumstances adopt, whilst as to the second alternative, this was considered in the form of closing the works for a time. In this consideration full weight was given to the disorganisation in the company's business which would ensue if the 4,500 workpeople connected with Silvertown and Persan Works had been disbanded for even three months. They decided, therefore, to battle through the difficulties as best they could, with the result that was now before them. Finally, it was true that the board now felt that it might perhaps have been better to have paid 5 per cent. dividend, instead of 10 per cent. a year ago, and 5 per cent. at the present juncture; but the difference to the shareholders, had this course been adopted, would not have been very material.

Mr. R. K. Gray seconded the motion.

Mr. Reynell remarked that, with one exception, the directors had paid a dividend of 10 per cent. for over 40 years. The past year during which the price of their raw material soared up to 12s. 6d. per lb., must have been a most difficult and anxious time for them. Therefore, if they could show that they had used proper discretion, even if the balance was against them, he thought their good record of 40 years should obtain for them the continued confidence of the shareholders, and a belief that the company would again return to its old times.

Mr. Schmitto said the chairman had said absolutely nothing as to what had happened since the end of the financial year, and as to how the company was doing at the present time. For a long period now, rubber had averaged about 5s. or 6s. per lb., and he thought the directors would have to regard that as the staple price for some time to come. What he would like to know, as a preference shareholder, was whether, assuming that to be the case, the directors considered that they would be able to make a profit. He also would like to know whether the reserve fund was a cash investment, or was it invested in the business. If it was in the business he regarded it as wholly illusory as a reserve fund.

Mr. Winkley complained of the baldness of the information given in the report, and said the directors had not expressed one word of regret for the present condition of things. He took it that, on the whole, their foreign agencies had done fairly profitable business, and it was the head department which had been an absolute failure. In the balance-sheet there was an item of £95,000 odd for shares in other companies. Had any dividend been received on those shares, and, if so, why was it not shown in the profit and loss account? It seemed to him that the whole position from beginning to end was very unsatisfactory. He saw that the Telegraph Construction and Maintenance Co. had paid a dividend of 10 per cent., and why had they not done the same?

Mr. Collis said the most material point for the shareholders to know was whether the directors had valued the stock at such a price that there would be a margin of profit for the future. If they had only half dealt with the situation they would have to write down the stocks again next year. It would be a satisfaction if the shareholders could be assured that the situation had been really grappled with, and that from now the stocks were on a safe basis. He noticed that the auditors drew attention to the fact that nothing had been written off depreciation of steamships during the year, and he would like to know whether that was anything unusual. With regard to the reserve fund being used in the business or invested separately, that was always a debateable point, but it was quite clear that in their case if the fund had not been so used the directors would have had to raise additional capital.

Mr Rathbone asked whether all the losses which had been made had been in respect of contracts entered into before the fluctuations occurred in the price of rubber.

Mr. Furse said he believed the company manufactured as good an article now as they ever did, but speaking as a commercial man dealing with the class of goods which the company sold, he had no hesitation in saying that their methods were as antiquated as the hills. During the last 25 years other huge concerns had sprung up doing the same class of business, which were making big profits, because they went the right way about it in putting their goods on the market. He (the speaker) came from Nottingham, and there they very seldom heard anything of Silvertown now. He was an electrical engineer and could remember the time when Silvertown cable was always specified for in contracts, but, to a large extent, that cable had disappeared from present-day specifications, simply because the thing was not persevered with among consulting engineers. The company still had a name to conjure with, but new ideas and new methods must be brought to bear on the commercial side, so that the business might be brought there instead of going to other firms. He questioned whether the whole of the loss was in rubber; he rather thought it was in the general turnover. He would like to know from the chairman whether the total sales were up or down.

Mr. Verey remarked that he was an original shareholder in the company, and he failed to see how the fluctuations in the price of rubber should have caused the enormous losses which they had had to face.

Mr. Atkinson asked whether it would be legal for the directors to use part of the reserve fund in payment of the dividend.

Mr. Charrington asked what rates the company was paying at Silvertown. There was, he said, a suggestion some time ago that if the rates continued to go up they should follow the example of other firms, and remove their works into the country. So far, they had spoken entirely about rubber, but he would remind them that all cables were not covered in rubber. He admitted that the cables manufactured by the company were "tip-top"—there was nothing

to touch them, but other companies adopted paper and jute insulation. If they depended entirely upon rubber they were bound to have these continual fluctuations in price of raw material, and he would suggest that the directors might consider the advisability of selling more jute and paper cable.

Mr. Foster called attention to the remark of the auditors to the effect that they were unable to certify the value of the shares which the company held in other companies, and said that surely that information must be in the possession of the directors.

Mr. Ware remarked that for years there had been a mention in the report of 150 miles of cable, laid and not paid for. There was no mention of that this time, and he would like to know whether the money had been paid.

The Chairman, in reply, said that Mr. Schmitto had asked whether there would be any difficulty in making a profit if the price of rubber remained fairly steady at from 4s. 6d. to 6s. a lb. To that he could only say that they saw no more difficulty in making a profit in the future than in the past if the price of rubber remained steady. They maintained that it was the fluctuations in the price that had caused their misfortunes, and, therefore, if the price remained steady, whether it was 4s., 5s. or 6s., it made very little difference to the profits—the point was that it should remain steady. Then he asked about the reserve fund. That was entirely in their buildings. As the company was built up, money was taken from profits and employed in buildings and machinery, and, therefore, the reserve fund was in those items and in the business generally. He maintained that it would have been absolutely impossible to have built up the company to its present state of prosperity if they had adopted any other method. If instead of taking that £450,000 from their profits they had gone to the public and asked for more capital, they would have had great difficulty in getting it, and the only possible way of building up a company of that sort was by taking money from profits and putting it into the business. It might not be a reserve fund in the way the word was sometimes used, and they would be glad, if possible, to adopt some other word for it, but it was a word adopted in the trade. Mr. Winkley inquired as to the shares in other companies. The largest other company in which they had got shares was the Palmer Tyre Co., and it was mainly a matter of book-keeping. If he remembered rightly, the company owned practically the bulk of the shares in the Palmer Tyre Co., and, therefore, the amount appearing on the balance-sheet as the Palmer Tyre Co.'s shares was almost a matter of cross entries, and the valuation would be in the same way. There was one other company in which they had got a certain share—an electric lighting company which they had established in the North of England. One way of doing business was to start a company for electrically lighting a town, and in that way get contracts for the work. In one instance they had done that, and that company was now beginning to pay, so that every one of the companies they had got shares in was paying. The Palmer Tyre Co. this year paid a dividend of 15 per cent., but as he had said that was only a nominal transaction, because it was really taking money from one pocket and putting it into another. Mr. Winkley referred to the Telegraph Maintenance and Construction Co., and compared it with their company. That confirmed the directors' opinion that the price of rubber was to a large extent the factor in their losses, because unless he was misinformed that company dealt far more in gutta-percha than in rubber. Mr. Collis asked a question as to the stocktaking. They had found that the safest method of stocktaking was to lay down definite rules as to the prices at which stocks were valued. It was very difficult to lay down a definite rule which did not work unfavourably in some respects. If the market was falling that did, no doubt to a certain extent, over-value the stock, but it was difficult to prevent that. The safe way really with a big company of that sort, and looking from one year to another, was to adopt a definite rule, and if they took their stocks over a number of years they could not go far wrong. They had adopted that definite rule, and he thought he might say that their stocks now were in a satisfactory condition. They were not excessive, and they had no reason to suppose that they were in any way overvalued. As to the ships, it was perfectly true that they had not written down their value this year, and not for many years. They were all old ships, and had been written down heavily in the past, and they believed that that writing down, and keeping them up out of revenue, had the result of ensuring that they were not overvalued in the books. Mr. Rathbone asked whether they did not raise their price in selling their goods, consequent upon the rise in raw material. To that he would say that very often they had to make contracts in advance for a long period. If they made a contract in advance when rubber was 5s. or 6s. a lb. and the price went up, they could easily see how they were hit. It was almost impossible to avoid being hit by the contract system with changing prices. But really that was not the way in which they had been hit seriously. The way in which they had been most seriously hit was that with the price of rubber advancing, they had to go on manufacturing, and they had to put 12s. 6d. rubber into their manufactures. It was often three or four months before those materials could be sold, and therefore they had in stock a large amount of material with rubber in it which cost them 12s. 6d. a lb. When the price fell, all the different manufacturers got nervous as to the fall continuing, and as to the danger of maintaining those stocks. They had to bear in mind that the longer they kept a stock manufactured at a high price, the greater the loss when they had to sell if they held it back. They could not sell under those circumstances, according to the market price, if they were not to be hit with a still bigger loss in the future. If all the manufacturers had agreed to keep up their prices for some little time after the fall in rubber, so as to get a profit, they would have been all right, but it was impossible to get such a combination, and the only possible course to adopt was to sell at market prices for fear of further greater losses. Mr. Verey spoke of profits they ought to have made when prices were rising, but there again they came in contact with the optimism of the trade. Personally, he believed they would have been better off if, two years ago, they had maintained higher prices and reduced their sales considerably. It was, however, a bold course to adopt—to reduce their sales, perhaps by from 20 to 30 per cent., by raising their prices. Mr. Furse had said there were many companies doing a similar trade to theirs which had made a large profit. He (the chairman) would very much like to know the names of some of those firms. He dared say there were such companies, but he would like to know them. The chairman then read an extract from the speech of Mr. Du Cros at the Dunlop Tyre Co.'s meeting, to show the disastrous effects which had been produced by the high price of rubber.

Mr. Furse said he was referring to cable companies.

The Chairman said he would be glad to hear the names of rubber cable-making companies which had made a profit last year. With regard to the turnover, measured by bulk, it was larger now than it had ever been before, or just as large. As far as the turnover was concerned, they had nothing whatever to fear—they were doing as big a business as ever, the question was the difficulty of making profits. Mr. Atkinson asked about the reserve fund, and whether it was possible to utilise it for the purpose of paying dividends. They had done that this year for the purpose of paying the preference dividend; but, of course, it was a policy that they could not carry very far without becoming short of cash. Mr. Charrington had spoken of the rates. Well, they were always with them, and he suggested that they should move their works to the country, if they could possibly do so. Those who had any knowledge of a manufacturing company would know that it was an exceedingly difficult thing to up-root a manufactory from one place and take it to another, but the board had had that possibility in view. As to paper and jute insulation, that had got to be looked at from a manufacturing point of view. It was not possible to start every line, and they had believed up till now that the profit on paper-covered cables was very small, but they would consider whether they ought to develop that line of trade or not. Mr. Foster spoke about the shares which they held in other companies. As he (the chairman) had already explained, by far the largest amount was in the Palmer Tyre Co., and as that was entirely in their own hands, there was no market quotation for the shares. The other company was in a similar position, for they practically owned the whole of the shares, and there again they were not quoted on the market, and no auditor could put a value on them. He could only give them his own opinion, which was that the shares, if anything, stood at less than their real value. That was his honest belief. Mr. Ware asked about the 150 miles of cable, which he referred to as an old friend. That cable had been sold to the French Government, and had been paid for. One shareholder had complained that he had said nothing as to the future. That was perfectly true, and therefore he would just like to say one or two words generally as to the future. They had the old question of the rates with them, and now they had the question of the Insurance Bill, and there was the price of cycle tires, which were not quite as satisfactory as they might be; but those were the kind of things which in an ordinary year they would not trouble about very much. He did not think that any of those circumstances need cause them any alarm. The only cause for alarm in the future was the unknown, and being unknown he could not say what it would be. There was always the possibility of another large rise in the price of rubber. He did not think it was likely to occur, but it was a possibility, and if it should occur—if there were any such circumstances as had occurred in the past—then they would still more seriously take into consideration the closing of their works if necessary. They would do more than that; they would take into consideration whether such circumstances could not be met by a combination between the various manufacturers refusing to buy rubber above a certain price; because the price to which it had gone at one time was not a fair price—it was quite a speculative price, and the only way to meet that would be to do the same as had been done in the cotton trade, viz., by combination between manufacturers to refuse to buy above a certain price. He did not think it was likely to occur, and, broadly speaking, he could only say that, looking to the future, they saw no cause for alarm. The past had been a disastrous year, and they had expressed their regret for it. That regret was sincere, and shareholders could, perhaps, understand his position at having to stand there and try and explain the losses they had suffered. He was deeply grieved at the past, but, on the whole, he looked forward with as much confidence to the future of that company as to the future of any manufacturing company in England. He saw no special difficulties ahead of them, and they must try to fight with such difficulties as there were, and he thought they would do so with considerable confidence as regarded the future, but with great regret as regarded the past.

The report was then adopted.

The meeting passed a very hearty vote of thanks to the directors, and also to the chairman for his conduct of the meeting.

Perth Electric Tramways, Ltd.—The directors state that the profits for the year 1911 show a very large increase over those of any previous year, and fully bear out the anticipation of the chairman, as expressed at the general meeting. Accordingly, they have declared an interim dividend upon the ordinary share capital of 6d. per share, free of income-tax, for the first half of the year, being at the rate of 5 per cent. per annum, payable on January 1st next, on which date the warrants will be posted. The ordinary share transfer books are closed from December 16th to 30th.

Costa Rica Electric Light and Traction Co., Ltd.

The directors' report for the year ended June 30th, 1911, shows that the net earnings in Costa Rica, after charging all expenses incurred, amounted to £18,451, as compared with £14,530 for the previous year. These figures are conservative, and have been arrived at after writing down by a substantial sum stock values and other items appertaining to the concessions. The volume of business exceeded that of the previous year by approximately £4,800, a sum largely made up by increased earnings in the tramway department. The number of lamps installed in the lighting department also increased about 16 per cent. during the 12 months, and the motor supply by 52 H.P. To obtain this result the station plant was worked at overload and at considerable risk throughout the year, no assistance having been rendered by the new station. The first section of the new power station at El Brasil, some 12 miles from the capital, is now completed, and the manager hopes to inaugurate a supply to the public during the present month. This section consists of three hydro-electric sets of 500 KW. capacity each, with one pipe line capable of supplying power for two of them, together with switchboard, transformers and pole-lines, and a sub-station adjoining the old power house at Los Anonos, two miles from San José. To complete the station, and utilise to its full extent the hydraulic force now at the company's disposal through the installation of the dam, tunnel, aqueducts and tanks, there will be required a further three 500-KW. sets and two extra pipe lines, with transformers and pole lines to correspond. This extension will raise the switchboard capacity of the power house to nearly 3,000 KW. The directors are advised that for safety's sake they should install, without any avoidable delay, at least a second pipe line and a fourth unit of plant, as in case of accident to the single pipe the entire station would be out of action. The whole of the £100,000 prior lien bonds authorised by the debenture-holders for tramway extensions and for the development of the Brasil water-power to its present extent, have been issued. Owing to engineering difficulties beyond the control of the management, encountered in connection with the piercing of the tunnel, the construction of the dam and other items, the cost of the work has not been entirely covered by the amount received from the issue, and the directors have arranged for a temporary advance of a further £10,000 on the collateral security of the unissued 5 per cent. debentures (£52,900). The directors have appointed as general manager in Costa Rica (in succession to the late Mr. G. Holt Green) Mr. William Norman Brand. This gentleman, who has had considerable experience in a similar capacity in Argentina, took up his duties on February 21st last, and the board are satisfied with his energy, capacity and tact, and his devotion to the company's interests. During the year the gold premium has averaged 113 per cent., as against 110 per cent. for the previous year, The general manager certifies that all buildings, machinery, plant, &c., have been kept in good working order. The insurable buildings, machinery and rolling stock are adequately covered against risk from fire, except the buildings and machinery at Brasil, on which insurance will be effected as soon as particulars are to hand.

The annual meeting of the shareholders of the above company was held on Wednesday at the offices, Dashwood House, Old Broad Street, E.C. We are unable to give a report of the proceedings, as the representative of the Electrical Review was informed that the meeting was not open to the Press.

Manx Electric Railway Co., Ltd.

Colonel Sir A. G. Boscawen, M.P. (chairman), presided on Tuesday at the offices, 3, Finch Lane, E.C., over the ninth ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report, said they had behind them an exceptionally fine summer, and the result of their efforts proved that, given such favourable conditions, the railway was as attractive and as well able to earn revenue as ever, in fact, better ; for both the number of passengers carried, and the gross revenue earned, constituted a record. The passengers totalled 606,497, as against the previous best of 546,666 in the year 1906-7, and against 533,104 last year. The gross revenue amounted to £36,013, as against the previous best of £35,345 in 1906-7, and against £32,581 last year. The passenger mileage, on the other hand, was only 344,968, as compared with 360,079 in 1906-7, which showed that they had by no means lost sight of the necessity of economical working even in times of bumper traffics. Of course, as compared with last year, when they carried over 73,000 fewer passengers, they had had a considerable increase in passenger mileage, in fact, 15,030 miles, but that was only natural. The traffic receipts per mile were this year 1s. 9·34d., as against 1s. 8½d. last year ; per passenger carried 12·88d., as against 13·2d., and the passengers carried per train-mile showed 1·76 this year, as against 1·61 last year. The reduced figures per head carried went to prove what was also clearly demonstrated by their traffic statistics, namely, that the increased number of passengers carried consisted mainly of short-distance travellers. On the expenditure side they showed this year a total of £17,214, as against £17,310 last year, and £16,772 in 1906-7. The ratio of working expenses to receipts was 47·78 per cent. this year, against 53·12 per cent. last year. Their reserve account at the beginning of the year under review stood at £5,317, represented by investments costing them £5,174, at which amount they stood in their books, and a small balance in cash, nothing having been added to it for the last two years except the interest earned thereon this year, amounting to £147, and bringing the total reserve to £5,463. They now proposed adding the sum of £1,500 thereto. At present market prices their investments were valued at £5,313. They had paid an interim dividend of 2¾ per cent. on the 5½ per cent. cumulative preference shares, and proposed paying a final dividend of 2¾ per cent. thereon, which would leave a sum of £1,375 to be carried forward to new account. The island generally had had a prosperous season, the total of arrivals at Douglas for the five months—May to September—aggregating 540,067, which again constituted a record, and was 71,796 above last year. Ramsey, on the other hand, showed a decrease of 1,532, but then there were no Territorials this year, whereas last year there were 3,451. Peel also had a decrease of 6,451, owing entirely to the absence of Territorials, who last year counted 7,090. The railway and shipping strikes undoubtedly had a deleterious influence on arrivals during a short time in August, for the boat service between Liverpool and Douglas was seriously affected from August 15th to the 20th. Many people who might otherwise have prolonged their stay, hurriedly left the island for fear of not being able later on to return, and intending visitors were altogether prevented from crossing from Liverpool to Douglas. The arrivals in the island on Saturday, August 19th, numbered only about 3,000, instead of the usual figure of 24,000 at that period in previous years. Their own week ending August 23rd, showed a decrease of £147 in passenger revenue as compared with the corresponding week last year, whereas in view of the beautiful weather they might under normal conditions easily have experienced a big increase.

Mr. B. E. Greenwell seconded the motion.

Mr. Owen said he was one of the unfortunate holders of ordinary shares, and, with such a season as they had had, he thought they would have seen a profit, if ever they were to have one. Naturally, he felt disappointed, and would like to know if the chairman could give them any idea of whether there was a chance of improving in any way, for it was certain they would never get a better summer. If there was not, he wondered whether the directors would be generous enough to take compassion on the shareholders and reduce their fees, so that, at all events, there might be a chance of the ordinary shareholders getting 1 per cent.

The Chairman said, naturally the board would have been glad to have declared a dividend, and it was true that the last season was a fine one. But they had had two bad years previously, during which nothing was added to the reserve, whilst last year, also, they brought forward only £236. They were bound, therefore, to use the profits to make up the reserve, and to carry something more forward. He did not wish to hold out the idea that there was no prospect for the ordinary shareholders—far from it, for when they had built up the reserve the position would be very different. When the reserve had reached a certain figure the interest on it would lead to its increase year by year, and then, if they had fine summers, there was no reason whatever why they should not be able to pay an ordinary dividend.

The report was then adopted, and the retiring director re-elected.

British Electric Traction Co., Ltd.—The *Financial News* states it is announced that the resignations of the directorships of Sir Charles Rivers-Wilson and Sir Charles W. Fremantle have been accepted.

Eastern Telegraph Co., Ltd.—The directors announce a dividend (payable on January 15th) at the rate of 3½ per cent. per annum, less income-tax on the preference stock for the quarter ending December 31st, and the third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax, in respect of profits for the year 1911.

Hobart Electric Tramway Co., Ltd.—The directors have declared an interim dividend at the rate of 2½ per cent., free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets are, of course, in holiday mood, but this did not stop a fair amount of business in the earlier part of the week. In fact, orders came in satisfactorily enough ; and in spite of the interruptions offered by innumerable charitable appeals, members as a rule managed to make their expenses before the Christmas recess, which this year is an unusually long one.

The unrest in the railway world continues to provide the principal lever with which prices are manœuvred up or down. Although the fear of a general strike next week is removed, it is obvious that the railwaymen are far from being satisfied with the result of the Conference between their leaders and the railway companies ; while the threatening aspect of the crisis which arose in the coal trade made an added cause of depression. Steam stocks, therefore, have been a great deal subdued, and this reacted upon electrical issues. City and South London rose superior to the prevailing dulness, it being expected that the holiday traffics on this line would be more dense than ever. Metropolitans, however, fell ¾, while Districts rose ¼. It is said that arrangements are being made for the Piccadilly Tube to be extended to Ealing in order to meet the competition of the Great Western and Central London. A few of the prior securities in this department are firmer, District Debenture stocks being particularly noticeable in this respect. Underground United 6 per cent. Income bonds continue to improve, the price having hardened to 67 middle.

Metropolitan Electric Tramways Deferred shares have come on offer, and the price eased off to 3s. 1½d. Dealings in British Electric

Tractions have marched to something like a state of confusion, because the company's books close at the end of this week for a month, and upon their reopening there will be a distribution of the new securities to the Ordinary and Preference shareholders. In the market the arrangement is not at all relished. For one thing, holders will be given stock instead of shares, and stock is generally less easy to deal in. This may be exemplified by the case of the River Plate Electric Company, where the turning of thes harcs into stock has had the result of reducing transactions to almost a minimum ; whereas in the old days there was always a more or less free market in the shares. On the week there are no quotable changes in British Electric Traction issues, and some of the dealers complain that it will be impossible to have any sort of a free market, at all events, until about the middle of February.

Good must be the wind that hurts nobody, and the announcement that the Capital of India is to be changed from Calcutta to Delhi brought about a sharp fall in the prices of Calcutta Electric Supply Ordinary and Calcutta Tramways Ordinary, both losing 10s. These declines do not represent the full extent of the fall that took place at the end of last week, some recovery having been made since the announcement. We must say that the selling appears to us to have been distinctly unnecessary, to put it mildly. Calcutta, after all, is not going to be relegated to the background, and its streets given over to rubber plantations. It is quite conceivable that, under the new arrangements, Calcutta will go ahead more progressively than she has done in the past, and this aspect ought to carry weight with those who are still tempted to realise their shares upon what looks very much like a mere scare.

Other Colonial and Foreign Supply issues are steady, the especial feature being a fresh rise in Montreal Light, Heat and Power, whereby the price has been carried up to all but 200. The rise in the price of this stock is one of the features of the year, the lowest price having been 144, and the last 20 points having been put on in about a couple of months. Shawinigan water has hardened a little, and Kaministiquia bonds are ½ higher.

The Latin-Canadian group, as a whole, is very firm as regards the pre-ordinary issues. Some of the Common shares are easier—Mexican Trams, for instance, having lost 2 points, Rio Trams ½, and so on. Brisbane Trams Ordinary at 8⅞ have improved a little, and the British Columbia descriptions are a trifle irregular.

Victoria Falls Power Preference have gone back to 15s., and the drought which has been prevailing over South Africa is said—though with what truth we have not been able to trace—to be exercising a serious effect upon the company's undertaking. The South African market as a whole is under a heavy cloud, and it may be that Victoria Falls shares justify their name simply in sympathy with the rest of the market. There are, however, disquieting rumours about ; and although to rush into print is seldom a wise proceeding on the part of directors of any concern, this may be one of the exceptional cases in which a statement of the actual position of affairs might be fully justified on the real cause for anxiety which shareholders in the company have, by reason of the long-continued drought.

Marconi shares monopolise nearly all the attention in the Telegraph section, and the prices of the Ordinary and Preference have both improved 5s. The Ordinary changed hands as high as 59s. 6d., a huge account having been built up in them. Anglo-American Telegraphs are harder, and American Telephone and Telegraph Capital stock put on 1. New York Telephone bonds have been bought by some of the finance houses on this side. National Telephones are a little better, the Deferred stock having recovered most of its 2-point fall of last week. A few *ex*-dividend markings have taken place, but the great number comes, of course, at the end of the year.

Manaos Trams and Lighting Ordinary shares—which, it will be remembered, were introduced to the market some few weeks ago at 14s. and were taken up to 16s.—have just been undergoing their special settlement. Upon this, some of the speculative buyers hastened to take what profit they could get, in view of the fact that carry-over facilities were not offered, and the price receded to 14s., to rally later to 15s. 6d. New issues as a whole are maintained at about their prices of last week. South American Light and Power, for instance, are 2½ premium ; Puebla Trams, 1½ discount ; Mexican Light and Power Second Debentures, ¾ discount. A number of others are promised immediately the new year begins, when money is expected to rule more cheaply, and the release of dividends will offer company promoters a hope that the publio appetite will be rather more keen for fresh investments than it was during the rush of new issues a week or two ago.

London Lighting companies' stocks and shares are very firm, but prices have not moved much. The chief feature is the rise of ¼ in County of London Ordinary shares, still on the expectation of an increase in the dividend in respect of the current half-year. Chelseas are up ⅛. London Electrics regained their 5s. fall, and South Metropolitan Preference continued to be bought, the price hardening to 1$\frac{1}{16}$. St. James', on the other hand, are ⅛ off.

In the Manufacturing group there has been no recovery in India-rubber shares after their heavy fall, and dealings in the Ordinary are for the time being largely a matter of negotiation, on the basis of £10 middle. Brush Debenture stocks have attracted a little attention, and the Firsts rose a point. Edison 4 per cent. Debenture at 73 is better to the same amount. The Rubber market has shown further vivacity, with prices on the rise. It is declared that the demand from American manufacturers for the raw material shows a considerable expansion, but this is a report which is not altogether in its first youth. However, rubber shares have no doubt fallen upon levels that render them attractive-looking to the speculative investor for the sake of the yields which they offer, and it is this factor more than mere gambling which has been responsible for the increased activity in the market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, December 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£11 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£25 10	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Sbellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3⅜d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 109 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£63	£3 inc.
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅜d.	⅛d. dec.
c „ Tube (brazed)	„	9⅛d.	⅛d. inc.
c „ „ (solid drawn)	„	8d.	⅛d. inc.
c „ Wire, basis	„	7⅜d.	⅛d. inc.
c Copper Tubes (brazed)	„	10⅜d.	⅛d. inc.
c „ „ (solid drawn)	„	9⅜d.	⅛d. inc.
g „ Bars (best selected)	per ton	£79	£4 inc.
g „ Sheet	„	£79	£4 inc.
g „ Rod	„	£79	£4 inc.
e „ (Electrolytic) Bars	„	£65	£4 10 inc.
e „ „ Sheets	„	£82	£4 10 inc.
e „ „ Rods	„	£70	£5 inc.
e „ „ H.C. Wire	per lb.	9d.	⅛d. inc.
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	5/- to 7/-	..
h India-rubber, Para fine	„	4/3½	1½d. inc.
j Iron Pig (Cleveland warrants)	per ton	49/7½	6d. dec.
j „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£15 17 6 to £16	5/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 2 6	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½.	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	9½d.	1d. inc.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£203 to £204	£1 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/4	1d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sb't (Vieille Montagne bnd.)	„	£31 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Mattbey & Co., Ltd.
p
r W. F. Dennis & Co.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock ; and £200,000 5 per cent. cumulative perpetual preference stock.

The Committee has appointed a special settling day as under :—

Friday, January 5th.—Toronto Power Co., Ltd.—Scrip, fully and partly paid, for £821,917 4½ per cent. consolidated guaranteed debenture stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each (Nos. 8,298 to 8,497).

Toronto Power Co., Ltd.—Scrip, partly paid, for £821,917 4½ per cent. consolidated guaranteed debenture stock.

Tri-State Railway and Electric Co.—$668,000 first mortgage and collateral trust 50-year 6 per cent. gold bonds of $1,000 each (Nos. 1 to 668).

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7¾ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅞ — 8⅜	..	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 12 4
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	93 — 96 xd	..	4 3 4
Chelsea, Ord.	5	5	4†	4 — 4½	+ ⅛	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	99 —102	..	4 8 3
City of London, Ord.	10	7	6†	12⅝ — 13⅛	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅞ — 9⅜	+ ⅛	5 6 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	+1	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	+1	5 4 8
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅞	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	..	1½ — 2	+ ¼	3 0 2
Do. 6 % Pref.	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	87 — 90 xd	..	4 8 11
Metropolitan	5	5	4†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	..	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 — 88	+ ½	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3¾ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	..
Oxford	5	7¼	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	7⅝ — 8¼	..	6 1 3
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	— ⅛	4 19 1
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2¾ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	99 —100	—2	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 — ⅛	+ 1/32	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	1/32 — 3/32	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅞ — 8⅜	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8½	7†	6 — 6½	— ½	6 10 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	110 —115 xd	..	6 1 9
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93 xd	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90½ — 92½	..	5 8 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — ¾	+ 1/32	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ — 104½	+ ½	4 15 8
Madras, Ord.	5	..	..	2⅞ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	100 — 102	..	4 18 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	87½ — 89½	— ½	4 9 5
Do. 7 % Cum. Pref.	$100	7	7	107½ — 109½	..	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	— ½	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Montreal, Lt., H. and Power	$100	7	8	196 —200	+ 4½	3 10 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	41 — 43	..	11 12 6
River Plate, Ord.	Stock	10	..	233 —243	..	4 2 4
Do. 6 % Non-Cum. Pref.	Do.	6	6	104 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	125 —127	+1	3 3 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½ — 104½	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11 7d.	11/16 — 13/16	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ — 108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7 — 7½	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	143 —145	+1	5 10 4
Do. Collat. Trust	$1000	4	4	95 — 97	..	4 2 6
Anglo-American Telegraph	Stock	3¾	3†	6⅔ — 6⅞	..	5 9 6
Do. 6 % Pref.	Do.	6	6	110¾ — 111¼	..	5 7 7
Do. Def.	Do.	30/-	..	25/6 — 26¾	+ ⅛	5 14 3
Anglo-Portuguese Tel., 5 % Reg. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	7 — 7½	..	4 16 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86 — 88	— ½	4 10 11
Cuba Telegraph	10	6	6†	10 — 10¾	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¼ — 8⅝	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100½ — 102½	..	4 7 10
Direct United States Cable	10	4½	..	7⅝ — 8⅛	— ⅛	5 10 9
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Eastern Telegraph, Ord. Stock	Stock	7	5†	137½ — 140½	+ ½	4 19 8
Do. 3½ % Pref. Stock	Do.	3½	3½	83½ — 85½	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½	..	3 18 1
Eastern Extension	10	7	5†	13¼ — 13⅜	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ — 102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10¾ — 11¼ xd	..	5 6 8
Do. 6 % Pref.	10	6	6	12¾ — 13¼ xd	..	4 10 9
Great Northern Telegraph	10	18	5†	32¼ — 33¼	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	82 — 85 xd	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	73 — 76 xd	..	5 5 3
Marconi's Wireless Telegraph	1	5	..	2⅞ — 3	+ ⅛	..
Do. 7 % Cum. Partic. Pref.	1	16	..	2⅝ — 2¾	+ ¼	..
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1¾	..	5 12 11
Do. 5 % Pref.	1	5	5	1⅜ — 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ — 105½	..	5 13 9
Do. Def.	Do.	6	6†	121¼ — 123½	+ ½	4 16 9
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10¼	..	5 14 8
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	+ ⅛	5 14 8
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¼ — 5½	..	4 10 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100⅜ — 101⅜	— ¼	4 8 5
Oriental Telep. and Elec.	1	8	..	1½ — 1⅝	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 5/32 — 1 7/32	..	4 13 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacifio and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5†	8⅜ — 9¼	..	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 1/16 — 1 3/16	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99 —101	..	3 19 3
West India and Panama Teleg.	10	1¼	1½	2¾ — 3	..	4 3 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	103 —105	..	4 15 3
Western Telegraph, Ltd.	10	7	6†	13⅜ — 14⅞ xd	..	5 0 11
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds.	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1/4 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	7/8 — 1 1/4	..	Nil
Do. 6 % Pref.	10	1½	1½	3 3/8 — 4 3/8	..	3 8 7
Do. 5 % Deb.	100	5	5	92 — 95	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	..	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1 3/4†	30 1/2 — 31 1/2	+ 1/2	4 15 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1 1/4	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/8 — 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	78 — 78	..	5 14 8
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 3/8 — 2 7/8 xd	..	4 5 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	2 1/2 — 3 3/8	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1 7/8	2†	43 1/4 — 43 3/4	— 3/4	3 3 3
Do. Surplus Lands	100	2 3/4	3†	66 — 68	..	4 0 11
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 17 0
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	31 1/2 — 32	+ 1/4	Nil
Do. 6 % Deb.	100	6	6	145 —147	+1	4 1 8
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3 1/4	4 1/4†	88 — 90	..	8 12 3
Do. 3½ % Gtd.	100	3 1/4	3½	75 — 77	+1	4 10 11
Metropolitan Elec. Trams, Ord.	1	5/8	5†	2 7/32 — 2 1/2	..	5 12 4
Do. Def.	1	Nil	..	1/16 — 1/8	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	2 5/32 — 2 9/32	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	13/32 — 15/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	91 — 94	..	4 15 9
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 3/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Income	100	1	1½†	56 — 58	+1	1 9 0
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/8 — 2 7/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5 1/2†	5 1/16 — 5 5/16	..	4 14 1
Do. 2nd Pref.	5	5	5 1/2†	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 5
Do. 4½ % Deb.	100	4½	4½	101 1/2 —103 1/2	..	4 7 0
Do. 5 % Deb.	100	5	5	99 —101	+ 1/2	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	104 —107	..	4 13 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10 7/8 — 11 3/8	..	5 5 5
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 1/2 —100 1/2	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	8 1/2 — 8 5/8	+ 1/8	4 12 9
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	103 —106	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8†	137 —142 xd	..	5 1 8
Do. Pref. Ord.	100	6	6	118 —122	—2	4 15 4
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 5
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	+1	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	104 —105	..	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	101 1/2 —103 1/2	— 1/2	4 7 0
Calcutta Trams, Ord.	5	6	..	5 1/2 — 5 5/8	— 1/2	5 5 8
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	7/16 — 9/16	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 3/8 — 5 5/8	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	102 —105	..	4 15 3
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94 xd	..	5 5 5
Do. 6 % B Deb.	100	5	6†	58 — 62 xd	—2	8 1 4

La Plata Elec. Trms, Prf.	1	6	6	29/32 — 1	..	5 0 0
Lisbon Elec. Trams, Ord.	1	5½	5†	1 — 1 1/8	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1 1/4	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93 1/2 — 95 1/2	..	5 4 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —103	+ 1/2	4 18 0
Mexico Trams Com.	$100	7	7†	121 —123	—2	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	103 —105	+ 1/2	5 14 8
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7 1/8	..	6 18 0
Do. 6 % Pref.	5	6	6	5 1/2 — 5 5/8	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	97 1/2 — 99 1/2	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	13/16 — 1	..	2 10 0
Do. 5 % 1st. Deb.	100	5	5	101 1/2 —103 1/2	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 1/2	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	114 1/2 —115 1/4	— 1/2	4 6 9
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	+ 1/2	4 16 2
Do. 5 % Mort. Bonds	100	5	5	95 1/2 — 97 1/4	+ 1/4	5 2 10
Sao Paulo Tram, Lt. and P.	$100	10	10†	184 —188 xd	..	5 6 5
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 15 2
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 1/2 — 97 1/2	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5 3/8 — 5 7/8 xd	..	5 2 2
Do. 6 % Pref.	5	6	6	5 — 5 1/4 xd	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	23/32 — 27/32 xd	..	7 2 2
Babcock & Wilcox	1	25	24†	5 3/4 — 6 1/8	..	4 5 0
Do. Pref.	1	6	5	1 3/4 — 1 7/8	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/4 — 7 1/4	..	7 0 4
Do. Pref.	5	5	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	55 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. Deb	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/2 — 3 5/8	..	5 10 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	60 — 70	..	7 2 10

Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	7/8 — 1	..	Nil
Do. fully paid	5	Nil	..	1 1/8 — 2 3/8	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	+1	5 5 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	3/8 — 7/8	..	..
Do. Pref.	2	7	7	1 3/8 — 1 5/8	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8 1/2 — 9 3/8	..	5 6 8
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/8 — 5 1/8	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9 — 11	..	..
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	20	10†	35 — 37	..	6 7 5
Do. Deb.	100	4	4	100 1/2 —102 1/2	..	3 18 1
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	53 — 53	..	7 2 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

THE FORMATION OF DEPOSIT BY TRANSFORMER OILS.

By HAROLD D. SYMONS, A.M.I.E.E.

The use of oil for cooling and insulating transformers has extended so rapidly that it is becoming increasingly necessary not only to carry out careful and systematic tests for the selection of an oil suitable for this purpose, but regularly to test consignments before they are put into service.

The tests for the usual physical and insulating properties have been dealt with by numerous writers, and it is not proposed to treat of these, except in so far as may be necessary from the point of view of the formation of deposit.

It has been known for some time that many oils used for transformer insulation form a deposit in service, but the matter was not considered of great importance until Mr. Peck called attention to it in the discussion on Messrs. Digby and Mellis's paper on "The Physical Properties of Switch and Transformer Oils."

This formation of deposit, or sludge, is an objectionable feature, and in some cases has been cited as the cause of breakdown. The reasons that have been put forward for its formation are:—(*a*) Collection of dust; (*b*) Solubility of insulating materials used in the construction of transformers: (*c*) Poor quality of oil. Under the term "poor quality of oil" are included any physical or chemical changes in the oil due to ageing.

Whilst dust may cause sludging where a transformer with badly-designed terminal gear is placed in a dirty situation, it is frequently of such a fine nature that it merely remains in suspension in the oil. A very small quantity of fine dust in oil is sufficient enormously to reduce brilliancy and render it more viscous. When the transformer is in use there will be a tendency for this dust to be deposited on the coils and in the ventilating ducts; but with recent designs of terminal gear and transformer tanks trouble arising from this source need not be feared.

The formation of sludge due to the use of insulating material soluble in mineral oils with present insulation design is impossible; oil-immersed transformers are insulated with fibrous materials treated with insulating varnishes. Micanite or built-up mica in any form is not, or, at any rate, should not be, used on oil-immersed transformers, though it is quite satisfactory for oil switches. The fibrous materials, whilst tending to absorb the oil, do not disintegrate, and the volume of varnish actually covering the insulating materials, compared with the volume of oil used, is negligible. The volume of varnish rarely equals 2 per cent. of the volume of oil, and in the majority of cases it is less than a half of 1 per cent. The volume of deposit must be considerable to cause trouble, and whilst the author has in some few cases found traces of resinous substances in the deposit, it has always been attributable to the use of either an air-drying varnish for finishing purposes or unsuitable cement used on the terminal gear. Also, a careful examination of the insulating materials used in the construction of the transformers from which the deposits were removed showed no loss or softening of the varnish upon them.

Most air-drying varnishes are soluble in oil, but the baking varnishes employed for transformer insulation, if thoroughly dried, are insoluble and unaffected by continued immersion in hot mineral oils. Some investigations on the sludge formed by oil in service have shown the presence of driers used in the manufacture of insulating varnishes, and fatty acids resembling those of the linoleic series, but the author would suggest that those were due either to fatty edges of varnish or insufficient drying, rather than to solubility of the varnish in oil. It is extremely doubtful, therefore, if the solubility of the insulating materials has ever been responsible for the formation of deposit in sufficient quantity to cause breakdown.

The oils must consequently be looked to as the cause of the formation of sludge, and as a preliminary experiment a sample of oil, flash point (closed) 180° C., was submitted to a temperature of 100° C. for four days; during this time it not only badly discoloured, but formed an appreciable deposit, small in quantity, but analogous to that found in transformers.

For the selection of a suitable oil for use with transformers, therefore, it became necessary to conduct a series

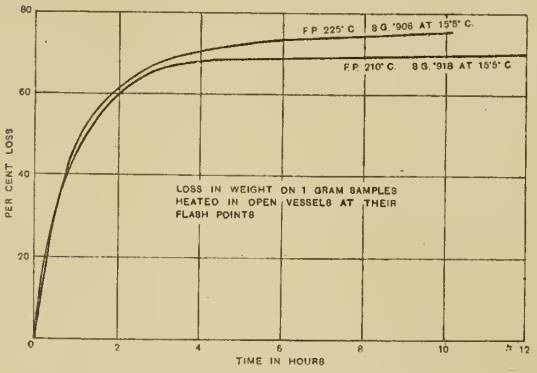


Fig. 1.

of experiments with a view to determining the best methods of testing an oil for the formation of deposit.

A number of oils were submitted to heating tests at various temperatures for varying lengths of time under different conditions; whilst it appeared that the temperature, time, and oxidation, were all factors in producing deposit, the temperature and the length of time it was maintained

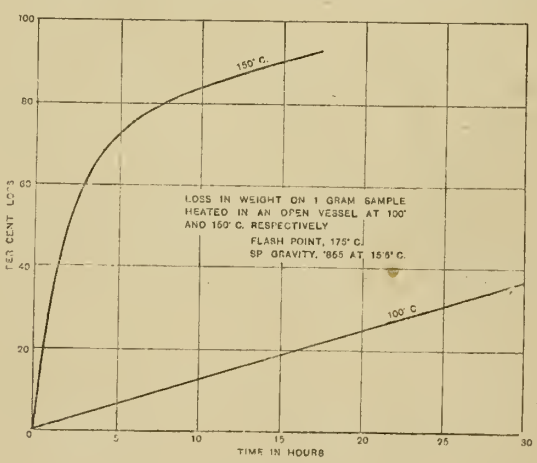


Fig. 2.

affected the oil to a greater extent than oxidation. During the whole of the heating tests, observations of the loss in weight were periodically made. Figs. 1, 2 and 3 are typical of the results obtained, figs. 1 and 2 being the losses on 1 gramme samples, and fig. 3 on 70-gramme samples, under the standard conditions of test finally adopted. From

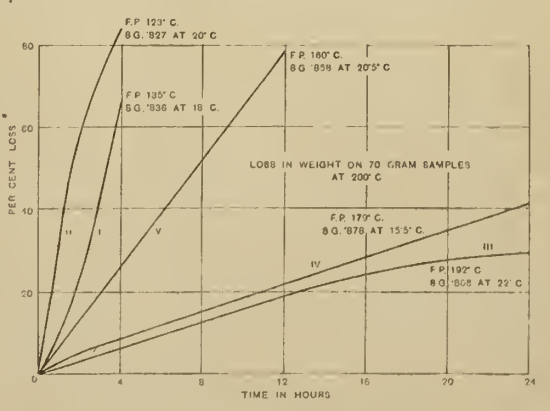


Fig. 3.

these results it was apparent that the loss in weight was affected by the ratio of the volume of oil to the area of surface exposed. To determine the error that this would introduce, three different volumes of the same oil were heated in the same sized vessel at 100° C. Fig. 4 shows

the loss in weight of the three samples, and fig. 5 the loss calculated to a volume per unit area, from which it will be seen that the loss in volume from unit area is uniform over a fair range of time, when the volume is large compared with the area.

The following conditions were finally adopted as standard for all heating tests: Weight of oil 70 grammes, placed in a

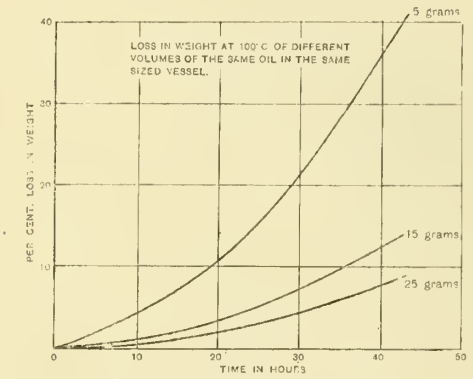


Fig. 4.

beaker 4 in. high and $2\frac{1}{8}$ in. in diameter. The ratio of volume of oil to area of surface exposed is large, the beaker sufficiently tall to prevent air currents unduly sweeping the surface of the oil, and, at the same time, not of such dimensions as to cause condensation of the vapour given off during heating tests. This renders the per cent. loss in weight comparative, but for different oils this loss is not a measure of the formation of deposit. Fig. 3 shows five oils, and the order in which they have been numbered indicates their tendency to form deposit. The loss in weight is, however, of value, for though an oil with a loss of 2 per cent. after six hours at 100° C. is not more likely to form deposit than an oil that has a loss of a half of 1 per cent. during the same test, if two samples of the same oil lose $\frac{1}{2}$ and 2 per cent. in weight respectively after six hours at 100° C., it is probable that the sample with a 2 per cent. loss would form deposit more readily than the sample with $\frac{1}{2}$ per cent.

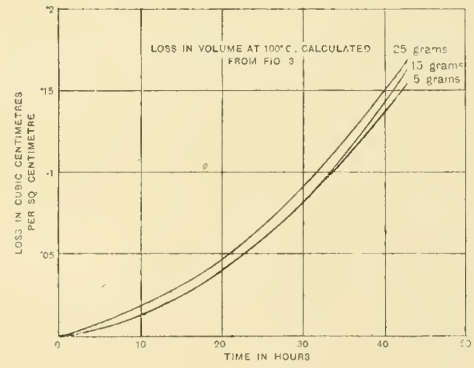


Fig. 5.

The formation of deposit or sludge is always accompanied by considerable darkening in colour, loss in brilliancy and appreciable thickening of the oil. Indeed, the discoloration precedes the formation of deposit, and to some extent the amount of discoloration will indicate the liability of the oil to form deposit. In this respect an endeavour was made to establish a colour test as a measure of the liability to form deposit, but the deterioration is not merely a change of tint so much as an actual discoloration, and the difference not in depth but in colour of different oils rendered the tests too uncertain to be of value, or capable of being performed by different operators.

The discoloration is hastened, and even accentuated, by oxidation, but it is not merely the result of oxidation.

Unaccompanied by heat, oxidation produces no appreciable deterioration in any reasonable time.

With a given oil, a deposit may be formed by heating at a low temperature for many hours, or at a comparatively high temperature for a short time; the latter test is, of course, the more severe, but discoloration and formation of deposit will be produced when oxidation is impossible. The per cent. loss in weight on heating will vary with the flash point of the oil (see fig. 3), and should always be obtained. It is of value for comparing different shipments of the same oil, but the method of test must be definitely specified and remain constant.

The tests, therefore, to determine the liability of oils to form deposit must be so based as to render oils of different flash points capable of being compared. After numerous experiments, the author has adopted the following tests:—

1. Heat six hours at 100° C.
2. Heat one hour at 200° C.
3. Heat six hours at 10 per cent. above the flash point.
4. Heat four hours at 200° C.

As previously mentioned, the heating tests carried out by the author were on 70-gramme samples, in beakers 4 in. deep and $2\frac{1}{8}$ in. in diameter, and the samples were maintained within 5° C. above the temperatures specified. The time was calculated from the moment that the sample reached the specified temperature, the raising and lowering being rapidly accomplished with the comparatively small volumes used. The figures hereafter given are for samples tested under the foregoing conditions.

Test 1.—*Heating for Six Hours at* 100° *C.*—Heating a sample of oil at 100° C. is a test that has been adopted by many engineers for some time, though the length of time it is maintained, the per cent. loss and the conditions of test vary.

The following gives the loss in weight, and times that have been specified:—Six hours' loss not to exceed ·25 per cent.: eight hours' loss not to exceed ·3 per cent.: 12 hours' loss not to exceed ·5 per cent.

This test (1) has been fixed for six hours, since it does not, to any extent, determine the liability of an oil to form deposit, unless it is exceedingly poor in this respect, in which case some discolouration may take place. It is, however, when combined with the dielectric strength, of service in judging the oil as an insulator and its condition with regard to moisture. At the end of six hours at 100° C., there should be no appreciable change in colour, and the following gives the loss that may be expected with good insulating oils:—

Flash point,	180° C. and over,	less than	·25	%
,, ,,	165° C. to 179° C.	,, ,,	·5	%
,, ,,	155° C. to 164° C.	,, ,,	1	%
,, ,,	145° C. to 154° C.	,, ,,	1·5	%
,, ,,	135° C. to 144° C.	,, ,,	2·5	%
,, ,,	125° C. to 134° C.	,, ,,	3·5	%

Whilst there is still a fairly large margin of safety even with an oil with a flash point of 125° C., the situation of the transformer and conditions of service would need careful consideration before adopting an oil with a lower flash point.

(*To be concluded.*)

Electric Iron Ore Smelting.—As the result of experiments made at Trollhättan in the smelting of iron ore by electricity, it is stated that by means of circular instead of square carbon-electrodes, which can be screwed into each other, the electrode consumption per ton of pig-iron has decreased from 10·28 kg. (including the valueless end pieces) to 5·5 kg. By placing the charge more in the middle of the furnace the experimenters have succeeded in raising the percentage of carbonic acid up to 30 per cent. The consumption of electrical energy has decreased to 1,736 KW.-hours per ton of pig-iron, as compared with 2,391 KW.-hours in previous trials. The consumption of charcoal per ton of pig-iron, which during previous trials amounted to 418 kg. (the best result being 370 kg.), has now decreased to 336 kg., the amount originally estimated. Calculations based on these results show a saving of over 6 kr. (6s. 8d.) in the production of a ton of pig-iron. It is hoped that 368 tons of pig-iron can be produced per H.P. per annum.—*Board of Trade Journal.*

Our American Contemporaries.—Our American exchange, the *Electrical Review and Western Electrician*, has purchased *Electrocraft*, a brightly-written electrical contractors' paper, from which we have frequently quoted in our pages. The *Review*, in announcing this fact, says that it recognises in making the purchase, that "development and advancement along commercial lines are the most striking characteristics of the present electrical era."

THE DOCTRINE OF ULTRA VIRES.

[BY OUR LEGAL CONTRIBUTOR.]

We have had occasion more than once to refer to what is known as the doctrine of *ultra vires* in relation to electric lighting companies. As companies are always wishing to know whether a particular course of conduct is open to them we make no apology for reopening the subject. The supply of electricity for lighting purposes has fallen so much into the hands of local authorities that most of the cases which come before the courts in connection with the subject have reference to the rights and duties of municipal and other such bodies. Nevertheless, it is sometimes necessary to consider the rights and powers of electric lighting companies in relation to the supply of electricity. It is proposed in the present article to consider some of these questions, and to dwell more particularly upon what is known as the doctrine of *ultra vires* in relation thereto.

It is provided by Sec. 4 of the Electric Lighting Act, 1882, that the Board of Trade may from time to time by provisional order authorise any local authority, company, or person to supply electricity. The expression "company" is defined by Sec. 32 of the same Act to mean "any body of persons corporate or incorporate."

That a company may in certain circumstances obtain power to supply electricity is clear enough; therefore, the question is: What are the powers of a company not specially floated or promoted for the purpose?

As a general rule, an electric lighting company which has been floated with the object of supplying electricity, has special powers conferred by the memorandum and articles of association. Power is thus conferred upon the company "to carry on at—and elsewhere in the county of——the business of an electric lighting company in all its branches, and in particular to construct, lay down, establish, fix and carry out all necessary cables, wires, lines, accumulators, lamps and works, and to generate, accumulate and supply electricity, and to light cities, towns, streets, docks and markets, theatres, buildings and places both public and private," and "to carry on the business of electricians, mechanical engineers, suppliers of electricity for the purposes of light and heat, motive power or otherwise, and manufacturers of and dealers in all apparatus and things required for, or capable of being used in connection with, the generation, distribution, supply, accumulation and employment of electricity."

Assuming that no power is conferred upon a company by the articles to supply electricity, a shareholder has the right in an action on behalf of himself and all other shareholders, to restrain the company from supplying electricity, although every shareholder but himself be acquiescent; but he has no right to come for a winding-up order under the Companies' Act, which provides that a company may be wound up whenever the Court is of opinion that it is just and equitable that the company should be wound up (Irrigation Co. of France, 6 Ch. 176, 184). It will be seen, therefore, that if no power to supply electricity is conferred by the memorandum and articles, some steps must be taken by the company to obtain the necessary powers.

Amalgamation, too, is a matter which must generally be specially provided for. To borrow an analogy from another industry, it appears that in the case of Greenwich Pier Co. *v.* Thames Conservancy, 1905, 21 T.L.R. 669, it was held that an agreement between the Greenwich Pier Co. and a waterman's society for the abandonment of their pier by paying to them a part of the net profits of the company's pier, was *ultra vires* of the pier company.

By the Companies' Act it is provided that a company registered under the Companies' Act may by special resolution alter the provisions of its memorandum of association with respect to the objects of the company. One of the purposes for which such an application may be made is "to carry on some business or businesses which under existing circumstances may be conveniently or advantageously combined with the business of the company."

In no case, however, can any such alteration take effect until confirmed on petition by the Court which has jurisdiction to make an order for the winding up of the company. Debenture-holders are entitled to notice of the application, and creditors may, by leave, appear and object to it.

Many companies have availed themselves of this section with a view to acquiring power to supply electric light; and it is probably owing to the facility with which the new powers may be obtained that the question of *ultra vires* is seldom considered. Under the foregoing powers, applications have been made successfully to the Court to confirm special resolutions to enable a gas and water company to supply electricity, *e.g.*, Colombo Gas and Water Co., Ltd., *Journal of Gas Lighting*, July 20th, 1896; Rugely Gas Co., W.N. (1899) 127. A telephone company was allowed to alter its memorandum so as to supply electricity for other than telephonic purposes on condition of making a suitable change of name (in *re* Oriental Telephone Co., W.N. (1891), 153); and a tramway company obtained similar powers (Leamington and Warwick Tramways Co., Electrical Review, July 18th, 1902, p. 100).

Coming now to the position of a statutory company, that is to say, a company empowered to supply something other than electricity—it appears that such a body may obtain Parliamentary power to supply electricity. Gas companies existing under statutory authority may obtain power from Parliament to make application for a provisional order under the Electric Lighting Acts to produce and supply electricity for public and private purposes. There are numerous instances of such power having been conferred upon companies and upon local authorities, and there is a clause to this effect in the Model Gas Bill. For an instance of a case in which a gas company applied for, and obtained, the necessary powers, reference may be made to the Walker and Wallsend Union Gas Act, 1899.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

At Auburn, a small town in Eastern Ontario, the Electric Power Co. will shortly start up a new generating station with one 500-kw., three-phase, 60-cycle, 6,600-volt unit: two more will be ready in the course of a month, and space is available altogether for four units of this size. Water is the motive power.

At No. 5 dam, about 5 miles from Trenton, another generating station is being built, which will be ready early next summer. The plant in this station will comprise four 650-kw., three-phase, 60-cycle, 6,600-volt vertical shaft generators driven by vertical shaft water turbines. In each of the instances given above the current will be stepped up to 44,000 volts for transmission purposes.

Messrs. Smith, Kerry & Chace, of Toronto, are the consulting engineers for all the Electric Power Co.'s work, and an order has just been placed by them with Messrs. Escher, Wyss & Co., of Znrich, Switzerland, who have an office in Toronto, for two water turbines to develop 5,400 h.p. each under a head of 76 ft. at a speed of 240 r.p.m. These are to be installed at Healy Falls on the Trent River.

The same company is also supplying, under this contract, two oil pressure governors and two automatically-operated relief valves each capable of discharging 60 per cent. of the total amount of water. These valves are said to be the largest ever constructed. Several other Canadian contracts have also been recently secured by this firm, including one for the Western Canada Power Co., Vancouver, B.C. This last-named company is putting in at Stave Falls two water turbine sets, each having a capacity of 13,500 b.h.p. to be developed under a head of 110 ft. at a speed of 225 r.p.m. The turbines are of the double Francis type, enclosed in sheet-iron casing. Power is to be supplied to Vancouver at the beginning of next month.

The Telegraph Department of the Canadian Pacific Railway has lately been busy opening new branch telegraph offices in the West, where new towns are growing up so quickly. Two new wires have been run from Winnipeg to Calgary, and one new one from Calgary to Vancouver. The

distance from Winnipeg to Vancouver is some 1,200 miles as the crow flies, and, as the Rocky Mountains intervene, it is no easy task to give a reasonably efficient service under such climatic conditions as obtain in this country.

At Edmonton, in Alberta, the City Council will shortly consider a proposal to spend some $20,000 on street lighting, whereby it is hoped to double the present lighting.

A scheme to erect a large plant for the production of salt by a new electrolytic process has been proposed to the municipal authorities in Gooderich, Ontario.

The Ontario Power Co., at Niagara Falls, will before long have in operation two extra units, each of 24,000 H.P.

Municipal telephone systems at home have not been a great success, and one is reminded of this by a report that the telephone system owned by the Manitoba Government will show a loss for the present year of some $150,000. Private companies must, somehow, manage better than this.

On account of the importance of the subject, no apology is needed for again referring to the Hydro Electric Power Commission, of Ontario. Various officials of the Commission are a present investigating the power possibilities in the extreme western, eastern and northern portions of this province. No fewer than 28 municipalities will, on New Year's Day, vote as to whether they will take electric power from the Commission or not, and there is little doubt that the majority will do so.

The Commission buys the greater portion of the power distributed and sold by it from one of the large Niagara Power Companies, but in some instances power is bought from small private companies, and it is now stated that power is to be developed on the Maitland and Sangeen Rivers, where at least 15,000 H.P. is available; a transmission line will, however, be run to this district from Niagara, as in summer these rivers are almost dry. In this way power will be available all the year round, and at the same time the load factor at Niagara during the summer will be improved.

If the western lines be built one will run from Seaforth to Gooderich, Clinton, Bayfield, Hensall, Exeter, Zurich, Dashwood, Crediton, Leith, Brussels, Wingham, and Belgrave. The other will run from Guelph to Elora, Fergus, Arthur, Mount Forest, Harriston, Palmerston, Listowel, Durham, Shallow Lake, Owen Sound, Meaford, Thornbury, Wiarton, and Collingwood.

From these two trunk lines it is intended that branches shall be run to every town and village in the district, so that every farmer in the community will be in a position to have cheap power delivered at cost.

In the Trent Canal district all towns from Whitby to Cornwall will be served. More than 4,000 H.P. will be developed on this canal, and on the Ottawa River, at Chat's Falls, there is a possible development of at least 60,000 H.P.

It is estimated that about £1,000,000 will be needed for equipment for the vast scheme outlined above, and by means of it practically every town and village in the older parts of the province will have cheap power at its doors.

In order to give some idea of the cost of this power, it may be stated that it ranges, on a flat rate, from about £10 4s. per H.P.-year for 1 H.P., to £8 3s. per H.P.-year for anything over 100 H.P.

On a differential rate, the cost varies from about £3 1s. for a service charge per H.P.-year plus 1·75d. per unit for 1 H.P., to £2 9s. per H.P.-year for service charge plus 0·75d. per unit for anything over 100 H.P.

Besides these rates, there are special ones for "restricted-hour" and "restricted-season" use.

Discounts from 20 per cent. upwards are obtainable on the foregoing figures, according to the locality and the consequent cost of power.

The subject of rates for electric lighting and power is as far from reaching finality in Canada or the United States as it is at home. The writer has recently had occasion to investigate the systems of charging adopted by 35 distinct municipalities and electricity supply companies located in all parts of both these countries.

The most noticeable feature of these various systems was their utter lack of uniformity. Some undertakings are adopting flat rates in preference to meter rates, while in other instances the reverse is the case. Some favour a fixed meter rate, and some a sliding one, and instances are found of each of these being used with or without any or all of the following :—

Service charge, fixed (or sliding).
Minimum charge ,, ,,
Discounts ,, ,,
Meter rental ,, ,,

Fixed discounts are not considered, as these do not affect the question of rates. Some base these sliding meter rates on the total capacity of an installation, and others on the maximum demand, while the same remark applies to service and minimum charges both fixed and sliding.

Many of the companies have no definite schedule of rates at all for large power consumers, but treat each case on its merits. Evidently there is room for improvement in this matter, as many of the systems are quite bewildering, at first sight, even to one accustomed to the complications of various sliding charges, to say nothing of that even more disturbing item in alternating-current systems, the power factor.

Telephones for railway service have evidently come to stay on this side of the Atlantic, as in Canada and the States, during the last three years, according to a recent estimate which is said to be conservative, over 50,000 miles of railway have been equipped, and are now being operated by their means.

In many instances both the old telegraph and the new telephone systems are operated on the same wire without any alterations to the original equipment of the former. In one case, three telephone and eight telegraph messages are being sent simultaneously over two pairs of wires.

Lethbridge, Alberta, has just decided to order 10 street cars of the latest pattern, and a certain quantity of overhead equipment.

The City of Winnipeg will, before long, be in a position to supply electrical energy from its great power station at Point du Bois. The cost of this plant when completed will amount to about £450,000, and it will be capable of generating some 100,000 H.P. The Canadian Pacific Railway has already made a long-term contract for 500 H.P. with the Civic Power Commission, and is likely to be taking 18,000 H.P. in the near future.

In Western Ontario, flowing in a northerly direction into Lake Huron, is the Aux Sables River; though not very long, its volume is considerable, and at a place called Rocky Glen, where there is already a natural fall, from which power is taken, the London and Sarnia Radial Railway Co. proposes to build a huge dam, the top of which will be 80 ft. above the present water level.

Plans of this scheme have already been prepared by Toronto engineers, and these are to be submitted to the Middlesex County Council early in December. The level of the river will be affected for about 20 miles up stream, and at a point several miles above the dam a bridge, now 35 ft. above the water, will have to be raised 15 ft.

Some day, no doubt, peat will become a valuable source of power in certain parts of Canada. The present known area of bogs covers about 37,000 sq. miles, capable of yielding nearly 30 thousand million tons of air-dried peat, having a calorific value equal to rather more than that of half that weight of coal. The Canadian Government has for some time taken an active interest in this subject, special investigations having been made by a branch of the Department of Mines.

A section of peat bog, about 300 acres in extent, was acquired by the Government, and an experimental plant for the manufacture of peat established; besides this, information has been obtained from eight or nine European countries where peat is used, on the different methods of cutting, drying, and utilising it.

A number of attempts has been made in Canada already to manufacture peat, but so far they all, or nearly all, seem to have been failures financially. The Dominion Government, however, evidently consider that the question is one of great importance to the country, and should not be given up because of past disappointments.

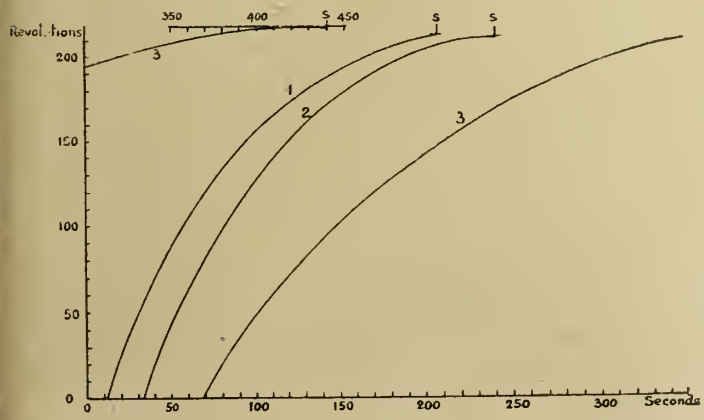
Perhaps the most promising method of using peat for the generation of power is in suction gas plants, as although its calorific value is low, its lower cost compared with coal, combined with the fact that a suction gas engine can utilise

a considerable percentage of the total energy of the fuel, should enable it to compete with coal. If, therefore, the Government's efforts at peat manufacture result in the establishment of the industry here on anything like a large scale, the cost of the fuel will be cheap, and locally, at any rate, its utilisation for power generation is almost sure to follow.

Coal in Canada is much dearer than in England, and although a good deal is mined in the east and west, the central provinces are practically without it. It has, therefore, to be imported from the United States, and statistics show that almost half of Canada's total coal consumption, amounting to about 16 million tons per annum at the present time, is purchased from America. A strike which occurred in the latter country caused very great inconvenience here some years ago. These are the main considerations which have led the Government of Canada to take up this subject.

FRICTION IN ELECTRICITY METERS: ITS DETERMINATION, COMPENSATION, AND RESULTANT ERRORS.

The frictional resistance of the bearings, clockwork and collector gear is of the utmost importance in determining the accuracy of working of electric meters with rotating armatures. Hitherto the friction prevalent in a meter has been indicated by the starting current of the latter or some similar constant, but the following notes* show how the total frictional torque of meters may be separated into its component parts, and determined both absolutely and as a percentage of the driving torque of the meter.



(1) With clockwork and brushes; (2) Without clockwork, with brushes; (3) Without clockwork, without brushes.

Fig. 1.—Retardation Curves, D.C. Meter "A."

Lack of space prevents a complete account of the experimental methods employed, but the test most frequently carried out was a determination of the speed-time curve ($u = f(t)$) of the meter when "coasting" (*i.e.*, unexcited, and freed from the control of its damping magnets). Every time a mark on the braking disk of the meter passed a stationary index mark, a key was depressed to record the occurrence on the tape of a "double-writer" Morse set—the second circuit of which was connected to a seconds contact. Starting from the curve $u = f(t)$, and remembering that—

$$\frac{\text{Frictional torque}}{\text{Mt. inertia rotating parts}} \left(= \frac{D_R}{K}\right) = \text{angular retardation},$$

we have that $D_R = 2\pi K \cdot d^2u/dt^2 = f_1(du/dt)$, ... (1)

which gives a curve showing the friction as a function of the armature revs. per second (r/s).

Now it is possible, by an application of the well-known graphical method of tangents, to derive from the experimental curves $u = f(t)$ (fig. 1), velocity-time curves ($du/dt = f(t)$, fig. 2), and thence the curves $D_R = f_1(du/dt)$ (see fig. 3); but to obtain good

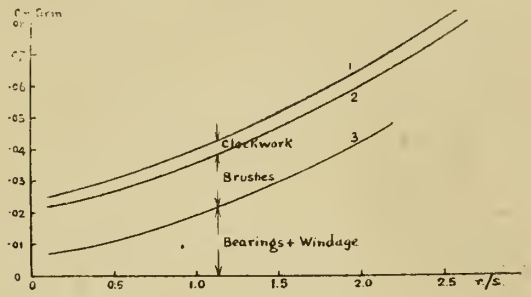


Fig. 3.

results by this procedure, the curves and tangents must be very accurately drawn, and the process is inevitably tedious. In most cases, however, the following approximate method of working fulfils all practical requirements:—

Referring to fig. 4—

$$\left.\begin{aligned} u_b &= f(t_b) = f(t_m + \Delta t/2) \\ u_a &= f(t_a) = f(t_m - \Delta t/2) \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

whence, by the application of Taylor's expansion, and taking (Δt) to be very small, we have—

$$f(t_m) = u_a + u_{b2}$$

and $$f^1(t_m) = u_b - u_a/t_b - t_a = \Delta u/\Delta t \ldots \quad \ldots \quad (3)$$

We now work, therefore, with chords instead of with tangents, thus obtaining more accurate results (in practice) by less laborious methods.

As an example, taken out of the complete tables of data from which curve 1 in fig. 1 is plotted—

For $t_m = 44{\cdot}9$ sec., and $\Delta u = 16$ revs.,

$\Delta t = t_b - t_a = 49{\cdot}1 - 40{\cdot}9 = 8{\cdot}2$ sec.

Hence $\Delta u/\Delta t = 1{\cdot}96$ r.p.s.

Repeating this process and plotting the results, we have the curves of fig. 2—

$$du/dt = f^1(t),$$

whence, the values of—

$$\frac{\Delta(du/dt)}{\Delta t} = d^2u/dt^2 \text{ (in limit)},$$

corresponding to various values of du/dt, may easily be calculated The values of D_R ($= -d^2u/dt^2 \cdot 2\pi K$) at once follow, and thence the curves of fig. 3, showing D_R as a function of du/dt.

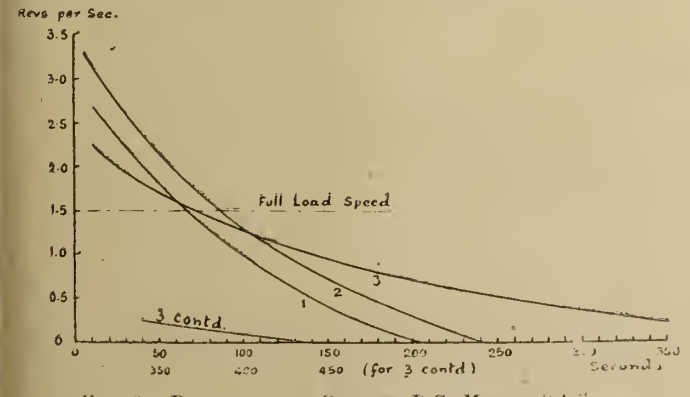


Fig. 2.—Retardation Curves, D.C. Meter "A."

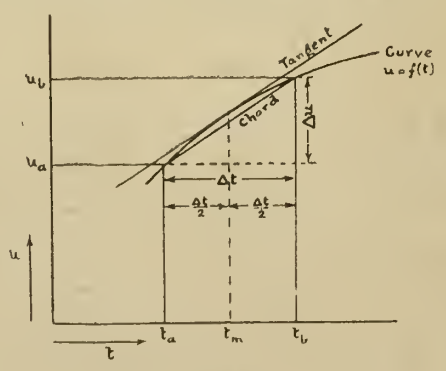


Fig. 4.

Determination of Moment of Inertia of Meter Armature.—A method is later explained whereby K may be determined by a retardation test (armature *in situ*), but wherever possible, the armature system should be removed from the meter and suspended by a wire about 2 m. long, so that it may oscillate about its axis. After determining the period of oscillation (τ_1) of the armature alone, a brass ring, of known moment of inertia K_R, is placed concentrically with the armature shaft on the braking disk. The new period (τ_2) of the system being noted—

$$K = K_R \cdot \frac{\tau_1^2}{\tau_2^2 - \tau_1^2}, \quad \ldots \quad \ldots \quad (4)$$

If the mt. inertia of the suspension clamp, &c., cannot be neglected, its period (τ_3) of oscillation should be noted; then—

* Abstracted from a very long and comprehensive article on the subject by Karl Schmiedel in the *Verhandlung des Vereins zur Beförderung des Gewerbfleisses.*

$$K = K_R \cdot \frac{\tau_1^2 - \tau_3^2}{\tau_2^2 - \tau_1^2} \quad \ldots \quad \ldots \quad (5)$$

Experiments Conducted and Results Obtained.—Tests were carried out on eight alternating-current meters (including three-phase types) denoted hereafter by *a*, *b*, *c* . . . . *i*, and on six direct-current meters denoted by A, B, C . . . . G. The A.C. meters were all of the Ferraris pattern and of modern construction, while five of the D.C. meters were of the watt-hour Schuekert-Hummel

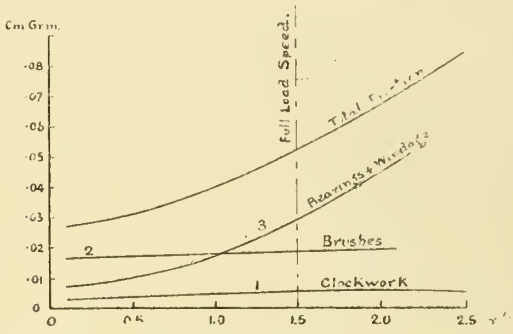


Fig. 5.—Frictional Resistances in D.C. Meter "A."
Full-load driving torque, 5·06 cm.-grm.

type, the sixth being an ampere-hour meter. All the meters had vertical axes, and conformed to modern practice as regards gearing, bearings, brushes, &c. The assembly of the various parts and the disposition of the damping magnets are only of present importance, in so far as they affect windage friction.

The clockwork, brush and (bearings + windage) frictional torques were separated by carrying out retardation (or "coasting") tests:—

(*a*) With clockwork coupled and brushes on commutator.
(*b*) With brushes down, but clockwork uncoupled.
(*c*) With clockwork uncoupled and brushes raised.

Curves 1, 2 and 3 were thus respectively obtained in fig. 3 (for D.C. meter A), and, by subtracting ordinates—

Curve (1)—(2) gave the frictional torque due to clockwork alone.
" (2)—(3) " " " brushes alone.
While (3) " " " (bearings + windage) alone. (See curves 1, 2, 3 respectively, fig. 5.)

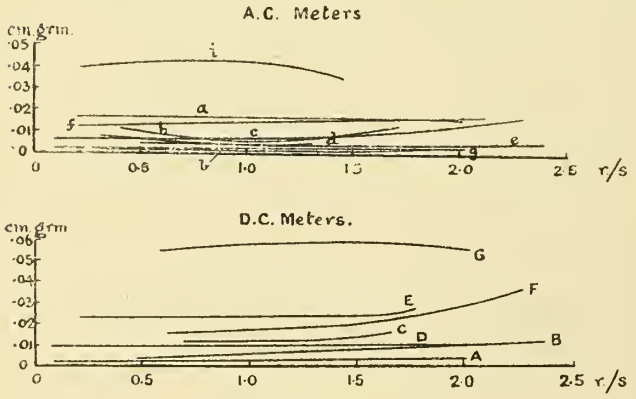


Fig. 6.—Clockwork Friction.

The coasting time from 3 r.p.s. (the maximum speed at which accurate timing can be effected by eye), to standstill, seldom occupied more than 2 to 6 minutes, and the armature system being relatively heavy, the moving forward of the recording train during this period does not appreciably affect the results of the retardation test.

Clockwork and Brush Friction.—Figs. 6 and 7 represent the clockwork and brush frictional torques as a function of the meter armature speed. It will be seen that these resistances are practically independent of the armature speed, and may therefore be permanently compensated by the introduction of a constant torque.* Reducing the actual and percentage values of the clockwork and brush friction to an assumed armature speed of 1 rev. per sec., the extreme and mean values thereof are as shown in Table I.

The actual arrangement of the various recording trains did not vary greatly, and had no great influence on the results obtained. The care with which the parts were made and assembled, and the attention paid to the bearings, were proved to be of the utmost importance; thus, two direct-current meters of the same type, but varying in this respect, showed over 100 per cent. difference in clockwork friction.

Spur-gearing connection between the armature spindle and the recording train was found to give a higher mechanical efficiency than worm-gearing, speaking generally, but meter A, for instance, employed worm-gearing, yet showed a very low clockwork friction.

* See, however, later notes concerning the influence of the earth's field on this compensation in D.C. meters.

TABLE I.

		Brush friction (at 1 rev. per sec.)		Gearing (armature spindle to recording train).		Clockwork friction (at 1 rev. per sec.)		Coefficient of friction (brushes and commutator).	Brush friction (as %, total friction) at full load speed.
		Absolute (cm. grm.)	Total friction (%)			Absolute (cm. grm.)	Total friction (%)		
Direct-current meters	Fm. to Mn.	0·0085 0·025 0·0182 (6)	14 42 24	Worm	From to Mean	0·004 0·060 0·022 (6)	11 54 24	0·17 0·30 0·238 (6)	10 34 21 (6)
				Spur	From to Mean	— — 0·005 (1)	— — 7		
Alternating-current meters		—	— — —	Worm	From to Mean	0·0055 0·043 0·0148 (7)	15 58 31	—	— — —
				Spur	From to Mean	0·0024 0·0032 0·0028 (2)	11 14 12½		

Bracketed numbers show from how many meters the averages are derived.

The values of the coefficient of brush friction—

$$\mu = \frac{\text{Torque due to brush friction (cm. grm.)}}{\text{Total brush pressure (grm.)} \times \text{collector radius (cm.)}},$$

were found to be practically independent of the composition and hardness of the metals employed, but the mechanical perfection of the brush construction and the dimensions of the collector were, of

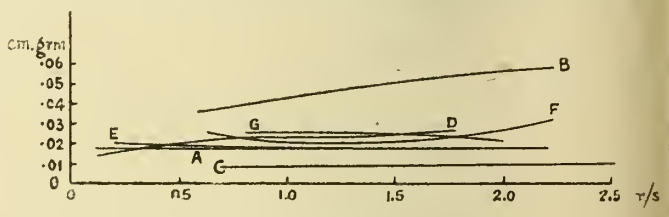
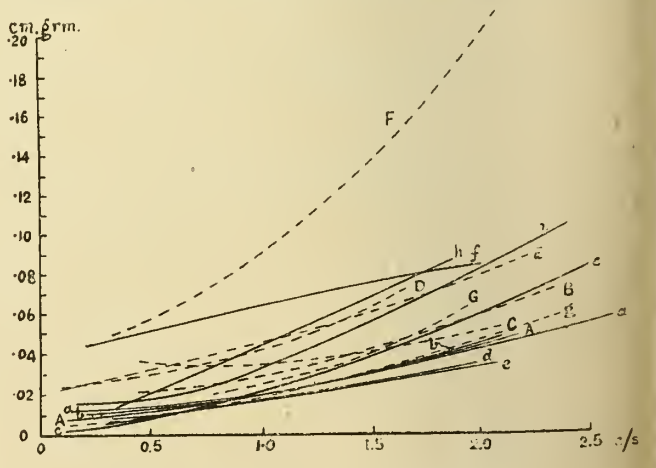


Fig. 7.—Brush Friction, D.C. Meters.
In case of meter B, brush friction accidentally excessive.

course, of great importance. The total brush pressure per meter (normal to collector) varied from 0·1 to 0·4 grm. but, even at much higher brush pressures, the coefficient of friction does not depart from the normal. Thus, in a particular case, owing to excessive brush pressure, the brush-friction torque rose to 0·042 cm. grm. (corresponding to 56 per cent. of the total meter friction) but the



a—*i*, A.C. meters; A—G., D.C. meters.
Fig. 8.—Bearings + Windage Friction.

coefficient of friction remained at the normal value of $\mu = 0{\cdot}30$ (*cf.* Table I). The figures given in Table I, regarding the percentage value of brush friction at full-load speed, show that this resistance no longer represents the major portion of the total friction.

(Bearing + Windage) Friction.—We now come to a frictional resistance which varies considerably with the armature speed (*vide* fig. 8). In fact, the curves of the latter may be approximately represented by an equation of the form—

$$D_R = a + b\,(du/dt) + c\,(du/dt)^2, \quad \ldots \quad (6)$$

the average values of the coefficients *a*, *b*, *c* for the various meters tested being as shown in Table II.

The greater the relative magnitude of the constant term (*a*), the easier it becomes to compensate for bearing and windage friction by a constant auxiliary field. Should the coefficient *b* be

TABLE II.—Values of Coefficients in Equation (6).

		a	*b*	*c*
D.C. meters	From	0·0064	0·0000	0·0023
	to	0·0280	0·0426	0·0220
	Mean	0·0186 (7)	0·0153 (7)	0·0082 (7)
A.C. meters	From	0·0000	0·0053	− 0·0008
	to	0·0390	0·0470	+ 0·0105
	Mean	0·0083 (9)	0·0160 (9)	0·0040 (9)

Bracketed numbers show from how many meters the averages are derived.

large, the corresponding part of the friction can be allowed for by increasing the main current field, or by displacing the control magnets. The coefficient *c* may occasion considerable distortion of the calibration curve at high speeds (particularly in D.C. meters which have a small driving torque), and its value should therefore be as low as possible.

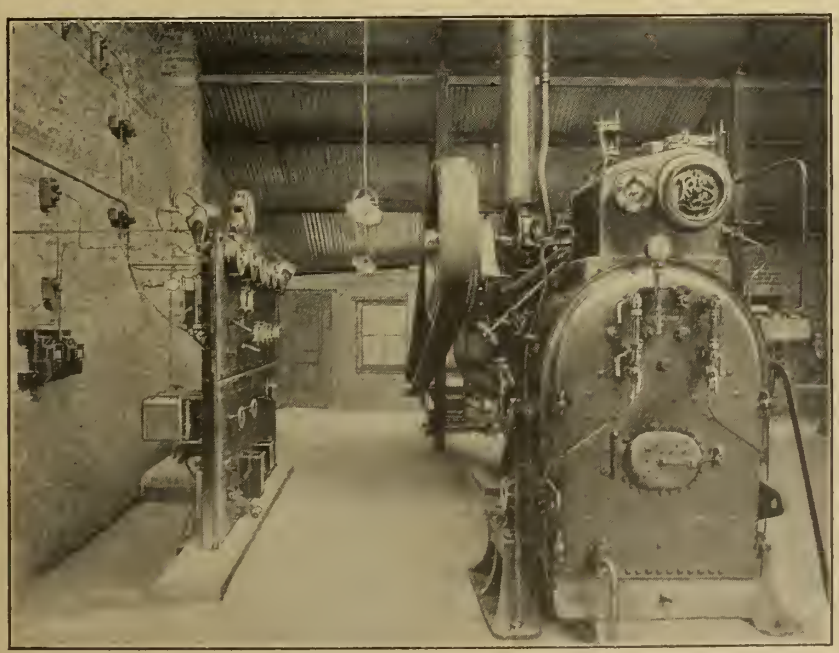
(To be concluded.)

ELECTRIC LIGHTING AT DAWLISH.

In 1903 the Dawlish Council, in conjunction with Messrs. Crompton and Co., took out a provisional order for an electric light installation for public and private purposes. This order was, with a good many others, transferred to a company formed to operate several groups of towns in the kingdom, but it was found inexpedient to carry out the work at Dawlish.

In 1909 a proposal was made that a local company should be formed to take over the powers with the consent of the Board of Trade, by means of an amending order. This company was duly registered in the name of the Dawlish Electric Light and Power Co., with a board of local directors, and a local gentleman as secretary.

Dr. J. A. Purves, of Exeter, was appointed consulting engineer, and the contract was placed with Messrs. Crompton & Co. for the complete electrical installation, consisting of plant, overhead mains, &c., in accordance with the original arrangement come to with the Council.



Dawlish Electric Supply: Showing Garrett Superheated Steam Engine and Switchboard.

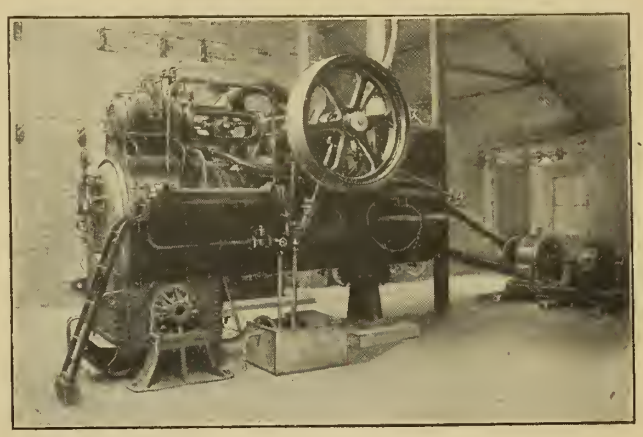
The plant is installed in a neat brick building, and a spacious engine room with a corrugated iron roof is provided, having ample room for an additional set to be added. A battery room is situated next to the engine room, and is provided with a tiled roof, special ventilating tiles being fitted at the peak. Leading out of the battery room is the engineer's office, while in the yard, coal bunkers and an ash store are provided, with a space for storing outside material.

The generating machinery installed in the engine room consists of a Garrett highly superheated semi-portable steam engine, which drives, by means of a belt, a Crompton dynamo-booster set. The rated output of this set is 25 KW. at 200/230 volts. The Garrett engine has proved to be exceedingly economical, and a recent test showed a fuel consumption of 2·36 lb. of coal per I.H.P.-hour.

The engine is of the single-cylinder, non-condensing type, and is consequently the most simple prime mover that it is possible to install. The steam distribution is effected by a balanced piston valve, and the cylinder and valve casing are jacketed with boiler steam.

The superheater is of particularly substantial construction, and so placed that it can be very readily kept clean and in no way interferes with the use of the tube brush for the boiler flue.

It should be noted that if the size of unit had warranted it, a



Dawlish Electric Supply: Garrett-Crompton Generating Plant.

Garrett compound condensing engine of the same type would have shown quite 50 per cent. greater economy in fuel.

The battery consists of 116 cells of the D.P. 17-plate type, having a capacity of 480 ampere-hours at the 10-hour rate.

The usual switchboard and meters are provided.

This installation is interesting from two points of view; the first is that overhead mains are used throughout, and bare copper is used in every possible position in the station for the connections between the battery and the switchboard, the only insulated cable used on the whole installation being that for coupling the dynamo booster set to the switchboard, where the connections have been made under the floor in pipes. The other novel point is in the use of the highly superheated steam engine, as this is the first installation giving a public electric supply where an engine of this type has been used, and in small electric light stations these engines should prove very economical and reliable.

The supply was commenced on June 26th, 1911, and some street lighting has already been undertaken.

Mr. C. C. Hodges, late of Dover, has been appointed engineer, and under his energetic management the number of private consumers is rapidly increasing.

NEW SYSTEM OF CONNECTING BUSINESS TELEPHONE LINES.

On modern business telephone lines, the possibility of unlimited connections is of prime importance, yet must not be purchased by the sacrifice of secrecy of speech. It is imperative that a connection between two subscribers should not be prematurely broken or overheard by a third party. Various of the systems hitherto employed to enable a number of subscribers in one building to employ a limited number of main lines brought to a central distributing bureau have been subject to the grave disadvantage that a third person might be connected to a line already in use; such a state of affairs is quite unpermissible, and one of the most recently devised means for its avoidance is described below.

The selective calling of various subscribers is easily arranged by the use of alternating-current bells responding only to A.C. of a given frequency; each subscriber is given a definite frequency, and may thus be called without disturbing any other stations on the line. Various "blocking" devices have been arranged to secure secrecy of speech under such circumstances, but have usually involved considerable complications in the initial calling and connecting of the desired subscribers.

Probably the most difficult case in which to secure the above desiderata is that of a number of offices connected in parallel at

the end of a common line from a central battery exchange. In such a case, the subscribers can no longer be called directly; a selective "frequency current" first operates a relay at the connecting point of the branch desired. An auxiliary circuit is thus closed, and, by means of a switching battery, the desired subscribers are connected, to the exclusion of all others.

In the system illustrated diagrammatically in fig. 1 (described by M. R. Grossman in a recent issue of *Elektrotechnischer Anzeiger*), the exchange can call up any desired subscriber and connect him as requested without the use of long-distance auxiliary circuits or switching batteries and without the co-operation of the subscribers. Three stations are shown connected in parallel to the common line La, Lb from the central battery exchange. At G_1, G_2, G_3 the terminals a, b are the points of connection of the local circuits and E_1, E_2, E_3 represent the switching relays at the three stations. The relay magnet windings are shunted by condensers C to provide a path for the speech currents and their excitation is controlled by special keys as shown.

P A is a polarised switching relay, so constructed as to be very sensitive to direct currents while ignoring the A.C. flow. Its electromagnet is again shunted by a condenser, and again controls

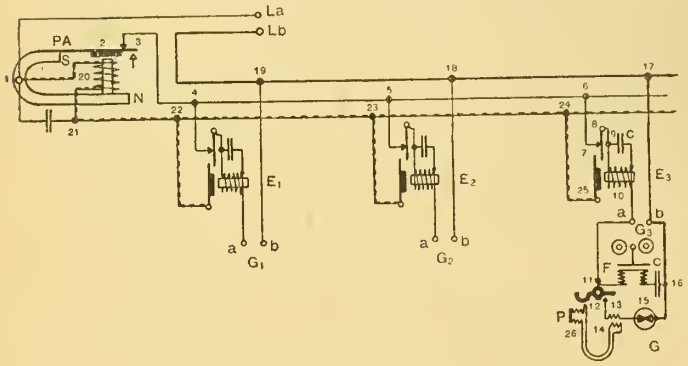


Fig. 1.

a Morse contact. Attraction of the armature 2 opens the local common calling and switching branch circuit. Referring to the diagrammatic view of a complete subscriber's circuit, F is an A.C. bell (D.C. flow through which is prevented by C); 12 is the switch hook; 14 is the transformer; 15 the microphone and T the receiver.

If the subscriber at G3 calls up the exchange by lifting his receiver, the central battery current follows path A, viz.:—La, 1, 2; 3, 4, 5, 6, 7; 8, 9, 10, G3a, 11, 12; 13, 14, 15, 16, G3b, 17, 18, 19, Lb. Magnet 10 then attracts armature 25, so closing the contacts 8, 25, and opening 7, 8. In consequence of this change, the current now flows *via* path B:—La, 1, 20, 21, 22, 23, 24, 25; 8, 9, 10, G3a, 11, 12; 13, 14, 15, 16, G3b, 17, 18, 19, Lb. The strength and direction of the current exciting magnet 20 is such that the contact 2, 3 is opened, and thus the common call and switching line 3, 4, 5, 6 is disconnected, and switching current is cut off from the other stations on the branch line. Other subscribers cannot destroy or overhear the existing connection.

To call up a given subscriber, the exchange sends a selective A.C. of the requisite frequency through the circuit La, Lb. This calling current takes path C:—La 1, 2, 3, and from 4, 5 and 6 through F and C in all the stations in parallel to 17, 18, 19 Lb. The only bell F which rings is the one set to the frequency of the calling current; the subscriber at this station lifts his receiver and his connection is then completed according to the process A, B above.

Should two of the branch stations desire to intercommunicate, the exchange temporarily reverses the polarity of the central battery connections to the terminals La, Lb. After the second subscriber has answered the call, the exchange reverses the central battery current, and the two stations remain in connection without possibility of interruption or overhearing by a third party (the switching-in relays are more sluggish than the switching-out relay, hence the connection of the subscribers is not disturbed during the second reversal of the central battery current).

ELECTRIC LIGHTING COMPANIES AND THE SALE OF FITTINGS.

[BY OUR LEGAL CONTRIBUTOR.]

Among the legal conundrums offered for solution in "Our Legal Query Column," those which relate to the right of undertakers to deal in electrical fittings are of very frequent occurrence. Such dealing is looked upon, naturally, with considerable jealousy by the private trader. The company or local authority supplying electricity is in "on the ground floor" with the consumer. The man who attends periodically to register the meter record has unrivalled opportunities for pushing the wares of those who employ him; while, if the undertakers are a local authority, they have the security of the rates to back their quasi-commercial enterprises.

What powers, then, are usually vested in local authorities to enable them to erect an installation on the consumer's premises and supply him with miscellaneous fittings?

The general powers of electricity authorities are defined and delimited by Sec. 10 of the Electric Lighting Act, 1882, which provides that: The undertakers may, subject to and in accordance with the provisions and restrictions of this Act, and of any rules made by the Board of Trade in pursuance of this Act, and of any licence or order, or special Act authorising or affecting their undertaking, and for the purpose of supplying electricity, acquire such lands by agreement, construct such works, acquire such licences for the use of any patented or protected processes, inventions, machinery, apparatus, methods, materials or other things, enter into such contracts, and generally do all such acts and things as may be necessary and incidental to such supply.

Attempts have been made so to construe this section as to make it extend to the supply of electrical fittings. In the case of the Attorney-General *v.* Corporation of Leicester (1910) 26 T.L.R. 568, which may be regarded as the leading case on the subject, the plaintiff alleged that the defendants, purporting to act in pursuance of their statutory powers, had (to use the cumbrous legal phraseology of the lawyer) "carried on and were still carrying on the trade or business of providing, selling, supplying, erecting, installing, altering and repairing electric light cables, wires, fittings, electric bells and motors for working various machines in connection with houses and buildings, both within and outside their area; and that the defendants had no power under the said Acts or Order to carry on such a trade or business." The plaintiff, therefore, claimed a declaration to that effect, and an injunction to restrain the defendants from carrying on such trade or business.

To this the defendants boldly replied that power to sell and erect fittings was conferred on them by the section above mentioned.

It appeared that the defendants had showrooms in one of the principal streets of Leicester, with windows fronting the street, in which were exhibited for sale all kinds of electrical fittings and appliances—lamps, shades, radiators, wiring, &c.—suitable for use by consumers of electricity, and that the defendants had been selling and supplying such fittings both inside and outside the borough to consumers, some of whom took their supply of electricity from the defendants, and some of whom had their own installations and generated their own electricity.

It was contended on the part of the defendants that "the supply of" electricity did not cease at the consumer's terminals, but continued to the lamps on the consumer's premises. Mr. Justice Neville, who heard the case, came to the conclusion that the argument of the defendants was unsound. Pressed to its logical conclusion, it came to this—that if the duty to supply extended to the fittings in a house, the undertakers might have to bear a serious burden. To use his own words:—

"By Clause 21 of the Provisional Order, however, they are bound to give a supply of energy on demand, and if the wiring of the house and provision of fittings is part of the supply, they would be compellable to do it without remuneration, and I think there is force in the plaintiff's argument that this cannot have been intended by the legislature. In my opinion, 'supply,' within the meaning of the Act and Order is completed at the consumer's terminals. The installation of electricity and provision of fittings is, in my opinion, a separate business incidental to the use but not to the supply of energy. I think that the defendants have misinterpreted their powers and have been carrying on a business in excess of them. In my opinion the Electric Lighting Act of 1909 does not throw light upon the meaning of 'supply' in the Act of 1882, Sec. 16 in the Act of 1909, not having, in my opinion, reference to any power given by the Act of 1882. I think the plaintiff is entitled to the declaration and injunction asked for, and that the defendants must pay the costs of the action."

Having regard to this decision, any local authority or company seeking to supply and erect fittings must do so by virtue of some authority other than the Act of 1882.

When the Electric Lighting Act, 1909, was under consideration in Parliament, an attempt was made to introduce a clause conferring a general right to supply fittings, but the clause disappeared from the Bill before it became an Act of Parliament. If a company supplies fittings it generally does so under the following clause (which will be found in Knowles's "Law Relating to Electricity," Vol. I, p. 310):—

1. The company may purchase, sell, let for hire, or otherwise deal in, fix, repair, and remove, but shall not manufacture dynamos, motors, accumulators, meters, burners, stoves, lamps, fittings, wires, plant, engines, conductors, machinery, appliances, and other apparatus for or in relation to the production, supply, distribution or utilisation of electrical energy and may provide all materials and do all work necessary or proper in that behalf and may make such reasonable charges therefor as they may think fit.

2. Apparatus let for hire under the provisions of this section shall not be subject to distress or to the landlord's remedy for rent or be liable to be taken in execution under any process of any court or any proceedings in bankruptcy against the persons in whose possession the same may be. Provided that such apparatus has upon it a distinguishing metal plate affixed to a conspicuous part thereof or a distinguishing brand or other mark conspicuously impressed thereon sufficiently indicating the company as the actual owners thereof.

Having such powers, it is clear that the company could compete with all the electricians in the neighbourhood. The proviso at the end of the second paragraph is inserted in order to enable the company to avail itself of the provisions of Sec. 16 of the Electric Lighting Act, 1909, the purpose of which is to protect undertakers who let fixtures on hire. In law there is a principle by which every fixture attached to the wall of a house becomes part of the

freehold; by virtue of the maxim *quicquid solo plantatur, solo cedit*, a fixture becomes the property of the landlord, and cannot be removed by the tenant, or by any person from whom the tenant has hired it.

In the case of a local authority supplying electricity, the "fittings supply clause" is generally somewhat more elaborate. It usually provides that (according to the authority above quoted, page 319):—

The Corporation may provide, let for hire, and fix, repair and remove, but shall not manufacture lamps, meters, electric lines, fuses, switches, fittings, lampholders, motors, and other fittings for lighting and motive power, and for all other purposes for which electrical energy can, or may, be used, and may provide all materials and work necessary or proper in that behalf, and with respect thereto may demand and take such remuneration as, or rents and charges, and make such terms and conditions as may be agreed upon.

2. Any fittings let for hire under the provisions of this section shall not be subject to distress or to the landlord's remedy for rent, or liable to be taken in execution under process of law or proceedings in bankruptcy against the person in whose possession the same may be; provided that such fittings are marked or impressed with a sufficient mark or brand indicating the Corporation as the actual owners thereof.

3. Provided as follows:—(*a*) It shall not be lawful for the Corporation to expend money (except through a contractor) upon the provision of such fittings, or of labour and materials required, for the fitting, repairing or removal thereof, upon or from the premises of their consumers or prospective consumers.

(*b*) The Corporation shall so adjust the charges to be made by them for any such fittings, or for the fixing, repairing or removal thereof, as to meet any expenditure by them under the powers of this section in connection therewith (including interest upon moneys borrowed for those purposes, and all sums applied to sinking fund for repayment of moneys so borrowed).

(*c*) Every sum charged by the Corporation to a consumer in respect of the provision of such fittings, or the fixing, repair or removal thereof shall be separately stated on every demand note delivered by the Corporation to the consumer.

(*d*) The total sums received and expended by the Corporation in connection with the purposes in this section mentioned in each year (including interest and sinking fund) shall be separately shown in the published accounts of the electricity undertaking of the Corporation for that year.

A question may arise on the above clauses as to how far it will be necessary to mark each fitting with a sufficient mark or brand. It would manifestly be impossible to mark every lamp, switch, point, bracket and piece of wire with a brand indicating the name of its true owner. It is conceived that a plate fixed at or near the meter giving a brief and practical schedule of all the parts which belong to the company will meet the case.

No person about to levy a distress could then justify the seizure of any fitting which was enumerated in the schedule.

It follows from what has been said that he who would question the right of a company or local authority to supply fittings must take care to examine the terms of the provisional order under which the powers are exercised.

LEGAL.

The National Telephone Co., Ltd.

On Friday, December 15th, an action by Lord Avebury against the National Telephone Co., Ltd., was mentioned to Mr. Justice Joyce in the Chancery Division.

Mr. Younger, K.C. (for plaintiffs), said he had a motion in the matter, but he proposed to save it and take liberty to amend his notice of motion and the writ. It was a very important question, although a very short one. It turned upon the construction of the debenture trust deed and of an agreement entered into between the company and the Postmaster-General.

His Lordship gave leave to amend.

The matter was again mentioned before his Lordship on Wednesday.

Mr. Younger, K.C., counsel for plaintiffs, said his Lordship would remember that the action was brought by Lord Avebury and Lord Wolverhampton, trustees of two issues of debenture stock in the National Telephone Co., with the object of obtaining the decision of the Court as to whether the debentures were redeemable with a premium of 3 per cent. The point was whether the debenture-holders were entitled not only to the return of their principal with interest, but whether they were entitled also to this premium of 3 per cent. That would depend upon the true construction of the agreement, upon which there were two or three issues. Both the plaintiffs and defendants were agreed that the question was one of serious importance, and one which his Lordship would desire time to consider, but as the agreement for the sale of the company's undertaking to the Postmaster-General by the 31st of the present month, the parties had thought it necessary that some determination should be arrived at before that time arrived. They had, however, come to an arrangement which it was thought would allow of the matter going over until next sittings. It had been agreed that the defendants should set aside a sum of £50,000, which was the amount that was in dispute between the plaintiffs and defendants, out of the proceeds of sale received from the Postmaster-General and upon the company undertaking to do that the interlocutory motion should stand over until the trial of the action. They also asked, subject to his Lordship's approval, that they should be allowed to set the action down for trial now without pleadings with liberty to apply at the earliest possible day next sittings to get a speedy trial.

Mr. Hughes, K.C., for the company, said it seemed to him that the course proposed was a reasonable one. They desired to give every possible protection to the debenture-holders. They only desired to do what was right.

Mr. Younger said that on behalf of the trustees he desired to say that they did not desire in any way to hamper the company in carrying the sale through.

His Lordship said that on the undertaking which would be signed by junior counsel, he would make no order except to give leave to set the action down for trial without pleadings, and the parties might apply to him on the first day of next sittings to fix a day for the hearing. Possibly it might be arranged for Monday, January 15th.

Sunderland Forge and Engineering Co. *v.* The Antrim Ore Co. of Newcastle.

This case was heard by Mr. Justice Bray, sitting to deal with commercial causes in the King's Bench Division, on Friday, December 15th. Plaintiffs claimed damages from the defendants for damages to plaintiffs' dynamo plant sent from Newcastle to Belfast on December 21st, 1910. Defendants denied either negligence or liability.

Mr. Geo. Wallace, K.C., for the plaintiffs, said the parties were in the habit of doing business with one another, and on December 21st, 1910, the plaintiffs sent three dynamos from Sunderland to defendants' wharf at Newcastle, for carriage to Belfast by defendants' ss. *Glendun*. The ship was loaded with pig-iron, and there was no room for the plaintiffs' goods except on deck. The captain thereupon saw Mr. Thompson, the defendants' agent, who decided to take the risk without consulting plaintiffs. Upon the voyage it blew a gale, and the covering upon the machinery was burst open, and the plant was seriously damaged by water. Defendants pleaded that the plaintiffs were bound by the conditions on the invoices, but that could not be, and the only question would be as to the liability of the defendants as the amount of damage it was arranged should be subsequently ascertained. It was obviously improper that goods of this kind should be packed on a deck and thus exposed to the risk of damage by bad weather.

Mr. Marr, one of plaintiffs' directors, said he never read the conditions on the invoices, and did not agree with them.

Mr. Bailhache, K.C., argued the case for the defendants, but called no evidence.

His Lordship, in giving judgment, said the only evidence he had in addition to that of Mr. Marr, was that of documents. Invoices were delivered which bore certain conditions on them, but he found it was true, as Mr. Marr said, that he never agreed to be bound by them. He had no evidence to show that plaintiffs misled the defendants as to the nature of the machinery, but he thought it was complicated machinery which anyone would know was dangerous to pack on deck. The captain thought this, as he consulted Mr. Thompson, defendants' agent, who evidently decided to risk it. He did not think Mr. Thompson thought that plaintiffs had agreed that the goods should be carried on deck. Everyone knew that there was more risk in carrying goods on deck than in the holds, and that insurances which covered goods in the holds would not cover them when on deck. He found that plaintiffs never agreed to be bound by the conditions, and there was no evidence that Mr. Thompson was not the agent of the defendant company. There would, therefore, be judgment for the plaintiffs, the amount to be agreed between the parties.

Tram Accident Claim.

In the King's Bench Division, on Tuesday, before Mr. Justice Lush and a common jury, Mrs. Elizabeth Sales claimed damages from the Metropolitan Electric Tramways Co., Ltd., for injuries received while alighting from one of defendant company's trams near Harrow Road, in May last. She complained that the driver negligently started the car before she had properly alighted. Defendants denied negligence. Having heard witnesses on both sides, the Court returned a verdict for the defendants.

Fatalities.—A correspondent writes:—"A shocking fatality occurred on the 13th inst. at Sir John Robinson's Worksop Manor Estate. A girl named Edith May Cutts, daughter of Albert Cutts, a joiner employed on the Estate, took her father's dinner up to the Manor, and while at the workshop her dress was caught in the shafting of an electric motor, which whirled her round and round, and she was cut to pieces."

Alex. McDonald, assistant electrician, was found dead at the foot of a ladder, from which he had fallen, in the sub-station at East Wemyss of the Fife Electrical Power and Light Co.

"Davis" Challenge Cup.—Round 1.—From the G.E.C. Athletic Club we learn that the results of the matches played on Saturday last, the 16th inst., for the above Cup, were as under:—G.E.C. 9 *v.* Edmundsons, 0; St. James' 6 *v.* Drake and Gorham, 4; Anti-Attrician 0 *v.* Ediswan, 9; Siemens 2 *v.* Electrical Installations, 2.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIAN COMMONWEALTH.—The Government of Australia have recently formulated certain tariff amendments which were to come into force on December 1st. The following are the amendments affecting electrical and similar goods :

The heading "Electrical Machines and Appliances and Parts thereof" has been changed, and the words "and parts thereof" have been eliminated. The parts will now presumably be dutiable separately according to class.

The heading "Generators for direct coupling to steam turbines" has been eliminated. These were formerly free of duty, but they will now presumably be dutiable as other generators—*i.e.*, as dynamo-electric machines, as follows :

Up to 200-H.P. capacity	...	20 % ad val.
Over " "	...	12½ % "

The duty on "electroliers" has been raised from 20 % to 25 % ad val.

The duty on "arc lamp carbons" of foreign origin has been raised from 5 % to 10 % ad val., whereas British goods continue free of duty.

"French chalk preparations and steatite" have been made dutiable at the rate of 25 % ad val.

The duty on "asphalt tiles" of foreign origin has been raised from 15 % to 20 %, whereas British tiles remain dutiable at the rate of 15 %.

N.B.—The duties quoted above are in all cases those under the British Preferential Tariff, except when otherwise stated.

PORTUGAL.—The Portuguese Government have decided that posts or poles of wood suitable for use as supports of electric wires, impregnated or not, simply barked, without further working and without accessories, are to be dutiable at the rate of 3 % ad val.

The Portuguese Government have also issued a decree fixing the tariff of fees payable for the visa by Portuguese Consuls of declarations of cargo (*declaraçao de carga*) consigned to Portugal by sea.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,121. "Firing cartridges electrically in small arms." SOC. PEUBLE ET DURIF and G. PEUBLE. December 1st.

27,150. "Sparking plugs." G. NAGEL. (Convention date, December 6th, 1910, Germany.) December 4th. (Complete.)

27,155. "Electric inspection lamps for use on automobiles." W. PETO and PETO & RADFORD, LTD. December 4th. (Complete.)

27,163. "Automatic electric fire extinguishers." S. B. PRIEST. December 4th. (Complete.)

27,189. "Electric resistances and apparatus for the manufacture thereof." J. A. HIRST and P. S. BROOK. December 5th.

27,192. "Miners or the like electric safety lamps." I. FAWCETT. December 5th.

27,212. "Commutation of direct-current dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) December 5th. (Complete.)

27,227. "Methods of applying, and apparatus for, the production of intermittent X-rays for the treatment of deep-seated parts." K. SCHALL. December 5th. (Complete.)

27,254. "Electric switches." J. H. WHYMAN. December 5th.

27,260. "Process of reducing tungsten oxides." J. PINTSCH AKT.-GES. (Convention date, November 7th, 1911, Germany.) December 5th. (Complete.)

27,261. "Incandescent filaments for electric incandescent lamps." J. PINTSCH AKT.-GES. (Convention date, November 17th, 1911, Germany.) December 5th. (Complete.)

27,262. "Method of sharpening thin wires." J. PINTSCH AKT.-GES. (Convention date, Novemher 20th, 1911, Germany.) December 5th. (Complete.)

27,263. "Incandescent electric lamps." G. LUNECKE and BRIMSDOWN LAMP WORKS, LTD. December 5th. (Complete.)

27,290. "Manufacture of metal-filaments for electric lamps." E. R. GROTE. December 5th.

27,291. "Electric clock." C. VOGT. December 5th. (Complete.)

27,360. "Tungsten wire especially suitable for use as incandescence body or filament for incandescent electric lamps." O. KRAUSE. (Convention date, March 2nd, 1911, Germany.) December 6th. (Complete.)

27,366. "Apparatus for sterilising fluids by means of rays of short wave length." R. RENONCE. (Convention date, December 6th, 1910.) December 6th. (Complete.)

27,377. "Method of manufacturing electric steel castings." G. FISCHER and B. SCHUDEL. (Convention date, December 7th, 1910, Germany.) Decemher 6th. (Complete.)

27,386. "Electric brakes for tramway and like vehicles." P. S. TURNER. December 6th.

27,388. "Incandescent electric lamps." R. JAHODA and ELEKTRISCHE GLUHLAMPEN FABRIK "WATT" SCHARF LOTI & LATZKO. December 6th. (Complete.)

27,392. "Portable electric lamps applicable for use in mines and elsewhere." R. RUMNEY and H. HUNTE. December 6th.

27,399. "Matrices for electrotypes." F. F. PERSHKE, E. H. RUDD and W. MATTHEWS. December 6th.

27,400. "Production of high-grade steel and slag rich in soluble phosphates in an open hearth or electric furnace." DEUTSCHE LUXEMBURGISCHE BERGWERKS-UND HUTTEN AKT-GES. (Addition to 19,610, 1911.) December 6th. (Complete.)

27,433. "Electrically-operated mechanism for reversing and accelerating the movements of the tables of planing machines." W. R. DELL & SON, LTD., and G. RICHARDS, trading as High Speed Planer Reconstruction Co., and R. Stewart. December 7th.

27,474. "Method and apparatus for the electric transmission of pictures." L. TSCHORNER. (Convention date, February 11th, 1911, Austria.) December 7th. (Complete.)

27,482. "Lighting motor-driven vehicles by electricity," H. LEITNER. December 7th.

27,483. "Metal-filament lamps and a method of manufacturing same." EHRICH & GRAETZ. (Convention date, July 18th, 1911, Germany.) December 7th. (Complete.)

27,510. "Telegraphic system." P. FAIELLA. (Addition to 4920/1911. Convention date, December 9th, 1910, Italy.) December 7th. (Complete.)

27,536. "Automatic electrically-actuated taximeters for cabs and like vehicles." C. ROBINSON. December 8th.

27,542. "Portable electric accumulators and charging apparatus. K. R. SMITH. December 8th.

27,550. "Thermo-electric generators." P. FERRA. December 8th.

27,560. "Means for and methods of localising and clearing faults in alternating-current high-tension systems." A. M. TAYLOR. (Addition to 27312/1910.) Decemher 8th.

27,568. "Bracket spindles for use on telegraph, telephone or other wire supports." F. J. S. BAKER. December 8th.

27,620. "Electrodes." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) December 8th.

27,635. "Incandescent electric lamp." W. F. MELHUISH. December 9th.

27,669. "Arc lamps." KORTING & MATHIESEN AKT-GES. December 9th.

27,686. "Vapour current rectifying devices." F. CONRAD. (Convention date, December 10th, 1910, United States.) December 9th. (Complete.)

27,697. "Electric apparatus for keeping and preservating the persons or things against breakings, robberies and other criminal attacks." A. RICHON. December 9th. (Complete.)

27,699. "Means for guiding the electrodes of electric arc lamps." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, December 10th, 1910, Germany.) December 9th. (Complete.)

27,708. "Flexible pipe connectors for electrical purposes and the like." H. R. DOEL. December 9th.

27,729. "Electric maximum and minimum excess voltage switches." E. EISEMANN and E. EISEMANN & Co. G.m.b.H. December 9th. (Complete.)

27,730. "Electric generators for motor-driven vehicles." E. EISEMANN and E. EISEMANN & Co. G.m.b.H. December 9th. (Complete.)

27,734. "Electromagnetically-operated switch and like arrangements." BRITISH ELECTRIC TRANSFORMER Co., LTD., and W. MCWILLIAM. December 9th.

27,735. "Apparatus for use in the distribution of alternating currents." BRITISH ELECTRIC TRANSFORMER Co., LTD., and A. F. BERRY. December 9th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1910.

MACHINES FOR WINDING ARMATURES OF DYNAMO-ELECTRIC MACHINES, AND FOR ANALOGOUS PURPOSES. B. Brooks and F. H. Alston. 26,225. November 11th.

METHODS OF AND MEANS FOR OBTAINING ALTERNATING CURRENTS FROM CONTINUOUS-CURRENT CIRCUITS, AND VICE VERSA. A. M. Taylor. 26,390. November 14th. (Addition to No. 20,867 of 1909.)

DYNAMOS. E. R. Freeman. 26,393. November 14th.

DEVICES FOR CONTROLLING THE SPEED OF ELECTRIC MOTORS. Adams Manfg. Co. (Cutler-Hammer Manfg. Co.) 26,420. November 14th. (Addition to No. 13,406 of 1910.)

ELECTRICAL WELDING MACHINES. British Insulated and Helsby Cables, Ltd., and P. Bucher. 26,478. November 15th.

ELECTRIC CURRENT CONTROLLING DEVICES OR SWITCHES. W. K. L. Dickson. 26,627. November 16th.

ELECTRIC REGULATORS AND THE LIKE. H. Leitner. 27,037. November 21st.

THERMALLY-ACTUATED ELECTRIC SWITCH. W. K. L. Dickson. 27,277. November 23rd.

ELECTRICAL APPARATUS FOR THE HEATING OR ELECTROLYSIS OF LIQUIDS. R. von Brockdorff. 27,562. November 26th.

ELECTRIC APPARATUS FOR GAS LIGHTING AND EXTINGUISHING PURPOSES. T. F. Canning. 27,986. December 1st.

FUSE-BOXES FOR CONTROLLING ELECTRIC CIRCUITS. V. Hope. 29,631. December 21st.

ELECTRIC CLOCKS. H. B. Swift and W. D. Baxter. 29,747. December 22nd.

AUTOMATIC ELECTRIC ILLUMINATED AND TIMED ADVERTISING CABINET. J. J. Tanner. 30,176. December 29th.

1911.

LAMP GLOBES, PARTICULARLY FOR ELECTRIC ARC LAMPS. Johnson & Phillips, Ltd., and J. Brockie. 402. January 6th.

ELECTROSTATIC OR INFLUENCE MACHINES. E. A. Watson and Morris & Lister, Ltd. 1,036. January 14th.

RHEOSTATS OR THE LIKE. R. Walker. 3,510. February 11th.

ELECTRIC BELL-PUSHES. W. Bonnet. 3,514. February 11th.

SPARK PLUG. L. Podszus. 3,821. February 15th. (October 8th, 1910. Addition to No. 7,617 of 1910.)

MAGNETO-ELECTRIC IGNITION APPARATUS FOR EXPLOSION ENGINES. Mea Fabrik Magnet Elektrischer Apparate Ges. 4,085. February 17th. (February 17th, 1910.)

CONTROL OF ELECTRIC MOTORS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 5,289. March 2nd.

VACUUM DISCHARGE TUBES FOR LIGHTING PURPOSES. M. Claude. 5,589. March 6th. (March 7th, 1910.)

APPARATUS FOR STERILISING LIQUIDS BY MEANS OF THE ULTRA-VIOLET RAYS. F. Triquet. 9,047. April 7th.

CONTINUOUS ELECTRIC PHOTOGRAPHIC PRINTING OR COPYING MACHINES. J. Halden & Co. and H. R. Watts. 10,702. May 2nd.

SIGNALLING DEVICES FOR TELEPHONE SYSTEMS. A. J. Dunton. 12,898. May 19th.

ELECTRIC CONDUCTORS MORE ESPECIALLY SUITABLE FOR USE AS INCANDESCING BODIES FOR ELECTRIC LAMPS, FURNACES AND THE LIKE. British Thomson-Houston Co. (General Electric Co.) 13,021. May 30th.

TELEPHONE MOUTHPIECES. N. Steinberger. 14,591. Juue 22nd. (August 20th, 1910.)

THE

ELECTRICAL REVIEW.

VOL. LXIX. DECEMBER 29, 1911. No. 1,779.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS. — New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

SMALL ELECTRICAL EXHIBITIONS.

ALTHOUGH we fully recognise that publicity literature, properly prepared, has its place to fill in the important work of popularising electricity for lighting, heating and power purposes, we have not hesitated to express the conviction that this department of effort is, and can only be, subsidiary, auxiliary or supplementary to the general scheme of commercial development. We believe that recent experience has shown that small local exhibitions are invaluable for arousing and stimulating electrical interest among ratepayers and residents; it may be that publicity literature can be profitably utilised in working up interest to a point inclining the public to attend an exhibition, though we think the fact that there is an exhibition within easy reach will act as a magnet by itself. The literature may serve a useful purpose in fostering the electrical desire or habit in the almost-persuaded after the exhibition has been visited. Be this as it may, we believe that the local electrical exhibition is an effort which soon fully repays the supply authorities for the trouble and expense involved, and it is not rendered less necessary by the existence of permanent showrooms such as some we have in mind—electrical exhibitions in miniature, may we call them? The holding of a special exhibition, either by one authority or jointly by several, implies a drum-beating summons and a special complementary effort for bringing the people intimately into touch with the concern from which their own or contiguous districts derive their electricity: and often at such times there is an earnest, concentrated effort in a comparatively small area which is more distinctly felt than when we hold a big exhibition for the whole of a large area like London, and only approach the general populace in a scattered or half-hearted way. At the big exhibition—whether purely electrical, as at Manchester and Olympia, or mainly general with a slight electrical character, as at Brussels, Paris, Turin—there are so many things of other kinds attracting attention that, from the electricity supply station point of view, the needs are not met, however satisfactory they may be in business done by the industrial manufacturer. Such exhibitions undoubtedly do a world of good in their own particular sphere, but the local electrical exhibition is promoted purely and solely for interesting and educating the public regarding the practical applications of electricity and the devices by which these are performed. The travelling-exhibition idea, started some years ago by Edmundson's Electricity Supply Corporation, for visiting the various small localities in which that company had supply powers, formed a very worthy attempt, and is deserving of emulation, if the cost of a special local show is considered too great. It has been suggested to us that, as a means of pushing the business, arrangements should be

made on a comprehensive scale for organising a complete system of educational exhibitions under the management of experienced experts. It might be undertaken by an independent company, arranging with the various electrical undertakings throughout the country to establish exhibitions for a week or two, accompanied by popular lecturers and demonstrators, charging a fixed fee, or, if charges for admission were made, sharing the profits.

An exhibition of the kind we suggest was held in one of the metropolitan suburbs about 10 years ago, in connection with an electric lighting station then newly established, and proved to be very successful in promoting the business. The room in which it was held was in a large private house and about 100 people attended by invitations sent to residents on the route of the mains. On the platforma selection of domestic appliances was arranged consisting of kettles, saucepans, flat-irons, ventilators, and small motors for sewing machines, &c. The room being, of course, lighted by lamps in various styles of fittings—all supplied by one of the local firms, free of expense, for the purposes of advertisement.

The lecture delivered was of a thoroughly popular character—illustrated by a cooking demonstration undertaken by the servants belonging to the house, who had acquired the necessary skill—and an excellent dish of cutlets, mashed potatoes and tomato sauce, was cooked to perfection in presence of the audience and pronounced to be perfect. Tea and coffee, with toast and cakes, followed, the lecturer finally ironing the pocket handkerchiefs of the ladies. The ventilator on the platform was worked to show the action of the motor and the success in ventilating the room.

Exhibitions of this character, given at intervals of a few months, would, it is thought, be of great practical value in educating the public to the use of electricity for domestic purposes, and tend to increase rapidly the number of consumers.

At the recent exhibition at Olympia, nothing interested the general public more than the cooking demonstrations, the suites of rooms fitted with electric radiators, the ozone ventilators, and various domestic appliances.

In addition to the local exhibitions, the public might be invited to inspect the stations and see the machinery in operation, or, if the necessary accommodation is available, hold the Exhibition and have the explanatory lecture delivered at the works, in which case the expenses could be reduced; but this would only be practicable where a suitable room was available away from the noise of the moving machinery, or in stations where the energy was taken in bulk and not generated on the spot.

Of course, as we have said, these exhibitions should only constitute one element in the general business-getting arrangements.

Everybody must admit that, notwithstanding the developments in the use of electricity, there is still a great deal of spadework to be done, even in towns where supply works have been in operation for many years.

Where the mains have been laid for 10 or 12 years, the proportion of those who are receiving a supply of electricity to the number of residents thereon is very small, and this seems to prove that the means employed for obtaining consumers are not perfect.

Those who have had considerable experience in organising the business in many towns know that the ordinary canvasser, however eloquently he may describe the advantages of adopting electric light or power, is constantly met with the reply, "*I will consult some of my neighbours who have tried it.*" This points to the necessity of obtaining and publishing local testimonials, which are far more effective than any other kind of literature.

When the customers have been secured and become familiar with the use of electricity for lighting, they will be interested in receiving the manufacturers' price lists and leaflets offering appliances for other uses, such as cooking, heating, ventilating and power for a variety of domestic purposes, which are of no use until the preliminary result has been obtained of connecting the customer with the mains.

It is satisfactory to find that the supply of small houses is being profitably undertaken on terms which prove that Sir Wm. Preece's old description of electricity as "the poor man's light" has to-day become true. The experiment by the Corporation of Eccles is a case in point, rows of small cottages being supplied each with four suitable lamps to light that number of rooms at a charge to the occupiers of 6d. per week, which more than covers the cost. This is accomplished by one connection with the mains, the wiring being run through the row of cottages.

At Sydenham a row of 16 large houses, each containing two modern flats, built on a road running at right angles to that in which the electric mains are laid, are supplied by a similar connection, so that this by-street is served without the cost of laying a main. This arrangement points to a considerable saving in capital outlay, and is, we believe, already adopted in many places, the wiring being carried in some cases externally and in others internally from house to house, as at Sydenham.

In one town within our knowledge, 40 workmen's cottages are supplied from one service connection with the mains, at a cost of 3d. per unit, which realises a substantial profit to the company.

To our mind, the time is fully ripe for launching out on a far bolder electricity supply business-getting enterprise in most parts of the country, and particularly in the metropolitan area. The reports that reach us from time to time from different directions make us ashamed of some of those who ought to be leaving no stone unturned to replace gas by electricity.

Memorandum on Steam Boilers.

A VERY excellent White Paper has recently been issued by His Majesty's Stationery Office, upon steam boilers. If not particularly original, it has the advantage of being made up from information derived from the best sources. It is designed for the use of those in charge of steam boilers.

Steam users are specially reminded that they are responsible for their selection of the competent person whom they require to undertake the periodical statutory examination of steam boilers. We always regarded it as a somewhat meddlesome interference on the part of the Board of Trade when it instituted supervision over steam boilers by itself, a Government department. The early reports of the Board's inspectors were very farcical indeed, and later legislation, of the kind which makes a householder into his own tax-gatherer, has thrown on a boiler owner the incubus of selecting competent persons. The very wording of the Act is ridiculous, and has resulted in the handing over of boiler inspection to very incompetent persons, for the Act does not suggest that a competent person shall have any experience in boilers. Now, before the Act a boiler owner would have been responsible for the results of his neglect. To-day he may escape behind his belief that he did select a "competent person." The author of this White Paper appears to us to be better than the Act, for he recommends insurance as the best course to adopt. A series of nearly a score of lithographed sheets of details of dangerous faults of combustion, samples of corrosion, of settings and setting blocks, and leakage packings, will prove useful. At one time, we believe, the Board of Trade decreed safety-valve areas solely on boiler grate surface, irrespective of pressure, and this, of course, gave very excessive valve sizes in high-pressure boilers. The Table 8 in this memorandum is evidence that this error has been amended. Practically all the good points in this paper have been evolved in the course of boiler-insurance experience. With a body of specialists constantly observing the action of steam boilers all over the country, and their observations being all focused at one head office, the occurrence of a particular defect was soon found to be accompanied by a definite environment. Cause and effect in engineering matters can only be very surely determined as parent and child by a sufficient number of occurrences to carry the coincidence into conviction; and it has been this correlation which has elevated boiler engineering from its crude state of 1854 to the high position it occupies to-day. Change has been steady, if slow, and often

has been delayed by the boilermakers themselves, who at one time rather tended to resent the interference of the insurance companies.

According to this paper, the proportion of Lancashire and other cylindrical boilers is about 10 to 1 water-tube boiler. The ratio of explosions is less than two to one. This shows that the shell boiler is by far the safer boiler. But the worst boiler is the horizontal multitubular, with a number ratio of about 1·06 and an explosion ratio of over 2·5. It is four times as dangerous as the water-tube boiler, and 24 times as dangerous as the large shell boiler. It is computed that there are 150,000 to 200,000 boilers in use on land in the United Kingdom.

No reference is made to the method of preventing end-plate grooving by the use of slotted rivet holes—a new method well worthy of careful note.

It is to be noted that the unstayed ends of thermal storage drums—and, we may suppose incidentally, of water-tube boilers—should be carefully examined. This appears to be a certificate of safety for these unstayed ends, but we are strongly of opinion that such ends ought to have a central stout bolt stay between them. Dished ends are not hemispheres, or they might be trusted to look after themselves. A dished end is always on the move, breathing with every change of pressure and trying to produce grooving. This point was enforced by boiler experts at the time of the Greenwich explosion several years ago.

Lightning and Electricity Supply.

It is a curious fact that the greatest enemy to the transmission of electricity over considerable distances should prove to be of its own kin—the oldest known form of electrical phenomena warring with the newest developments of electrical science. It is true that in this country little trouble is experienced from this cause, our most violent "thunderstorms" being comparatively tame compared with those which occur abroad; but, on the other hand, we have no use at present for long transmissions, and owing to the special conditions obtaining in this densely-populated country, we are often compelled to lay our cables underground, where they are practically immune from lightning troubles.

Another singular feature of the situation is the fact that the greatest difficulties are met with where pressures of the order of 50,000 volts or less are employed; at the higher pressures such as 80,000 and 110,000 volts, which are now coming into use—pressures which ten years ago would have been regarded as wholly impracticable—the trouble is to a great extent alleviated, mainly on account of the extremely good insulation necessary to control such high voltages, which at the same time provides an effective safeguard against lightning discharges.

Probably there is no part of the world where greater difficulties have been experienced from atmospheric electricity than the Witwatersrand; within a remarkably short space of time the utilisation of electric power has there attained to extraordinary dimensions, and electricity has become practically indispensable to the economical operation of the gold-mining industry. It naturally follows, therefore, that the phenomena connected with atmospheric electricity have demanded and received the closest attention on the part of the engineers responsible for the transmission lines, and their experience in this subject is probably unique. We print elsewhere in this issue an abstract of an interesting paper read before the South African Institute of Electrical Engineers by Mr. Adendorff, describing the conditions prevailing in the Rand and the precautions observed. Apparently the most effective safeguard against lightning discharges is the simple one of shielding each cable throughout its length by an earthed wire suspended above it, and in spite of its costly nature, the author declares that this is well worth the necessary expenditure. But experience on the Pacific Coast has not been favourable to the ground wire, and there are other dangers against which this device is of little effect, such as the surges set up in the line by sudden changes in its electrical condition through the occurrence of a short or an open circuit; there is very much still to be done before these can be wholly overcome.

NEARLY A SHUT-DOWN.

[COMMUNICATED.]

Central station engineers have often to be thankful that incidents through which they have passed, have been only nearly, and not quite, a breakdown. Probably the majority of charge engineers can relate more than one anecdote of occurrences which were for a moment or two touch and go, but which were fortunately saved from becoming a serious matter. One such incident is of interest, as it points out the value of having, if possible, a fairly good reserve of power in the exciting set of an alternating-current station. In the case considered the station included not only some high-speed generators, but also one or two low-speed machines driven by horizontal cross-compound engines. The whole plant was alternating current, and the excitation for the generator fields was taken from a common bus-bar supplied from one or other of two duplicate direct-current steam-driven exciting sets. These two sets were controlled from the same switchboard as the main generators having exciter panels containing their main switches, rheostats, fuses, and also the shunt field switch.

The exciters were compound wound, and were frequently subjected to considerable overload especially when towards evening the lighting peak came on the station. At one time some extensions were going on involving a little reconstruction work on the switchboard, and, although it was hardly an advisable procedure, the work was carried on at all available hours, and part of this work had to be done behind the switchboard, care being taken to prevent as far as possible anyone but skilled men from going behind. One evening, however, just as the lighting peak was on the station a sharp flash was noticed behind the board, and immediately the station lights began to drop in brilliance. These were fed from a transformer connected to the main supply, so that attention was immediately directed to the main voltmeter, and to the consternation of the engineer in charge it was seen that the supply voltage was also falling. One of the drivers who was near the exciters at the time, shouted out to the engineer, and it was seen that the brushes on the exciter commutator were sparking violently. The engineer at once jumped to the conclusion that something was wrong with the exciter, and he signalled for the second set (which was always kept turning slowly when peak loads were on the station) to be run up immediately, and made all preparations to get the second machine in by switching on the field. At the same time, it was noticed that the ammeter needles on the alternators began to swing violently, and by the grunting which went on in the machines it was evident that heavy cross currents were surging between the machines, tending to throw them out of step. The situation was therefore at this point very critical. Before, however, the incoming exciter could be brought up to the working pressure, owing to the time taken to build up its shunt field, the danger symptoms appeared to be slightly alleviated. The voltage of the working exciter, which had begun to drop, appeared stationary at about 10 per cent. under its normal value, and then the needle began to move slowly upward again. At the same time the station lights grew brighter, and gradually everything resumed its normal state. The surging between the alternators ceased, and although, as a precautionary measure, the exciters were changed over, it was afterwards found that even this was really unnecessary.

The clue to the whole affair was given by a rather scared workman who emerged from the back of the board, and who, after some little questioning, admitted that he was responsible for the occurrence. It seems that in working on an adjacent board, which was rather close to the working exciter panel, he had accidentally knocked against the moving contact of the shunt, which was operated by a hand-wheel from the front of the board, and it had gone right back on to the open-circuit stop. He had immediately snatched off his cap and gripped the switch contact, twisting it back again into place, but although he showed great presence of mind in doing so, he was not quite quick enough to prevent the magnetisation of the shunt field from falling, and thus for a very short time the working exciter was dependent upon its series field for all the magnetisation it possessed. There was, therefore, a struggle between the armature reaction in the

exciter and the demagnetising action of the series windings until the shunt field was able to build up again to its proper strength, and while this lasted it was touch and go whether the exciter would lose its magnetism altogether, or could build it up again under the conditions of loading. It was very fortunate for the station supply that the field remaining was strong enough to overcome the demagnetising effect of the armature current.

At it happened, no one was hurt over the matter, but the incident is interesting as pointing out the advantages of a good stiff field on the exciter, in order to cope with unexpected affairs of this sort. Had the exciter been simply a shunt-wound machine, there would have been no hope at all. Another lesson which was derived from the occurrence was not to allow projecting portions of the switchgear, even at the back of the board, to remain exposed without some form of guard in any position where men passing along the back of the board, or working thereon, could come into contact with them.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

May I beg the hospitality of your columns to express my entire agreement with Mr. Sankey's letter of last week's issue? Personally, I have no objection to paying an increased subscription, even in my class (student), if it is "for the good of the hive": but is it?

I note Mr. Sankey says "some attempt should be made to get a minimum salary basis, especially for central station posts." This point should be the fulcrum about which any movement to improve the status of electrical engineers must turn. Surely it is not possible for a profession to stand high when its members—even those with technical college training and practical experience—are paid 25s. a week (ELECTRICAL REVIEW advertisement). Married electrical engineers are to be found, all over the British Isles, filling responsible positions, and living in the abject poverty which 50s. a week entails.

Truly, electrical engineering is a dog with a very dirty tail, and it behoves the Institution to set to work and remedy this defect; if possible, without amputation. As regards the new class, I, for one, strongly object to the transference of the "student," or the admission of the new member without some examination and an approved course of training, either in a technical college or works. The period spent in the works might be made shorter for the college student: a preference might also be made in favour of those who had been through the "student" class; but, in any case, evidence of examination should be made compulsory for the junior class, not for the Associate membership.

Surely the Institution need not fear the taint of trade unionism when the House of Commons has condescended to dabble in domestic finance.

George E. Graham
(*Student, I.E.E.*).

Merrion, *December 20th*, 1911.

P.S.—I am sure that many other juniors will join me in thanking Mr. Sankey for his letter. It is a great thing that a man of his position should have given us a lead.

Post Office Telephone Charges.

I enclose a notice received from the general manager of the London telephone service in reference to my private telephone, which I think is rather instructive. If this is an indication of the trend of events under the State control, and a foretaste of what we may expect in the future, I think the outlook is anything but encouraging. By my existing contract with the Post Office, which does not expire till April, I pay £5 per year, and 30s. *in advance* to cover the cost of any calls I may have. This never proves to be sufficient, and I am constantly sending them amounts for the excess above the deposited minimum, after the date, of course, when this minimum has been exhausted in calls. Now they ask me to send, *by return of post*, a further 15s. on account of any such excess as may in the future occur. Personally, I hold that until my existing contract expires they have no right to alter the conditions of same; but whatever the legal aspect of the case may be, I think the policy involved in such a demand is vexatious.

Thos. Browett.

Westminster, *December 19th*, 1911.

LEGAL.

JENKINS *v.* THE EMPIRE ABERDARE, LTD.

IN the Chancery Division, Mr. Justice Neville had before him, on Wednesday and Thursday (December 20th and 21st), this action, by which the plaintiffs, as trustees of Trinity Chapel and schools, Aberdare, sought an injunction and other relief in respect of an alleged nuisance of noise and vibration caused by machinery for lighting electrically the defendants' music hall. Mr. Jenkins, K.C., and Mr. Adams, were counsel for the plaintiffs, and Mr. Peterson, K.C., and Mr. Simmonds for the defendants.

MR. JENKINS explained that the buildings in respect of which the plaintiffs sued belonged to the Calvanistic Methodist Connection, and consisted of a chapel, schoolroom, lecture room, classrooms and minister's room. The defendants' building was at the rear of the chapel, and to some extent ran by the side of the other buildings. Between was a yard, and before the commencement of the action in that yard the defendants had a gas engine, which was used for the purpose of supplying power for generating electricity for lighting the theatre. This the plaintiffs contended caused an actionable nuisance. The gas engine, however, was removed in May last, about two months before the action was commenced, and when the local Council obtained powers for supplying electricity, instead of taking their electricity for lighting direct from the Council, which would have caused no nuisance, the defendants took electricity for the purpose of supplying power to a motor which they had erected in the place of the old gas engine, and from that they lighted their music hall. This motor when running, it was alleged, caused a whistling and humming noise which seriously interfered with the use of the plaintiffs' buildings, and further there was sufficient vibration to cause the windows of the room to rattle. Evidence was called in support of the plaintiffs' case, which was not concluded when the Court rose for the Christmas vacation, and the further hearing was adjourned until January 11th next.

A FIFE TRAMWAY CLAIM.

SHERIFF MORISON has affirmed, on appeal, the judgment in the action raised by a butcher against the Wemyss and District Tramway Co. He sued for £300 in respect of damages sustained by him through being run down by one of the defenders' cars. The damages were assessed at £112.

Liverpool Electricity Supply.—The Corporation had before it on December 20th the report of the Electricity Committee, recommending, on the advice of the consulting electrical engineer, the replacing of the old engines at the Lister Drive station with new turbines, at a cost of £40,000. The following tenders in connection therewith were submitted for acceptance:—British Westinghouse Co., two 2,000-KW. direct-current turbo-generators, with accessories; British Thomson-Houston Co., two 3,500-KW. turbo-alternators, complete with circulating water pipes and accessories, and for the purchase and removal of existing plant; and the Worthington Pump Co., four cooling towers and pipes. Sir Chas. Petrie (chairman of the Committee), in supporting the recommendations, said, in regard to this particular machinery, that it did not refer in any way to the turbines that were put in Lister Drive station five years ago. Aspersions had been made, and innuendoes cast, that these turbines were the plant they wished to get rid of. The machinery to be replaced had been working for 12 to 13 years at Lister Drive, and had paid very well for itself. There would be some additional expenditure in connection with the £40,348 required for the plant, such as the foundations of cooling towers, &c., so that some £52,000 would probably be required. It was true economy to substitute up-to-date machinery, and in that spirit the resolution was brought forward. An amendment was moved to refer the matter back to the Committee, with instructions to obtain the best expert advice available on the position of the electrical undertaking. Alderman Sir Wm. Bowring, in submitting this amendment, argued that the public's suspicion had been aroused by the hurry with which the Committee had brought the scheme forward, involving serious cost, and possibly a considerable departure in new experimental developments. An animated debate followed, in which it was pointed out that so long ago as January 6th, Mr. Bromley Holmes (consulting engineer) reported to the Council upon the needs of the generating station. The amendment was defeated by a large majority, and the Committee's recommendation was approved.

THE FORMATION OF DEPOSIT BY TRANSFORMER OILS.

By HAROLD D. SYMONS, A.M.I.E.E.

(*Concluded from page* 1040.)

Test 2.—*Heating for one Hour at* 200° *C.*—This test will at once determine whether an oil will form deposit readily, for, should there be any formed during the test, such an oil will form deposit readily at lower temperatures. It is necessary to examine carefully after test, as in some cases the deposit is of such a fine nature that it will remain in suspension in the oil for some while. The sample should not be examined less than 24 hours after test. Some discoloration takes place, but the change with a good oil, though marked, does not destroy its brilliancy. A pale yellow oil with a flash point of 170° C. will turn a dark red colour, and lose from 7 per cent. to 8 per cent. in weight. The loss in weight with oils of different flash points will vary considerably; the lower the flash point the higher the loss. The marked discoloration and loss in weight is accompanied by a thickening of the oil. In cases where the per cent. loss in weight is high, this thickening may be considerable, particularly if the oil will form deposit, but not very readily.

Test 3.—*Heating for Six Hours at* 10 *per cent. (in degrees C.) above flash point.*—As an example of 10 per cent. above flash point, an oil with a flash point of 150° C. would be heated at 165° C. This test is not so severe on pure oils with a flash point lower than 165° C., as Test No. 4, but is nevertheless a severe test; in fact, one that very few oils will withstand without forming deposit.

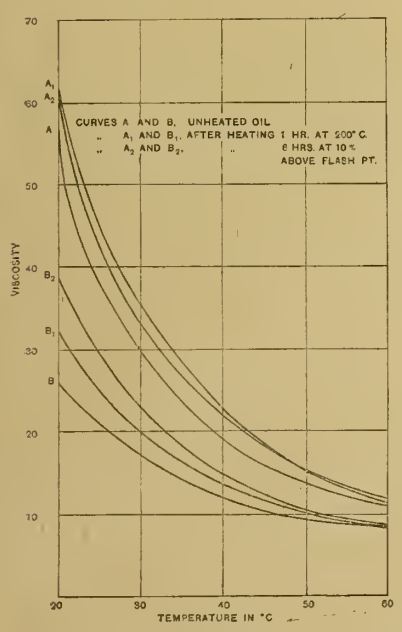


FIG. 6.

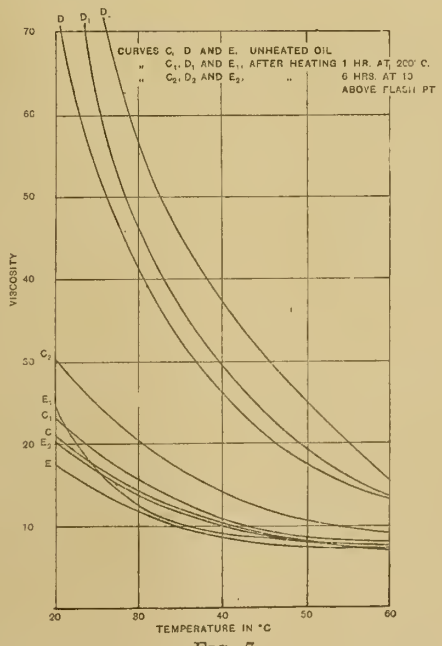


FIG. 7.

For the oils having a flash point higher than about 165° C., this test is rather more severe than Test No. 4, and any oils that do not form the least trace of deposit during this test will be immune from its formation during service. The discoloration is considerable, and the thickening marked, whilst the loss in weight is high. The higher the flash point the lower the loss in weight, but a more marked thickening of the oil generally takes place. No examination for the formation of deposit should be made within at least 24 hours after the test.

Test 4.—*Heating for Four Hours at* 200° *C.*—This is the most severe test that can be applied to oils having a flash point below 165° C., and any that will withstand this test without forming the least trace of deposit will be free from its formation in service. Naturally, considerable discolouration, very marked thickening, and a great loss in weight, takes place, and few oils will withstand the test without forming deposit.

Every transformer oil should be submitted to Test No. 2, and if it passes this without the formation of deposit, Tests 3 and 4 should then be made.

The heated samples should be retained and examined. Comparison should be made with a sample of the original oil, to judge of the discoloration, and, if possible, with other oils that have been submitted to similar tests.

Any comparison should always be made in a perfectly clean vessel, of the same shape and dimensions, and containing approximately the same volume of oil.

For commercial purposes, the examination and comparison of the sample submitted to heating tests will be sufficient to indicate an oil that will not form deposit in service.

The discoloration should be judged against a white background. An oil that will form no trace of deposit, and is not rendered very dark and murky by Tests 3 and 4, will be free from the formation of deposit in service.

In cases where deposit is formed, it is small in volume and difficult to free from the oil. It is almost impossible to obtain accurate measurement of the quantity, but since its formation condemns the oil for the purpose in view, there is no particular object in doing so.

The discoloration during Tests 3 and 4 is generally accompanied by a marked change in odour, which should also be noted.

Whilst the comparison of samples is a convenient method of selecting an oil that will be free from the formation of deposit, it necessitates retaining a number of samples. These tend to deteriorate with age, and the personal element then becomes even a greater factor in the judgment by comparison. A series of experiments were, therefore, undertaken on samples of heated oils, with a view to ascertaining whether there was a relationship between any physical or chemical change other than discoloration, and freedom from deposit.

The results of these tests, however, were disappointing so far as enabling any test to be established that would indicate the liability of an oil to form deposit was concerned. The physical changes are far more marked than the chemical changes; the latter are very slight and irregular, being affected apparently almost entirely by impurities. Of the physical changes, the most marked is the increase in viscosity, and it was hoped that the increase might be a measure of the deterioration of the oil due to heat; this, however, was not found to be the case—the increase in viscosity bears no relationship to the liability of the oil to form deposit. Fig. 6 shows the increase in viscosity of two oils after heating one hour at 200° C., and six hours at 10 per cent. above the flash point. Both these oils behave exceedingly well during heating tests, and would not form deposit in service. Fig. 7 shows the increase in viscosity of three oils, all of which form deposit in service. Oil E forms deposit more readily than oils C and D, and oil D forms deposit more readily than oil C.

The increase in viscosity is sometimes accompanied by slight increase in specific gravity and flash point; any increase of these, however, is no indication of the extent to which deposit will be formed.

The foregoing outlines laboratory tests that may be easily carried out, and the results can be relied on if a uniform method of test is adopted; one precaution only need be emphasised, and that is the necessity for maintaining a uniform temperature throughout a sample by stirring, or adopting such methods as shall prevent local heating.

It now only remains to deal with the chemical changes in the oil due to heat, and the deposits obtained by heating tests and from transformers in actual service. The physical changes produced by heating are accompanied by chemical changes in the oil, the most marked of which is increased acidity. This increase is affected by the temperature and length of time it is maintained, and also by oxidation during heating. The acidity, however, is not increased by oxidation without heat, and the amount of increase cannot be taken as a measure of the liability of an oil to form deposit.

The saponification value is also increased by heating, and the amount of oxidation during heating, but is unaffected by oxidation without heat. The increase in no way indicates the liability of an oil to form deposit.

Impurities in the oil become more pronounced, but these are usually present in such minute quantities as to neither form any deposit nor cause discoloration.

The deposits formed by the heating tests have been so small in volume that it has been impossible to carry out any thorough investigations upon them. Their separation from the oils is an extremely tedious and difficult matter, since they are of such a fine nature that they remain in suspension for many hours, and in some cases even days. The deposits obtained with different oils vary considerably in their nature and colour. They vary in colour from a light brown to a dark chocolate, and some have quite a wax-like appearance. The variation in colour seems to be affected by the colour of the oil at the completion of the heating test. The yield appears to be a definite quantity from a given volume of oil, and, though more readily formed by a high temperature, the quantity is not greater than that formed by a low temperature for a longer period of time. On heating, they either exude oil, melt, or turn to a black bituminous substance that is quite tacky when hot.

With regard to the deposits obtained from transformers in service, it has not been possible in every instance to make an examination of the transformer, though this has been done in the majority of cases.

The deposit is generally quite uniformly distributed over the transformer, and no evidence of its formation by reason of one portion of the winding being at a high temperature has yet been discovered. This may be due to the circulation of the oil carrying the deposit uniformly throughout its mass by convection currents which do not allow it to settle until it is cool. The deposit formed in an oil-immersed transformer in service, however, is, on removal, totally unlike in appearance to the deposits formed by heating tests. It is generally a thick sludge or slime which may be rubbed down to an oil between the fingers. Its distribution is general, not only on the transformer, but on the bottom and sides of the tank, for it clings to vertical as well as horizontal surfaces, particularly if they are rough. In water-cooled transformers sometimes the greatest deposition of sludge occurs around the water-cooling pipes. This is objectionable since it retards the cooling of the oil.

In every instance the deposit appears considerable in volume, but when it is removed it has always been found to consist largely of oil. The solid portion of the deposit as it settles retains a quantity of oil which does not readily drain from it when the oil is either run from the tank or the transformer removed. It will, therefore, be appreciated that such a sludge is liable to contain anything that may have been left in the tank before filling, and any impurities in the oil, dirt or scale that may come off the transformer. Examination of the insulating materials of a number of transformers after varying periods of service, even where deposit has been formed, has not revealed any deterioration. The varnishes become slightly discoloured by heat, and the fibrous materials on which they have been used absorb some of the oil ; for though the varnishes are insoluble in the oil, they are not absolutely impervious to it in the sense that they can be so applied as to entirely prevent its absorption by the fibrous materials.

A series of oils in which treated insulating materials were immersed and heated by coils, treated with baking insulating varnish, at a temperature of 80° C. for 400 hours, showed no greater increase in saponification value than a series of the same oils maintained at the same temperature for the same length of time under the same conditions of test. Examination of the treated materials and coils showed no softening of the varnish and no deterioration beyond a slight darkening in colour.

A large volume of sludge only yields a small quantity of solid matter, and examination of a number of cases has shown traces of all sorts of impurities, according to the locality in which the transformer has been placed. The oil obtained from it has exactly the same characteristics as the oil in the tank, and it would seem that the solid deposit is of almost the same specific gravity as the oil, remaining in suspension while the oil is hot, and, gradually settling as it cools and forming a kind of emulsion on all the surfaces. The sludge always gives an acid reaction, though it is more markedly so than the oil, and generally contains considerable moisture.

The saponification value is generally higher than the oil, though it has been impossible to reproduce this by any heating or oxidisation tests on small samples, and has been judged to be due rather to the impurities than to solubility of the insulating varnishes.

Solid matter similar to that formed by the samples of oils submitted to heating tests has been obtained from some sludges, whilst others have yielded a thick oil almost of the consistency of vaseline, and in one case paraffin wax. In the latter case this could only have come from the oil, which had been in service for nine years, but, unfortunately, no information as to the origin or history of the oil could be obtained. The solid matter in the sludge resembled the brown powder formed by the heating tests, and exhibited the same properties.

In one case only has it been possible to obtain a sufficient quantity of this to make a thorough investigation of it, and it then proved to be paraffin wax.

From the examination of the samples after heating and the oils after service, there is evidence to show that the discoloration and formation of deposit are due to decomposition of the oil by heat.

The amount of discoloration and deposit varies with different oils, so-called blended oils being worse in this respect than the pure oils.

Prevention of the formation of deposit is probably impossible by mere blending, and, in general, the lighter coloured oils form less than the dark ones. American oils appear to form deposit rather more readily than Russian oils, though the latter are generally darker in colour.

It is probable that only a pure oil which will completely evaporate at a high temperature, leaving no residue, will fulfil the desire for absolute immunity from the formation of deposit, but the difficulty of obtaining information as to the origin and refinement of an oil renders the task of determining definite reasons for discoloration and formation of deposit one of considerable difficulty. A complete analysis of a number of oils before and after heating tests and service can alone solve the question.

From the experiments and observations carried out by the author, it is now possible to judge how long oil will, under given conditions, remain free from the formation of deposit, and some have been tested that seem likely to be entirely free from this objectionable feature. Such oils can only be obtained by the most careful selection from the crude distillation and refinement. Indeed, it is possible that care in distillation and refinement have a greater influence on formation of deposit than the crude material from which the oil was obtained.

Besides testing oils for transformer insulation, the author has conducted tests on lubricating and organic oils, but the conclusions drawn have been based only on those which could be used as insulating oils, since the physical properties of some are obtained by artificial means, and are not inherent properties.

The market for oil for insulating and cooling transformers, already large, must expand in the future, so that the formation of deposit by oils is a matter that must receive greater attention from oil refiners than it has received in the past.

In conclusion, the author's thanks are due to Messrs. R. P. Boyd, E. L. Buttenshaw, R. Dodds, S. Evans, L. D. Hill, L. H. Page and A. White, for the care they have exercised in carrying out laboratory experiments.

Mexico.—H.M. Consul-General at Mexico City reports that a company, which was incorporated in August last in Ontario, Canada, with a capital of about £3,080,000, for the purpose of carrying on outside Canada the business of an electric light, heat and power company in all its branches, and also of constructing in Mexico railways, tramways, telegraph and telephone lines and works in connection therewith, has now been registered in Mexico City. H.M. Consul-General is informed that the company will obtain its power from falls on the principal rivers in the States of Nuevo Leon and Tamaulipas, and from the River Naranjo in the State of San Luis Potosi. It is intended to extend the power transmission lines to Monterrey, San Luis Potosi, Tampico, and other principal cities of the north-east of Mexico. Contracts have been made for the hydraulic and electric works, and for the construction of the transmission lines. The constructional works are to be completed within 18 months.—*Board of Trade Journal.*

PROCEEDINGS OF INSTITUTIONS.

Notes on Standards for Electrical Machinery.

By Dr. Robert Pohl, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Leeds, December 6th, and London, December 7th*, 1911.)

The "British Standards for Electrical Machinery" were issued by the Engineering Standards Committee in August, 1907 (report No. 36). Their main provisions are identical with those contained in the interim report (No. 17) published in 1904. This first step in the direction of standardisation was necessarily of a tentative nature. It was so, unfortunately, to such an extent that it exerted but little influence.

It will be further admitted that in an industry progressing so rapidly as the manufacture of electrical machines, standard rules, even if quite satisfactory at the date of issue, will not remain so for more than a few years. Under these circumstances it is natural that criticism of the present rules and suggestions for a decisive advance in the direction of standardisation should have lately become more frequent.

Such standards, if generally adopted, must prove of immense value to the manufacturer, by enabling him thoroughly to standardise his machines, with consequent appreciable reduction in the cost of manufacture. Judging from this point of view, the British Standards of 1904 to 1907, in contrast to the German "Normalien," can only be termed a complete failure.

The British Standards are not comprehensive, and they have practically remained a dead letter. To make the standards effective, they must be brought forcibly to the notice, not only of the manufacturer, but of the buyer and user of machines. It would further be essential to secure adoption by the leading insurance companies and the Government Departments as far as possible. If these and other suitable steps were taken to force the attention of all concerned upon the standards, I feel convinced that an immediate change would come over our industry.

Due to the existence of generally accepted rules, and to the fact that the consumer is accustomed to adjust his plant so as to suit the manufacturer's standard outputs and speeds, the German firms can produce standard machines in large quantities by piece-work methods and sell them from stock. On the other hand, generally speaking, British firms manufacture individual machines in the absence of accepted standards, and competition forces them to quote to almost any specification and for any desired output and speed.

Two methods of working are recognised by the Committee, viz.:—(*a*) Continuous working; (*b*) Intermittent working. A third, "short-period working," is recognised by the German and Belgian Standards.

(*a*) A machine for continuous working is defined as one which can work continuously for six hours and conform to the prescribed tests. I suggest that the words "for six hours" be eliminated and that the following definition be adopted: "The output of machines for continuous working shall be the output at which, with suitable attention, they can work continuously from week-end to week-end. Their suitability for this shall be proved by their passing the prescribed tests."

(*b*) When framing the definition of intermittent working, the Committee were aware that the 1-hour test used for this definition did not meet the requirements of the industry, leading to unnecessarily large motors.

The following definition may be submitted: "The output of motors for intermittent working shall be the output at which, with suitable attention, they can work from week-end to week-end intermittently with the specified load factor. Their suitability for this shall be proved by their passing the prescribed tests."

I further suggest that only three standard load factors be adopted—namely, $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$. The load factor $\frac{1}{2}$ is generally applicable to motors for lifts and for severe crane and hoist work; $\frac{1}{4}$ for ordinary shop cranes (lifting and travelling), &c.; $\frac{1}{8}$ for traversing and other light duty.

The present standards give the classification of motors with reference to the degree of protection under four headings—*i.e.*, open, protected, ventilated, and totally enclosed. This classification should apply to machines generally, and not merely to motors. The developments of the last few years have made it necessary to extend the list by the addition of flame-proof enclosed machines as used for mining purposes. A flame-proof enclosed machine may be defined as one in which all live parts are enclosed in a casing or casings, so designed as to withstand the effects of an internal explosion and to prevent the transmission of the latter to an outside explosive atmosphere. This definition would comprise the two known classes of flame-proof motors, the non-ventilated or long-joint type, and the ventilated or grid type.

The recommendations under the heading of wearing depth of commutators, especially those for the larger diameters, go considerably beyond what corresponds to good modern practice. A wearing depth of $1\frac{1}{2}$ in., for instance, is justifiable only on the assumption that the corresponding commutator will require grinding up or turning some 30 to 40 times during the useful life of the machine. Such a provision was hardly necessary even in the days of copper brushes and glass paper. The advent of carbon brushes and commutating poles, coupled with improvements in the mechanical design of commutators, has resulted in the fact that turning or grinding, except perhaps shortly after erection, has become altogether unnecessary. A revision of the figures is desirable, not only in the interest of the manufacturer exposed to international competition, but also in order to save the purchaser useless expense.

Ruling British practice requires stringent conditions on sparklessness. I suggest the following clause: "There shall be practically no sparking at the brushes of commutators or slip-rings at any load up to and including full load, and no injurious sparking at the specified overloads, and the position of the brushes, except where otherwise stated, shall remain fixed for all loads."

There is no difficulty in complying with these conditions in modern machinery, and the corresponding clauses in the French, Belgian and German standards appear to be unduly lenient.

As regards overload capacity, we find a very striking discrepancy between average British practice, which has adopted very large factors of safety, and the French, Belgian and German standards. The last specify 25 per cent. for $\frac{1}{2}$ hour, and 40 per cent. for three minutes, whilst, according to the French and Belgian rules, it is 20 per cent. for a period equal to $\frac{1}{10}$ and $\frac{1}{5}$ respectively of the full-load run. On the other hand, British specifications generally ask for an overload capacity of 25 per cent. for two hours, 50 per cent. for $\frac{1}{2}$ hour, and the standard machines of good makers will stand up to this without difficulty. Judged from this point of view only, they are on an average 20 per cent. larger in output than Continental machines made for the same nominal output and complying with the respective country's standard specification.

In view of the fact that modern well-ventilated machines reach their final temperature after a comparatively very short run, an overload of two hours' duration is an unnecessarily severe test for small and medium sizes when following upon a continuous run. I suggest that 25 per cent. for one hour, 100 per cent. momentarily, be adopted for machines for continuous rating, and 25 per cent. for five minutes, 50 per cent. momentarily, for intermittently working machines. Generators should be capable of maintaining their full voltage up to 25 per cent. overload (15 per cent. in the German specification) when running at their full-load speed, the power factor in the case of alternating-current generators being equal to the normal power factor.

A clause fixing the loads for which the efficiency and power factor should normally be stated, and subsequently tested, is desirable. Under ordinary conditions the full-load and half-load figures are sufficient. A regulation is further desirable stating by which method the efficiency is to be ascertained. I suggest that the measurement of the individual losses be adopted as the standard test, where not otherwise agreed upon, in view of its simplicity and of the ease and accuracy with which it can be carried out under almost any commercial conditions.

No hygroscopic materials such as cotton and paper should be employed in electric machines unless they are thoroughly impregnated either before or after winding. I suggest that all windings for working pressures above 200 volts be flashed to earth with alternating current of twice the working pressure, but not less than 1,500 volts; windings for less than 200 volts with 1,000-volt alternating-current. The pressure should be raised gradually for this flash test, and the full voltage be applied for one minute.

There is an extreme diversity of view as to the highest permissible temperature rise, which reflects itself in the specifications. The rise specified varies between limits as wide as 25 and 55° C.

The investigations of the National Physical Laboratory, made on samples of cotton-covered wire, lead to the conclusion that cotton, when exposed for prolonged periods to temperatures up to 125° C. (257° F.) undergoes no serious change. Above 125° C. it darkens in course of time, without, however, losing its insulating qualities, and even at 180° C. it proved an excellent insulator from the electrical point of view. Judging merely by change in colour, 125° C. (257° F.) is given as approximately the safe limit.

Impregnation reduces to a certain extent the deleterious effect of high temperatures on the mechanical properties. In view of the above, I submit that we work with an ample margin of safety if we limit the highest internal temperature of field coils to 125° C.

For direct-current armatures and alternating-current stator and rotor windings a more conservative rating is desirable, in view of vibrations and high differences of pressure between layers. I suggest the rules should be framed in such a manner as to ensure that the highest internal temperature of distributed windings will in no part exceed 110° C.

The British standards give the highest temperature of the atmosphere permissible for standard machines as 25° C. (77° F.), whereas the German rules are based on an air temperature of 35° C. as a maximum. I strongly urge that the same figure, *i.e.*, 35° C., be adopted as the basis for the British standards, in order to meet the requirements of the export trade.

Average British practice, as distinguished from the "British Standards," permits a rise of 70° to 75° F., or about 40° C., as measured by thermometer on the surface of any stationary or moving coils. This is lower than required in the interest of safety where distributed windings are concerned, in which there is only a small difference between the highest temperature in the interior of the coils and the surface temperature. It is justifiable, however, in the case of stationary field coils, in which the highest internal temperature rise may be even $3\frac{1}{2}$ times as high as the rise of the surface.

The present practice of judging field coils from the temperature rise measured on the surface is not only unscientific, but may be misleading to the point of danger. This is generally becoming more serious with the employment of forced ventilation, which must necessarily raise the internal temperature gradient. So long as the surface temperature is made of foremost importance there is little inducement for manufacturers to introduce methods of design and ventilation leading to a low temperature gradient inside the coil.

In view of these or similar considerations, the Engineering

Standards Committee in 1907 followed the decision come to a few years previously by the German Institution, viz., that the temperature of field coils shall be measured by the resistance method. The increase in resistance indicates the mean instead of the surface temperature, and is therefore considered to approach more closely the all-important peak value.

"The permissible temperature rise for stationary coils (by resistance) is 60° C. (108° F.)."

The recommendations of the British standards relating to temperature tests have made practically no impression on the British electrical industry. The resistance method is not adopted in more than, perhaps, one case in 100, and where it is specified its spirit is frequently misunderstood, and a temperature rise of about 40° C., usual for surface

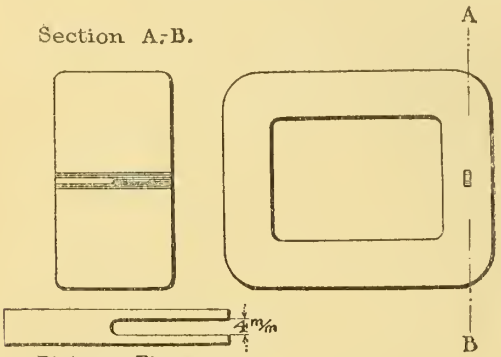


Fig. 1.—Distance Piece for Field Coils.

measurements, is specified to be obtained by resistance method. As it requires the measurement of the resistance cold in addition to the warm resistance, definite conclusions cannot be obtained from the state of the machine at the end of the test only. The method furnishes, after all, only the mean temperature of the whole field circuit, and takes no account of the discrepancies in the temperatures of individual coils. In spite of its almost universal official recommendation, it represents by no means an ideal solution of the problem.

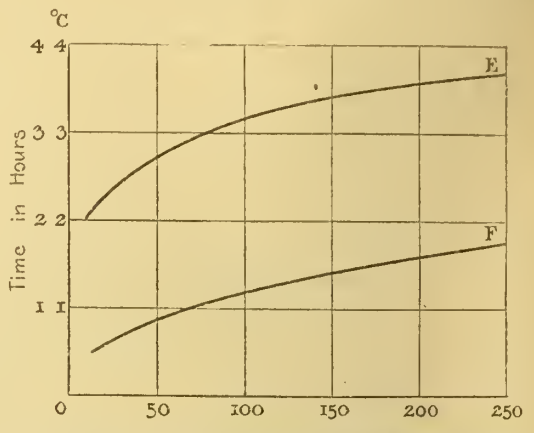
It is possible, without serious inconvenience, to provide for a direct measurement of the internal temperature by means of the thermometer. It is only necessary to this end to wind into the field coil, at a point where the maximum temperature may be expected, a distance-piece of wood or other insulating material enabling the subsequent insertion of a thermometer. Fig. 1 indicates the arrangement of the distance-piece for field coils. To receive a thermometer about 3 mm. thick, the distance-piece need only be 4 mm. wide, and would not add to any appreciable extent either to the external dimensions or to the cost of the coils. In a series of tests carried out on coils as shown in fig. 1, the internal thermometer registered in all cases a temperature rise between 12 per cent. and 20 per cent. higher than was ascertained by the resistance method. In the case of very small machines, below, say, 10 H.P., the temperature of the surface is a sufficient indication of the internal rise.

According to the present British standards all stationary coils must be tested by the resistance method. For rotating coils the rule applies that they shall be tested by resistance method whenever practicable, but in the case of all distributed windings, it is generally possible to find portions, the temperature of which, as measured by thermometer, is at least as high as the mean temperature of the whole winding measured by resistance method. Furthermore, the resistances in question are mostly of a very low order, and their accurate measurement is frequently impracticable on site. The resistance method is also unsuitable for windings in which equalising connections are employed, as it will give no indication of the temperature to which the latter will rise. Under these circumstances there appears to be no justification for retaining the resistance method for distributed windings, the simple thermometer test being preferable from all points of view.

The present rules provide for a 6-hour test for all rotating machines irrespective of size. It is well known, however, that very small machines may reach their final temperature within less than one hour, whilst large slow-speed generators and alternators require sometimes more than 10 hours to reach a settled state. I submit that one gets near enough the final temperature rise in modern rotating machines if the temperature at the end of the run is still rising at the rate of 1° C. during the half hour.

The curve, fig. 2, giving the time required for well-ventilated machines to approach their final temperature, will perhaps be surprising to those not in intimate contact with modern developments. It appears that under the suggested rule a 10-H.P. protected type motor need only be tested for two hours, a 50-H.P. protected-type motor for 2¾ hours, and the error introduced by reducing the testing period to these low figures is less than 1° C. in both cases. Summarising, I suggest the following rule: The duration of the full-load test shall be such that the temperature rise shall not increase by more than 2 per cent. during the last half-hour of the run. In order to ascertain this, a thermometer fixed to a suitable stationary part of the machine shall be employed.

The permissible temperature rise, as ascertained by the specified tests, must be such as to ensure that in the interior of field coils the actual temperature of 125° C., and in distributed windings 110° C., is not exceeded. The highest rise must, in consequence, not exceed 125 — 35 = 90° C. and 110 — 35 = 75° C. respectively. For distributed windings, such as D.C. armatures, A.C. stator and rotor coils, which must be measured by thermometer on the surface, an allowance must be made for the temperature drop in the outer insulation and in the interior of the coil. The sum of these is not likely to exceed 20° C. In addition we will allow 5° C. to meet the discrepancy due to reducing the duration of the test, or a total of



Curve E.—Hours run for temperature rise of 1° C. in last half hour.
" F.—Difference between final temperature and temperature after run for 1° C. rise in last half hour.
Final temperature rise 50° C.

Fig. 2.—Horse-Power of Protected Type Motor.

25° C., leaving a rise of 50° C. In the case of field coils for D.C. machines and alternators, if measured by internal thermometer, the margin to be allowed consists of 10° C. possible error due to the thermometer not being placed at the point of highest temperature, and 5° C. on account of the reduced length of run, leaving a rise of 75° C. This is, in my view, a much safer specification than the usual one of 40° C. rise measured at the surface, and also safer than the present recommendation of 60° C. measured by resistance method.

Where special materials designed to resist high temperatures are employed, a much higher temperature rise is rightly permitted by the present standards, but the exact amount is left to agreement. The development of such well-known materials as asbestos and enamel-covered wires, which are bound to become of great importance, might well be encouraged by allowing definite higher figures where they are employed.

Single-layer windings of heavy copper strip, wound on edge, as largely employed for commutating poles, and sometimes for alternator coils, would also be quite safe if one allowed a temperature rise of 75° C. as measured by thermometer on the surface, seeing that such coils possess an almost uniform temperature throughout.

There need be no limit to the temperature of squirrel-cage rotors, unless ordinary soldered joints are employed, for which the approximate limit of safety is a temperature of 150° C.

The provision for 115/110-volt armatures in a series of standard D.C. machines leads to many difficulties due to the great length of the commutator. Happily this pressure continues to be employed only in a few small private plants, and, generally speaking, it should be discouraged. I also suggest the replacement of 525 and 500 volts by 580 and 550 volts respectively.

For ordinary industrial purposes a 25-cycle supply has important disadvantages, and its adoption renders the standardisation of machinery appreciably more difficult. The frequency of 40 cycles has been largely adopted for private installations, and is the standard frequency of some of the largest supply authorities in the country. It is approximately the lowest periodicity at which metal-filament lamps may be employed without discernible flicker, and it leads to higher power factors compared with 50-cycle circuits, especially where slow-speed machinery has to be installed. From the manufacturer's point of view the provision for 40-cycle machines in connection with a system of standard 50-cycle motors and alternators would cause no serious difficulty.

The tables for motors given in the standards of 1907 unfortunately contain only one speed for each standard output, and the output steps are too big. These lists fail to satisfy the greatly varying requirements of the user. It is particularly essential that for every standard output there should be a reasonable number of standard speeds arranged with approximately uniform steps.

The irregularity in the steps of motor output and speed, and consequently in the frame steps, would embarrass a designer if he were to attempt laying out a systematic line of machines on the basis of the present recommendations. On the other hand, the prospective purchaser of a motor when referring to the list is likely to find the speed given so far different to the one most convenient under the circumstances, that he proceeds to send out inquiries without any reference to standards, whereas a table of four or five speeds would most likely contain one quite near enough to his requirements.

I suggest that we decide on three classes of machines—namely, small machines, frame figure (B.H.P. per 1,000 R.P.M.) below 10; medium size machines, frame figure between 10 and 750; and large machines, frame figure above 750; and that we fix the output steps for each class as follows:—

Small motors, output steps 100 per cent. to 50 per cent.

Medium-size motors, output steps 25 per cent.

Large motors, standardisation of these may be left to manufacturers for the present, as they are not made in quantities.

The outputs suggested are as follows:—

Small motors, ½, 1, 2, 3, 5, 7½ H.P.

Medium-size motors, 10, 12½, 16, 20, 25, 32, 40, 50, 62, 80 100, 125, 160, 200, 250, 320 H.P.

The first line of standard speeds must also be chosen with approximately constant steps, so that equal frame steps are obtained, especially for the medium-size machines.

SMALL MOTORS.

B.H.P.	R.P.M.	$\frac{\text{B.H.P.} \times 1{,}000}{\text{R.P.M.}}$	Output step. Per cent.	Speed step. Per cent.	Frame step. Per cent.
½	1.650	0·303	100	10	120
1	1.500	0·666	100	11	122
2	1.350	1·480	50	10	65
3	1.225	2·450	66	11	85
5	1.100	4·550	50	10	65
7½	1.000	7·500			

[Tables based on these principles are given in the paper, and shown to meet all requirement with very few frames.]

In the case of polyphase motors for 40 cycles, seeing that the step from 40 cycles to 50 cycles is 25 per cent., and this equals the output steps, we may use the whole list of standard 50-cycle machines and run them as 40-cycle motors with correspondingly slower speed and the next lower standard output, without any alteration except to the stator winding.

For the standardisation of alternators, it will be desirable, instead of making new patterns throughout, to employ as far as possible the mechanical parts of the polyphase motors. For this and other reasons, I suggest that the principle of 25 per cent. output steps be adhered to, and that the standard outputs in kilovolt-amperes be as follows: 10. 12½, 16, 20, 25, 32, 40, 50, 62, 80, 100, 125, 160, 200, 250, 320, 400, 500 K.V.A. These figures are the same as the B H P. figures suggested for motors. This list would hold good for 50 as well as for 40-cycle machines, the same frames being employed. The standard polyphase alternators could, of course, be wound for single-phase, and in this case the list of outputs might again be left unaltered. By way of example, the 500-K.V.A. size, if wound for single-phase, would be designed to give 320 K.V.A.

The output list of three-phase transformers should be identical with that of polyphase alternators, so that the above figures are again applicable. If a line of single-phase transformers were developed by using in all cases two cores of the standard three-phase transformers, the output list need not be altered, the 500-K.V.A. transformer for three-phase corresponding with the 320-K V.A. size for single-phase, &c.

It should be clearly recognised that the proposed thorough standardisation is likely to be a success only if it is to the advantage of both producer and user. Engineers cannot be expected to adopt the standard specification and, wherever practicable, to adjust proposed plants so as to employ standard machinery unless it is clearly to their or their clients' benefit to do so.

In opening this discussion, MR. HARDING CHURTON said he had said, in Leeds, that the system of individual standardisation had produced good results, but the adoption of general standardisation would have retarded progress. There was, however, an opening for general agreement on matters, such as rating and testing on standard lines. There was a great variety of supply systems in use, and it would be difficult to provide a number of standard outputs for each one. He agreed with the author as to the arbitrary nature and indefiniteness of the standard six hours' running test, but considered that the one-hour test for intermittent use was also open to question. He had found that a ventilated motor run for one hour continuously, had the same temperature rise as if run for a period with a rate of intermittency of three in four. The same motor totally enclosed was run on the half-hour rate, which corresponded to one in six intermittency. The methods of testing with A.C. could not be commonly applied in the case of D.C.

MR. W. E. ROBSON said the Engineering Standards recommendations were known to be a dead letter; if manufacturers would agree faithfully to keep to the specified performance, and if foreign manufacturers could be prosecuted for selling machines with inferior performances here, then something might be done. The purchaser generally considered price in the first place, and cheapening of the cost of manufacture without an agreement as to price would not benefit the manufacturer, as the selling price would be lowered. The author's tables for machine outputs gave even more steps than were at present used, and did not represent any advantage. Looking at the matter of standardisation from another point of view, the designer of a costly machine could not be expected to alter his design for the sake of the motor which would drive it, and would cost only a fraction of the whole. The great fault was that too many firms were building the same sized motors and dynamos, and an agreement to alter this and divide orders according to sizes would lead to a great saving in production costs and in other directions. He had come to the conclusion that electric motors would eventually be excluded by law from fiery mines, and that such motors need not be considered.

MR. ROBERT HAMMOND defended the Standards Committee who made the original recommendations. The paper was a valuable one, and the criticisms which it contained would be of assistance when the rules were revised in the near future. He suggested that all the good stuff the author had included had actually been obtained in the interests of the Committee by the National Physical Laboratory. The standard test would certainly give a good machine to the client, in whose interest it was adopted. The author's remarks on temperature rise were made under a misapprehenson, as the Committee specifically provided for the case of the temperature being above 25° C.

PROF. S. P. THOMPSON disagreed with the author's recommendation that machines for 100 and 115 volts should be disregarded. From the consumer's point of view, such pressures were very suitable under existing conditions. He described a method which would render unnecessary a 6-hours' run to find the eventual temperature of a machine.

MR. H. A. JONES considered that British manufacturers quite held their own in machines of up to 100 H.P., and that foreign competition was negligible; this, in spite of the lack of standardisation and manufacturing facilities here. He thought machines were purchased more on the reputation of the maker than on the strict guarantee.

Atmospheric Phenomena and Over-Voltages in Overhead Transmission Lines.

By MR. G. V. ADENDORFF.

(*Abstract of paper read before the South African* INSTITUTE OF ELECTRICAL ENGINEERS, *Johannesburg, August 17th*, 1911.)

IN the case of a power company supplying a mining consumer (where a comparatively short stoppage of supply may involve the loss of a large sum of money) it is usual for the power company to compensate the consumer in the event of the supply failing; consequently it will be seen that continuity of supply is an item of prime consideration, and no effort should be spared to attain such a condition of working.

Disturbances due to atmospheric phenomena are obviously only found in overhead circuits, whilst underground cable systems are free from them, unless connected to overhead lines. In the latter case, the disturbances generally are more pronounced and dangerous owing to the combination of the relatively large capacity of the cable system, and the high inductance of the overhead line.

The main items which come under the category of atmospheric phenomena, and which, directly or indirectly, are connected with the production of over-voltages, may be simply classified as follows:—

1. Temperature effects; (2) altitude effects; (3) rain, snow and hail storms; (4) wind and dust storms; (5) atmospheric electrification; (6) thunderstorms.

1 and 2 may be considered together. It is found that sudden changes in temperature, such as occur at sunrise and sunset, produce static charges on conductors—the amount of static being a function of the amount and rapidity of the change in temperature. Similarly, it is also found that a conductor suspended at varying altitudes above the earth's surface receives a decided amount of static charge, depending upon the difference in level between the highest and lowest points of the conductor. Both these effects are probably closely connected with the phenomena of atmospheric electrification.

3. Rain, snow and hail are found to have a static charge, and when either moves in the vicinity of a conductor, the latter takes up a definite charge and becomes electrified.

4. It is easy to show experimentally that a high wind blowing across a conductor causes it to take up a definite static charge, which may, under certain conditions, assume an enormous value. If the wind be accompanied by dust this effect is magnified considerably. Experience has shown that arresters on overhead lines have discharged at various points on bright, clear, windy days, which clearly indicates that the lines had been subject to some rise in potential. Further, linesmen working on dead overhead lines on windy days always encounter static on the lines, and take the precaution of earthing them before proceeding with their work.

5. The result of investigations shows that during fine weather the atmosphere is positively electrified with respect to the earth's surface, which is relatively negative. The potential increases with the height above the ground, and is a very variable quantity. Probably we may estimate as an average a natural potential gradient in the air of about 100 volts per foot.

During wet and changeable weather the potential may be negative, and its value seems to undergo greater changes than usual. This electrification, besides varying with the state of the weather, varies under normal conditions of weather, with the seasons and the hours of the day. The diurnal variation seems to be associated with the hours of changing temperature, the electrification being a maximum at the time of greatest variation in temperature, and a minimum during the hours of constant temperature. Our knowledge of this important phenomenon is very imperfect.

6. There is no doubt that the phenomena of a thunderstorm result from the clouds being in a highly electrified state. If solids or liquids are charged, the electrification resides only on the surface, but gases and vapours, which are composed of minute particles, are capable of receiving a charge throughout their mass.

In the same way moisture particles floating in the upper regions of the air assume the potential of this air, and so have a definite charge given them. It is conceivable that the condensation of water vapour in positively charged air may result in a cloud of positively charged water drops. The dark colour of a thunder-cloud probably results from an extra amount of condensation taking place. The potential in this way may rise to an enormous value.

The maximum tension which air can stand is approximately ½ gramme weight per sq. cm., and whenever the electric tension

rises to this value, disruption occurs, and the well-known phenomenon of lightning supervenes. Calculation leads to a figure of about 5,000 million volts for a lightning flash between cloud and earth 1 mile in length. Since the potential required to produce a flash a mile long is so enormous, it follows that the quantity of electricity required for the energy need not be so great. Sir Oliver Lodge states that 217 million electrostatic units of quantity per square mile would give the requisite bursting tension. Now 217 million electrostatic units are just about 70 coulombs, or not enough to decompose one-hundredth of a grain of water. It must not be supposed, however, that because the quantity is small the current is also small, for if the quantity flows only for a very short time, as in the case of lightning, the current may be exceedingly large, and no doubt this is usually the case.

As a brush discharge would probably occur first, the real potential of the discharge would be possibly a considerably lower figure. The point is, however, that the voltage is of the magnitude of millions of volts.

Lodge distinguishes between two main cases of lightning discharge, and there can be no doubt that both exist :—

(*a*) When the strain on the dielectric near the earth has been of gradual growth, in which case the path of discharge will be prepared inductively beforehand.

(*b*) When the strain arises so suddenly that there is no time for any prearranged path.

The first case he calls "steady strain" and the second "impulsive brush" discharges.

The result of calculation brings out the frequency of discharge at anything over a million cycles per second.

At lightning frequencies the depth of penetration is far less than the thickness of sheets which can be constructed with sufficient mechanical strength. Consequently, the earth path for arresters intended only for high-frequency discharges should be made of thin sheet-iron.

Over-voltages in this paper will be classified according to the mode of occurrence, and so immediately come under the following category :—

(*a*) Direct strokes.
(*b*) Steady electrostatic stress.
(*c*) Impulses or travelling waves.
(*d*) Standing waves or oscillations.

(*a*) If the discharge is very heavy, as usually is the case, the probabilities are that a portion of the section struck will completely disappear, but if the discharge is not so severe, or if, say, one of the poles or masts is struck, then the line at the point struck is suddenly raised to an enormously high potential, and no insulation would prevent arcing over to ground. Such a voltage wave peak would probably set up a wave train which would travel along the line away from the point struck. The greater the frequency the steeper the wave front would be, and the less distance the wave would travel before dying out. It will thus be seen that the effects due to a direct stroke are purely local, and result in puncturing the insulation and consequent arcing over, irrespective of the fact that protective gear may be installed in stations at the ends of the line. Although not the primary cause of danger to the apparatus in stations, they may, of course, set up secondary dangerous disturbances, resulting from an arcing ground or recurrent surge.

(*b*) The gradual accumulation of static charge on a line increases its potential with respect to earth, and in this way the line potential against ground due to "static" may become very great and ultimately may puncture the insulation or discharge over the protective gear, whichever presents a path of least resistance.

If the lightning protective gear is efficient, this potential difference against ground may result in a series of discharges over the arresters following each other periodically. Alternately, with inefficient protective gear, there is a probability of flashing over at the insulators or any weak spot in the insulation.

(*c*) The most complex phenomena connected with lightning discharge are associated with travelling waves. Assume a + charged cloud to move over an overhead line. Then the line and ground will assume by induction from the cloud a negative electrostatic charge. Suppose, now, a lightning discharge takes place between cloud and cloud, or between cloud and ground, then immediately there is a redistribution of the electrostatic field, and the static charge set free moves along the line as an impulse or travelling wave. Such a wave of potential may be enormous, with a steep wave front, which gradually broadens out and flattens until it reaches the end of the line.

Another source of impulses is that due to electro-magnetic induction arising from a lightning discharge. A direct stroke passing over an overhead line will electro-magnetically set up impulses on the lines due to induction. The impulse in this case is only really serious when the stroke passes parallel to the lines, and so is more severe when discharges take place between cloud and cloud than when occurring between cloud and ground.

Whilst in the case of direct strokes the damage done is generally localised, the effects due to impulses originating from induction are felt throughout the system. Travelling waves directly cause most damage to transformers on the line, and it is often observed that the first few turns only on the transformer are punctured. This puncturing generally occurs between two conductors and seldom between the whole coil and earth.

If the frequency is very great the wave length is very small, and the whole potential may then occur between two neighbouring conductors of the winding, so that a puncture may occur, even if the potential of the impulse is not necessarily high. When the impulse reaches the end of the line a new disturbance is set up ; the waves are reflected back on to the line again, or partially reflected and broken up by choking coils, and so produce *standing waves*, in which the voltage has maximum and minimum values at fixed points of the line. When the potential of the travelling wave is at its maximum at the end of the line, the maximum voltage of the reflected wave is twice that of the incoming wave. In this way very high voltages, sufficient to puncture insulation and produce arcing generally, may be set up at the station.

Any circuit disturbance may produce oscillations containing only the very high-frequency harmonics, and in this case is purely local, but it may become general throughout the system by including the lower and fundamental harmonics, and in this case it is known as a "surge." In this case, the power which oscillates is the generated power of the system, and the destructiveness of the oscillation is dependent upon the available generated power, and is independent of the power of the disturbance which primarily caused the oscillation. For this reason internal surging set up by external influences is so very dangerous. High-frequency oscillations, such as standing waves due to lightning discharge, are mainly dangerous then, owing to direct puncture of the insulation and to the liability of producing low-frequency surges.

The four types of disturbances which have been discussed may occur singly, in groups, or all may occur together or successively. A direct stroke and static charge, for instance, sets up a travelling wave. A travelling wave breaks up at a station into standing waves. A standing wave punctures the insulation and causes a short circuit, which may produce, on rupturing itself, a high-power, low-frequency surge. A similar effect is produced by a static charge discharging to ground.

The only protection against the possibility of a direct discharge on to the line is the use of lightning conductors on each pole. If the poles are made of wood this becomes practically essential, but if the poles are of metal the use of lightning rods becomes unnecessary. There is no doubt that the overhead guard wire, if properly earthed, affords a good method of protection, in that it acts as a lightning rod, *i.e.*, its action in this case is entirely preventative and not curative. Again, there is the possibility of a discharge on to one of the poles taking the overhead guard wire as an earth in preference to jumping on to the line and then over the insulator to earth, but when a direct discharge takes place there is so much "side flashing" occurring that it is impossible to say how and where the discharge will distribute itself.

The problem of dealing with static charge consists in designing a piece of apparatus which will continuously conduct away the charge and at the same time offer an enormous resistance to the line voltage. There are, at any rate, four well-known methods of dealing with this trouble.

1. The line may be earthed through a choking coil whose self-induction is regulated to carry, say, about ·1 ampere of the line current. Such an apparatus constitutes a complete earth for static charge, without causing any serious disturbance to the system, and as the normal line current flowing through it to earth is very small, and at the same time wattless, the energy lost is also very small. In practice the choking coil is made like a transformer with only a primary coil, one end being connected with the line and the other to earth.

2. Another method is to earth the line by means of a water-jet earthing arrangement. In this the line is continually earthed by a jet of water sprayed upon it. At a power station where water is not in abundance the maintenance may prove expensive, and also the apparatus requires a fairly large space, and, comparatively speaking, careful attention.

3. There is also the gap arrester method, whether of the horn or multigap type. It may be contended that gap arresters are not primarily intended for dealing with static phenomena, yet, at the same time, if no other protective device is in commission, they have to serve as protection. The objection to this form of protection from static over-voltage lies in the fact that they do not conduct the static charge away continuously. The device only becomes operative when the static potential has risen to a value sufficiently high to jump the gap, and consequently the potential may have risen to a dangerous value before the device operates. Moreover, supposing the device operates safely, there is the trouble which may occur owing to the dynamic current of the line following the static discharge.

4. Lastly, there is the method of earthing the neutral. Earthing the neutral of a generator is quite feasible where the generator operates at line voltage, but it introduces the question of the third harmonic voltage, which is one of the fundamental causes of induction in telephone lines. The second method of earthing the neutral is quite extensively carried out, and consists in having an idle transformer on the line, whose line winding is starred and secondary winding meshed. Provided a sufficient number of transformers is distributed over the system, this method is probably the best, although undoubtedly the most expensive.

In grounding the neutral of a system, the greatest caution must be exercised, as there is also the danger of the short-circuit surge being developed through the occurrence of a fault on the line. Grounding the neutral on a system in which an "arcing ground" has developed, would, of course, immediately convert the oscillating arc into a short-circuit arc, and so into a short-circuit surge. It is safe, however, to ground the neutral with a non-inductive resistance.

With resistance in the neutral there is no likelihood of a short-circuit surge developing, and an arc discharge to ground, so dangerous to the system, immediately forms a dead short-circuit of a current which is limited by the resistance. The resistance should be made as high as possible, but, at the same time, sufficiently low to allow enough current to pass to operate the feeder switch, and so cut out the disabled feeder. Great care must be taken to make the resistance absolutely non-inductive, as any reactance in the

neutral circuit would tend to increase the dangers of a surge, and consequently in all cases the resistance should take the form of a water tank. The tank should be kept enclosed, so as to be free from contact with any matter which would tend to alter its resistance, and for safe operation the water resistance to earth should be periodically tested for standard value.

For dealing with over-voltage due to impulses and standing waves, there are at present four well-known devices on the market—the horn arrester, the multigap arrester, the aluminium arrester, and the Moscicki condenser. The fault of all arresters on the gap principle is the trouble of extinguishing the arc after the arrester has operated. The arc once started is almost invariably followed by the dynamic current of the line, which has then to be broken, and the mere fact of rupturing the current has a tendency to create another over-voltage: unless the resistance to ground is made sufficiently high this danger is always present. The multigap arrester is suitable only for low-power systems. This arrester allows a passage for a lightning discharge, limiting it somewhat, and ruptnres the power arc, by means of non-arcing gaps, with considerable effect. The most promising type of arrester for high-tension, high-power systems is probably the aluminium arrester. Its principle and application are both ideal and simple, in that it provides a path to ground through which the normal line current cannot flow, while offering an easy path for lightning discharges. The objections to this arrester are—the electrolyte must be pure or the film will be easily punctured; the arrester must be kept cool, and must always be kept level to prevent the electrolyte from flowing over the edges of the plates; the electrolyte must not freeze, as it becomes inoperative when frozen; and, lastly, it is difficult to insulate the series of plates at the edges. The Moscicki condenser is comparatively a new type of arrester, and has not as yet been in operation in this country, although there are a large number installed on the Continent. In this type there are no horn-gaps in the earth path, the line being connected dead to the earth through a series of condensers. The principle involved is one of capacity pure and simple, and its action is dependent on the fact that a high-frequency current prefers a capacity path to any other. At the line frequency the condenser is inoperative, and it only operates when subjected to a high-frequency surge. It will thus be seen that as far as lightning discharges are concerned, in which the the frequencies are usually very high, the principle is ideal, but as a protection against a low-frequency surge it is valueless. The great feature of this arrester is undoubtedly the fact that at no time during its operation does it allow the flow of the line current, and there is consequently no dynamic arc to break, and no fear of subseqnent surging being produced.

Complete protection from atmospheric phenomena can be obtained by putting the lines under the ground, but in cases where this is not possible an alternative is to put the ground over the line. Good protection is in most cases secured by placing a grounded wire above each phase of the line, provided the wires are of good conductivity. The wire should be grounded at every pole, and no expense should be spared in order to obtain a thorough and satisfactory ground. If a system of installing grounded wires on either side as well as on top of the line were adopted, the extra expense would be jnstified by the better protective results obtained. The main objection to the use of grounded wires is that if the wires become loosened, contact with the line is probable, causing trouble.

There can be little doubt that an effective system of grounded wires affords more protection from atmospheric phenomena than any other piece of apparatus on the market.

The whole question of atmospheric phenomena in this country is of such vast importance to the electrical engineer, that a complete study of the whole subject should receive his careful consideration.

Discussion.

Mr. J. W. Kirkland (vice-president) said he doubted whether such high potentials as 5,000,000,000 volts for a lightning flash ever existed. A lightning flash one mile in length (*i.e.*, from a cloud 5,000 ft. high to the earth) was unheard of. It had not been suggested by men who had investigated the subject. Prof. Elihu Thomson's theory of a discharge was that it was a gradual breaking-down from one end of a cloud to another through various ramifying branches into one common centre of discharge, beginning in an electrical breakdown through a comparatively small distance—50 or 100 ft. Thus it was not necessary to think of such an enormous potential as the author had suggested.

As regarded high-frequency effects, it was not necessary to conceive of tremendously high rates of alternation. One need only conceive of equivalent phenomena, such as a very steep wave. The conditions as regarded electrostatic and electromagnetic conditions varied with that steepness just as they would with very high frequency.

Mr. D. Otter cast doubt on the theory that lightning discharges were oscillatory, preferring a theory that the discharges were intermittent. Such impacts of current would behave to an inductive resistance exactly as a high-frequency oscillating current.

Mr. F. Davidson (Associate Member) was inclined to think that a lightning discharge 1 mile in length had never taken place. He referred to experiments carried out by Mr. G. C. Simpson at Simla in 1908 and 1909, who accounted for the electrification of clouds by a strong npward draught of air.

Mr. R. Soldin thought that voltage rises in networks produced through instantaneous changes of the state of the energy were at least as important to the practical engineer as atmospheric phenomena.

These surges occurred where self-inductions were switched in series with capacities; in switching-out inductively loaded cables or overhead lines; during momentary short circuits, where the harm was so much greater, the larger the plant and the smaller the pressure drop of the generators; and in switching off continuous-current magnets.

Generally up to now the same apparatus had been used for over-pressures which were caused through atmospheric influences, as for over-pressures due to voltage changes in the network, although for the latter the number of cycles generally only amounted to a few thousand per second, whereas one generally took it that the number of cycles for lightning amounted to from 100,000 to 1,000,000. The practical result of this was that for lightning-arrester gear a suitably constructed condenser would be best.

In his opinion the great disadvantages of aluminium arresters were the inevitable horns. Oscillations were generated by the arc itself, to extinguish which always took a few seconds. These oscillations were not only led to earth through the aluminium cells, but also on to the line, and were thereby reflected in the apparatus in conjunction with it, thus causing damage.

As far as he had been able to learn, interruptions and breakdowns occurred very frequently on high-tension power lines in America, in spite of the contrary assertions of interested parties. Moreover, it was the custom not to put down breakdowns of short duration, as such.

With reference to the Moscicki condensers mentioned by Mr. Adendorff, opinions differed greatly.

They had as yet no absolutely safe working protection for over-pressures of high and low frequency, caused by sudden changes of the condition of the energy of the system itself, as well as due to sudden atmospheric phenomena. A large field was open for inventors here.

THE PHYSICAL SOCIETY EXHIBITION.

The seventh annual exhibition of the Society on December 19th was very well attended, and passed off with the usual success. In addition to the exhibition of apparatus, there was a lecture by the Hon. R. J. Strutt, F.R.S., at both the afternoon and the evening session, on "Electric Discharge and the Luminosity that Survives it," and many of the apparatus and processes exhibited were shown in operation. We give below particulars of some of the items of special interest to electrical men.

John J. Griffin & Sons, Ltd.

This exhibit included the Reden oscillating pump for high vacua; Tucker's hygroscopic battery, which gives pressures up to 1,000 volts for charging electrometers and electrostatic voltmeters, and various types of laboratory apparatus. The most striking features were, however, the Rosenhain electric furnaces, shown in use. One was a muffle furnace for temperatures of 900°-1,000° C., as used at the National Physical Laboratory. The heating chamber was a large tube of fused silica, wound with platinum strip and mounted in a

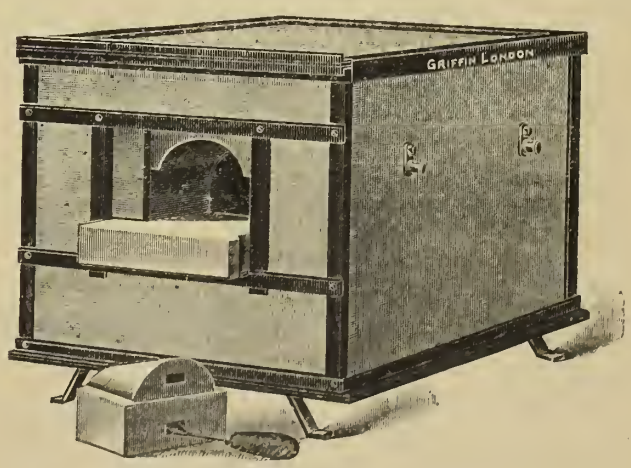


Fig. 1.—Rosenhain Muffle Furnace.

highly insulating casing, the exterior of which was quite cool. The furnace takes about 1,100 watts. A tube furnace with four combustion tubes of fused silica for the determination of carbon in steel was also shown, taking 800 watts. These furnaces are so constructed that the heating elements are readily accessible, and can easily be replaced when necessary. A furnace with a porcelain tube for higher temperatures was another exhibit. Messrs. Griffin also showed "quartz glass" mercury thermometers, made entirely of quartz, and capable of reading up to 750° C. These thermometers have the great advantages that they do not crack when suddenly exposed to high temperatures, and the zero point does not vary, no matter how long the instrument may have been highly heated.

A. C. Cossor, Ltd.

This firm showed the "Rose" patent high-vacuum pump, in which the iron piston is actuated externally by a solenoid traversing

the outside of the cylinder; there is thus no possibility of leakage past a piston rod, and a remarkably high vacuum can be obtained, suitable for exhausting metal-filament lamps and vacuum tubes. A low-vacuum pump for the preliminary exhaustion is mounted on the same base, the whole apparatus being complete without mercury or any auxiliary apparatus.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.

A very interesting collection of apparatus was shown by this firm, representing the standard instruments used at the Marconi stations. The exhibit included the valve receiver, with three inductively connected adjustable circuits combined in one instrument with the oscillation valve detector and regulator—this being the type of detector generally used by the company; the wavemeter, consisting of a simple oscillatory circuit adjusted by means of a variable condenser with ebonite dielectric, a crystal detector and telephones indicating resonance; a multiple tuner and a magnetic detector, which are generally used together for receiving a particular wave-length and tuning out all other waves, with a range from 100 to 2,500 m.; an instructional buzzer for training operators, a direct-reading decremeter for measuring the rate of decay of electrical oscillation amplitude and other functions, and a model of the Marconi land station mast to $\frac{1}{8}$ scale of the modern steel tubular type. Most of the instruments were shown in use, and gave an excellent idea of the high pitch of development which has been attained in wireless work.

W. G. PYE & CO.

The apparatus at this stand was mostly non-electrical, but included a simple and compact pattern of potentiometer bridge consisting of a slide wire 20 m. long wound on a grooved slate cylinder. The position of the contact maker can be read to 1/200 of a turn, and there are 100 turns of wire, with a resistance of 30 ohms and a current-carrying capacity of 1 ampere. The instrument can be used for a variety of purposes. A Kohlrausch bridge with contacts arranged on the dial principle was also shown.

SIEMENS BROS. & CO., LTD.

This company exhibited a complete wireless telegraph set on a small scale, representing two stations in operation.

The set has been specially designed for demonstrations in the lecture room, or for simple experiments in the laboratory or in the open air; it operates on the "quenched singing-spark" system, and is a copy of the larger stations employed in practice. The source of energy is a 12-volt accumulator battery, operating an induction coil with a hammer interrupter, producing about 350 interruptions per second. A feature of this coil is the use of a thin U-shaped steel spring on the adjusting screw, making contact with the hammer. This spring vibrates with practically undamped oscillations, and a clear musical note is thus produced. The spark-gap is placed vertically, and is made up of five sections, any number of which up to four may be short-circuited as required.

For the primary capacity four Leyden jars are used, and by means of clips on the primary self-induction, various wave-lengths may be obtained. A helium tube is supplied for the purpose of tuning.

The range of this set, with antenna 16 ft. high, is 1,100 yards, but under favourable conditions ranges up to about 2,000 yards are obtained, and with a special antenna over 30 ft. high messages can be transmitted over distances up to five miles.

A complete outfit called the "Oscillothermex" was shown, in which were combined the apparatus used for diathermy, high-frequency treatment, and X-ray work, in a form convenient for the use of electro-medical practitioners. Frequency and speed indicators of the resonance type, and the "vibragraph," were also shown in operation.

SYNCHRONOME CO.

Besides the standard apparatus of the company the new astronomical regulator with automatically compensated escapement was shown in operation.

SANITAS ELECTRICAL CO., LTD.

The company showed a new pattern of the "Sanax" X-ray apparatus and the "Multostat" universal apparatus, designed for use in hospitals and by medical men in private practice.

NEWTON & CO.

Besides various physical apparatus, some new arc lamps for use in projection lanterns were shown, with rectangular carbon feed and convenient universal adjustments.

(To be continued.)

Citroën Gears.—MESSRS. ANDRE CITROEN & CO., the sole makers of the Citroën machine-cut helical gears, have received an order to the value of £5,000 from the Oerlikon Co. for gears in connection with electric locomotives. We are informed that this contract is the outcome of the successful working of the Citroën gears in the Oerlikon locomotives used in connection with the Loetschberg (Switzerland) Electric Railway.

Germany.—THE WESTFALIA GLUHLAMPENFABRIK GESELLSCHAFT is the name of a new company which has lately been formed at Aplerberk to manufacture incandescent lamps.

CAPITAL AND LABOUR.

As we anticipated, the Miners' Federation on December 21st decided to take a ballot vote on the question of striking for a minimum wage. We are told that the decision was a unanimous one, but we are inclined to doubt this, for the reason that we cannot believe that *all* the men's leaders are so absolutely devoid of intelligence as to think a national strike can in any way compel the consumers of coal to pay a price which is fixed not by supply and demand, but by the amount of wages to be paid to the miner for obtaining it. This is really what the minimum wage amounts to, and it forms the basis of the miner's reasoning in formulating his demand. He is, unfortunately, not aware of the enormous coal deposits of other countries, and no one takes the trouble to inform him either of this or of the fact that coal can be—and, in fact, is—brought into this country in ships.

The passing year, which closes on Sunday next, has been a remarkable one in the number and magnitude of labour disputes, involving fatal rioting and the use of the military in quelling disorder and defending private property. At one period, in fact, it seemed as though we were nearly on the verge of civil war, the disputants being for the most part a band of ruffians led by labour dictators on the one side, and the recognised officials of law and order on the other. During the past few days we have had the strike in Dundee, accompanied by disorder, and the threatened lock-out in the whole of the cotton industry, which, taken in conjunction with the threat of a national strike in the coal trade, make the advent of the New Year anything but a bright and prosperous one.

So far as the miners are concerned, we are inclined to think that the result of the vote will be in favour of a strike, even with the proviso that a two thirds majority is required; for the reason that the individual miner believes the coal-owners and royalty-owners are enormously wealthy, and that they can afford to pay the wage he requires, and, moreover, he also thinks that if the worst paid workman is to get, say, 7s. or 8s. a day, he—if he is a good workman—will have his wages increased proportionately. Again, if the owner cannot pay a minimum wage out of his present selling price, the miner in his limited reasoning capacity thinks it is an easy matter to raise the price of coal to enable this to be done: this, in fact, is the sort of stuff that has been drummed into him for some time past, and its easy logic appeals to him.

In the cotton trade the ruling question is in regard to non-unionists. The labour leaders wish to control the whole of the workpeople in the industry; and, in fact, in every industry the labour leader is climbing to wealth and power, which is fast becoming little short of absolute dictatorship, and the worst of it is these men think they have the support of the Government behind them. One naturally asks what is to be the outcome of all this disturbance and when and how it is to end. In our opinion, the time for ending it is now, and we should recommend the masters in the cotton trade to stick to their guns, as undoubtedly a great principle is involved—viz., that of freedom of the subject—and we believe that many employés now in the Union are only members through being terrorised into joining, and would leave at once if given an opportunity. In our opinion, it was a false move on the part of the Government to *force* recognition, or partial recognition of the Unions in the recent railway dispute, owing to the fact that it creates a precedent for Parliamentary support of the Labour leaders' demand. Once they can force every employé into the Union, the mills or works are practically in the hands of labour, and control and discipline are lost to the owners and managers for ever. As regards the coal-owners, we cannot see how they can do anything but accept the inevitable and make all the necessary arrangements to close down their pits and to keep them closed until they get complete control back into their own hands. At present they are mainly controlled by the "coal-hewers" and "lads." It would, in fact, be a great blessing if they could keep them closed until the "Eight Hours Act" was repealed. Fortunately, there are about two months in which to make all preparations, and in all probability enterprising merchants are already making arrangements to

ship coal into the country as soon as the demand warrants the higher price which it in all probability will mean. We have, however, only to assume that the transit workers will refuse to handle such coal—which is quite likely—to contemplate a state of complete chaos. Then it is that we should expect the Government to do its duty to protect capital, or, rather, property representative of capital, during the terrific struggle, with all the sorrowful and innocent suffering that would undoubtedly be involved. This suffering cannot, however, be avoided—war is always cruel—but the doctor has very frequently to inflict pain to cure the patient, and, moreover, the mental suffering of a near relative is often more acute than that of the patient. It is the same with a large community. For the good of the community it is necessary that pain be inflicted upon an unruly member who wishes to damage it, but in doing so it cannot escape from suffering itself. That is the pity of it all. We sincerely hope, however, that the coal-owners and mill-owners will stand fast, and that everyone else so far as they possibly can will prepare for the coming conflict, by laying in a stock of coal, or making such arrangements as may be necessary to import it, in order to keep their various industries at work, and that every person who has even a slight interest in the welfare of the country will unite in forcing the Government to change their present attitude and to make full—even ostentatious—preparations for the keeping of law and order. Under such conditions the struggle can only be brief, but what is of very great consequence, the result will be both lasting and beneficial.

ELECTRICITY ON THE WHITBY BRIDGE AND HARBOUR WORKS.

By L. H. KING, A.M.I.E.E

During the last three years there have been considerable alterations made in the town of Whitby, with a view to reclaiming the fishing industry and making the harbour a safe port of refuge. The scheme includes a new swing bridge across the River Esk, and the deepening and widening of the waterway, also the construction of two additional breakwaters some 500 ft. long. Contracts have been placed for over £100,000 of work.

The bridge was the first part of the scheme; it was designed by Mr. J. Mitchell Moncrieff, M.I.C.E., Newcastle-on-Tyne, and constructed under his supervision by Messrs. Heenan & Froude, of Manchester. It is made up of two spans, each span being about 200 tons in weight, and these can be swung 90°, so as to leave a clear waterway 75 ft. wide. Previous to the demolition of the old bridge, a temporary bridge was constructed; this had spans suspended by chains and wire ropes, the raising and lowering of each being operated by a 13-H.P. series-wound motor, driving through worm reduction. The motors were controlled by liquid controllers, and were most satisfactory; they were worked by ordinary labourers, and not a single failure was recorded.

During the construction of the west side foundation it was necessary to sink a large caisson, the air supply for which was obtained from a single-cylinder vertical compressor coupled direct to a 40-H.P. motor; this compressor ran continuously for three months, four days excepted. Space was most valuable, and without a ready supply of electricity the work must have been more difficult. The lighting inside the caisson was by 25-C.P. carbon lamps, used in "cargo light fittings," each containing eight lamps. As previously stated, the new bridge is made in two halves, each half containing its own motor and switchgear.

With regard to the motors, there is nothing calling for a detailed description. Each machine is totally enclosed, compound wound and back geared.

The switchgear (by the Adams Co.) was designed to meet the following conditions:—10 sec. acceleration against full load; 10 sec. normal running; 10 sec. retarding and bringing to dead centre.

Each wing weighs 200 tons, which weight is accurately balanced on a centre pivot, this pivot being fed with oil under pressure. The retardation of this mass was a matter for anxious consideration: the question of wind pressure had to be considered, and the motors had to be capable of exerting full torque during a part of the last 10 sec. at a slow speed, if the ordinary momentum of the bridge was checked by an adverse wind.



Electrically-Operated Swing Bridge at Whitby.

The second part of the work includes the building of the two breakwaters and dredging, &c., and is being carried out by Messrs. Hill & Co., contractors, London. In this case space is again a consideration, and electric power has been adopted throughout.

The work is divided into two sections, East Pier and West Pier; each side has a railway with rope haulage, two cement mixers, a marine stage, and one sand pump which is used as required on either pier.

The railway and cement mixers have a 40-H.P. motor on each pier; the sand pump also requires 40 H.P.

The marine stages are not quite alike; the one on the West Pier has its spuds driven by ropes from the 25-H.P. motor on the travelling crane, which it carries. The East Pier stage has a considerable distance further to travel, and its spuds are driven individually by a motor and worm gear. These motors are of 7½ H.P. each, series wound, and controlled from one central switchboard.

All motors, starting switches and controllers were supplied by the General Electric Co.; they are of their ordinary semi-enclosed type, and housed over by a wooden cover and felting.

It may be of interest to know that these machines have given no trouble whatever. They were, of course, far cheaper in first cost than if totally enclosed, and it has been the writer's experience that on contracts of this sort, a rough-and-ready wooden hut is more suitable than a metal cover; the wood can be easily altered or repaired to suit conditions.

All the gear is on what is acknowledged as one of the most exposed parts of our coast, and has all been drenched with sea-water, but has not given any trouble. The motors have been in use about three years, and there has not, at the time of writing, been a single case of burnt-out armatures or coils.

Current for the work is supplied by the Whitby Council at the usual power rates; a small distributing hut is erected at the entrance to the works, a ·3-twin armoured cable had to be laid for about 500 yards, and is connected into the Flowergate sub-station. The supply to the East Pier is taken from the distributing hut by two V.B. marine cables, laid direct in sand: at sections where shale is exposed, a cut has been made in the shale, a layer of sand on the cable and a thin coating of cement gives good anchorage for these cables, the work of laying which was carried out at low tide, by Messrs. Callender's.

Current for the motors is conveyed down the length of the existing piers by aerial cables, ·1 stranded conductors;

these are carried on single wooden uprights, with pot insulators of the usual type.

The work is all sub-divided, and each section controlled by a Dorman & Smith water-tight interlocking D.P. switch and fuse. The sand pump is fed at various points through a D.P. 100-ampere size foolproof switch and plug.

The whole of the apparatus has proved most reliable ; a competent electrician has been constantly employed from the start, and no accidents from electric shock have occurred.

The whole of the electrical work, both for the bridge and for the harbour works, was arranged by the writer.

CENTRAL STATION VIEWS ON HOUSE WIRING.

Our contemporary *Electrocraft* recently contained some interesting impressions of the wiring problem obtained from a number of American supply managers by means of a series of questions sent round by the National Electric Light Association. Although it does not appear what, if any, portion of the replies emanate from municipal undertakings, they suggest that the American point of view is not widely different to our own, and certainly not more unanimous with regard to means for overcoming the first-cost difficulty, which alone to-day prevents the use of electricity from becoming general in houses of small and medium rating.

The question first in the list and in importance : Have you a system for aiding the consumer financially in wiring his house ? If so, what is it ?" is clothed in language which shows a nice regard for the feelings of the impecunious. It met with a negative reply in one-half of the 160 reports received ; from the remainder seven representative cases are given in detail. Five of them carry out wiring through the local contractors, one fears the financial risk, and one carries its own wiring department, which will suggest different reflections on the need of municipal wiring according to the mental bias of the reader.

The terms of payment described appear to be as follows :—

(*a*) Cash if possible.

(*b*) Hire agreement, option of purchase, monthly payments subject to landlord's or other guarantee.

(*c*) By instalments in 12 months subject to contract for supply by meter for three years.

(*d*) Twenty-five per cent. cash, balance on monthly payments plus $1.00 to supply department for carrying the account.

(*e*) By instalments in 12 months.

(*f*) Five lights, surface wiring free, against a minimum charge for energy of $1.00 per month for 12 months.

(*g*) Amount of wiring bill allowed as free supply within one year, three-year supply contract.

(*h*) This correspondent, controlling 75 undertakings, does not appear to have quite grasped the question. In 1909 his method of "aiding" the consumer consisted in getting quotations from local contractors for small house work, then canvassing the public and placing the contracts, presumably recommending those contractors whose quotations were approved of, as he goes on to say that the latter (the contractors), collected their accounts on a cash or other basis.

Apparently a little more "aid" was needed to secure desired results, for in 1910 the scheme was the same plus a commission to the contractor of $1.50 to $2.50 for each house, or 10 to 20 per cent. on cost of wiring ; the results are stated to have been very satisfactory. No doubt much peace descended upon the "financially aided" households after the electric light had been duly installed and paid for.

The prices quoted for this class of work are of interest :—

Five-light installations wired on surface at 5s. 3d. to 8s. 4d. per light in small towns, rising to 13s. in centres having a population up to 75,000 persons, cord pendants and carbon lamps being allowed for in these rates.

The wording of the replies suggests that the special facilities apply more particularly along the routes of existing supply mains. The value of these inquiries would have been greater if the current rates for electricity and gas had been printed with the answers.

The second and third questions were directed to ascertain the extent to which technical advice and general educative work was being carried out amongst the public ; out of 160 stations 125 replied that no such system was in operation—a surprising result. Unless these consist of very large communities, where presumably contractors and consultants are found in force, it would appear that British practice is in no way behind with regard to business getting. There are few undertakings now in this country without some system of following up possible consumers, and it is generally understood that the station staff can be called upon for free advice. Perhaps, if it were not free, it would be more frequently acted upon.

The selected replies are rather in the nature of counsels of perfection and hardly touch the first-cost problems. Most of the undertakings appear to give advice and to keep technical men to prepare wiring specifications and draw attention to electric utilities other than light. The ideal appears to consist in providing plenty of "outlets" in every part of the house, and ample conductor capacity to enable heating and mechanical devices to be used ; nothing is said with regard to metering or charging for such supplies, which makes it difficult to judge of the results attending the programme described.

The fourth query is of real interest, asking clearly if co-operation with contractors is undertaken, and how.

Forty-eight negative replies were obtained, the remainder, presumably 112, work with the local firms. A few representative answers show that technical advice is offered to them, and lists of approved firms are put before the public by the supply authority, which also takes up the technical aspect of the work with architects where possible. As is rightly pointed out, it is often possible for the supply engineers to make advice acceptable to clients and architects, where it would not be so if coming from a wiring contractor with a direct selling interest in the work.

One of the replies refers to a contractor who teaches his men to canvass and pays bonuses for results. This firm, as well as the supply undertaking, conducts regular gatherings at which lectures on current problems are given and technical matters discussed amongst the local electrical workmen. This most valuable practice should commend itself in this country, as has been suggested before in these columns ; it would well repay suppliers to make a determined effort to raise the status of all wiremen in their area. The ideas prevalent amongst some of the best workmen with regard to simple theory, and particularly with regard to the cost of using electrical apparatus, are often most grotesque, and give rise to misunderstandings on the part of the consumer which are slow to be discovered and difficult to remove.

A query on the subject of educating architects elicits 105 negatives, and a few sample replies from those who try to carry on this useful work appear to show that the profession must be approached with considerable tact if any good is to be done, which only goes to show that even an American may cling to his own mental outfit, although he carries out the principle of frequent scrapping with regard to everything else. It is without doubt well worth while to obtain the confidence of the local architects, who will generally be found open to receive schemes of lighting for use in their specifications, provided that the advice is put forward by a competent and experienced person, and the architect is allowed to deal with his client without interference on the part of the supply authority.

Questions 6 and 7 ask for an expression of opinion with regard to the influence of present costs on the wiring of houses.

Some two-thirds of the replies suggest that prices are not prohibitive in any general sense. Of the remainder, a few examples call for reductions ; one, apparently coming from Chicago, states that, owing to the rigidity of the local wiring rules, deferred-payment systems are necessary to enable persons of ordinary means to face the costs of wiring.

Another points out how frequent are the failures of contracting firms, due to lack of those business methods which can only be employed when a fair amount of working capital is available.

British and American wiring appear to have many characteristics in common.

Some costs for wiring old houses are given, $3.00 to $4.00 per point being quoted, with the suggestion that a reduction to $1.50 is needed to encourage the owners of old houses to have them wired and also to meet the purse of the "poorer class" of householders, *i.e.*, those earning £3 to £6 per week.

$1.50 is mentioned as an average figure for carcase wiring in new houses, which are apparently arranged for electric supply as a matter of course.

The last query concerns any system of wiring which is safe and cheap, and not at present recognised by the National Electrical Code.

One hundred and thirty replied that no such system was known; of the rest the samples are interesting. One asks for a well insulated flame-proof wire which may be pulled or threaded into the building without flexible conduit (presumably the cardboard tube called "loom") and for use with it a special type of "Branch" fuse, which can only be fused up to a certain capacity.

Three of the answers refer to the English "Stannos" system, which appears to be but little known, although attractive to the writers.

There are also references to "knob and tube" work, apparently meaning surface wiring on insulators, with tube ways through walls and partitions. There can be no doubt that this simple system is very suitable for many purposes; its nakedness secures to it a certain amount of care which makes for safety, and it cannot suffer from hidden faults caused at the time of erection, which are so often the cause of failure with the more elaborate metal-cased systems.

The inquiry, which is to form the basis of a hand-book for canvassers and the trade generally, is of interest, but reveals no striking improvement on our own practice, nor any greater development on the commercial side, whilst the growing stringency of American regulations suggests that we should hasten slowly in imitating those rough-and-ready methods which may have done something to promote the rapid growth of the industry in its youth, but which apparently are being discarded as rapidly as possible in its maturity.

EFFICIENCY IN FUEL COMBUSTION.

One-fifth of the coal raised in the United States, both anthracite and bituminous, is used by the railways, which form the largest single group of coal consumers in the land. The amount thus used amounts to 90 million tons annually, the number of locomotives being 51,000, so that a locomotive uses nearly 1,800 tons. This was Prof. Goss's estimate in 1906, and two years later the gross coal production was 410 million tons of 2,000 lb. each. It was estimated by the Federal Conservation Commission that nearly as much coal was lost in the getting. The present practice in the United States is thus like what our own practice once was; the coal owners are greedy and are putting out the more marketable qualities. What is left behind becomes lost, like the huge pillars left in Staffordshire.

In locomotive work not more than four-ninths of the coal represents heat in the steam formed, and with this and friction losses not over 5 per cent. of the heat value of the coal does useful haulage. We think this is over-stated, and should read not over 5 per cent. of the thermodynamic possible work.

The figures quoted are from an article in *Cassier's Magazine*, which quotes them from an address by Mr. H. M. Wilson, at Pittsburg. He urges better consideration of economies. The producer gas plant of to-day has an efficiency averaging 13 per cent. of the heat value of the fuel, and there are 500 producer plants in the United States, totalling up to 120,000 H.P. He points out that the waste culm banks at the anthracite mines have been proved to be a valuable source of fuel for producers as well as for boiler furnaces, if briquetted. So also has been proved unnecessary the fuel waste represented by blast furnace and coke oven gases.

Better mining practice should save 25 per cent. of the present annual coal output of 500 million tons, to which enormous total it has now grown.

The Federal Government have done much through the Geological Survey Department by way of helping on economy. They have instituted fuel-testing work and determined the best methods of briquetting coals, and have proved coals to possess coking property which only needed special treatment to bring it out.

In one public building in Washington a saving of £3,000 a year was effected by altering furnaces to burn buckwheat coal in place of furnace anthracite.

The American authorities have advocated the sale of coal on its calorific capacity basis, thus ensuring the sale of the cheaper grades, though the Government is accused, as regards the Navy, of fostering an aristocracy among the coals. For naval purposes, it is more justifiable to use the best coals, for the dirt in inferior coal oocupies space of more importance at sea than ashore.

At the Pittsburg testing station, coal is tested under horizontal return tube boilers, and standard makes of water-tube boilers. The furnace baffling is changed from time to time, and firing is done both by hand and machines of various makes. In this way, in a preliminary manner, have been determined the type and arrangement of furnace and its working methods, in order to secure best efficiency.

A bulletin has been prepared showing the analyses and heat values of nearly 5,000 mine samples, and with this an engineer can pretty well determine the sort of coal he can obtain in various parts of the country.

In producer testing, West Virginia coal gave an efficiency 3·3 times what it gave in steam generation, and the lowest grade of lignite in the gas producer beat the best steam coal burned under a boiler. In briquetting, the binder is usually pitch to the extent of 5 or 6 per cent. The mixed mass is heated and put under a pressure of 1 to 2 tons per sq. in. Certain lignites briquetted under great pressure—about 9 tons per sq. in.—were hard and firm like anthracite. Lignite costs 4s. a ton at the pit mouth, and with 2s. for binder and labour, a product costing 6s. is saleable at 10s.

It is stated that in the Western States there are millions of acres of these lignites. An advantage of lignite briquettes is that they can be stored for any reasonable time, and may so be employed to reduce the suffering which results when heavy snow shuts off the supply of fuel in certain localities. But all these finds of fuel, and the most rigid of fuel economy, cannot avail for ever to prevent the approach of the ragged end of a rope of coal supply which is travelling past at a rate of 500 million tons a year.

Over a million tons a day!! Tipped out of an ordinary cart, in touch with each other, these tipped heaps of coal would extend every day a distance of 1,200 miles. Even the stored coal of the United States cannot endure for ever. That it will last our time is certain. Potato-grown alcohol and the cumbrous tidal mill form the staple comfort of posterity to-day. It may be that posterity will laugh at our present day care for posterity in this respect. At least, we will hope so, for the sake of posterity.

"Foster" Festivities.—On the night of December 22nd the Foster Engineering Co., Ltd., celebrated the opening of their new metal lamp factory extensions by means of a tea and concert—the first entertainment of its kind. Both events were a distinct success. Earlier in the day the lamp-capping department was cleared and tables brought in. At 5.30 p.m., when about 300 sat down to tea, the aspect of this room was entirely changed. Apart from definite fixtures, such as annealing furnaces which it was found impossible to remove, one could not recognise the place, which in the ordinary every-day life resembles a human bechive, so transformed was it with holly and evergreens, to which the tinted shades and lamps lent a pleasing note of colour. After the meal, which was served to the accompaniment of music befitting the season, all adjourned to the lamp testing department, where an impromptu stage had been erected. Here, for the space of a good three hours, various members of the lamp factory held the stage in turn. Half way through the evening a bouquet was presented, on behalf of the hosts, to Mrs. Grote, the wife of one of the directors. Mr. Grote, in replying, referred to the kindly feeling that characterised the relations between all departments, individuals, and especially between the directorate, staff and works. "This," he said, "was not only exceedingly gratifying from a personal point of view, but it also expressed one of the essential factors in commercial success, *i.e.*, co-operation."

BUSINESS NOTES.

Book Notices.—*Who's Who*, 1912, 10s. net; *Who's Who Year Book*, 1912-13, 1s. net; *The Writers' and Artists' Year Book*, 1912, 1s. net; *The Englishwoman's Year Book and Directory*, 1912, 2s. 6d. net. London: Adam and Charles Black.—Experience in the past has convinced us of the great usefulness of this series of books. In many business offices, and, of course, in private libraries, they are practically indispensable if one desires to be up-to-date in one's information respecting well-known men and women of to-day. To most writers they are constantly necessary as works of reference. The biographies in *Who's Who* are corrected up to August 31st, 1911, and in the *Who's Who Year Book* are the tables which used to form part of the contents of *Who's Who*, relating to peers, members of the House of Commons, dignitaries of the Church, Consuls, law officers and others of eminence, also a directory of clubs, schools, colleges, societies, &c. The value of the *Writers' and Artists' Year Book* is seen at once when we say that it tells the character of the articles accepted and published by principal journals and magazines. The last of the set has a large field all its own, its contents being of the kind that every woman—whether our wives, daughters or whatsoever relations—ought to know, for it tells of educational, professional and social life and philanthropic effort so completely as to form an excellent guide for every woman who wishes to know the organisations and facilities that are available to assist her to secure her way to healthy, active life, and intellectual and beneficent career. As we have said before in announcing these books, they would form an excellent New Year gift.

The Commercial Year Book of the Birmingham Chamber of Commerce, with Trade Index and Trade Mark Section. Bemrose and Sons, Ltd., Midland Place, Derby.—We have received a copy of the fourth edition of this volume, which is an exhaustive, classified trade index, in English and French, to Birmingham manufacturers, and contains a full account of the industries of Birmingham and district, prepared for the instruction of merchant importers and buyers in all parts of the world. There is an introduction by Mr. H. W. Sambidge, the President of the Chamber, followed by a vast amount of matter concerning British import and export trade, iron and steel consumption and production in various countries, shipping, and information of a general kind concerning foreign money, weights and measures, certificates of origin, and so forth. We understand that the Year Book has a valuable circulation in the home and foreign markets

Hazell's Annual, 1912. Edited by Hammond Hall. London: Hazell, Watson & Viney, Ltd. 3s. 6d. net.—This is a very old and well-tried friend. It has reached its twenty-seventh annual issue, and this edition is revised to November 25th, 1911. It claims to give the most recent and authoritative information on the topics of the day, and to be a record of the men and movements of the time. With so wide a ground to cover, a good index is essential, and the number of entries therein has consequently been again enlarged, the references alphabetically stated being over 7,000. In many respects, 1911 has been a full and remarkable year; therefore, many new articles have been added. It is impossible to even attempt to particularise the vast variety of subjects—political, scientific, trade, and so forth—that are covered by different writers; indeed, it should not be necessary in the case of so well known a work. Electrical and engineering progress are briefly reviewed, as are also scientific progress, telephone statistics, motors and motoring, tramways and railways.

The Law of Contracts. By D. Aikenhead Stroud, LL.B. London: H. Alabaster, Gatehouse & Co. 6d. net.—The author of this pamphlet should by reason of his official position in the Solicitor's Department at the G.P.O. have a very complete and special knowledge of the subject of contracts, large and small, and therefore should be recognised as an authority. The contents of this study of the matter formed a lecture delivered last year before the Institution of Post Office Electrical Engineers, the treatment being divided up into sections as follows:—Offer and acceptance; lapse and revocation; form and consideration; mistake, fraud and misrepresentation; interpretation; breach.

The "*Journal* of the Tramways and Light Railways Association" for December contains the full reports of the Board of Trade on the Lewisham and Birmingham tramway accidents, an abstract of the report by the London Traffic Board of the Board of Trade for 1911, and some Notes on Railless Traction.

Temperature Indicator Patent.—We have received from Mr. William Rudd, solicitor, of Liverpool, the following communication:—"Letters Patent No. 15,831, of 1908.—I shall be obliged if you will allow me, as solicitor for Mr. Arthur Barry, of this city, to make public the fact that the licence granted by him to George William Clarke, for the . . . manufacture of the 'Barry patent distant temperature indicator-recorder and alarm,' under the above letters patent, was cancelled as one of the terms of the settlement of an action in the Chancery of the County Palatine of Lancashire (Liverpool District) 1911, Letter B, No. 707, in which the said Arthur Barry was the plaintiff, and G. W. Clarke & Co. (Liverpool), Ltd., were the defendants. The manufacture of the above apparatus is now carried on by Distant Recorders Co., of 13, Rumford Street, Liverpool."

Meter Approved.—The Board of Trade recently approved of the single-phase A.C. induction wattmeter, type R H, submitted by the British Thomson-Houston Co., Ltd. It will be remembered that a short time ago their M H mercury ampere-hour-meter (continuous current) was also approved.

Trade Announcements.—For the convenience of their electrical customers in London, the Adams Manufacturing Co.'s London business has been transferred to Balfour House, Finsbury Pavement, London, E.C., to which address all communications regarding Adams Igranic motor-controlling apparatus should be directed. Telephone, No. 841 City; telegrams, "Admocar, London."

Messrs. Moncrieff P. Ford & Co., of Colmore Row, Birmingham, have taken more commodious premises, owing to increasing business, and from January 1st onwards, their addresses will be 12, Bromsgrove Street, and 64-65, Dean Street. A large showroom, facing into both thoroughfares, is being fitted up for the display of machine tools, &c. (both English and American), in operation.

Messrs. G. Birch & Co., of Islington Tool Works, Islington Grove, Salford, Manchester, have converted their firm into a private limited company. Mr. Ernest Hollings becomes managing director, and Mr. T. Fletcher Robinson, the manager of the old firm since the death of the founder of the firm 11 years ago, has been retained as chairman of directors.

Bankruptcy Proceedings.—Wm. Henry Howard, electrical engineer, 5, Featherstone Buildings, Holborn, lately carrying on business as "The Holborn Electrical Co."—Under this failure a sitting for his public examination was held last week before Mr. Registrar Hope at the London Bankruptcy Court. The statement of affairs disclosed liabilities £506, and assets book debts amounting to £78, but returned as irrecoverable. Questioned by Mr. G. W. Chapman, Official Receiver, the debtor stated that he commenced business in 1900 without capital, in partnership with another person, as a jobbing electrical engineer at 60, Red Lion Street, Holborn. The partner retired in 1903, and witness continued the business alone as the Holborn Electrical Co. and as Howard & Co., successively at 18, Red Lion Street; 49, Lamb's Conduit Street; 1, New Oxford Street; 5, Featherstone Buildings; 64, Red Lion Street; and again at 5, Featherstone Buildings. About three years ago he sued the landlord of 1, New Oxford Street, for damages for trespass in connection with repairs to the roof of the building, but judgment was given against him. During the course of the action, his business fell away, as he could not give it proper attention, and he eventually closed it in April, 1911. He had since been employed as a canvasser for an electrical supply company. In 1909, his solicitor obtained judgment against him for the costs of the action, and also, in May last, an order for payment by instalments of £2 a month. Witness was unable to pay the instalments, and on committal proceedings being started, he filed his petition and obtained a receiving order on November 1st. Witness attributed his failure to want of capital, to the general falling away of business during the last three years, owing to competition by the electrical supply authorities, and to the adverse result of the action before mentioned, with the consequent liability for costs. The examination was concluded.

W. R. N. Gard, electrician, 65, Kingsley Avenue, Ealing, late Orchard Electrical Works, Orchard Street, Canterbury.—The adjourned public examination was held at the Court House, Half Acre, Bradford, on Tuesday last week. The ranking liabilities were put at £283, and the assets were estimated to produce £5. The failure was attributed to want of capital and bad trade. Debtor said he had expected to meet his liabilities from future earnings as a telephonic engineer. He admitted that he first became aware of his position in 1906, and he stated that £98 of his unsecured liabilities were due in respect of loans made between 1905 and 1909, the balance being in respect of trade debts. The examination was closed.

Bertram Newman (trading as B. Newman & Co.), 4, Cranbrook Road, Ilford, Essex, electrician.—The receiving order herein was made on a creditor's petition, and according to the accounts filed, the gross liabilities amount to £1,072, of which £853 is expected to rank for dividend, and the assets are estimated to produce £3 16s., leaving a deficiency of £849. It appears that the debtor started trading in April, 1908, in partnership with another, trading as Ward and Newman, at Ley Street, Ilford, his father purchasing a share in the business for him for £60. In October, 1908, the partnership was dissolved, and the liabilities were discharged, and the debtor started trading at 4, Cranbrook Road, Ilford, for which purpose he borrowed £100, about £50 of which has been repaid. Debtor executed a deed of assignment in April, 1910, to secure a composition of 20s. in the £ to his creditors. The composition is stated to have been duly paid. Two creditors had obtained judgment against the debtor and two others were suing him at the date of the receiving order. About the end of August, 1911, the debtor's father distrained upon his effects at 4, Cranbrook Road, Ilford, for about £40 rent due to June 24th, and the goods were sold by public auction for £31. The failure is ascribed to bad debts, and the debtor admits knowledge of his position since July, 1911. The only book of account kept is debtors' and creditors' ledgers. The fully secured creditors hold charges on a book debt.

The B.T.-H. and Illuminating Engineering.—In order to ensure the installation and use of lamps on correct principles, the British Thomson-Houston Co. has organised an illuminating engineering department as a permanent branch of its organisation. The company has been led to take this step, through the fact that the illumination results obtained with its Mazda lamp can be multiplied when it is installed on scientific lines. Under existing conditions, the full value of the new light is seldom realised, because of want of knowledge on the part of the public of scientific illuminating principles. The lighting efficiency of the lamp is frequently materially impaired by masking it with unsuitable shades, or by the use of reflectors which distribute the light in the wrong directions. Many users of the metal-filament lamp, for instance

are clearly not aware that one of the principles of its employment is that it should be placed well above the line of vision, and its light properly diffused and reflected upon the working plane.

The new undertaking of the British Thomson-Houston Co. may be divided, broadly, into two parts. The first is purely educational, and mainly consists in placing at the disposal of architects, consulting engineers, electrical contractors and others, rules and instructions which will enable them to deal unassisted with the general lighting of interiors. Where special problems are involved, the illuminating engineering department of the company will freely afford expert assistance. These instructions have been issued by the company under the general heading, "Ready Rules for Lighting Work," and consist of simple explanations how to secure effective and efficient illumination, so as to obtain greatly improved lighting results.

The company has also produced a series of complete lighting units, composed of scientifically designed reflectors and Mazda lamps. The reflectors supplied by the company are divided into three types. The first gives a concentrated stream or focusing distribution of the light. It throws an intense light over a comparatively small area, and is adapted to the illumination of rooms or interiors having lofty ceilings. The second type, the "Extensive Reflector," distributes the light in a widespread spray with a maximum intensity at about 45° from the vertical. This class is suitable for rooms with low ceilings compared with length and breadth and analogous conditions. The third is known as the "Intensive Reflector." This gives a light distribution midway between the focusing and extensive reflectors, and is intended to illuminate uniformly interiors such as large shops, restaurants, public rooms, &c., or when the lamps are arranged in chess-board fashion on ceiling.

These three types of reflectors are considered to fill practically all requirements met with in general lighting practice. With the selection of the proper class of reflector, and the correct placing of the units as regards type and distance apart, it becomes a simple matter to secure even and economical illumination under all ordinary circumstances. The reflectors are supplied in two varieties, prismatic glass or metal, the latter having the trade name of "Mazdalux." The complete lighting unit of lamp, reflector and gallery is known as the "Mazdalier." A copy of the "Ready Rules for Lighting Work" can be had free on application to the British Thomson-Houston Co.

Dissolutions and Liquidations.—The Electrical Trust, Ltd.—This company, at meetings held at 9 and 10, Pancras Lane, E.C., has resolved to wind up voluntarily, with Mr. H. G. Ash as liquidator. Creditors must send particulars of debts, &c., to Mr. Ash, 13, Finsbury Circus, E.C., by January 31st. A meeting of creditors is called for December 29th (to-day).

Electric and General Assurance, Ltd.—This company is winding up voluntarily, with Mr. Lionel Maltby, 5, London Wall Buildings, E.C., as liquidator. A meeting of creditors is called for January 8th at 5 and 6, Bond Court, Wallbrook, E.C.—Claims should be sent to the liquidator (Mr. L. Maltby) at once.

Raworth's Traction Patents, Ltd.—This company is winding up voluntarily, with Mr. F. J. Riches, 24, Basinghall Street, E.C., as liquidator. A meeting of creditors is called for January 2nd

John Musgrave & Sons, Ltd.—A meeting of creditors will be held at the Central Hall, Acresfield, Bolton, on January 3rd.

Teleautograph Co., Ltd.—A meeting is called for January 29th, at Pinners' Hall, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. F. A. Bagnall.

Lancashire Electrical Co., electrical engineers, 35, Dickenson Street, Manchester, and Chorlton-on-Medlock.—Messrs. L. Bradbury and G. B. Broughton will continue the business and attend to debts, the partnership, so far as concerns Sylvester Bayliffe, having been dissolved.

Kevan Electric Co., Ltd.—January 10th is the last day for the receipt of proofs for dividend by Mr. H. de Vaux Brougham, 33, Carey Street, W.C.

The Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd.—This syndicate is winding up voluntarily with Mr. F. L. Muirhead, Elmers End, as liquidator. A meeting of creditors will be held on January 8th, at 2, Wardrobe Place, Doctors' Commons, E.C. Creditors must send the usual particulars to Messrs. Farrar, Porter & Co., at that address, by February 14th.

Nye & Co., motor dealers, electricians, and dealers in electrical apparatus, 69, Leather Lane, and 138, Gray's Inn Road, Holborn.—Messrs. R. G. Nye and P. J. Budge have dissolved partnership. The former attends to debts and continues the business.

Calendars and Catalogues.—The Electric Construction Co., Ltd., have issued to their friends a very neat and useful little vest-pocket card and stamp case, with a diary for short engagement notes.

The North-British and Mercantile Insurance have issued a new hanging calendar with perpetual date-cards.

Messrs. Alfred Herbert, Ltd., Coventry, have again favoured us with a copy of their clearly-printed monthly sheet calendars for 1912. Each sheet bears half-tone illustrations of the firm's machine tools. They have also issued a catalogue of over 40 pages of excellently illustrated descriptive matter regarding their automatic lathes.

Messrs. Simplex Conduits, Ltd., have sent us examples of thei pocket diaries, in two forms—as a refill, and as a bound pocket-book The diary, as we know from a year's trial, is of a most convenient form, and contains in addition to the ample memoranda section particulars and prices of the company's well-known specialities and numerous tables and data of great use to engineers and contractors.

Messrs. Hayward Tyler & Co., Ltd., of 99, Queen Victoria Street, London, E.C., have again prepared for their friends their well-known pocket diary for the coming year. As usual, there are a number of useful tables of memoranda relating to water supply, and illustrated particulars of some of their pumping and other machinery.

From Messrs. Haslam & Schontheil, Ltd., of 11, Windsor Place, Cardiff, we have received a handy engagement pad for 1912, with an artistic stamped metal design on the front cover.

From the Union Electric Co., Ltd., of Park Street, Southwark, S.E., there have come to hand several desk note-taking blocks bearing the compliments of the season. The company has also just issued a new list, No. 5,025 (16 pages), wherein are given illustrated particulars, also tabulated sizes, prices, and code-words for Union direct-current motors of from ¼ to 50 H.P.

The Universal "Big-Figur" calendar received from Messrs. W. V. Waite & Co., Ltd., 31, Queen Street, Cardiff, has daily tear-off slips indicating the date clearly in large red figures.

St. Helens Cable and Rubber Co., Ltd., Warrington.—Card showing the use of cab-tire sheathed flexible in dangerous situations, with useful data for easy remembrance on the reverse side.

Greece.—Amongst recent orders received by Messrs. J. W. Brooke & Co., Ltd., is one from the Greek Government for six sets of 25-H P. "Brooke" marine motors, and full equipment of reverse gears, tail-shafts, propellers, &c., for revenue boats for use amongst their islands, and also for the same boats six searchlight plants, to consist of combined 4-H.P. "Brooke" motors with dynamos on cast-iron base-plates, necessary switchboards, and 6,000-C.P. projectors. Messrs. Brooke report that orders in hand at present exceed those that they have ever had in hand at one time.

LIGHTING and POWER NOTES.

Aylesbury.—The U.D.C. has decided to apply to the B. of T. for a prov. order for electric lighting without committing itself to all the details. The Council has adopted a scheme submitted by Mr. Philip Dawson.

Barking.—A L.G.B. inquiry was held on December 21st into the application from the U.D.C. for a loan of £11,000 for electricity purposes. There was opposition on the part of ratepayers, it being alleged that the loan was required "to bolster up the undertaking," and on the ground that the average price realised for energy was only 1·8d. per unit, whereas the cost of production was over 2d. per unit. For the Council, it was urged that the scheme was put forward in order to reduce the working expenses.

Blackpool.—A revised estimate of the cost of the proposed extensions to electric lighting and tramway plant necessary to meet the demands of the coming summer has been submitted; the original estimate was for £12,000, but since obtaining tenders this has been reduced by £2,000. The Finance Committee will be asked to obtain sanction for the necessary loan.

The whole length of the Promenade is to be lit with flame arc lamps; the proposal affects 140 lamps, and the cost will be £1,350.

Burnley.—A special meeting of the T.C. to consider the question of supplying electricity to Reedley Hallows was held on December 21st. Alderman Emmott said that the Salford Corporation was promoting a Bill to supply gas to outside districts, and the question of profits had been raised. Would the provisional order Burnley was seeking affect them as to profits made if they supplied an outside district with electricity? Mr. Garratt (Deputy Town Clerk) said Reedley Parish Clerk had asked certain questions, and one of these was the price at which it was proposed to supply current. He did not think the question would assume the same proportions as it had done at Salford in regard to gas. The resolution for the provisional order was carried.

Buxton.—The U.D.C. has received the sanction of the L.G.B. for loans of £280 for E.L. mains; £235 for services; and £198 for meters.

The U.D.C. has decided to support the Bill of the I.M.E.A., and to contribute up to £3 towards the costs.

Canada.—According to the *Board of Trade Journal* an extension of the street lighting system, at a cost of about £36,000, is contemplated in a town in Western Canada. It is proposed to form a company, being a merger of several existing companies, to set up power works and supply electrical energy over a large district of Nova Scotia.

The authorities of a town in Ontario propose the extension of the municipality's hydro-electric system, at a cost of about £277,700.

Doncaster.—A special meeting of the T.C. has formally approved of the memorial to the B. of T. for a provisional order in connection with the supply of electricity to Wheatley.

Douglas (Isle of Man).—The T.C. has asked the Manx Electric Co. to submit terms for a supply of current in bulk. In the meantime, steps are being taken to ascertain the probable number of consumers and the quantity of current required, together with the cost of wiring premises.

(*Continued on page* 1071.)

WORCESTER ELECTRICITY SUPPLY DEVELOPMENTS.

Having passed through many vicissitudes since its inauguration in 1894,* electricity supply in Worcester seems at length to have fallen on brighter days. In the first place, high hopes were based on the utilisation of the water power of the Rivers Severn and Teme. Opposition from the River Authority prevented the erection of a station on the Severn (which is, as a matter of fact, very unsuitable for the present purpose). A water-power station was ultimately erected at Powick (2½ miles from the centre of Worcester), and, despite inherent limitations due to summer drought and winter flood, has been much improved in later years. As is the case in so many hydro-electric undertakings, the heavy capital burden on the Powick installation remains a serious handicap on its profitable operation.

When the limiting capacity of the Powick station was reached in 1903, it was decided to erect a purely steam-driven station in Hylton Road (on the bank of the Severn, and near the centre of Worcester).† This station operates in parallel with the Powick plant, and has itself been considerably extended, now comprising seven Belliss and Morcom engines driving E.C.C. alternators and Bruce Peebles dynamos. The present general appearance of the

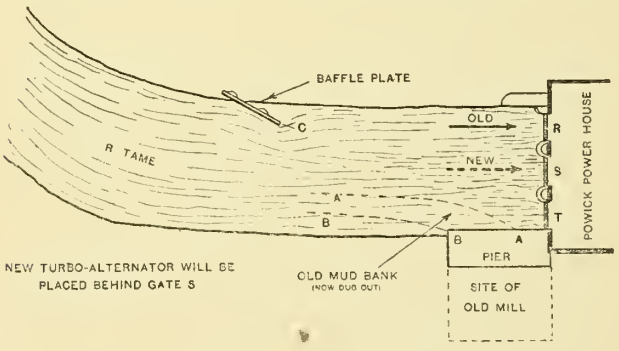


Fig. 1.—Alterations in Bed of River Teme, at Powick.

power-house, containing 3,300-B.H.P. generator capacity, is shown in fig. 2.

The original Powick station contained only single-phase generators, but the mooted electric traction developments (since realised) led to the Hylton Road station being arranged for D.C. supply, with only such motor-alternator equipment and A.C. switchgear as would allow of the co-operative working of the two stations. During the past six years preparations have been made for the ultimate substitution of two-phase 50-cycle A.C. for the original single-phase, 100-cycle supply, and, with this end in view, all the station switchgear, transformers, alternators and motors installed during this period have been designed to facilitate their conversion to two-phase working at minimum expense. Additional power connections henceforward will be to the two-phase mains whenever possible. Eventually, the Powick and Hylton Road stations will supply only direct current and two-phase alternating current (50 cycles), but, for some years to come, the undertaking will also supply a large one-phase 100-cycle demand.

Such an important change in the supply system has naturally necessitated considerable alterations in the equipment of both generating stations. It is worthy of note that the whole of the alterations to buildings, construction and installation of switchgear, and alterations in, and installation of, old and new machinery, is being conducted by the department's own staff. The wisdom of such a policy, enabling, as it does, the permanent maintenance of a large skilled staff familiar with the whole equipment, is evidenced whenever alterations or extensions are to be effected.

During the past five years great improvements have been made in the river bed above and below the Powick station, with a view to increasing the total output available and the regularity of the same. At the time of the visit of our representative the alterations indicated in fig. 1 were approaching completion. Hitherto the flow of the stream has been largely concentrated on the left hand sluice R, and a mud bank had gradually formed at A A, further reducing the output obtainable at sluice T. By means of a wooden baffle plate C, projecting into the stream as shown, it is hoped to deflect the centre of flow to S, meanwhile adhering to a new batter line B B.

As the result solely of the improvements in the head and tail races, it was found possible to run one 30-in., one 48-in., and two 54-in. turbines simultaneously for the greater part of last winter at Powick. It is expected that this record will be again broken as a result of this summer's work on the river bed.

During the spring and autumn, the flow of the River Teme at Powick varies from 20,000 to 60,000 cb. ft. per minute, the average head being 10 ft. Owing to the restricted area of canal to the works and the limited power of the turbines, only 26,000 cb. ft. per minute can be utilised. Under these conditions, the output of the station reaches 3,500 B.T.U. per day. In summer, the flow of the river greatly diminishes: water is then stored during the day for use from midnight to 7.0 a.m. for public lighting and general night supply. The costs at the steam station are thus materially reduced. Under these circumstances, the mean effective head of the stream is 10 ft., and the daily output from Powick, 250 B.T.U. During the weeks of extreme flood, the Powick station is entirely shut down, but a great improvement in the output during the remainder of the flood season has been lately effected by the installation of a 70-KW. D.C. generator, which, by its wide range of field excitation, allows of the maintenance of sufficiently steady terminal voltage. With this D.C. machine there is, of course, no question of a "synchronous" speed (the necessity for which is responsible for the difficulty of operating A.C. machines by turbines subject to variable head). During the five months' flood season of 1910-11, this set increased the station output by 75,000 B.T.U.

A new turbine is soon to be installed for driving a 250-KW., two-phase, 50-cycle alternator. Provision will be made for varying the speed ratio between the turbine and alternator shafts, so as to compensate roughly for the variations in turbine speed due to alterations in the available head of water. The turbine will pass about 20,000 cb. ft. of water per min. at full load, and will have four runners arranged in two pairs, only one pair being in service at times of reduced flow. Maximum annual efficiency will thus be secured on the new equipment.

The old mill at Powick, which shared the water power with the electricity station, has now been removed and its buildings have been demolished. On its new site the mill employs 30 electric motors, totalling about 140 H.P. output.

The present equipment of the Hylton Road station includes one compound and six triple-expansion Belliss & Morcom engines (fig. 2) supplied by four B. & W. boilers, with chain-grate stokers, burning slack and small nut coal (10s. 6d. per ton), with natural or slightly forced draught.

A 125-KW., two-phase, 50-cycle alternator is to be added in the main engine room, and a second 200-KW. motor-generator will be erected in an outhouse adjoining the engine room. The latter machines, together with the 250-KW. set at Powick, will supply the two-phase load (supply for the motor-generators being taken from the lighting or traction

* Electrical Review, Vol. XXXV, pp., 441-446; Vol. XL, pp. 443-444.
† Electrical Review, Vol. LII, pp. 881-883.

bus-bars), and will be supplemented at a later date by two 400-kw. steam alternators (converted to two-phase). The motor-generators will connect the d.c. and the a.c. supply systems, balancing on the d.c. side and correcting power factor on the a.c. side.

Under the management of the city electrical engineer, Mr. C. M. Shaw, the supply of various classes of consumers has been vigorously pushed on. Though the Worcester Corporation has not joined the Joint Publicity Association, a consumers' department and a limited scheme of canvassing and general publicity have already been adopted, and with such marked success that further developments may be expected at an early date.

The City of Worcester is essentially conservative, and is certainly not a manufacturing centre. The city is market town for the surrounding country, and, though this fact is responsible for its commercial prosperity, it does not especially favour the development of electricity supply. Yet, under comparatively unfavourable conditions, extraordinary developments have recently been made, and there is every sign that still more rapid advances will be made in the near future.

In 1894 it was a matter of congratulation that the town waterworks employed two 30-b.h.p. asynchronous motors (which, by the way, are still in everyday use), but Messrs. Heenan & Froude alone are now installing 400 h.p. of motors. Most of the manufacturers in the town have adopted, or are contemplating, electric drive for their machinery; and, in all, over 200 motors (totalling over 1,000 h.p.) are in present use, while from £500 to £750 worth of power business is in immediate sight (excluding Messrs. Heenan & Froude's installation). As regards generating economy, the total station cost per b.t.u. was 1·88d. in 1905, as against 0·92d. per b.t.u. in 1911.

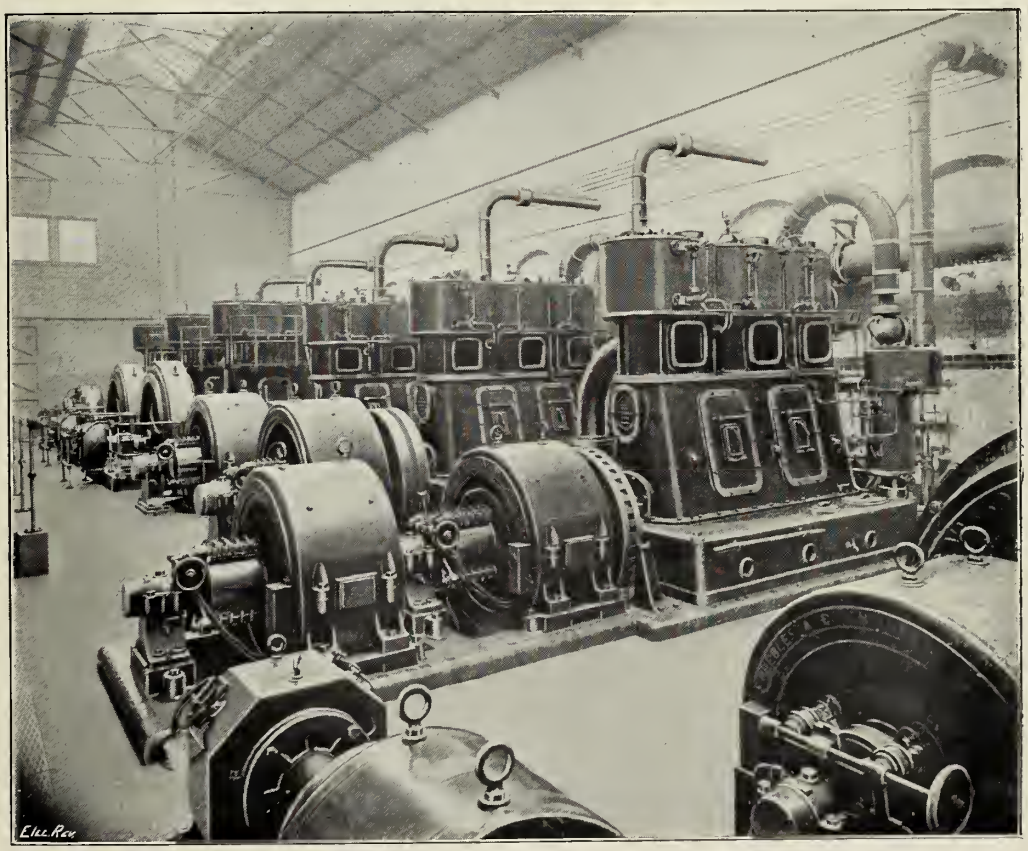


Fig. 2.—Hylton Road Station, Worcester: Interior of Engine Room.

As regards street lighting, the Corporation has powers to attach street lamps to the tramway company's trolley poles, and this licence is utilised to the full. A very handsome and effective type of metallic-filament lamp fitting comprises four 100-c.p. Osram lamps covered by a specially designed white enamelled reflector (three lamps are at the apices of an equilateral triangle, the fourth is placed centrally and at a slightly lower level). Arc lamps are employed for lighting the main streets of the city. Alternate poles are provided with d.c. and a.c. arcs respectively: the d.c. arcs are extinguished at midnight, but the a.c. lamps burn till dawn. So steady is the running of the latter, and so perfect the gradation of the two sets of globes, that it needs a special test to distinguish between the d.c. and a.c. arcs.

In the outskirts of the city two 50-c.p. metal-filament lamps are attached to each trolley pole, and are supplied by a bare two-wire overhead line (see fig. 3), fed from the ordinary lighting mains at various points. In the pole here illustrated, the feeder connecting box, lamp fittings and general wiring are clearly visible.

Various very neat and efficient types of street corner lamp brackets, with distributing top reflectors, are used, and a specially elaborate fitting for six 100-c.p. Osram lamps (on top of a convenience at the centre of cross roads) is illustrated in fig. 4 herewith. A life of 3,000 burning hours is frequently exceeded by the metallic-filament lamps used for street lighting in Worcester.

There are already some 12 miles of bare overhead wiring in use for street lighting on the above system, and trial is now to be made of a simple type of wooden pole carrying two wires on telephone-type insulators for the lighting supply of outlying residential districts. These poles will each carry a 50-c.p. metal-filament lamp for street lighting, and will be placed 50—60 yards apart. An earthed guard wire on the overhead line side of a 1/1 transformer will be used as a switching lead for the pole lamps, suitable groups of the latter being controlled by Venner time switches. In special cases, lamps will run all night. A 200-yard length of such a line is undergoing observation, and if the system is approved, some 10—15 miles will be erected in the near future.

In interior house wiring, surface flexible leads, carried by wooden or porcelain cleats, are often employed. High quality material is used, but no special mechanical protection is provided. The wires are finished to match their surroundings, and form an ideally cheap and inconspicuous installation. No serious mishaps have yet been attributable to this wiring system, and the construction is accepted by all the insurance companies concerned.

As regards the main supply feeders to various localities, lead-sheathed, paper-insulated cables drawn into conduits or laid in bitumen are being used for all extensions. The original high-tension single-phase mains from Powick to Hylton Road, insulated on the Brookes oil system, are still in use. The outside of the w.i. containing-pipes (which were not galvanised), is slightly pitted, but the tubes will stand for several years longer before extensive renewals become necessary. Meanwhile the only attention required is the occasional make-up of the slight oil leakage from the various section boxes.

Not the least remarkable feature of the Worcester undertaking is the fact that all the important developments noted above have been *paid for out of revenue*. Since 1905 about £9,200 has been charged to revenue for items which undoubtedly come under the heading of capital expenditure. This unusual policy is very favourable to the future prosperity of the undertaking, but it has naturally

handicapped the department during the last six years. With higher capital powers, the electricity department would have made more rapid progress, and the Corporation was only deterred from seeking extended borrowing powers through a desire to reduce the abnormal capital debt on the original works. Under the circumstances, the financial policy adopted is undoubtedly sound, though it has resulted in a net deficit to date of £777.

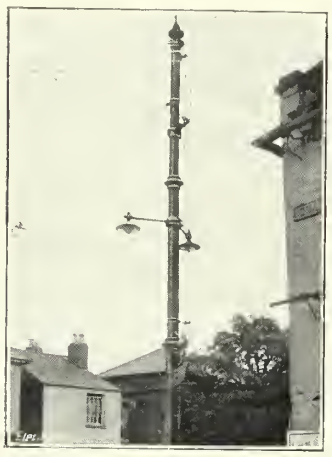


Fig. 3.—Lighting Mains and Feeder Box on Tramway Pole.



Fig. 4.—Special Lighting Fitting at Cross Roads.

In such an old-established undertaking, the introduction of the metallic-filament lamp was keenly felt: its effect has been about £5,000 total loss of revenue, and the temporary reversion from a hardly-won profit (in 1907) to a loss. The crisis is now past, and a period of exceptional development and prosperity lies before this historic station.

Our thanks are due to Mr. C. M. Shaw, city electrical engineer, for his kind assistance in collecting the above information.

Electrometallurgical Progress in Sweden and Norway.—According to a contract with the Waterfalls Authorities, the Elektrotermiska Aktiebolag, Trollhättan, has since 1910 hired 7,000 H.P. from the Trollhättan Waterfalls. The company has now entered into a new contract for the hiring of a further 10,000 H.P. over the period from 1912 to 1940 at a fixed price of 35s. 6d. per H.P. per annum. At the same time it has been decided to increase the company's capital from £33,333 to £100,000, for which shares are to be issued, which will be taken up by the mother company, the Hydraulic Power and Smelting Co. It is intended to employ the additional capital in extending the works and the production. Large factory buildings are already in course of erection, and the work is being pressed forward with all possible speed. The whole of the production from the zinc-ore mines of Saxberget, amounting to about 10,000 tons of roasted zinc-ore per year, has already been contracted for, but as the capacity of the works after the completion of the extension will amount to 35-40,000 tons per year, the company will have to rely upon imported ore to a great extent. The Zinc Works are estimated to be capable of producing 12 to 15,000 tons of zinc, and 3,500 tons of lead per annum, when worked to their full capacity. The stipulated price of the electrical energy is very low, but in view of the fact that the Trollhättan Electrical Works at present are capable of producing more energy than they can dispose of to the industry, the contract is considered as being advantageous to both parties. The increased activity will be of great importance to the traffic of the new Trollhättan Canal, which has recently been constructed, and which connects the large lake of Venern with the sea.

At the last general meeting of the Ringerike Nickel Works in Norway, it was decided to authorise the directors to sign a contract for the delivery of the whole output of ore from the mines to the Kristiansand Electrical Refining Works. The working of the mines, which have been lying idle for years now, will be started in the spring, and electricity will be employed in the mines for most purposes. The energy is to be supplied by the Vikesunds Electrical Works.

NEW ELECTRICAL CRANE INSTALLATION AT THE GRIMSBY DOCKS.

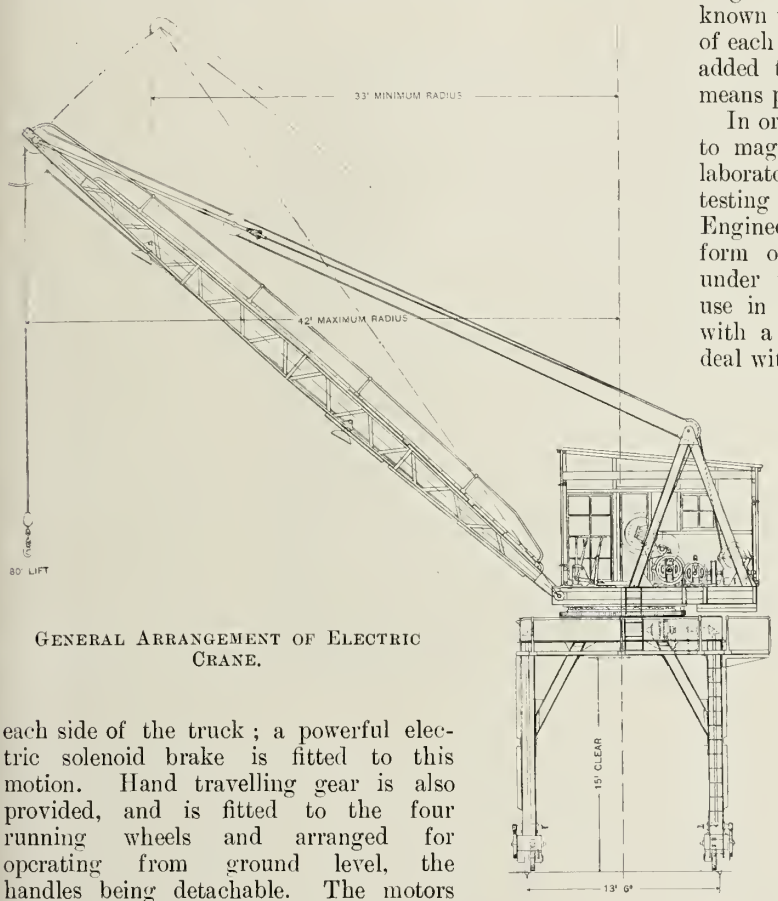
An installation comprising three 2-ton electric jib cranes has recently been provided by Messrs. Stothert & Pitt, Ltd., of Bath, on the north side of the Great Central Railway Co.'s Alexandra Dock at Grimsby. These cranes, which we illustrate in the accompanying figures, are capable of lifting 2 tons at a maximum radius of 42 ft., and are fitted with the motions of lifting, slewing, jib-derricking and travelling, each operated by a separate motor. Hand-travelling gear is also provided. The cranes are mounted on a truck 13 ft. 6 in. centres of rails, with a clear head-room between the legs of 15 ft. The speeds of the cranes are as follows:—Lifting, 2 tons at 150 ft. per minute; slewing, 2 tons at 400 ft. per minute, with jib at maximum radius; derricking, 2 tons at 50 ft. per minute; travelling without load, 50 ft. per minute. The lifting gear is of double-purchase, and the load is lifted on a single part of rope, the rope being fitted with overhauling weight and ball swivelling hook. The lifting gear is arranged on Stothert & Pitt's patent "free-barrel" system, which has previously been described in our pages. All the cranes are fitted with "Pitt's" patent overwinding gear and no-voltage release. Direct current at 460 volts is used; the lifting motor is of 30 B.H.P. at 430 R.P.M., the derricking motor 15 B.H.P. at 430 R.P.M., and both the slewing and travelling motors are of 6 B.H.P. at 550 R.P.M. The slewing motion is operated from the motor through a train of worm and spur gearing and a vertical shaft, on which is keyed a steel pinion, which engages with the externally-toothed slewing-ring fixed to the top of the gantry. The slewing-ring is of cast steel. The weight of the revolving superstructure is carried on a live ring of steel rollers bearing on top and bottom roller paths of steel.

The derricking motion is operated through a suitable train of bevel and worm gearing. The derrick barrel is in two parts, one part having right-hand and the other left-hand spiral grooves turned to suit the derrick ropes. The derrick gear is capable of adjusting the radius of the jib from 33 ft. minimum to 42 ft. maximum. A switch is provided in the driver's cabin, which is operated by a lever



Electric Cranes at Grimsby Docks.

attached near the foot of the jib, in the event of maximum or minimum radius being exceeded. The travelling motion is operated by spur and bevel gearing engaging one wheel on each side of the truck; a powerful electric solenoid brake is fitted to this motion. Hand travelling gear is also provided, and is fitted to the four running wheels and arranged for operating from ground level, the handles being detachable. The motors and gearing are fixed in such a manner that they may be easily inspected from the floor level of the cabin. A small traveller is fitted in the roof of the cabin for lifting the motors and gearing for examination and repairs.



General Arrangement of Electric Crane.

The spur gearing throughout is of cast-steel with machine-cut teeth, and the lifting and travelling motors are fitted with compressed paper pinions. The first reduction of slewing gear consists of a forged steel worm engaging with a worm wheel, having phosphor-bronze teeth, the worm running in an oil bath and being fitted with ball-bearings to take the thrust. The derrick worm gear is the same as described for the slewing.

THE USE OF ELECTRICITY IN THE TREATMENT OF MAGNETIC ORES.

There are in existence a large number of metallic ores which are more or less magnetic, and it is obviously useful, therefore, to subject these to some form of concentration, utilising their magnetic properties before subjecting them to any reducing operation, inasmuch as the cost of obtaining the pure metal from the ore will be very much lessened the higher the yield is from a given bulk of the ore put into the reducing plant. In addition to this, the use of magnetic separation is very much widened by the fact that in nature very few metalliferous ores are found in an absolutely pure state, and one of the most common impurities found is that of iron. This iron impurity, although small in quantity, is yet sufficiently affected by an intense magnetic field to enable the grains of mineral to be removed. So useful is this process, that cases are known where ores originally non-magnetic are initially treated by one of the many processes known to metallurgists, and adapted to the peculiar conditions of each particular ore, whereby an iron impurity is actually added to the ore in order to render concentration by this means possible.



Fig. 1.—Hand-operated Magnetic Separator.

In order to determine the property of an ore with respect to magnetic dressing, it has frequently been felt in the laboratory and assay office that some form of separator for testing purposes is necessary, and the Brush Electrical Engineering Co., Ltd., have placed upon the market a small form of separator, shown in fig. 1, which is designed under the patents of Mr. Marcus Ruthenburg, for hand use in testing and separating samples of ore. It is built with a gap variable from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in., so that it can deal with different sizes of ore, the gap being easily adjusted by means of the hand-wheel on the top. The magnetic circuit is made of soft iron of high permeability, and is excited by a winding contained inside the bowls. The standard winding is arranged in two coils, and four terminals are provided, by which the coils can be put in series for 200 volts or in parallel for 100 volts. The winding can, however, be arranged for any voltage required up to 500 volts. As the separator is only of small size, and it is desirable to have as strong a field as possible, the windings are only suitable for intermittent use, and are not intended to be in circuit for longer than 30 minutes at a time, on account of overheating. It is often necessary to have a weak field when separating ores which are strongly magnetic, and for this purpose a regulator is required for use in series with the winding. This regulator is provided with about 20 steps, so that different strengths of field can be obtained. The weight of the whole outfit is only 160 lb., and it measures 1 ft. 8 in. high × 1 ft. over the largest diameter. The power taken by the exciting winding is 1 kw.

It would be tedious to enumerate all the separations which have been made by this simple apparatus, but among them may be mentioned the withdrawal of low-grade black-band iron ore from slate piles without grinding. Iron ores containing copper and sulphur have been separated, the recovered

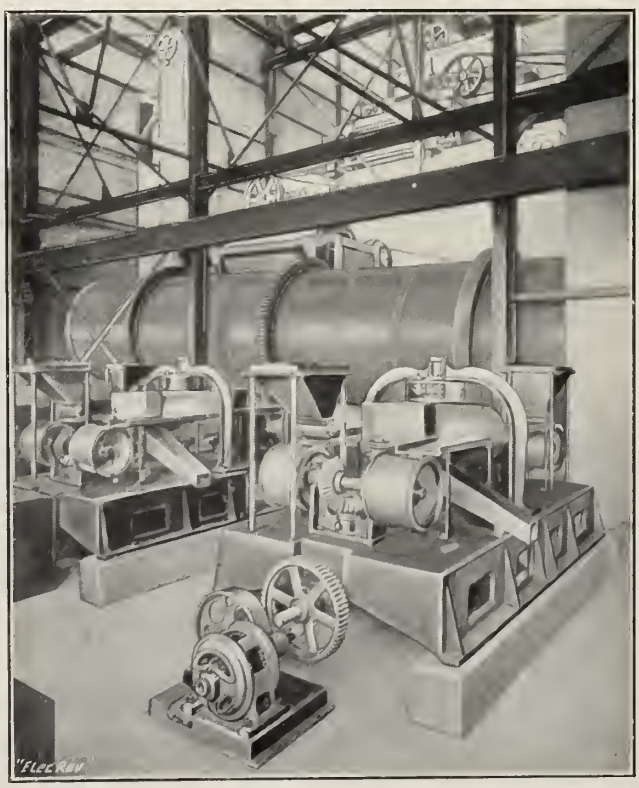


Fig. 2.—Magnetic Separators at a Cornish Mine.

copper paying for the work; manganiferous iron ore has been separated into high manganese and iron ore low in manganese, the separation of tin from monazite sands and from spathic iron has been effected, and there have been interesting cases where copper, antimony and silver in iron and manganese were separated into antimonial copper carrying silver, and manganiferous iron ore. In addition to these small experimental plants, larger sizes of separator have been built for continuous operation under commercial working conditions, and figs. 2 and 3 are interesting as showing some large separating plants on this principle erected in Cornwall.

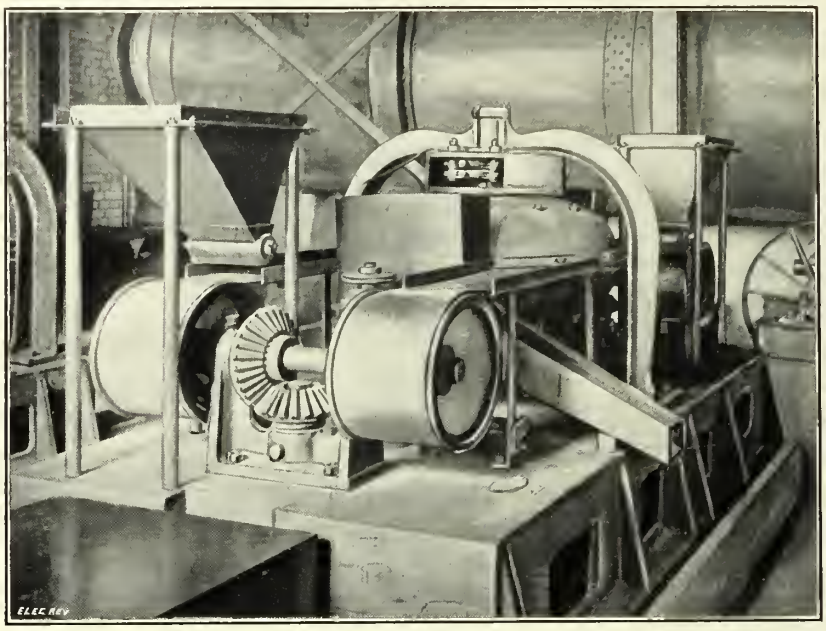


Fig. 3.—Ruthenburg Ore Separator.

The mill is terraced on a hill side. The crude ore as mined is delivered at the top to a rock breaker, breaking to an inch cube, followed by a ring screen set to 30 mesh. Fifteen per cent. of the weight of the original ore being small enough is passed by this screen, saving the subsequent handling of this amount.

The oversize flows by gravity to a pair of motor-driven rolls which are set to $\frac{1}{4}$ in., the product going to a second ring screen set to 30 mesh which passes 45 per cent. of the ore as small enough. The oversize goes to the second rolls, also motor-driven. These rolls are set close and reduce the last of the ore to 30 mesh. All of the screenings are combined and fed to a revolving roaster (seen in fig. 2), in which they are given a flash roast, making all ferruginous particles magnetic. The roasted ore is then cooled and fed to the magnetic separators, where every grain having the least iron in it is picked out. The concentrates are sold to the smelter. The equipment illustrated does the work of 80 California stamps with half the expenditure of power. The compactness and ease of observation and adjustment of this plant will be apparent.

The mode of operation of the apparatus is indicated in fig. 4. The double mushroom magnet A is mounted on a vertical spindle B, running in suitable bearings, and has a central core, round which is wound the exciting coil C. The magnetic field is used in the gap round the periphery, the upper pole-piece A^2 being bevelled to concentrate the field, while the lower pole-piece A^3 is left flat. A channel D of non-magnetic material is secured by flanges to the inside of the pole-pieces, and annular brackets E of the same material are bolted to the outside. Pulleys G carry belts H, which convey the crushed ore between the pole-pieces; the magnetic particles are attracted, and adhere to the upper pole-piece, whence they are swept off by the rope M, which is driven faster than the mushroom magnet, and fall into a receptacle N, while the unattracted particles are carried away by the belts and fall into receptacles K.

It will be seen that magnetic separation under the Ruthenburg patents has reached a pitch of perfection which removes it from the category of experimental work, into the class of standard mining operation. Magnetic machines for treating ores are generally described as separators, and not as concentrators, for the reason that they are usually used for a secondary dressing of a concentrate previously made by other means. This is not a case of necessity, and sometimes not of expediency. Especially is this a wasteful practice if the ore slimes, as in the case of copper or lead, and the slimes float, causing a heavy loss of the mineral of greatest value. In dealing also with tin and wolfram ore, much of the wolfram slimes, and is lost in the washing. In any of these cases, if the magnetic machine were used (assuming, of course, that the ore was amenable), much better recoveries would be made, as slimes are magnetically recovered as easily as the larger particles.

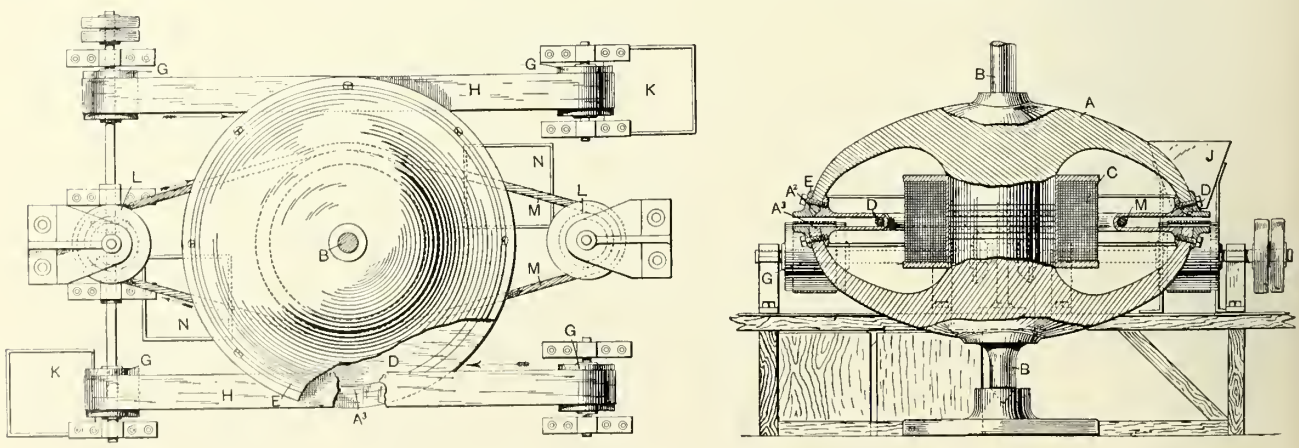


Fig. 4.—Details of Ruthenburg Magnetic Separator.

Haslingden Electricity Supply.—The Corporation supply was inaugurated on the 19th inst. Energy is taken in bulk from Accrington Corporation and distributed to the tramway, &c., from the Prinny Hill Station. Councillor Waddington, chairman of the Electricity Committee, switched on the current, and reference was made to the fact that the Corporation got its first provisional order for electric lighting so far back as 1896. Councillor Waddington entertained the members of the Council to a banquet, at which the Mayor presented him with an electric candelabrum, in recognition of his services in connection with the question of electricity supply.

LIGHTING and POWER NOTES.

(*Continued from page* 1065.)

Chester.—At a meeting of the Council on the 20th inst., Alderman Hewitt moved that the Refuse Destructor Committee, whose recommendations have caused much controversy in the city, consider the advisability of suggesting to the Electricity Committee the erection of a joint electricity and destructor works. They had been told authoritatively that to separate the destructor from the electricity works was to saddle the ratepayers for at least 30 years with an annual expenditure of £1,000. The Council on several occasions had voted the question of the destructor being placed on the present site of the electricity works, as the present electricity works included about £18,000 worth of buildings, and a large expenditure would be necessary for the removal of the buildings and plant. Since 1900 they had trebled the consumers and more than doubled the output of electricity, having spent on an average £1,000 a year on new buildings. If Hoole came within the city boundary, they would have to spend a great deal more on their electrical undertaking, and would require a larger building or another station. The motion was adopted.

Continental Notes.—Belgium.—La Société des Charbonnage de Corvette-Rufin is about to establish an electricity generating plant in connection with its collieries at Beyne-Hensay.

Excellent progress is being made with the adoption of electric driving at the steel rolling mills of the Société Metallurgique d'Esperance-Longdoz, at Longdoz. All the rolling mills except one are now electrically equipped, and the last steam engine will be displaced next month. The necessary electrical energy is supplied from the company's own plant at Seraing.

Russia.—H.M. Consul at Riga reports that the municipalities of Pernau and Wenden have been authorised to raise loans for the installation of electric lighting.

Greenock.—At the last meeting of the T.C. it was reported that the output from the Corporation's electricity works had reached a total of one million units for the month, this being 61 per cent. higher than for the same period last year. Notwithstanding an average expenditure of £15,000 annually in improvements and new machinery, the works were at present taxed to their utmost capacity.

The Corporation has decided to approach the Secretary for Scotland with a view to obtaining borrowing powers for £20,000 for the extension of the electricity works.

Guildford.—The B. of G. has rejected the recommendation of a Committee that the workhouse should be lighted by electricity. The electricity company offered to light the institution for £297, and to spread the cost of the installation (£600) over 10 years, free of interest. The gas company's offer was £312 per annum for lighting.

Holmfirth (near Huddersfield).—By 10 votes to 7 the U.D.C. at a special meeting has decided to apply to the B. of T. for a prov. order to generate and supply electrical energy within the urban districts of Holmfirth and Netherthong.

Hornsey.—At the last meeting of the Council, it was decided to carry out extensions to plant at the electricity works at an estimated cost of £8,941, and application is to be made to the L.G.B. for sanction to the borrowing thereof. This amount includes a new 750-kw. steam set and condenser, £4,900; cooling tower and pipes for same, £950; switchboards, cables, &c., £1,196; water and steam piping, &c., £820. In moving the adoption of the report, the chairman of the Electricity Supply Committee stated it would be about nine months before some of the machinery could be delivered. This expenditure was not of a speculative character, but was forced upon them by the exigencies of the growing load. It was further decided at the meeting to support the Bill of the Metropolitan Electric Tramways Co., and the Middlesex County Council is to be asked to invite the District Councils of Tottenham, Wood Green, Friern Barnet, Southgate, Edmonton, Enfield and Finchley and the directors of the Great Northern and City and Great Northern and Piccadilly Tube Railways to support such Bill.

Horsham.—The annual report of the electrical engineer, just published, contains the following:—"The reduced running costs, and the increased output have had an excellent effect upon our finance, the year's working having resulted in a net profit of £314, against £41 for the previous year. The gross profit of £2,345 represents a return of just over 7 per cent. on the capital expended."

Ipswich.—The T.C. has decided to apply to the L.G.B. for a loan of £9,130 for the provision of additional plant, viz., steam turbine, dynamos, &c., £4,881; foundations, £300; extension of main switchboard, switches for pump motors, connections, &c., £490; boiler, £2,200; pipe work, water softening plant, &c., £759; contingencies, £500.

Lancaster.—The Corporation has decided that electricity be supplied for lighting purposes to consumers of current for motive power at 2½d. per unit (less 5 per cent.) between the hours of 11 p.m. and sunset on the following day (a charge of 3s. 6d. per meter to be made for each quarter), the number of units allowed on the above basis not to exceed 10 per cent. of the units used for power. Consideration of the revision of the charges for current for lighting purposes has been deferred for the present.

Linlithgow.—The application for a provisional order for the purposes of supplying electric light in the parishes of Linlithgow, Bo'ness and Carriden, Bathgate and Torpichen, was considered by the County Council at its last meeting. The Council, after hearing the report of the sub-committee appointed to consider the proposal, while withholding its consent meanwhile, agreed to the passing of the order, provided the promoter agreed to insert the same protective clauses which were included in the order granted to the Scottish Central Electric Power Co. in 1903.

London.—Poplar.—The Electricity Committee has decided to transfer the two existing 500-kw. motor converters at the generating station to the Millwall and Glengall Road sub-stations at an estimated cost of £100, also to install two 1,000-kw. converters at the above sub-stations at an estimated cost of £5,000, and tenders are to be invited for the supply and erection of the converters and necessary switchgear.

In connection with the experimental installation of three types of arc lamps recently placed in Bow Road and East India Dock Road with a view to improvements in public lighting, the Committee recommends that 77 "Angold" magazine flame arc lamps should be erected. The Committee further reports regarding the extension of plant at the generating station, which was reported upon to the Council, when the mutual standby of the Poplar and Stepney undertakings was approved in September last. The present load on the Council's station, estimated at 4,120 kw. when negotiations were proceeding with Stepney on the subject of this second extension, had already reached 4,440 kw., while the effective capacity of the plant installed and on order, assuming one 3,000-kw. set being out of commission, would be only 4,200 kw., with a maximum overload, under the most favourable conditions, of 600 kw. Stepney B.C. could not guarantee a standby during the winter 1912-3, and it was anticipated the load demanded at the generating station would, at that time, exceed 5,200 kw., being 1,000 kw. in excess of the effective capacity of the plant installed and on order. Negotiations for further standby and bulk supplies to be afforded to neighbouring electricity undertakings, were also proceeding. Under these circumstances, it would be necessary to at once proceed to make arrangements for the provision of an additional 3,000-kw. set to be installed before the winter of 1912-13. The estimated cost of the proposed extension is £21,171, made up as follows:—Engine room plant, £8,316; boiler house plant, £8,880; pump room plant, £350; pumping station plant, £600; coal-handling plant, £2,000; switchgear, £1,025. The proposed extension includes the provision of coal-handling plant for conveying coal by mechanical means from barge at Limehouse Cut into the generating station. Provision was made, the Committee further states, in the contract with Messrs. Willans & Robinson for the supply of a duplicate 3,000-kw. turbo-alternator and condenser, if required, at the amount of the contract for similar plant now on order, viz., £7,581, and it recommends that a further order should now be placed with that firm at the sum mentioned, less prices of spare parts not required, and that the proposed extensions, to cost £21,171, should be approved. At the meeting on the 21st inst. these three proposals were agreed to with the exception of the last, which was not moved owing to the Finance Committee deferring the consideration of submitting an estimate.

Willesden.—A contract is to be entered into with the Aron Electricity Meter Co., Ltd., for the quarterly inspecting and testing of the bulk supply meters for the sum of £15 per annum on a six years' contract.

St. Pancras.—Sanction has been received to the borrowing of £9,964 for electric lighting. Instructions are to be given for the preparation of a priced inventory of the Council's electrical machinery, plant, and instruments, as required by the district auditor.

Macclesfield.—The B. of G. has decided to have the new mental wards lit by electricity generated on the premises.

Manchester.—The L. and N.W. Railway Co.'s Exchange Station, Manchester, which is really situated in Salford, is now electrically lighted, current being supplied by the Manchester Corporation.

Mansfield.—The B. of G. has appointed a Committee to consider the advisability of installing an E.L. plant at the workhouse infirmary. A scheme, with an estimate of the cost, is to be prepared by the Board's architects.

Oldham.—The Corporation Electricity Committee has decided to apply to the L.G.B. for a loan of £19,567, made up as follows:—Turbine, condensers, water pipes and foundations, £6,424; switchboard extension and cables, £544; superheaters, £1,571; mechanical stokers, £2,028; mains extensions (three years), £8,000; three years' other expenditure, £1,000.

Pontypool.—The U.D.C. has decided to improve the public lighting by erecting 10 new 4,000-c.p. arc lamps, the annual cost of which will be £14 each.

Port Glasgow.—The T.C. has appointed an expert to advise as to the cost of installing an electricity station and the rate at which electricity could be supplied therefrom.

Ramsbottom.—The Lancashire Electric Power Co. has applied to the B. of T. for permission to use overhead lines for the transmission of current at a pressure of 230 volts for the purpose of supplying electricity in the urban area of Ramsbottom.

Salford.—The B. of G. has appointed Messrs. Lacey and Sillar to advise the Infirmary Committee, and to submit a scheme for lighting the infirmary by electricity, at a fee of 20 guineas.

Southend-on-Sea.—The T.C. has instructed the electrical engineer to report on the application of the Leigh U.D.C. for a supply of current in bulk.

Stoke-on-Trent.—The T.C. has decided to contribute up to £25 towards the cost of the promotion of the Bill of the I.M.E.A.

Wellingborough.—The R.D.C. last week unanimously decided to assent to the prov. order for E.L. which is being applied for by the Rushden and District E.L. Co.

TRAMWAY and RAILWAY NOTES.

Adlington.—At a meeting of the D.C. on December 20th a communication was received from the solicitors for the Preston, Chorley and Horwich Tramways Bill, stating that the company was applying for an extension of time for the completion of the tramway, &c. The Council assented to the proposed application to Parliament.

Airdrie.—At a special meeting of the T.C., the Provost called attention to the prov. order being applied for by the County Council to take over and extend the Lanarkshire tramways. It was agreed to ask the promoters to include in the Order an extension of the line from Lanehope Road, near Holytown, to Airdrie, and thereby tap a very populous district.

Baildon.—The U.D.C. has had under consideration a report on the conference between representatives of the Council and the Tramways Committee of the Bradford Corporation, in reference to a proposed tramway service for Baildon. It is estimated that the cost of the line, &c., would be about £10,500. Two schemes were presented, viz.:—(1) That the Baildon authority should obtain the running powers and lease the line to Bradford; (2) that the Corporation should construct the line and find the capital for everything. The latter scheme was the more favoured by the Baildon representatives, and it was suggested that in case of this proposal being adopted it would be necessary for Baildon either to contribute in money or else make concessions in the way of freedom from liability to district rate.

Belfast.—The position of affairs in regard to the financial deal between the Corporation and the Cavehill and Whitewell Tramways Co. practically remains where it was before reference to the arbitrator, after the proceedings in the King's Bench Division, Dublin, which resulted in the Court remitting the matter to Mr. Macassey, with the direction that he should find the value upon the basis that the undertaking was a going concern and a rent-producing undertaking. In brief, the situation now is that the arbitrator has confirmed his original award of £56,155 as the price to be paid for the undertaking, and the Corporation is advised by the Law Committee to take the opinion of counsel with a view to contesting the matter further. In other words, there is every prospect of another legal battle over the Cavehill tramways. A specially-summoned meeting of the Law Committee, to consider the matter of the amended award, was held last week in the City Hall. The meeting was a prolonged one, and no official report was supplied to the Press. We understand, however, that it was decided to "take up" the amended award on payment of the usual fees from Messrs. R. E. M'Lean & Sons, solicitors for the arbitrator. It is stated that, in the meantime, the award will be submitted to Mr. Balfour Browne, K.C., and Mr. S. Ronan, K.C., for the purpose of obtaining their joint opinion. It was felt by a number of the members of the Committee that the arbitrator had not, in his present award, paid due regard to the evidence given on behalf of the Corporation at the last hearing. It is erroneously stated by a contemporary, in reference to the deputation sent across to London by the Corporation, that "the arbitration decided to hear no further evidence." The fact is that the Cavehill and Whitewell Tramways Co. decided not to offer any further evidence.

Continental Notes. — Russia. — The Ministries of Finance and Ways and Communications have submitted to the Council of Ministers an application for the formation of a company, entitled the "Moscow-Podolsk Electric Railway Co.," for the construction and working of an electric railway from Moscow to Podolsk. The line will have a length of 37 miles, and the cost of construction is estimated at about £790,000, one-third of which will be in share capital, and the remainder in debentures.—*Board of Trade Journal.*

Sweden.—The Swedish postal authorities are at present making some trials in Stockholm with an electric motor mail van.

Dewsbury.—The T.C. has confirmed the proposal that application be made to the B. of T. for a provisional order authorising the construction of tramways in Halifax Road and along Willans Road to Staincliffe Road as far as the borough boundary.

Glasgow.—Councillor Roderick Scott has given notice that he will propose the following at the next meeting of the T.C.:—"That it be an instruction to the Tramway Committee to experiment with larger cars, either of the bogie or corridor type, carrying over 100 passengers, or probably double the number carried at present, with one motorman and two guards (one for looking after the passengers, stopping and starting the car, and one for collecting the fares), so as to ensure the success of the present experiment of two ½d. stages for one ½d."

Hurst (near Ashton-under-Lyne).—A Sub-Committee has been appointed to deal with the lease of the tramways.

Lancaster.—At a meeting of the T.C. held on the 20th inst., it was decided to cease the running of the electric cars between January 1st and April, on Sundays, the reason assigned being that the traffic did not meet the cost of current.

Llanelly.—With only three exceptions the whole of the tramway men at Llanelly went out on strike on the morning of the 21st. The men selected the season when the traffic should be at its heaviest. They belong to the Dockers' Union, and the cause of the strike is the non-recognition of the Union, and the alleged treatment of some of the men by the officials. The Dockers' Union asked the company to recognise the Union so that an endeavour might be made to avert a stoppage, but the company refused to do so. The strike is causing great inconvenience in the town and district. The company has issued a notice that it would be able to carry on only a limited service during daylight, as the police were unable to guarantee protection to the line or to the officials.

Manchester.—As the result of a poll amongst the car cleaners employed by the Corporation Tramways Committee, it has been decided to adopt the rotation system for dealing with the night work. At the present time two-thirds of the cleaners are perpetually on night work. As soon as possible this will be changed, so that each man will now do two weeks' night work and one week on day work. Between 300 and 400 men will be affected by the change.

Nottingham.—The whole of the Corporation's tramway service was suspended on Christmas Day so that every employé might have a holiday. The stoppage of electric cars means a loss in revenue to the Corporation of over £500. For the football match between Notts. County and Manchester City, enthusiasts had to use taxi-cabs, charabancs, and even costers' barrows.

Preston.—It has been decided by the Tramways Committee to purchase three additional cars, and to extend the car shed, the estimated cost being £3,000. The Tramways Committee has declined a request by Preston Trades Council asking for a public inquiry into certain statements alleged to have been made by the chairman of the Committee. At the same time it is prepared to receive a deputation on the question.

Rossendale.—The year 1911 has been an eventful one, electrically speaking, for Rossendale Valley, having witnessed the opening of the new electric car service between Bacup and Rochdale, a distance of seven miles, also the inauguration of the electric supply in Bacup, the Corporation taking current from the Rawtenstall Corporation, while Haslingden has just celebrated the commencement of the electricity supply in the borough, Accrington Corporation supplying the current. Bacup is now linked with Rawtenstall and Accrington and also with Rochdale by electric car service, and all routes are well patronised and appreciated.

Salford.—The Tramways Committee has recommended the purchase of 20 top-covers for the bogie cars. This is in response to a request from many of the regular travellers on the Salford system, the covered cars now in use being highly appreciated.

Tynemouth.—The Parliamentary Committee of the T.C. has received a letter from the secretary of the Tynemouth Electric Traction Co., stating that the directors could not accept the conditions of the Council as to the suggested extension of the system by railless trolley cars, but that any modified proposals which the Council might submit on the matter would receive the company's consideration. The town clerk was instructed to communicate with the company and state that the Committee would be prepared to reconsider the question of road widenings, but that the company must take the other conditions of the Council as final.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—N.S.W. Government Railways.—January 8th.—Four 1,000-kw. rotary converter units. January 22nd.—Supply and erection at the White Bay power house, Sydney, of eight water-tube boilers, with superheaters, economisers and mechanical stokers. January 29th.—A 25-kw. booster set. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.

January 9th.—Accumulators, booster, switchboard and accessories, for the Subiaco Council. Town Clerk's office. Deposit of £100.

Melbourne.—January 9th. Three tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" December 22nd.

Austria-Hungary.—January 20th. The time for receipt of tenders for the electric lighting of Bjelina, Bosnia, has been extended to January 20th. Conditions of tender at Board of Trade Commercial Intelligence Department, London. Tenders to the Stadtmajistrat, Bjelina, Bosnia.—*Board of Trade Journal.*

Belgium.—January 9th. The municipal authorities of Ghent are inviting tenders for the supply and installation of a new steam turbine and alternator at the central electric lighting station in the town.

Birmingham.—January 8th. (*a*) Supply, delivery and erection of 50 electric tramway cars; (*b*) 1,700 tons of improved steel girder rails, and 3,500 pairs of fishplates. Mr. A. Baker, general manager, Tramway Offices, Corporation Street, Birmingham.

Dartford.—January 23rd. One high-speed vertical uniflow engine, tandem generators and three-wire balancer, three superheaters and extensions to pipework, switchboard and electrically-driven centrifugal pump, for the U.D.C. See "Official Notices" December 15th.

Dublin.—January 30th. Dublin Port and Docks Board. Two 4-ton electric portal wharf cranes. Specification, £1 returnable, from Sir J. P. Griffith, Engineer to the Board, East Wall, Dublin.

Edinburgh.—The Governors of George Heriot's Trust invite tenders for the electric lighting and power installation in the science laboratories now under construction at George Heriot's School. Mr. John Anderson, superintendent of works, Heriot Trust offices, York Place, Edinburgh.

France.—January 5th. The French Post and Telegraph authorities in Paris are inviting tenders for a multiple telephone board for the Central Telephone Exchange.

Hornsey.—January 11th. One steam dynamo set (either reciprocating or turbine), for the T.C. See "Official Notices" December 8th.

London.—Hammersmith.—January 10th. Arc lamps for the B.C. See "Official Notices" to-day.

Manchester.—January 9th. (*a*) Steel girder tramway rails: (*b*) steel tie-bars for tramway rails. For (*a*) deposit of £1 1s. required. Specifications and forms of tender from Mr. J. M. McElroy, general manager Corporation Tramways.

New Zealand.—March 7th. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

Radcliffe.—January 13th. Electrically-driven centrifugal or turbine pump for the U.D.C.'s sewage disposal works. W. L. Rothwell, surveyor.

Rotherham.—January 10th. One 500-kw. rotary converter, for the Corporation. See "Official Notices" to-day.

Siam.—Bangkok. March 15th. Tenders are invited for the supply and erection of an electric power station with a capacity of 3,000 kw. Tenders, on the prescribed forms, to the Ministry of Local Government, Bangkok. For further particulars see this column for November 24th.

Slough.—January 3rd. Public lighting for a year, for the U.D.C. Surveyor, 4, William Street.

Spain.—Tenders have just been invited by the municipal authorities of Cenicientos (province of Madrid) for the concession for the electric lighting of the town during a period of 15 years.

Swansea.—January 6th. Water-tube boilers, superheaters and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" December 15th.

Turkey.—Tenders will be received at the "Ministère des Travaux Publics," Constantinople, up to 2 p.m. on February 20th, for a concession for the supply of electric light and power to the town of Adalia, which has a population of some 30,000. For particulars see this column December 22nd.

Walthamstow.—Tenders are to be invited for doubling the tramway track at the "Bell" Corner, Forest Road.

West Hartlepool.—January 2nd. 191 tons steel rails, 3 tons fish plates, 11 pairs manganese cast-steel spring points (12 ft. long), 11 crossings, and reconstruction of tramway permanent way (Park route), for the T.C. Mr. N. F. Dennis, borough engineer (returnable deposit £1 1s. for each contract).

CLOSED.

Australia.—The *Australian Mining Standard* announces the placing of the following Commonwealth contracts:—

Victoria.—Postmaster-General's Department:—
60,000 porcelain insulators, £475.—Western Electric Co. (Australia), Ltd.
36,000 earthenware conduits, £1,202.—George Sweet.
8,500 galvanised-steel spindles, £425.—Williams & Co.
Supply of Robertson carbon-filament and Osram lamps, total £331.—British General Electric Co., Ltd.

Western Australia.—Postmaster-General's Department:—
5,000 zincs for gravity cell, at 1s. 1d. each.—A. W. Dobbie & Co.
Various telephone instruments and accessories.—J. Bartram & Sons Pty., Ltd.
15 tons galvanised-steel wire, at £16 11s. 6d. per ton; 90 tons hard-drawn copper wire, at £70 1s. 6d. per ton; 1 ton galvanised-iron wire, at £16 1s. 6d. per ton; 10 tons, at £11 19s. per ton.—R. Johnson, Clapham and Morris, Ltd.
Dust extractors, dessicating apparatus, also various instruments and telegraph apparatus.—Siemens Bros. & Co., Ltd. (England).
30 miles tinned-copper wire, at £3 15s. per mile; 3 miles, at £3 2s. per mile.—British Insulated and Helsby Cables, Ltd.
Telephone cable, lead-covered, paper-insulated: 2 miles, 104 pairs, at £310 per mile; 3½ miles, 78 pairs, at £231 per mile; 12 miles, 52 pairs, at £173 per mile; 5 miles, 26 pairs, at £116 per mile; 5 miles, 13 pairs, at £70 per mile; 5 miles, 4 pairs, at £31 per mile; 3 miles, at £366 per mile; 5 miles, at £25 per mile; 50 miles tinned-copper wire, at £9 17s. 6d. per mile; 25 miles ditto, at £7 17s. 6d. per mile.—W. T. Henley's Telegraph Works, Ltd.
10 tons phosphor-bronze wire, at £78 0s. 11d. per ton; 30 tons galvanised-iron wire, at £10 5s. per ton.—Geo. Wills & Co.
50,000 porcelain insulators at 4 13/16d. each, and 90,000 at 1 15/16d. each.—Dalgety and Co.

Queensland.—Postmaster-General's Department:—
Extension of common-battery main distributing framework and equipment, £411.—Western Electric Co. (Australia), Ltd.
Galvanised-iron tubular cross-arms.—Stewart & Lloyds, Ltd.

The following acceptances are announced in the *Mining and Engineering Review*:—

Victoria.—Postmaster-General's Department:—
One mile copper rubber-insulated wire, three-twisted conductors, £8 10s. per mile; 17 miles copper rubber-insulated wire, two-twisted conductors, £5 15s. per mile; 28 miles single bridle wire, £7 3s. 6d. per mile; 10 tons twisted pair outside distributing wire, £145 per ton; 100 miles twisted pair copper V.I.R.-insulated wire, £17 7s. 6d. per mile.—W. T. Henley's Telegraph Works Co., Ltd.
Supply and installation in working order of an automatic switchboard, together with all associated apparatus, at the Post Office, Geelong, £14,293.—Automatic Telephones (Australasia), Ltd.
One motor-generator and accumulators, complete, at the Central Telegraph Office, Melbourne, £450.—T. K. Steanes.
20,000 insulators, stoneware, £250.—The Firebrick Insulator and Pottery Co. Pty., Ltd.
Victorian Railways Department:—
Electrical staff instruments.—McKenzie & Holland, Ltd.

Queensland.—Postmaster-General's Department:—
60 miles wire, single bridle, at £5 16s. 6d. per mile.—Brabant & Co.
70 miles wire, tinned copper, No. 20 S.W.G., at £2 19s. 6d. per mile.—Armorduct Manufacturing Co., Ltd.

Tasmania.—Postmaster-General's Department:—
Two miles cable, paper-insulated, lead-covered, £69 per mile.—Noyes Bros. Pty., Ltd.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Siemens for signal apparatus at the swing bridge at Avonmouth; and that of Messrs. J. H. Holmes & Co. for a spare armature for the granary motors.

Glasgow.—The T.C.'s Committee on Tramways, Works and Stores has recommended acceptance of the following offers:—

Brass rollers.—Chas. Henderson & Co., Ltd.
Testing transformer.—Brown, Boveri & Co., Ltd.
D.C.C. wire.—London Electric Wire Co. & Smiths, Ltd.; British Insulated and Helsby Cables, Ltd.
V.I.R. cable.—British Insulated and Helsby Cables, Ltd.

The general manager of the tramways department has been authorised to hire from the Bell Punch and Printing Co., Ltd., London, additional punches similar to those already hired from the company, at the rate of 10s. per punch per annum, inclusive of maintenance.

Ipswich.—The T.C. has placed with Messrs. Willans and Robinson, Ltd., an order for a second 1,000-kw. turbine, with dynamos and switchgear.

London.—Southwark.—The B.C. has received the following tenders for the supply and fixing of six new mechanical chain-grate stokers to the boilers at the electric light station:—

Babcock & Wilcox, Ltd. .. .. (accepted)	£1,020
Bennis & Co., Ltd...	1,044
Underfeed Stoker Co., Ltd.	1,283

Ship Lighting.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract for the supply of tantalum traction-type lamps for ship lighting, &c., from the Royal Mail Steam Packet Co., for a period of six months, commencing January 1st, 1912.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

Messrs. Ferranti, Ltd.—Traction meters on cars, £101.
Messrs. Doulton & Co., Ltd.—1,000 insulators for electric strip, 2s. 6d. each.
Messrs. Kerr, Stuart & Co.—45 tons of steel tram rails, £6 15s. per ton; fishplates and bolts, £300.

Taunton.—The T.C. has accepted the following tenders:—

Messrs. Crompton & Co.—200-k.v.a. alternator, £381.
Messrs. Heenan & Froude.—Superheater, £80.
Electric and Ordnance Accessories Co.—Induced-draught fan, £43.

FORTHCOMING EVENT.

Association of Engineers-in-Charge.—Saturday, January 6th. At St. Bride's Institute, E.C. Social. Dance.

NOTES.

Dundee Council and the Sale of Lamps, &c.—We understand that on 22nd inst. there was taken out of Court by a Joint Minute an action under which Mr. E. J. B. Lowdon, electrical engineer, Dundee, sought to interdict the Town Council of Dundee from selling electric lamps, shades or wire to private consumers. The action was settled by the town clerk giving a letter in the following terms:—

"18*th December*, 1911.

"E. J. B. Lowdon, Esq.,
"Electrical Contractor, Dundee.

"Dear Sir,—Referring to action of interdict raised at your instance as pursuer against the Lord Provost, magistrates and City Council of Dundee as defenders, I, on their behalf and on the condition that said action is taken out of Court by a joint minute, hereby undertake that the defenders shall not until statutory powers are obtained to enable them to do so sell to private consumers electric lamps, shades or wire, or in any way exceed our present statutory powers.—Yours faithfully,

"(Signed) Wm. H. Blyth Martin,
"*Town Clerk.*"

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch, held last week at Glasgow, a paper was read by Mr. C. Jones, of the South Wales Branch, on "Earthing, Earth Plates and Leakage Detectors." The author maintained that the ideal leakage protective apparatus should be designed to operate instantaneously on a leakage current equal to a very small fraction of normal load current, so that it might discover leaks in their incipient stages and before an accident occurred. Discussing the subject of the earthed or insulated neutral, the author remarked that probably the most important questions were whether it was wise to use a resistance between the neutral and the earth, and what the amount of such resistance should be.

Institution of Electrical Engineers (Newcastle Local Section, Students).—Mr. Vesey Brown, chairman of the Newcastle Local Section, presided over a meeting of Students at Armstrong College on December 15th, at which it was decided to hold meetings for Students every fortnight and to arrange visits. A committee of Students was appointed. The chairman clearly explained the working of the Students' Sections in London, Manchester, and elsewhere. As regarded the proposed modifications to the Articles, he stated that advices had been received from London of the present intention of the Council that Students should not exceed the age of 27 years, and that the subscription for Students should be one guinea per annum up to their 21st birthday, and 1½ guineas afterwards. There was to be no entrance fee. A large number of engineers engaged in the district signified their intention of joining the Institution. The enthusiasm shown at this and other recent meetings by Students augurs well for the organisation of a strong and successful Students' Section in Newcastle. Those interested in this movement, who have not already obtained application forms, should communicate without delay with the honorary secretary, Mr. H. W. Clothier, Hawthorn Villas, The Green, Wallsend-on-Tyne.

Institution of Electrical Engineers (Newcastle Local Section).—The annual dinner took place on December 20th. Mr. C. S. Vesey Brown was in the chair, and over 100 guests were present, including the Deputy-Lord Mayor of Newcastle (Councillor Herbert Shaw), the Sheriff of Newcastle (Councillor C. T. Stableforth), Mr. Ferranti, Mr. Kingsbury, Prof. Louis, Prof. Thornton, Col. Saxton White and Mr. H. W. Clothier (secretary).

Prof. Henry Louis proposed "The Institution of Electrical Engineers." He said he did not think that any branch of engineering had been more affected by electricity than that of mining. He could not believe that there was anything inherently dangerous in electricity as applied to coal mining, and he certainly could not see that there was anything more dangerous in an occasional electrical spark than in a continuously blazing flame such as one had in a miner's lamp. The tendency nowadays seemed to be to take refuge in repressive legislation rather than to trust to their inventive capabilities. This was not the spirit which actuated the colliery owners about a century ago, when they were faced with the problem of using a light in coal mines. The question of long-distance transmission of power was of supreme importance, and in Mr. Ferranti they were entertaining one who had taken a leading part in this development, and had lived to see his schemes come to fruition.—The President, in reply, said that with regard to the Parliamentary Committee's proposal to exclude electricity from coal mines where naked lights were not allowed, the Institution protested; its request to be heard in the matter was granted, and it was eventually agreed that the Act should go through on a more reasonable basis. When they got electricity within the reach of all the different demands for which it was suitable, what they were doing to-day would be nothing compared with the electrical developments of the future. Referring to the affairs of the Institution, it had been represented to him that it should be kept a professional Institution, but electricity with them was not a hobby, and they were in it to make a living. The commercial side, however, had not been recognised in the past as it ought to have been. His wish was to try and improve the commercial side, because in any scheme the purely electrical engineering part was an item only. In order that the Institution might represent electrical engineering, it was necessary that it should include all who contributed to electrical work, and progress could only be made by co-operation between all sections of the industry. A large membership and the necessary funds were essential to making the Institution more useful.

Mr. J. H. Holmes proposed the toast of "The Armstrong College, Learned Societies and Other Guests," which was replied to by Col. Saxton White on behalf of the North-East Coast Institute of Shipbuilders and Engineers. Dr. Andrew Smith, replying for "The Newcastle Clinical Society," drew a parallel between his profession and that of his hosts, in that they were all children of science; he instanced the case of the Panama Canal as an example of the interaction between electrical and medical science, as it had been made possible, by the efforts of members of his profession, to bring the completion of this work in view, and to ensure that the majority of the workmen would not die.

Mr. J. E. Kingsbury proposed "The Newcastle Local Section," and pointed out that a local Section was not to be looked upon as a branch, but as being composed of a number of members of the Institution of Electrical Engineers who met together outside London for the discussion and the elucidation of difficulties. Mr. C. S. Vesey Brown replied, and said that the expeditious manner in which the initial steps towards the formation of the Students' Section had been carried through reflected great credit on their secretary, Mr. Clothier, who had been instrumental in having the age limit raised to 27. He suggested that many difficulties regarding the new Articles would not have arisen had Mr. Ferranti visited the various Sections, and delivered the speech he had heard that night. He agreed that the commercial side of the Institution was a highly important one, because selling was, perhaps, the most difficult branch of the engineering profession. So far as their own Section was concerned, it had been decided to develop the social side of the Institution, and to hold meetings in other towns in order to give members at a distance an opportunity of taking part in their discussions.

Institution of Electrical Engineers (Scottish Local Section).—At the first meeting in Edinburgh of the Scottish Local Section, last week, Prof. Baily read a paper on the equipment of the electrical engineering laboratory at the Heriot-Watt College. Recently the laboratory has been greatly enlarged, while there have been important re-arrangements. Considerable addition has also been made to the equipment.

Junior Institution of Engineers.—The Presidential address by Commendatore G. Marconi, on "Engineering Considerations in Wireless Telegraphy," has been postponed from January 5th.

Sir Douglas Fox, presiding last week at the 117th award of certificates at the Crystal Palace School of Practical Engineering, said that in that school they were encouraged to obtain a general knowledge of engineering rather than to specialise. There was nothing more unwise than for a young engineer to fix his mind on one particular branch, until he had obtained a good knowledge of all the various branches, which would place him in a position to make up his mind.

Mr. Alex. Anderson, of Wishaw, recently delivered a lecture on "Electricity: Its Generation and Application to Mining," to a meeting at Larbert, under the auspices of the West of Scotland Branch of the Association of Mining Electrical Engineers.

Scottish Coast Cables.—The inhabitants of the island of Tiree have decided to appeal to the Postmaster-General for the installation of wireless telegraphy between Tiree and Tobermory. The restoration of telegraphic communication to the islands of Islay and Tiree has been seriously delayed by the recent tempestuous and unsettled weather.

Fatalities.—A miner, who was working at the coal-cutting machine at Barrdyke Colliery, Cambuslang (Summerlee Iron and Coal Co.), was killed on Friday last.

It is reported that, at the conclusion of a breaking-up party at a school at Rochester, an electrician named Whitaker suddenly died, through, it is said, coming into contact with a live wire.

A Central News dispatch from Berlin says that the explosion of an electric lamp at a picture theatre caused a panic and a rush in which two children were killed.

The Indian Visit.—An example of a modern direct-coupled petrol-driven electric generating set may be seen any evening on the Maidan, where it is employed supplying current for about 300 lights, to enable work to be carried out at night in connection with the Royal Pandal, which is now being erected. This installation was supplied and erected at a day's notice by Messrs. Pyne Hughman & Co., who are sole agents in India and Burma for the Aster Engineering Co.—*The Statesman*, Calcutta.

Faraday House.—The next term opens on January 8th, when a fresh course of instruction will be commenced. The entrance examination will be held on Friday, January 5th.

Appointments Vacant.—Commercial assistant in the Bradford Corporation electricity department (£250); temporary assistant for the Barrow-in-Furness Corporation Electricity Works (£3); assistant inspecting engineer for Provincial Cinematograph Theatres, Ltd. (£2); switchboard attendant for the Bermondsey B.C. (32s.). See our advertisement pages to-day.

Loss of the ss. Princess Patricia.—At the close of the B. of T. inquiry into the cause of the stranding of the steamer *Princess Patricia*, last week, the Court found that it could only be explained by the theory that the compass was deflected by an electric lamp in the pocket of the look-out man, who was stationed 2 or 3 ft. from the compass. On the face of things, the suggestion seems absurd; it was, however, given in evidence that the lamp when held 8 or 10 in. above the compass caused a deflection of about 8°, and at a distance of 2 ft. it deflected the needle about 4°. The effect was apparently due to the tin (*i.e.*, tinned steel) case of the lamp: obviously the magnetic effect of the lamp circuit would be insignificant—and it was not stated that the lamp was actually alight.

Arc Works Benefit Society.—Last Saturday week the annual general meeting of the members of the Arc Works Voluntary Sick Benefit Society was held in the Recreation Room, at the Arc Works, Chelmsford, Mr. A. J. Hodgson, the general manager, presiding. The report, submitted by the secretary (Mr. W. G. Bickmore), for the year showed that contributions to the general fund amounted to £210, and the donations from Messrs. Crompton and Co., Ltd., to £63, other receipts bringing up the total income to £316. The total number of sick pay days for the year was 3,545, or an average of nearly 8 days per member. There are 467 members, an increase of 17 for the year. The reserve fund stands at £103. The annual meeting of the subscribers of the Arc Works Voluntary Infirmary and Dispensary Fund followed. The income was £35, which was disbursed by donations to the local hospital and dispensary. The report of the Arc Works Benevolent Fund, which is supported entirely by Messrs. Crompton & Co., Ltd., was then read. It is intended to relieve any special cases of necessity among their employés who have done good service during the year. Grants amounting to £18 in all were distributed in weekly amounts among seven cases.

An Electro-textile Competition.—The Société Industrielle de Mulhouse (Alsace) is organising a number of competitions for 1912, amongst which is one for a new application of electricity in the bleaching, dyeing and textile printing industries.

The Telephone Transfer.—Before our next issue appears, the Post Office will be the sole telephone authority for this country, and we take this opportunity of expressing our sense of the indebtedness of the community to the directors, staff and employés of the National Telephone Co. for the splendid work which they have done in the past, in the face of innumerable difficulties, harassing restrictions, and continual and vacillating interference on the part of Parliament. That in spite of all these obstacles to progress the company has built up a magnificent business on sound financial lines, and has rendered to the public excellent service during the past 30 years, is a fact reflecting the greatest credit upon all engaged in the undertaking, and we congratulate them most heartily upon their record, whilst expressing the hope that their future, under the new *régime*, may prove, in spite of all misgivings, both prosperous and congenial.

The Association of Consulting Engineers.—We have received from the hon. secretary of the Association, Mr. A. H. Dykes, a copy of the Rules which have been drawn up by a committee appointed for that purpose. The subscription is to be one guinea per annum; there will be only one class of Member, who must be in practice as a consulting engineer, of approved standing, and a full Member of the Institution representing the particular branch of the profession in which he practises, but must not be a member of, partner in, or agent for any firm with which he may have to deal on behalf of his clients, or a director, employé or agent of any company doing engineering insurance work, and must not be connected with any concern that advertises or canvasses for consulting work. A member is forbidden to accept trade commissions or any indirect profit in connection with his professional work, to have any financial interest in firms with which he may have to deal on behalf of his clients without disclosing the fact in writing, to receive any royalty on patented articles or processes used on work done for his clients without authority from them in writing, to be the medium of payments except at the request of a client, to accept work in connection with which another Member has been appointed, to advertise or answer advertisements for consulting work, to solicit or pay commission for work, or to do anything which prejudices his position as a consulting engineer. New members are elected by the Committee after notice of their nomination has been given to all the Members. Each candidate must be supported by four Members of the Institution to which he belongs. Members who break the Rules are liable to expulsion, after an opportunity for explanation has been given.

The formation of the Association will be celebrated by a dinner in January.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bridlington T.C. has, by 11 votes to 7, referred back to the Electricity Committee a recommendation that the salary of Mr. A. J. Beckett, borough electrical engineer, should be increased by five annual instalments of £20 each from January 1st, from £300 to £400 per annum, on Mr. Beckett agreeing to remain with the Council for five years, and to forego for work done, after the end of 1911, any commission which, as consulting engineer, he would otherwise have been entitled to. Mr. Fenby, who opposed, considered it unfair to tie Mr. Beckett to Bridlington for five years, and that the recommendation would prevent him from getting promotion.

Mr. F. W. Highfield, consumers' engineer in the Worcester electricity department, has been appointed showrooms assistant to the Birmingham electric supply department. There were 117 applications.

Mr. H. Taylor, late shift engineer Luton Electricity Works, has been appointed boiler house superintendent, and Mr. W. J. Raby, senior switchboard attendant, has been appointed shift engineer.

General.—Mr. George Balfour, of Balfour, Beattie and Co., Ltd., Edinburgh and London, has made hosts of new friends in the Govan division, as the increase in the Unionist vote shows. Throughout the contest he worked at high pressure, and from morning till night he was engaged discussing political questions with workers and addressing meetings. His speeches on the Insurance Act attracted very wide attention, not only in the constituency but throughout the country. Interviewed by a representative of the Electrical Review, Mr. Balfour stated that he had never known working men to be so gravely concerned regarding any great question as they were in the case of the Insurance Act. Only time was needed, he thought, for them to study it, and, once they understood its real meaning, they would not tolerate it. It is understood that Mr. Balfour, had he wished, could have had a safe seat, and the pluck he has shown in fighting Govan, where the majority against him at the General Election was so large, is greatly admired.

Mr. C. Llewelyn Davies has been appointed solicitor to the Post Office jointly with Sir Robert Hunter, K.C.B., "who will continue to act until the arrangements connected with the transfer of the National Telephone Co.'s undertaking are completed."

Lord Furness has been elected deputy chairman of the Metropolitan Railway, in place of the late Sir William Birt. Mr. Paul Speak is to be appointed an additional director.

We are informed that Mr. E. C. Reed, chief publicity writer to the Westinghouse Co.'s Publishing Department, has been appointed sales manager to Messrs. Miles Sykes & Sons, of Calder Works, Sowerby Bridge. Mr. Reed will take up his new duties early in the the new year.

CITY NOTES.

Schuckert Electricity Co.

The Elektrizitäts Gesellschaft vorm. Schuckert Co. is now mainly an investment undertaking, although the company still owns certain central stations. The directors' report for 1910-11 draws attention in the first place to the known loan transaction with the Siemens-Schuckert Works, which necessitated an increase of £500,000 in the company's share capital. Negotiations in regard to the supply of Northern Bavaria with electrical energy had led to the conclusion of many contracts with local authorities in connection with the recently-opened station at Ansbach. These local authorities were to be supplied in three years, provided that the applications guaranteed a suitable return. The northern long-distance cable in the Erlanger district had been brought into use in regard to 42 communes, whilst the western cable to Lower Franconia, which was to supply 85 communes, was in course of construction, and would be started in the present winter. The report also refers to the formation of the Franconia power works, in which the company and the towns of Nuremberg and Furth were interested, and which proposed the erection of works for affording a supply to those two towns by the end of 1912. The following figures are extracted from the accounts:—

	1910-11.	1909-10.
Share capital	£3,000,000	£2,500,000
Bond capital	1,855,000	1,925,000
Gross profits	832,000	826,000
Net profits and balance forward	293,000	260,000
Dividend, per cent.	7½	7

The dividend on the additional share capital of £500,000 is only payable for six months. Among the assets the shares of £2,247,500 held in Siemens-Schuckert works remain unchanged as contrasted with 1909-10, and central stations stand at £74,000, as against £129,000 a year ago. On the other hand, securities have risen from £1,873,000 to £1,937,000, and syndicate holdings from £125,000 to £149,000.

Siemens-Schuckert Works.

The report of the Siemens-Schuckert Werke for 1910-11 refers to the acquisition of new sites in Berlin and Nuremberg for the extension of works, which would be completed in the course of the new financial year. The new cable factory in Gartenfeld was approaching completion, and a new building for the construction of transformers was being erected in Nuremberg. Two loans of a total of £3,000,000 had been raised for the purpose of proceeding with the extensions, as well as for the increased stocks of materials, manufactures and outstanding debts. The degree of employment during the year was such that night shifts had frequently to be worked, notwithstanding the enlargement of the works, and a further augmentation in the orders had taken place in the first months of the new year. The company's works in Germany and elsewhere delivered 95,116 machines, motors and transformers in 1911 of a total of 2,646,327 H.P., this number comparing with 66,227 of 2,100,879 H.P. in the preceding year, and the advance in individual outputs again kept step with the increase in the turnover. Motors up to 16,000 H.P. were constructed for reversing rolling mill trains, and primary machines up to 21,500 KW. at 1,000 revolutions were carried out for power stations. The extensive use of metallic-filament lamps, the rearrangement of tariffs, and the great progress of driving by electric power, had led to the further development of existing central stations, to the establishment of new overland stations, and to a more abundant opportunity for work. Electrical working in the mining and iron and steel industries had made progress, and orders for winding engines were again received to a large extent. Apart from the growing interest in overland electric railways and industrial railways, the Prussian State Railway authorities had decided, as the trial section between Dessau and Bitterfeld had proved fully satisfactory, to make various extensions of this method of electrical working. The report adds that despite the abundance of work available, it was impossible to maintain the prices of manufactures on the level which prevailed in 1909-10. The accounts show the following figures for the two years :—

	1910-11.	1909-10.
Ordinary capital	£4,500,000	£4,500,000
Bond capital	2,458,000	969,500
Non-terminable 6½ per cent. loan	1,500,000	—
Gross profits	913,000	695,000
General expenses	95,000	74,000
Depreciation provision	60,600	50,400
Net profits	658,000	526,000
Placed to reserve fund	125,000	—
Bonuses	65,000	50,000
Benevolent fund	17,500	17,500
Dividend	450,000	450,000
„ per cent.	10	10

The ordinary capital and non-terminable loan are held in almost equal halves by the Siemens & Halske Co., and the Schuckert Co. During the year the number of officials and workmen, including the foreign branches, increased by 14,000 to 66,000.

African Trans-Continental Telegraph Co., Ltd.

The following circular was issued by the company :—"The annual reports and balance-sheets submitted at the recent general meetings of the company, and the chairman's remarks at those meetings, will have shown you the position of the company's affairs. This position is further apparent in the accounts as received for the year ended March 31st, 1911, which show that the company's indebtedness has increased to £105,799. The revenue has fallen from £4,662 in 1904—the first year after the completion of the line to Udjidji—to £3,076 in 1911. As there appears to be no prospect of the revenue improving sufficiently to show a surplus over expenditure, and there are no means of reducing the general indebtedness of the company, your directors, after consulting the principal shareholders and creditors, have come to the conclusion that it is desirable for the company to go into voluntary liquidation forthwith. It is proposed to appoint Mr. Percy Johnstone Baird, who has for several years been familiar with the accounts of the company in Africa, as liquidator."

An extraordinary general meeting of the company was held on Wednesday, last week, at the office, 2, London Wall Buildings, E.C., to consider the advisability of winding up.

The Duke of Abercorn, who presided, moved a resolution for voluntary liquidatioon. He said that the company was formed at the instance of the late Mr. Cecil Rhodes in 1892, with an initial capital of £140,000 for the purpose of constructing a line from Salisbury, in Southern Rhodesia, to which point a telegraph line had already been constructed by the British South Africa Co. to Wady Halfa, in Egypt, a distance of 3,000 miles. The capital of the company was increased in 1898 to £300,000. Mr. Rhodes's original idea of a Cape to Cairo line was to assist in the development of the territories through which the line would pass and to compete with the submarine cables in through traffic to Europe. When this project was first started the cost of cable messages between England and South Africa was about 9s. a word, as against 2s. 6d., which was the estimated cost by an overland route. The Cable Co.'s charges, however, had now been reduced to 2s. 6d. per word. Of the issued capital of £226,850, £86,577 was subscribed by the British South Africa Co., and £84,354 by Mr. Rhodes or his trustees. Great difficulty was experienced in the early days of the construction, one section being destroyed during the rebellion. The line had only been carried so far as Udjidji, in German East Africa, and to build and maintain the line so far as it had, the company had had to incur a debt of £105,539 to the British South Africa Co. No construction had taken place since 1903, and it was estimated that it would cost a further £50,000 to complete the missing gaps in German East Africa and Uganda, amounting to 550 miles, before the Cape to Cairo telegraph line would be completed. They would have noticed from the recent annual reports and balance-sheets, and the chairman's remarks at the general meetings, what was the position of the company, and they would have been prepared for the notice sent them with regard to the proposed liquidation of the company. It was with much regret that they had called the shareholders together for this purpose, but having regard to the position he had set out, there was, he was afraid, no other solution of the difficulty.

Mr. R. Maguire seconded the resolution, which was adopted unanimously.

German Electrical Companies.

The Deutsche Beck Bogenlampen Gesellschaft, it is stated, has now brought to a conclusion the negotiations which have been proceeding for months in regard to reconstruction. The necessary funds are being provided by the issue of preference shares, additional payments on old shares and their conversion into the preference class, and by means of long term credits. A thorough reorganisation of the whole undertaking is associated with the scheme, and has already been carried out in part.

The Fabrik Isolierter Drähte zu Elektrischen Zwecken (Insulated Electrical Wire Works), of Berlin, report a surplus of £38,000 for 1910-11, as contrasted with £17,000 in 1909-10. After meeting general expenses and allocating £5,300 to depreciation, as against £3,900 in the previous year, the accounts show net profits of £19,000, as compared with £6,000. It is proposed to pay a dividend of 11 per cent. on share capital of £67,500, as against 7 per cent. in 1909-10, and 5½ per cent. on the new capital of £107,500. The report states that the favourable course of business continues and the large amount of orders on hand will afford full employment for months.

The Rheinische Schuckert Gesellschaft, of Mannheim, which owns and works various electric supply works and tramways, has just declared the previously-reported dividend of 7½ per cent. for 1910-11, as compared with 7 per cent. in the preceding year. It would appear from the annual report that the company is developing a large scheme of expansion in overland central stations in the Upper Rhenish district, where it is sought to secure a position of monopoly. The Rhine-Hessen undertaking will supply 134 localities, and it has been arranged that the Worms works shall co-operate with the Mayence municipal works in the event of any interruption in the supply from either stations.

The report of the *Telephon Fabrik Ges. vorm. J. Berliner, of Hanover*, which has just declared a dividend of 8 per cent. for 1910-11, as compared with 12 per cent. in the preceding year, states that the principal reason for the decline in the net profits on the same turnover as in 1909-10 was to be found in the circumstance that the works were more dependent upon the export trade than formerly, and this necessitated increased expenses. Government orders were also of less extent. The branches were sufficiently employed, and the participation in the French and English trade yielded satisfactory profits. The Buda Pesth factory, which was converted into a company, was fully occupied in the second half of the year, and a considerable stock of orders was brought over into the new year. The department for wireless telegraphy had to be equipped, although it had not yet resulted in substantial profits. The net profits were £23,000, as against £32,000 in 1909-10. It was mentioned at the recent meeting that the orders received for Government account had improved in the new financial year.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Mexican Light and Power Co., Ltd.—Fully-paid scrip for £1,000,000 5 per cent. second mortgage 50-year bonds.

And to allow the following securities to be quoted in the Official List :—

Central London Railway Co.—£385,000 4½ per cent. preference stock, in lieu of the scrip, together with £95,000 additional 4½ per cent. preference stock.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—$7,100,034 common stock in shares of $100 each; and $6,360,054 6 per cent. preferred stock in shares of $100 each.

Marconi's Wireless Telegraph Co., Ltd.—According to the financial Press, the secretary of this company has just issued a circular as follows :—"I am directed to inform you that the dividend on the 7 per cent. cumulative participating preference shares for the six months ending December 31st, 1911, will be paid on February 1st next. The company having interests in so many distant countries, it is feared that some six months must elapse before it will be possible to present the accounts for the year 1911. Therefore, feeling satisfied that the year's results will warrant their action, the directors have declared a further interim dividend on the ordinary shares at the rate of 5 per cent., making a total distribution to date of 10 per cent. for the year ending 1911. Should it be determined at the annual general meeting to make a further distribution in respect of the year 1911 both classes of shares would rank equally therein. The transfer books of the company will be closed from January 1st to 7th, 1912."

Direct West India Cable Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (1s. 6d. per share), free of income-tax, on the ordinary shares for the half-year to December 31st.

Siemens & Halske Co.

The report of the directors records a fresh increase in the orders received in 1910-11. In some departments a decline in prices was perceptible, but this was partly compensated by a larger output and partly by the advantageous development of other branches. The company realised £750,000 through the sale of Government securities, and transferred the sum as a loan to the Siemens-Schuckert Works. Noteworthy progress was made in the light electrical engineering departments. Automatic telephone exchanges had stood the test in every respect in Germany and abroad, and further orders had consequently been given by public authorities and private undertakings. The use of the Pupin loaded coil system both for cables and aerial lines had been further developed with good success, and the submarine telephone cable between Dover and Calais had been followed by the laying of a similar cable between England and Belgium. In the case of wireless telegraphy, the Gesellschaft-fur Drahtlose Telegraphie, of Berlin, had united with the Brussels Marconi Co. for the formation of the German Wireless Operation Co., the object of which was to erect and work stations on German merchant vessels. The equipment of the principal home railways and lines in other countries with the S. and H. section blocking system had again progressed. The development of the Wotan lamp had substantially advanced, and the company had arranged with the General Electric Co., of New York, for a mutual exchange of inventions and experience in this respect, the arrangement having been extended to the A.E.G. and the Auer Co. Concerning the recent reduction in the prices of glow lamps, the report states that it is believed that compensation will be obtained from increased sales, both of the Wotan lamp and the tantalum lamp. The accounts contain the appended figures :—

	1910-11.	1909-10.
Share capital	£3,150,000	£3,150,000
Bond capital	1,287,000	1,308,000
Gross profits	691,000	644,000
Depreciation	22,000	22,000
Net profits and balance forward	616,000	575,000
Special reserve fund	111,000	25,000
Bonuses	40,000	35,000
Dividend	378,000	378,000
,, per cent.	12	12
Carried forward	54,000	53,000

The extension of the Berlin Underground Railways again yielded large orders, and the new power station on the Lower Spree for the Elevated and Underground Railway Co. would shortly be opened, whilst the starting of a portion of the Hamburg Suburban Railways would also take place in the near future.

Tata Hydro-Electric Power Supply Co., Ltd.

The first annual meeting of this company was held at Bombay on November 2nd. Mr. R. D. Tata, who presided, moved the adoption of the report of the directors, the outstanding features of which were that certain contracts had been placed, certain lands taken possession of, a certain amount of excavation, masonry and building work had been done, and preparations had been in progress to obtain labour and raw material for further work this season, and for placing further contracts. More important than all is the sale of the company's power to Bombay factories. Their advisers were generally satisfied with the progress made, and on the whole, their outgoings on capital expenditure did not exceed the provision made in the estimates. In the matter of the sale of power, the agreements had been liberally drawn up to give every facility to the consumers, and the price charged had been appreciated also as liberal to the consumers. That the directors believed in the expected profit they proved by putting money into the Hydro-Electric Co.; that they believed the supply rate to be favourable, they demonstrated by applying for power on behalf of their concerns. It was a matter of regret to his firm that they could not secure the contract for the supply of power to the Swadeshi Mills at Kurla, of which they were the agents, because it was not situated in the municipal limits of Bombay city. He asked them to pass a resolution authorising payment of dividends out of capital at the rate of 4 per cent. to ordinary and preference shareholders. The interest earned on their moneys during the period under review would be more than enough to provide for payment of interest to debenture-holders, and in the estimates of capital ample provision had been made for the dividends out of capital to shareholders which they would be asked to approve.

Shrimant Ganpatrao Gaekwar seconded the proposition, which was unanimously carried.

The report referred to above contained the following notes respecting the progress of the works :—

"*Lanowla Dam.*—A length of 3,200 ft. of trench is in progress, and of this 1,200 ft. has been practically completed. The total quantity of excavation to date amounts to 6,530 hundreds of cubic feet. Masonry was commenced on March 8th, and is in progress over a length of 780 ft.; the quantity built to date amounts to 916 hundreds of cubic feet.

"*Walwhan Dam.*—Good progress has been made with the work of this Dam and the foundations have proved satisfactory. A length of 2,550 ft. of trench is in hand, 500 ft. of which is completed. Total quantity of excavation done is 6,810 hundreds of cubic feet. Masonry is in progress over a length of 380 ft., 200 ft. of which is built up to ground level. Total quantity built to date is 1,177 hundreds of cubic feet.

"*Duct.*—Excavation was commenced on a short length at the Walwhan, the total quantity excavated being 1,070 hundreds of cubic feet.

"*Tunnel Work.*—This work has uninterruptedly been proceeded with throughout the rains, excavation being done at each end. Quarters have also been erected for coolies at both ends. The tunnel is now driven 55 ft. and 75 ft. on the Shirawta and Javre sides respectively, the total length of tunnel being 5,000 ft.

"*Materials.*—Quarries for supplying Walwhan dams with stone have been opened up in the vicinity of both dams, and a quantity of stone has been collected. Lime sheds have been erected also at both dams, and a large stock of this material has been stored for use after the monsoon. The majority of this lime has been received from Bombay, but Messrs. Pauling & Co. have opened out kilns at Pomalwadi, and a small quantity of lime has already been received from these. A quantity of sand has been stacked at both dams.

"*Tenders.*—Tenders for power house, pipe line and transmission line have all been received from the consulting engineers, and have been submitted. It has been decided to accept tenders of Messrs. Escher, Wyss & Co., Zurich, Switzerland, for their hydraulic turbines; Messrs. Siemens, Berlin, Germany, for generators and exciters; and the General Electric Co., of New York, for the 100,000-volt transformers and switch apparatus. The other tenders are under consideration.

"*Receiving Station Site.*—A site at Parcel, which is very favourably situated and quite central for most of the mills, has been purchased. Foundation tests were made and proved favourable.

"*Cable-Distributing System.*—A contract was entered into with the Callender's Cable Co. for the supply and maintenance of an underground cable system for the purpose of conducting the electrical power from the receiving station to our consumers, with provision for complete installation and maintenance by the contracting company.

"*Sale of Power.*—Applications have been received aggregating approximately 34,000 I.H.P. for supplying power to the mills. Tests in accordance with guarantors' agreement are now being carried out, and lists of machinery and general details scheduled, so that formal contracts may be entered into. The work of testing and gathering general information in this connection is now two-thirds completed.

"A telephone line has been laid by the company connecting up the the tunnel ends and the dams with the contractors' and engineers' office. A portion of this line will afterwards form part of the permanent telephone system required when power supply is started.

"Labour supply was fairly good until the end of April, when the coolies started leaving for cultivation work, but it is expected that at the end of this monsoon labour will have arrived in large quantities to contend with the work in hand. Arrangements have been made with Messrs. Boyce & Co., army contractors, to open shops for supply of food stuffs to the workmen at fixed rates in relation to market prices.

"The general progress has been equal to expectations, and there now appears to be no reason why the work should not be carried out with all anticipated expedition."

Horsfall Destructor Co., Ltd.—Colonel A. P. James presided at the meeting of this company at Westminster Palace Hotel, S.W., on December 20th. He said that the turnover for the year was better by £7,585 than in 1910, and the general expenses were down £435. Though a net profit of £4,500 was earned, they thought it would be unwise to recommend any dividend in present circumstances. After providing for debenture interest, £3,676 remained, and of that £1,313 was to be transferred to reserve for depreciation of patents, and £500 placed to reserve for bad and doubtful debts. They had brought the cost of production down to a minimum, and their tenders would now be on keen competitive lines. If they could get a reasonable share of business they would go on progressing, and next year it might be possible to pay a substantial dividend.

Melbourne Tramway and Omnibus Co., Ltd.—The directors announce a dividend of 4½d. per share for the current quarter, and a bonus at the rate of 5 per cent. per annum for the half-year ending the 31st inst., making 7½d. per share.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 24th, 1911, were 739,287, compared with 626,393 units in the corresponding four weeks of 1910.

STOCKS AND SHARES.

Tuesday Evening.

Only a sterner sense of duty than a writer on finance might be expected to possess is responsible for any Stock Exchange article at all this week. The only things of fresh interest that are worth mentioning since our last notes under the above heading appeared are lively movements in Marconi shares, Underground Income bonds, and National Telephone Deferred stock, the last-named rising in rocket-like fashion upon a general tip to buy on the eve of the Government's pronouncement with regard to the price that is to be paid for the undertaking.

In the circumstances, it would appear an appropriate occasion for comparing the prices of a year ago with those current to-day—which, incidentally, is not the least laborious task that can be set during a Christmas season. Moreover, we have the solemn assurance of many people that nobody ever looks at lists of comparative prices. But this, of course, must be in respect of other markets, for the movements in electrical issues are always so interesting

that not to set them out would be to court reproach. The year has seen a good many vicissitudes in quotations, with an ever-increasing interest in Latin-Canadian issues of the electrical type; but we start our short catalogues with a list of Home Railway stocks, showing the fluctuations of the year :—

Stock or share.	Dec. 31, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Central London Ordinary	64	68	78⅝	63½
,, ,, Deferred	45	51	67¼	44½
City and South London	28	31	36½	26⅝
Metropolitan	41¼	43⅜	55¼	39⅜
Metropolitan District	27⅜	34¼	34⅞	23⅝
Underground 6 per cent. income	39	73	75	39

Following the above, we may proceed to the prices of some of the more popular tramway and traction issues, in which it will be seen that the feature is the big rise that has occurred in Sao Paulo stock. Where nothing is mentioned, it is to be understood throughout these lists that the stock or share quoted is of the Ordinary class.

Stock or share.	Dec. 31, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Anglo-Argentine Trams 1st Pref.	4⅞	5½	5⅝	4⅝
British Columbia Deferred	144	138½	153½	138½
British Electric Traction Ord.	1½	1½	2¾	⅞
,, ,, ,, Pref.	3⅜	4¼	5¼	3⅜
London United Trams Pref.	1⅞	3⅛	4 5/16	1 13/16
Mexico Trams	124	122	130½	114¼
Rio Trams	105½	114¾	120	104
Sao Paulo	153⅜	186	192	154

For lighting companies the twelvemonth has been one in which the transition stage still holds investors back from putting much money into companies that are known to have been hit heavily by the introduction of the metallic-filament lamp in the first place, and by the revived energy displayed by the gas companies in the second. Within the last few weeks a firmer tendency has been manifest, and these are some of the principal changes on the year :—

Stock or share.	Dec. 13, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Brompton	7⅛	8⅛	8¼	7
Chelsea	3⅜	4½	4 7/16	3⅜
Charing Cross	3⅜	3⅜	4⅜	3⅜
City of London	11½	12⅜	13⅛	11
County of London	7⅝	9⅛	9⅞	7⅛
Kensington	6⅜	7	7¼	6⅜
Metropolitan	3⅛	3¾	4⅜	3⅜
St. James'	7⅝	8	9⅛	7⅛
Westminster	7¾	8⅛	8½	7½

Several of the principal Colonial and foreign descriptions deserve to be mentioned, and this is a very short table of representative examples :—

Stock or share.	Dec. 31, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Calcutta	6⅞	6½	7½	6½
Canadian General	104	112½	119¾	103¼
Mexican Light and Power	89½	88½	95½	79⅝
Montreal	102⅝	198	199	144
Northern Light 5 per cent.	79	40	79¼	39¼
Shawinigan	111½	126	126½	111
Victoria Falls Pref.	13/16	¾	1 1/16	¾

In the Telegraph market the feature, of course, has been the wonderful rise in the price of Marconi shares. Changing hands as low as 13s. 6d. at one time, they have quite lately been up to £3, the latter price being *ex* valuable rights in respect of the new issue that was made to provide more working capital. The remarkable recovery shown by the rise rests upon the fact that the company's chief competitors have come into a working agreement, while the field of its operations expands year by year. At the same time, that there is plenty of scope for the older concerns has been abundantly demonstrated, and the prices of the latter have not been much affected. Here are a few examples of leading stocks and shares in this section :—

Stock or share.	Dec. 31, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Anglo-American Preferred	115	111	118⅛	110½
,, ,, Deferred	28¾	26½	28⅝	24⅝
American Telephone & Telegraph	145	143½	157¾	138
Eastern Telegraph	136½	139	140⅜	131½
Eastern Extension	13½	13½	14¼	12¼
West India and Panama	1⅞	2¼	3¼	1⅞
National Telephone Deferred	129	132	146	112
Marconi	1 1/16	2⅜	2 15/16	1 1/16

Manufacturing varieties, apart from India-Rubber shares, have attracted no particular attention, and the movements shown in a brief list of prices are explained by causes easily remembered. These are some of the chief fluctuations :—

Stock or share.	Dec. 31, 1910.	Dec. 22, 1911.	1911. Highest.	1911. Lowest.
Aron	½	1 1/16	1 3/16	½
Babcock	5⅞	6	6 3/16	5⅝
British Insulated	7	6⅞	7⅜	6⅝
Brit. Westinghouse 4% Debenture	58½	57⅞	64	55
Callender's	9⅜	9⅜	9¾	8⅜
Dick, Kerr	15/16	15/16	1 1/16	15/16
General Electric Preference	8¼	9⅜	9⅜	8 1/16
Henley's	12⅜	12¼	13¼	12
India-Rubber	15⅝	10	17	10
Telegraph Construction	39	35	40	34

It is, of course, impossible to even touch upon many of the most important points of the year in so short an article, which, after all, is intended to be statistical rather than anything else. The coming year will open with a brighter outlook for Home Electrical Supply companies, with a keen public demand for Latin-Canadians, and with public attention widely stirred by the giant strides of progress made by the District Railway; and prices should respond readily enough if business improves. It is with a sincere hope that everything which our readers buy may "go up" that we conclude this *résumé* of the old year, and with the expression of our best wishes for a very prosperous 1912 to all who read these notes so patiently.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Dec. 20	2,793	+ 196	29	44,285	+ 2,474	..	..
Ayr	,, 23	386	+ 9	32	10,808	+ 98	8	..
†Bath	Nov. 25	649	+ 16	48	40,218	+ 1,248	..	..
†Birkenhead	Dec. 19	1,089	— 1	37	42,780	+ 1,474	13·7	..
Birmingham Corp.	,, 16	19,415	+4,692	37	317,958	+63,181	56·4	..
Blackburn	,, 20	2,056	+ 62	38⅛	44,875	+ 3,708	14·6	..
Blackpool Corp.	,, 21	829	+ 87	..	57,767	+ 7,440	..	..
†Blackpool-Fleetw'd	,, 16	215	— 5	24	25,235	+ 2,068	..	..
†Bolton	,, 2	2,412	+ 172	36	90,575	+ 6,040	26	..
Bournemouth	,, 20	2,942	+ 155	38	69,658	— 200	21·9	..
Bradford	,, 16	10,051	+ 428	36	205,143	+13,861	56	1·2
Brighton	,, 24	1,711	+ 5	38⅞	41,132	+ 2,264	9·5	..
Bristol	,, 22	12,547	+ 326	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 15	528	+ 101	50	11,425	+ 524	3·65	..
Barnsley	,, 15	363	+ 21	,,	9,272	+ 683	..	..
Barrow	,, 15	688	+ 142	,,	15,488	+ 2,240	5·37	..
Devonport	,, 15	988	+ 100	,,	24,970	+ 3,662	8·85	..
Gateshead	,, 15	2,083	+ 83	,,	52,303	+ 2,851	11·25	..
Gravesend	,, 15	402	+ 7	,,	10,679	+ 368	6·5	..
Greenock	,, 15	1,424	+ 501	,,	36,503	+ 6,005	7·25	..
Hartlepool	,, 15	471	+ 99	,,	13,630	+ 1,458	6·72	..
Kidderminster	,, 15	178	— 13	,,	5,791	+ 391	..	..
‡Leamington	,, 15	276	+ 3	,,	8,837	+ 439	..	..
Merthyr	,, 15	396	+ 11	,,	10,454	+ 204	2·9	..
Metropolitan	,, 15	16,225	+1,476	,,	438,588	+65,032	22	..
Middleton	,, 15	683	+ 15	,,	16,964	+ 1,318	8·5	..
Mid. Joint Com'tee	,, 15	8,416	—3,454	,,	260,169	—30,523	..	..
Oldham—Ashton	,, 15	1,106	+ 35	,,	28,792	+ 1,811	9·13	..
Peterborough	,, 15	219	+ 2	,,	6,405	+ 626	5·31	..
Potteries	,, 15	4,194	+ 128	,,	98,020	+ 8,811	29	..
Rothesay	,, 15	79	— 2	,,	10,114	+ 57	2·75	..
Southport	,, 15	461	— 4	,,	15,054	+ 563	8·17	..
S. Metropolitan	,, 15	1,381	+ 3	,,	42,769	+ 2,168	..	..
Swansea	,, 15	2,132	— 5	,,	57,225	+ 3,246	12·5	..
Tynemouth	,, 15	278	— 14	,,	12,839	+ 388	3·75	..
Weston-s-Mare	,, 15	49	— 2	,,	8,187	+ 1,052	3	..
‡Worcester	,, 15	480	— 58	,,	14,680	+ 570	5·75	..
Wrexham	,, 15	196	+ 11	,,	5,126	+ 298	..	..
Yorks. Wool. Dist.	,, 15	2,003	+ 95	,,	52,773	+ 3,537	17	..
Miscellaneous	,, 15	405	+ 30	,,	11,499	+ 748	..	..
Burnley	,, 23	2,873	+ 314	..	..	..	11·75	..
†Burton-on-Trent	,, 17	261	— 20	37	10,817	+ 552	6·62	..
†Bury	,, 17	1,146	+ 38	37	48,211	+ 4,012	22·5	..
†Cardiff	,, 16	2,350	+ 155	37	91,8 9	+ 6,851	..	..
Chatham and Dist.	,, 21	1,603	— 94	..	43,389	— 115	15	..
Cork	,, 21	934	— 17	..	25,367	+ 546	9·9	..
Croydon	,, 1	2,991	+ 210	35	64,048	+ 4,651	11·1	..
†Darlington	,, 9	203	+ 15	37	8,201	+ 764	..	..
†Darwen	,, 15	246	+ 1	37	10,005	+ 710	4·36	..
Dover	,, 16	875	+ 21	37	9,842	+ 1,368	4·75	..
†Dublin	,, 15	5,259	— 82	..	147,461	+11,866	54	..
Dundee	,, 22	2,212	+ 87	27	82,513	— 760	15	..
†East Ham	,, 16	1,044	— 22	37	41,056	+ 2,276	7·87	1
Exeter	,, 22	624	+ 33	38	13,324	+ 876	5·5	..
Glasgow	,, 23	36,127	— 174	..	563,355	+36,191	98	..
†Hastings	,, 14	694	— 4	..	..	+ 62	..	..
Huddersfield	,, 16	3,612	+ 24	37	71,527	+ 7,149	29·5	1
Hull	,, 23	6,362	+ 387	38	111,816	+ 6,004	14·5	..
Ilkeston	,, 22	214	— 3	38	5,055	+ 87	..	..
†Ipswich	,, 16	289	— 10	37	16,981	+ 889	10·5	..
†Kilmarnock	,, 16	151	+ 8	21	5,146	+ 407	4·25	..
Lancashire United	,, 20	2,496	+ 43	51	68,573	+ 2,5.3	39	..
Leeds	,, 16	14,639	+ 909	37	281,637	+19,485	50·75	2
†Leicester	,, 16	2,499	+ 87	..	..	..	..	..
Leith	,, 23	1,180	+ 117	31⅝	20,978	+ 1,607	8·7	..
Liverpool	,, 16	23,540	+ 832	50	573,397	+18,688	116	2·5
‡L.C.C.	,, 13	84,756	+ 998	..	1,624,001	+85,484	139	5
†London United	,, 16	5,247	— 256	..	322,953	+11,380	..	..
†Lowestoft	,, 16	177	+ 2	11	1,948	+ 16	3·5	..
†Manchester	,, 16	16,127	+ 236	37	605,908	+32,624	183	..
†Newcastle	,, 16	4,824	+ 383	..	161,123	+12,781	14·5	..
Newport	,, 16	1,327	— 15	37	26,455	+ 976	14·5	..
†Oldham	,, 17	1,905	+ 101	38	74,001	+ 3,388	28·75	·5
†Pontypridd	,, 16	397	— 17	37	15,506	— 9	5 5	..
Portsmouth	,, 16	3,325	— 170	37	85,023	+ 6,537	15·25	..
Preston	,, 20	1,468	+ 57	38	30,012	+ 2,115	..	..
Rotherham	,, 21	1,380	+ 95	37⅞	26,152	+ 2,121	12	..
Salford	,, 18	9,511	+ 194	37⅞	183,716	+ 8,284	..	..
Sheffield	,, 19	6,666	+ 358	..	245,628	+15,711	40	..
†Southampton	,, 13	1,055	— 40	37	46 382	+ 5,466	22	..
Southend-on-Sea	,, 20	922	+ 102	38	27,409	+ 4,115	..	..
South Shields	,, 16	1,164	+ 156	37	23,526	+ 2,586	..	..
Swindon	,, 6	283	+ 22	..	5,834	+ 686	..	..
Tyneside	,, 20	852	+ 172	25	12,631	+ 1,998	..	..
Wallasey	,, 9	1,951	+ 147	36½	40,673	+ 5,534	..	..
†Walthamstow	,, 16	646	+ 11	37	28,370	+ 1,768	9	..
West Ham	,, 14	5,206	+ 178	37	101,131	+ 9,121	15·25	..
Wolverhampton	,, 20	1,932	— 9	38	37,671	+ 2,007	25	..
†Cen. London Rly.	,, 16	5,440	— 396	24	114,564	—16,562	6·32	..
City & S. Lon. Rly.	,, 24	7,196	— 188	25	80,924	— 611	7·26	..
Dublin-Lucan Rly.	,, 22	236	+ 1	25	3,692	— 41	7	..
†G.N. and City Rly.	,, 16	1,788	+ 194	24	35,010	+ 1,211	3·5	..
†L'pool Overh'd Rly.	,, 17	1,544	+ 161	..	36,027	+ 2,167	6·8	4·8
†Llandudno-Col. Bay	,, 15	115	+ 7	2½	251	+ 13	..	..
†Lond. Elec. Ry. Co.	,, 16	14,765	+ 330	24	311,660	+10,525	21·25	..
†Mersey Railway	,, 16	2,278	+ 79	24	47,026	— 994	4·5	..
Metropolitan Rly.	,, 24	88,268	+ 648	25	424,240	— 3,901	24·5	..
†Met. Distriot Rly.	,, 16	12,279	+ 512	24	269,903	+11,966	24	..
Anglo-Argentine	,, 23	105,815	+6,043	..	2,507,903	+201,893	..	..
§Auckland	Nov.	16 594	+1,168	20	81,451	+ 6,196	23·8	·6
Bombay (B.E.T.)	Nov. 24	6,533	+ 464	47	137,165	+ 8,801	..	..
§Brisbane	Nov.	21,890	+3,100	48	227,870	+27,450	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
†Calcutta	Dec. 18	3,834	+ 450	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Nov.	3,165	..	48	37,944	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Dec. 15	1,515	+ 80	..	34,036	+ 2,840	..	..
§Montevidoo	Nov.	26.614	+2 523	..	..	..	..	..
†Perth (W.A.)	Dec. 16	1 869	+ 229	..	81,112	+17,192	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 22nd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7⅜ — 8¾	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅞ — 8⅜	..	5 19 4
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3½ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	93 — 96 xd	..	4 3 4
Chelsea, Ord.	5	5	4†	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	99 —102	..	4 8 3
City of London, Ord.	10	7	6†	12⅝ — 13⅜	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅞ — 9⅜	..	5 6 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7¼	..	6 4 2
Do. 4 % Deb.	Stock	4	4	9¼ — 96	..	4 3 4
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	..	1¼ — 2	..	3 0 2
Do. 6 % Pref.	5	6	6	4½ — 4⅞	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	87 — 90 xd	..	4 8 11
Metropolitan	5	5	4†	3⅝ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —106	..	4 4 11
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3⅜ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	7⅜ — 8⅛	..	6 1 3
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 19 1
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅞	..	Nil
South London, Ord.	4	5	..	2¾ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	100 —103	+2	4 17 1
South Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	¼ — ⅜	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅝ — 8⅝	..	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8½	7†	6 — 6⅛	..	6 10 9
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	110 —115 xd	..	6 1 9
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93 xd	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	+1	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	⅝ — ¾	..	8 0 0
Kaministiquia Power, 5% G. Bs.	$500	5	5	102½ —104½	..	4 15 8
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	100—102	..	4 18 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	87½ — 89½	..	4 9 5
Do. 7 % Cum. Pref.	$100	7	7	107½ —109½	..	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	+ ½	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	91 — 93	+ ½	5 7 6
Montreal, Lt., H. and Power	$100	7	8	196 —200	..	3 10 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	—2	12 3 10
River Plate, Ord.	Stock	10	..	235 —245	+2	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	104 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	125 —127	..	3 3 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	+ ½	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¾d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½—108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7 — 7½	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	142½—144½	+ ½	5 10 4
Do. Collat. Trust	$1000	4	4	95 — 97	..	4 2 6
Anglo-American Telegraph	Stock	3¾	3†	66⅛ — 68⅜	..	5 9 6
Do. 6 % Pref.	Do.	6	6	110⅜—111⅞	..	5 7 7
Do. Def.	Do.	30/-	..	25⅞ — 26⅜	..	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	7 — 7¼	..	4 16 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	9⅞ — 10½	— ¼	5 14 3
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100½—102½	..	4 7 10
Direct United States Cable	10	4½	..	7½ — 8	— ⅛	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 8 3
Eastern Telegraph, Ord. Stock	Stock	7	5†	137½—140½	..	4 19 8
Do. 3½ % Pref. Stock	Do.	3½	3½	83½ — 85½	..	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100½—102½	..	3 18 1
Eastern Extension	10	7	5†	13¼ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10⅞ — 11¼xd	..	5 6 8
Do. 6 % Pref.	10	6	6	12⅝ — 13½xd	..	4 10 9
Great Northern Telegraph	10	18	5†	3½ — 83¼	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	83 — 86	+1	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	72 — 75	—1	5 6 8
Marconi's Wireless Telegraph	1	5	..	2 1/16 — 2 1/16	— 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	2⅛ — 2⅜	..	..
Monte Video Telephone, Ord.	1	6	6	1⅝ — 1 11/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1 3/16 — 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	104 —106	+ ½	5 13 2
Do. Def.	Do.	6	6†	131 —133	+9½	4 10 3
Do. 6 % Cum. 1st Pref.	10	6	6	9⅜ — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10½	..	5 14 3
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 6	+ ⅛	4 3 4
Do. 3½ % Deb.	Stock	3½	3½	95½ —101½	+ ½	3 9 4
Do. 4 % Deb.	Do	4	4	99½—101½	+ ½	3 18 10
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100⅝—101⅜	..	4 8 5
Oriental Telep. and Elec.	1	8	..	1 1/16 — 1⅛	..	4 18 6
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 3/16	..	4 13 8
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½	..	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5†	8¾ — 9¼	..	4 6 6
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 1/16 — 1⅛	..	4 15 3
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99 —101	..	3 19 3
West India and Panama Teleg.	10	1¼	1½†	2¾ — 3	..	4 3 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	103 —105	..	4 15 3
Western Telegraph, Ltd.	10	7	6†	13⅜ — 13⅞ xd	..	5 0 11
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds.	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Dec. 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 1/2	..	6 18 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1¼	+ 1/16	Nil
Do. 6 % Pref.	10	1½	1½	4 — 4½	+ 1/8	3 6 8
Do. 5 % Deb.	100	5	5	92 — 95	..	5 5 8
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	+1	5 8 5
Central London Railway, Ord.	100	3	3†	67 — 69	..	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	50 — 52	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	8 16 11
City & Soutb London, Ord.	100	1½	1¾†	30½ — 31½	..	4 15 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1¼	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	5/8 — 3/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 14 8
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 3/8 — 2 7/16xd	..	4 6 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancasbire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	98 —100	+1	4 0 0
London United Trams, 5 % Pref.	10	Nil	..	2 7/8 — 3 1/8	..	Nil
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1
Metropolitan Railway Consol.	100	1⅜	2†	43¼ — 43¾	..	3 3 3
Do. Surplus Lands	100	2½	3†	66 — 68	..	4 0 11
Do. 3½ % Deb.	100	3½	3½	90 — 92	+1	3 16 1
Do. 3½ % Pref.	100	3½	3½	86 — 88	+1	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	31 — 31½	+2½	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½†	89 — 91	+1	3 11 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5/8	5†	27/32 — 31/32	..	5 12 4
Do. Def.	1	Nil	..	3/32 — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	29/32 — 31/32	..	5 3 1
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	13/16 — 29/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	91 — 94	..	4 15 9
Soutb Metro. Trams, 6 % Pref.	1	6	..	5/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	2 3/8 — 2 5/8	+ 1/2	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1½†	72 — 74	+6	1 7 1
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorksbire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	Nil	..	2 3/16 — 2 5/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	5 1/16 — 5 5/16	..	4 14 1
Do. 2nd Pref.	5	5	5½†	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4½ % Deb.	100	4½	4½	101½ —103½	..	4 7 0
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Anckland Trams, 5 % Deb.	100	5	5	104 —107	..	4 13 6
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/8 — 11 1/8	..	5 5 6
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98½ —100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	8 1/4 — 8 3/8	..	4 12 9
Do. 5 % Pref.	5	5	5	4 3/8 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	103 —106	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8†	136 —141 xd	—1	5 13 6
Do. Pref. Ord.	100	6	6	117 —121	—1	4 19 6
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	104 —106	..	4 4 11
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 7 0
Calcutta Trams, Ord.	5	6	..	5 1/4 — 5 3/8	+ 1/8	5 4 4
Do. 5 % Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2½†	1/16 — 3/16	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 3/8 — 5 5/8	..	5 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	102 —105	..	4 15 3
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94 xd	..	5 6 5
Do. 6 % B Deb.	100	5	6†	58 — 62 xd	..	8 1 4
La Plata Elec. Trms, Prf.	1	6	6	23/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	..	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93½ — 95½	..	5 4 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com.	$100	7	7†	121 —123	..	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	103 —105	..	5 14 3
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 7/8 — 7 1/8	..	6 18 0
Do. 6 % Pref.	5	6	6	5 1/2 — 5 3/4	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	97 1/4 — 99 1/2	..	5 0 6
Pertb (W.A.) Elec. Tr., Ord.	1	2½	..	13/16 — 1	..	2 10 0
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 3/8 — 5 5/8	+ 1/8	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	114¼ —115¼	..	4 6 9
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	96¼ — 97¼	..	5 2 10
Sao Paulo Tram, Lt. and P.	$100	10	10†	184 —188 xd	..	5 6 5
Do. 5 % 1st Deb.	$500	5	5	101 —103	—1	4 17 1
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5 3/8 — 5 5/8 xd	..	5 2 2
Do. 6 % Pref.	5	6	6	5 — 5 1/4 xd	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	3 3/32 — 3 7/32 xd	..	7 2 2
Babcock & Wilcox	1	26	24†	5 7/8 — 6 1/8	..	4 5 0
Do. Pref.	1	6	6	1 3/4 — 1 7/8	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 7/8 — 7 1/8	..	7 0 4
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Britisb Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
Britisb Westinghouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	56 — 59	—1	6 15 7
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	5 — 5 1/4	..	4 15 3
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	3 1/2 — 3 5/8	..	5 10 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	60 — 70	..	7 2 10
Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/16	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	7/8 — 1	..	Nil
Do. fully paid	5	Nil	..	1 3/8 — 2 3/8	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	5/8 — 7/8	..	..
Do. Pref.	2	7	7	1 3/8 — 1 7/8	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8 7/8 — 9 3/8	..	5 6 8
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 1/8 — 5 1/8	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9 — 11	..	..
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	20	10†	34 — 36	—1	6 13 4
Do. Deb.	100	4	4	100 3/4 — 102 1/4	..	3 18 11
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	53 — 63	..	7 2 10

* Unless otberwise stated, all sbares are fully paid. † Interim dividend.

The yields are calculated upon tbe dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1911.

A month ago we had occasion to remark on the excellent returns for electrical export business during October. The November returns are even better, the total of £527,187, comparing with £464,191 a month ago, and easily taking first place during 1911. Of the above total for November, telegraphic exports account for £100,712, principally in two large items for Cuba and Brazil.

During the month electrical machinery exports amounted to considerably over £200,000 in value, while cable exports approached £99,000 in value. The electric glow-lamp section, to which we may again draw attention, shows exports amounting to £15,314, or nearly £2,000 in advance of the October figures.

The imports reached £229,471 in value, a comparatively high figure, and included no particular variation from the preceding month's returns, except as regards "glow lamps," which reached a total value of nearly £45,000, as against £29,000 in October, and "arc lamps and lamp parts," which were imported to the value of £15,000, as compared with £8,000 in October.

The re-exports have recently been on the up-grade, and reached a total of £25,049, as compared with £21,720 in October.

The division of business amongst the various purchasing countries remained much as in previous months, Russia and Cuba, however, coming well up in the list owing to exceptional purchases.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	432	1,060	494	400	...	716	28,172	4,196	56	...	1,769	264	37,559
Germany	2,604	473	27	14	711	7	2,834	...	8	...	...	73	6,751
Netherlands, Java and Dutch Indies ...	570	3,841	227	62	176	23	419	37	...	...	34	95	5,484
Belgium	852	1,907	23	10	264	104	900	245	...	...	1,661	...	5,966
France	1,914	44	1,020	50	155	106	5,456	117	...	100	319	463	9,744
Portugal	88	37	76	...	32	19	275	732	16	...	...	...	1,275
Spain, Canary Isles and Spanish N. Africa...	364	73	315	...	...	447	1,535	...	24	...	...	95	2,853
Switzerland, Italy and Austria-Hungary ...	496	...	30	...	106	...	6,572	313	8	...	450	3	7,978
Greece, Bulgaria, Roumania and Turkey ...	113	139	32	98	80	...	270	285	139	...	4	158	1,318
Channel Isles, Gibraltar, Malta and Cyprus...	343	16	16	62	...	8	93	5	7	...	...	6,244	6,794
U.S.A., Philippines and Cuba	139	66	31	501	...	41	411	15	11	54	...	32,865	34,134
Canada and Newfoundland	957	3,473	779	1,811	88	2,042	9,114	...	223	32	832	418	19,769
British West Indies and British Guiana ...	47	...	205	...	...	28	655	...	39	12	21	26	1,033
Mexico and Central America	11	35	2	...	...	...	615	...	8	...	7	38	716
Peru and Uruguay	172	818	108	122	38	30	535	385	...	20	23	15	2,266
Chile	356	889	244	129	29	262	9,357	332	886	...	216	256	12,956
Brazil	857	1,603	598	555	...	337	7,592	180	94	...	1,391	53,284	66,491
Argentina	3,306	9,984	694	1,201	759	1,049	11,288	413	2,261	67	2,180	1,592	34,794
Colombia, Venezuela, Ecuador and Bolivia	61	52	82	...	...	...	438	...	...	...	4	50	687
Egypt and Persia	347	...	77	54	38	288	3,124	99	239	...	137	557	4,960
British West Africa	84	38	256	...	...	...	48	16	46	115	51	42	696
Rhodesia, O.R.C. and Transvaal	2,240	1,968	417	1,149	20	114	5,214	2	142	28	...	1,359	12,653
Cape of Good Hope	1,471	1,669	285	582	24	182	2,813	170	87	11	241	...	7,535
Natal	1,105	5,815	396	178	16	300	2,600	3,082	97	...	323	136	14,048
Zanzibar, Brit. E. Africa, Mauritius & Aden	61	...	15	22	...	17	174	...	25	...	176	671	1,161
Azores, Madeira and Portuguese Africa ...	524	588	270	30	...	...	1,427	...	35	...	4	86	2,964
French African Colonies and Madagascar ...	...	350	66	...	26	...	...	...	...	...	...	...	442
China and Siam	710	3,729	307	297	473	894	1,719	86	178	54	36	...	8,483
Japan and Korea	868	7,803	157	60	158	1,457	28,938	3,067	65	...	1,263	37	43,873
India	4,414	9,923	2,973	3,787	281	1,200	16,625	3,779	7,317	233	184	279	50,995
Ceylon	220	296	132	32	...	4	262	66	51	...	498	20	1,581
Straits Settlements, Fed. Malay States and Sarawak	614	5,886	226	44	15	15	1,508	16	24	...	158	714	9,220
Hong Kong	251	408	...	283	...	22	765	84	10	...	59	297	2,179
West Australia	175	2,934	215	20	...	519	1,889	2	88	...	4,583	36	10,461
South Australia	1,125	3,769	88	342	...	149	4,153	...	57	...	121	...	9,804
Victoria	1,432	8,392	931	820	...	934	5,727	3,332	2,651	16	1,485	24	25,744
New South Wales	3,312	15,958	344	1,019	29	822	10,221	1,125	240	...	681	164	33,915
Queensland	279	319	60	239	25	...	4,518	...	133	...	1,892	...	7,465
Tasmania	72	180	16	140	...	...	...	91	...	...	120	44	663
New Zealand and Fiji Islands	1,590	4,045	934	1,201	14	1,979	6,183	300	168	...	3,056	307	19,777
Total, £	34,576	98,580	13,168	15,314	3,557	14,115	184,439	22,572	15,433	742	23,979	100,712	527,187

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	60	...	...	198	12	10	6,227	25	333	6	5,960	12,831
Germany	2,052	6,118	2,513	42,353	7,071	2,181	49,145	497	2,893	7,688	32,025	154,536
Holland	59	...	...	657	736	...	18	...	...	...	...	1,470
Belgium	674	921	42	12	24	266	3,663	8	527	502	7,798	14,437
France	173	250	1,224	736	414	174	591	286	640	2,860	396	7,744
Switzerland	140	1,501	...	26	...	234	1,790	...	4	21	32	3,748
Austria-Hungary	5	555	...	794	308	...	501	...	92	202	682	3,139
United States	2,149	473	581	...	6,397	...	8,098	7,188	311	81	5,723	31,001
Total, £	5,312	9,818	4,360	44,776	14,962	2,865	70,033	8,004	4,800	11,360	52,616	228,906

Additional imports: New South Wales, machinery, £20; Canada, goods, £105; Spain, carbons, £440.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,455	1,334	...	2,732	345	...	8,423	...	290	164	306

Total Exports: £527,187. Total Re-Exports: £25,049 Total Imports: £229,471.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

Motors, Secondary Batteries, Measuring Instruments and Switchgear. By S. Kenneth Broadfoot, A.M.I.E.E. London: Constable & Co. Price 1s. net.

This book has four chapters, one to each division of its title, and each chapter has a number of clearly-defined paragraphs. The salient fault is incompleteness, but this could hardly be avoided in so small a treatise. In Chapter I a statement of the various electrical units is hurled at the reader without any adequate introduction or explanation. The treatment given to measuring instruments, their applications and peculiarities is good, but would be greatly improved by the inclusion of wiring diagrams and illustrations showing the fundamental principles of the various instruments. The definition of a wattmeter as "an instrument that is influenced by the simultaneous values of current and voltage" is open to criticism. The introductory notes on power measurements are too cursory, familiarity with vectors is rashly assumed, and no mention is made of "leading" currents.

Chapter II includes a heterogeneous mass of information concerning the theory of electric motors and generators, and practical notes on a number of their faults. The practical notes should be useful, but the reader is introduced to shunt motors in 10 lines, alternators in eight lines and synchronous motors in 6½ lines; alternator faults are dealt with in four lines. The important practical distinctions between "cumulative" and "differential" compound motors are ignored.

Chapter III, dealing with motor-starters, circuit-breakers, starting difficulties, &c., is, on the whole, very good; a few more illustrations might well be added.

The notes on the charging and general management of accumulators (Chapter IV) are among the best in the book, and the index greatly enhances the value of the volume.

Far too much technical knowledge is assumed, considering the class of reader likely to be secured. We do not notice any actual technical errors, but the omission of explanatory matter is serious and the phraseology is often technically and grammatically lax. The book is capable of development into a really valuable handbook, but at present amounts to little more than an unsymmetrical expansion of a "pocket-book" treatment of the subjects concerned.—R. E. N.

An Elementary Course on Practical Applied Electricity and Magnetism. By Daniel H. Ogley, B.Eng. London: Longmans, Green & Co. Price 2s. 6d. net.

This little book is a compilation of experiments suitable for young students of electricity. It consists of a brief account of some 64 more or less simple experiments, and contains diagrams of the apparatus and working instructions. Dr. Rhodes, who writes the preface, says that he has been impressed for some time with the need for such a book; that students under present arrangements have about 1½ hours' practical work in the laboratory per week, and that during that time it is impossible for the instructors to get round them all; that students in many cases, therefore, think they are not getting value for their money; that however, with the present book in their hands, this disability will be removed, for such students will be informed beforehand of the experiment to be performed on any particular evening, and will thus be enabled to look up the theoretical work bearing upon it before they come to class.

We are not altogether impressed with this argument; and, as a matter of fact, we are not altogether impressed with the need for the book. The chief objection, if such a book were universally used in our technical schools, is that all elementary laboratory work (and laboratory work in the elementary stages is, without exception, the most important a young student can perform) would be stereotyped with the methods of one particular teacher. Even if the teacher is a good teacher, even if he is above the average, such a system is bad. It takes a very good teacher indeed, and one with long and varied experience, to know instinctively those parts of a subject that cause the average student trouble. Therefore we can expect to find in such compilations of laboratory experiments many instances where the instructions are not clear or lead to erroneous work. This, indeed, has occurred in those cases that have up to now been put to practical test.

Again, the actual teacher of the theoretical work should, in our opinion, have absolute charge of the laboratory arrangements. If he is an enthusiast in his work, he will not desire to have extraneous assistance in the form of lists of laboratory experiments with their accompanying instructions. Probably he would find that they did not agree in their setting out with some of his own methods; points on which he would lay special stress would be lightly touched upon or omitted altogether; methods which he had insisted upon would be violated, not necessarily in important points, but just in those little and apparently insignificant ones, which each particular teacher finds most effective for his own satisfactory teaching.

We are in nowise attacking the present work. It is excellent of its kind. Though we believe that the objects for which it is written can be obtained in a better way, in a way which allows individuality to the teacher, and arranges for the particular apparatus of each school, yet we are sure that the book itself has been carefully thought out, that the experiments are well graded, and that the instructions are clear. With one exception little improvement could be made in it. It is well known that elementary laboratory students have a rooted objection to satisfactorily writing up experiments. They don't mind doing them, but when it comes to entering them up in their laboratory note-books, it is another matter. Unless some systematic method is employed from the beginning results at the end of the session are apt to be disappointing. Therefore, we think it would have been desirable to have included in the book a descriptive method of writing up experiments.

With regard to laboratory work, we may say here that there is a tendency to try to make of it an exact science. Enthusiasts who got hold of experimental work in its earlier stages, when all was disorganisation and confusion, saw their chance. They foresaw possibilities that were really not in it. Consequently and naturally they overshot the mark.

We are engaged to-day in trying to restore equilibrium. For this purpose we discourage all cast-iron systems, and attempts to make the teaching of scientific work automatic. Needless to say such systems are frameworks which fall to pieces of their own weight, or which get their complex joints rusted up through impossibility of lubrication.

Imperial Telegraphic Communication. By Charles Bright, F.R.S.E., &c. London: King & Son. Price 3s. 6d.

Mr. Bright is a well-known writer on telegraphic matters and the latest addition to his list is a handy little volume in which he puts the case for Imperial telegraphs in a very condensed and convenient form. It is difficult to foresee who will read it, however. There are some, but they cannot be many, who are interested in such a subject. Those who are interested would naturally read the book on their own initiative without any suggestion from a reviewer; and it is equally certain that, no matter how the reviewer may laud it, those who are not interested would leave it severely alone. As explained in the preface, the author has made large use of reproductions of addresses and articles contributed to the British Association, the London Chamber of Commerce and various periodicals, extracts from speeches on the subject and Blue Books. With the help of these, and the promulgation of his own views, he certainly makes his case to read justly. But it is perhaps not proper to refer to the publication as a "book," it is rather an essay, and therefore an unbiased reader could not reasonably form an honest opinion on Mr. Bright's views unless he had an opportunity for considering also the views of others who may not be entirely in agreement with the author.

It is a difficult book to review, and the present writer is loath to express an opinion on Mr. Bright's views, but having read the book, and digested the arguments therein albeit not necessarily in complete agreement with the author on certain points, he must say—being one of those interested

in the subject—that he is glad to have had the opportunity for reading in concise form all the arguments which have been put forward from time to time in favour of the State ownership and control of the lines of communication between Great Britain and her numerous dependencies. The work is not without certain topical interest at the present time, because of the discussions now current in connection with the administrative changes developing in regard to the control over the various Atlantic cables, which have since culminated in amalgamation of the interests involved in the present trans-Atlantic communications. The book also has interest in connection with the announcements regarding cable rates made by the Postmaster-General in Parliament recently.—R. M. H.

The "Cole" Code or Code Dictionary. By C. H. Cole. 1911. Rugby: *Rugby Advertiser*, Ltd. Price 10s. 6d.

This code provides what is difficult to find in others, viz., valuable matter in sentences, although it seems to lessen the full value of a code word, as there are numerous instances where one single word is represented by five letters. The recommendation in the introduction that prefixes should be used in order to secure secrecy is, as is generally known, of not much value, as they can be easily ascertained by those whose desire to do so.

There is useful matter in the code, such as a very full list of banks and places, but the fatal mistake is made of putting together groups of letters which, although pronounceable, are very difficult to transmit, and are, in consequence, a frequent cause of delay and mutilation of telegrams. Such words as Luvutcuvja, Vylletyggi, Lynytvudur, Jetubvytio, Manuhhujyk, Pefykuvsy, put a great tax on operators. We have on previous occasions drawn attention to this, and in our review of Mr. Sydney A. M. Rose's "Universal Code Economiser" we had cause to explain that such words defeat the object of a telegram, *i.e.*, to secure rapid and correct transmission.

In one instance we notice that "Perim" is a code word. Names of places should never figure as such, as it may be necessary to use them in their proper sense. Although it is stated that all the code words differ one from the other by two letters, such words as Corsi, Sorci, Comip, Pomic, Farip and Parif are found, which do not fulfil these conditions. There are facilities for economising in certain directions, but the method to be adopted appears somewhat confusing; given time and thought, however, cablers may find it a useful adjunct to their present codes.

Encyclopædia Britannica. 1910. Cambridge: *University Press.*

The eleventh edition of this work has been before the public for some months, but it takes time to go carefully through the important articles on technical subjects and to gain some sort of an idea about the whole scheme of the edition. It is, of course, now fully recognised that, in almost every respect, this extraordinary collection of the latest knowledge on all subjects represents something which the world has never seen before. In this remarkable year of 1911 one of the events has been the appearance of this work. Concerning the commercial side of the enterprise the writer has no concern, although it must be obvious to anyone that the tact and diplomacy which obtained the magic words "Cambridge University" must have been of no ordinary calibre. And the mind which organised the production of this library in epitome was certainly one which was working at its correct vocation. We have little to say about the general appearance of the volumes, but, personally speaking, we have found that the thin-paper edition is a great improvement on the older and bulkier volumes.

On comparing this edition with the tenth there are two or three outstanding impressions left on the mind of the applied scientist. One is that the importance of engineering and the allied industries to the national existence is now more fully appreciated. Another is that the three branches of applied science which seem to have developed most rapidly are aviation, electrical engineering and applied chemistry. So far as pure science is concerned, the readers of this journal will think the most interesting portions of the volumes are those devoted to physical science. Before passing on to the engineering sections, we will mention these.

Many of the articles which originally appeared within the covers of the "Encyclopædia Britannica," in connection with the physical sciences, have become classical. Among those who, in the past, have written for this work, may be mentioned the names of Lord Kelvin, James Clerk Maxwell and Lord Rayleigh, all of whom wrote for the ninth edition. Sir Joseph Larmor, Sir J. J. Thomson and Sir James Dewar wrote for the supplementary volumes. In this edition we find that Prof. Hugh L. Callendar has revised Lord Kelvin's original article on "Heat," while Prof. A. E. H. Love (of Oxford), has taken hold of the article on "Elasticity."

Apparently, valuable expert advice has been obtained upon the subjects dealing with physics. It has been kept in mind that an encyclopædia must not only be a collection of articles alphabetically arranged, but it must also present facts and theories of all branches of knowledge as a co-ordinated whole. Careful attention has evidently been paid as to the best manner in which subjects could be dissected into fitting and encyclopædic and scientific headings. For it was necessary that these headings should not be regarded by the expert with offence, but should give the layman a clue to the information required. The tremendous triumph in the whole scheme is the fact that, as far as one can tell after a few months' constant use of the volumes, no particular point has been omitted, and nothing seems to have been unnecessarily duplicated. In the articles in the physics section we recognise, from the initials at the ends of the articles, such giants as Rayleigh, Callendar, Poynting, Fleming and Larmor.

Readers of this journal are familiar with the present-day notion of matter. Considered apart from its state of aggregation, we believe it to be composed of molecules, which in turn are made up of atoms, and these are collections of electrons. Who could treat that subject as well as Sir J. J. Thomson? He directs the discussion to the establishment of the electronic theory. In view of the vast amount of work in this field for which he has been responsible, his present treatment is indeed welcomed.

As for the subject treated under "Aether," that article is built up on the foundations laid by Clerk Maxwell and Larmor, in the ninth and tenth editions. It is, fortunately, Larmor who continues the story. The latter also deals with the doctrine of energy under the title of "Energetics." We must pass lightly over the Sound and Light sections, but must mention Callendar's brilliant work on "Heat" and several allied subjects. A section on instruments is well done.

Dr. Watson adds some articles to those of earlier editions on "Magnetism." Dr. Fleming is responsible for all of the work on electricity. We may say that he has divided the subject matter essentially into four articles, viz., "Electricity," "Electrostatics," "Electrokinetics," and "Electromagnetism." The first-named heading contains an historical narrative of the development of the science, and indicates the co-ordination of the principal subsidiary headings.

As an example of what may be expected, we may mention the subject "Electrokinetics." The matter of electric conduction is reserved for one article under the heading "Conduction, Electric." But that is divided into three parts—(1) solids (by Prof. Fleming); (2) liquids (by Dr. Whetham), and (3) gases (by Sir J. J. Thomson). The last is, indeed, a complete monograph of the most authoritative nature.

We must not omit a reference to a series of articles on measuring instruments. In the preceding edition that omnibus title was used. Now we find headings "Amperemeter," "Voltmeter," "Wheatstone Bridge," and so on. All of these many articles are on a uniform plan, and typical in form. Very lucid are the explanations of the instruments. There is a deal of theoretical matter under the title of "Electrolysis."

And so one could go on dealing with these fascinating subjects. After all, if one were to review completely the scientific and technical articles, one would need many issues of the Electrical Review for the purpose. It is only possible to point out a few of the good things; the others are all up to the same standard.

We are indeed glad to note that Mr. C. C. Hawkins has been

responsible for the article on the dynamo—it is up to the style of his book. Dr. L. Bell writes on the electric motor. The "Accumulator" article is by Mr. W. Hibbert. Power stations and questions of supply are discussed by Dr. Fleming under "Electricity Supply." His account of the practical work is splendidly supplemented by Mr. E. Garcke, who writes on commercial development, legislation and those other matters of finance which he has made peculiarly his own. Similarly, we find Dr. Fleming and Mr. Garcke responsible for "Lighting, Electric." As for "Telegraph," we have Mr. H. R. Kempe on Section I—devoted to land and submarine, while Mr. Garcke deals with Section II—the commercial aspect. Dr. Fleming devotes his attention to Section III—on wireless.

The article on "Telephone" is by Kempe and Garcke. How interestingly the latter can make a story march.

If he were less optimistic, the work of this reviewer would seem to him almost to have been wasted. For he has read all of these articles, and many of those on education, applied chemistry, metallurgy, and all the other subjects, which some of us look at with interest, and study a little, but affectionately regard as a relaxation (for our work is really connected with engineering); and then there are so many engineering subjects not yet mentioned—"Railways," for example, a capital article; and Ewing at his best on "Heat Engines," Dugald Clerk on his subject, and so on. Of course, we cannot mention all of them. The result of the hours of study of these articles could be written down in a few words. It is, "This work is simply splendid." As for the Editor of the Engineering Section, one cannot fail to envy him his task so well completed, or to congratulate him upon what he has accomplished; work such as that lives for all time. It is not ephemeral, because others will build up from it. It will always last, although, as science and its applications advance, it must be frequently revised.

As for the non-technical aspect of the volumes—well, after all, engineers are intellectual members of society. It is true that many of us find it not over easy to raise the sum needed for these books; but there are many less satisfactory ways of spending money, and the day may come when the money will pay itself back because of something found within the covers.

FRICTION IN ELECTRICITY METERS: ITS DETERMINATION, COMPENSATION, AND RESULTANT ERRORS.

(Concluded from page 1045.)

Fig. 9, reduced to a common armature speed of 1 rev. per sec. (at which velocity windage friction becomes inappreciable), shows

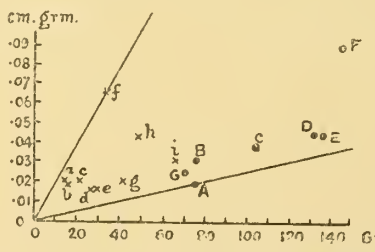


Fig. 9.—Bearing + Windage Friction at 1 r.p.s. as Function of Armature Weight.

that no definite relationship exists between bearing friction and the weight of rotating parts supported.

Figure of Merit.—From the magnitude of the quotient—

$$P = \frac{\text{Full load driving torque}}{\text{Total frictional torque at full-load speed}},$$

an opinion may be formed as to the general merits of a given meter as regards frictional resistance. It is *not* advisable to replace this quotient by—

$$Q = \frac{\text{Full-load driving torque}}{\text{Armature weight}}$$

when comparing meters, particularly if, as is generally the case, the full-load speeds of the various instruments are very different.

In fig. 10 one quotient is represented by abscissæ, the other by ordinates, and it is clear that, were Q a suitable index of the total friction in meters with rotating armatures, the various points would show a definite connection with each other. Actually, however, among the meters here tested, tan α_2 = 4·6 . tan α_1 (fig. 10), *i.e.*, the ratio P/Q varies *without rule* between values which are to one another as 1 : 4·6.

Supplementary Measurements.—As the result of carefully conducted experiments, the author concludes:—

1. Windage torque between brake disk and braking magnet varies linearly with the speed (up to 0·7 m./sec. at least), and with

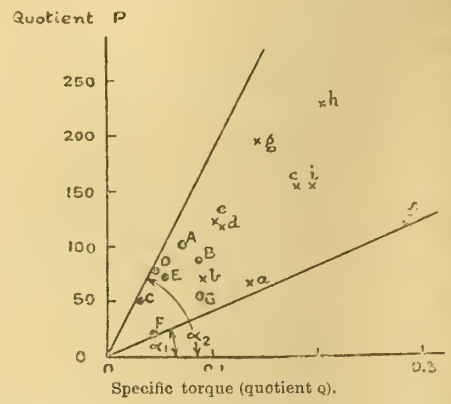


Fig. 10.—Total Friction and Specific Torque.

the air gap (at any specified velocity). In all practical cases this windage is negligible.

2. Errors in (bearing + windage) retardation tests, due to remanent magnetism in the meter cores may be avoided by exciting the field coils by a diminishing alternating current immediately prior to the test.

A method is described whereby the moment of inertia of the armature system of a meter may be determined within ± 20 per

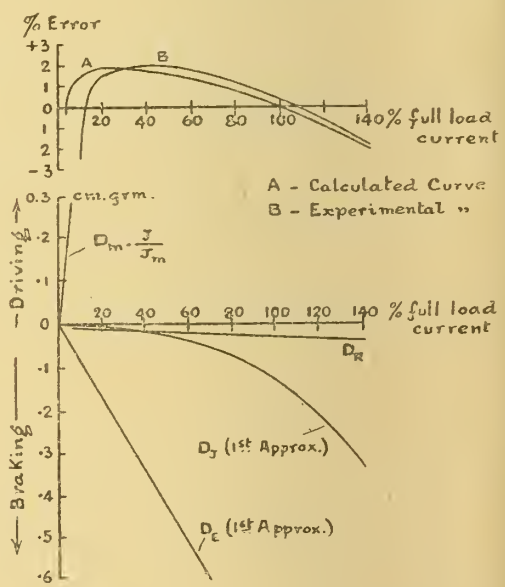


Fig. 11.—Error Curve of A.C. Meter "*g*" (Variable Current).

cent. by a retardation test. The oscillation method, already described, gives practically accurate results, and should be used whenever the armature system can be removed from the meter.

Compensation for Friction: Load-Error Curves.—In an elaborate mathematical section, the author discusses the theory of various means of meter compensation, and evolves equations whence the error curve of a meter may be predicted.

It is shown that the damping torques due to the stray fields from the current and voltage-circuits (D_J, D_E respectively) are given by—

$$\left.\begin{aligned} D_J &= C_J \,.\, du/dt \,.\, J^2 \\ \text{and } D_E &= C_E \,.\, du/dt \,.\, E^2 \end{aligned}\right\} \text{cm. grms.}, \quad \ldots \quad \ldots \quad (7)$$

(for meter "*g*", $C_J = 4{\cdot}67 \times 10^{-3}$; $C_E = 3{\cdot}29 \times 10^{-6}$ (C.G.S. units.)

The reliability of the equations deduced for the evaluation of meter error was tested by experimental verification of the predicted results. (See also Table IV.)

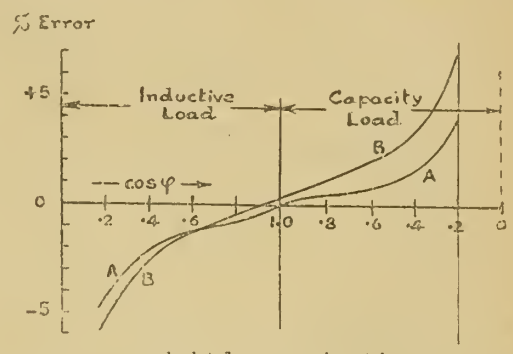
Alternating-Current Meter "g."—(a) Variable current, unity power-factor—the calculated and experimental error curves are as shown in fig. 11. At the higher loads good agreement is certain, but at low loads discrepancies arise owing to the impossibility of observing the friction compensating and light load resisting torque with sufficient accuracy. By adjusting the friction compensation the error curves of the meters here examined could be brought to almost any desired form up to 50% full load.

(b) Variable power-factor, constant current and pressure—comparative results shown in fig. 12. The calculated curve makes no allowance for friction compensation.

TABLE IV.—Extracts from Data for Error Curves (Figs. 11, 12, 13).

Case.	General data.	Cos ϕ.	Current I. % $I_{max.}$	Current I. Amps.	$\frac{d\alpha}{dt}$ (R.P.S.).	Resisting torques (cm. grm.). D_R	D_E	D_I	D_K	$(D_R - D_K)$ cm. grm.	$(D_R + D_E + D - D_K)$ cm. grm. 1st appr.	$(D_R + D_E + D - D_K)$ cm. grm. 2nd appr.	Error F_a (%) 1st appr.	Error F_a (%) 2nd appr.	Error F_b (%) 1st appr.	Error F_b (%) 2nd appr.	Error F (%). By Expt.
A.—Fig. 11. A.C. meter "g." Variable load.	500 v. 5 a. 50 ~ meter. Max. torque, 529 cm. grm. Max. R.P.S., 1·042. $\delta' = 0° 30'$. D_R — see figs. 6, 7, 8. $C_E = 3·29 \times 10^{-6}$. $C_I = 4·67 \times 10^{-3}$. $\kappa = 1·233$.	1·00	4	0·2	·0417	·0058	·0313	0	0	—	·0401	·0401	— 19·0	— 18·9	— 0·1	0	—
			20	1·0	·208	·0080	·172	·001	0	—	·1810	·185	— 17·1	— 17·5	+ 2·2	+ 1·7	+ 1·5
			60	3·0	·625	·0149	·515	·0262	0	—	·556	·565	— 17·6	— 17·8	+ 1·6	+ 1·3	+ 1·7
			100	5·0	1·042	·0233	·857	·122	0	—	1·002	1·002	— 18·9	— 18·9	0	0	+ 0·3
			140	7·0	1·46	·0330	1·20	·334	0	—	1·567	1·503	— 22·3	— 20·3	— 4·2	— 1·7	— 1·5
B.—Fig. 12. A.C. meter "g." Variable power factor.	Ditto Case *A*.	*Lagging* 0·8	100	5	·834	·0186	·686	·097	0	—	·802	·796	K.F_a — 23·4	K.F_a — 23·2	— 0·9	— 0·7	— 0·5
		0·2	100	5	·208	·008	·171	·024	0	—	·203	·193	— 23·6	— 22·4	— 5·5	— 4·3	— 5·3
		Leading 0·8	100	5	As for inductive load.				·035		·802	·809	— 23·4	— 23·6	+ 0·8	+ 0·6	— 1·4
		0·2	100	5							·203	·213	— 23·6	— 24·8	+ 5·0	+ 3·8	— 7·0
C.—Fig. 13. D.C. meter "D." Variable load.	65 v. 3 a. meter. Max. torque, 5·76 cm. grm. Max. speed, 0·969 R.P.S. D_R — see figs. 6, 7, 8. $C_K = 1·01 \times 10^{-5}$. $C_H = 1·13 \times 10^{-4}$. $\kappa = 1·000$.	1·00	3·3	0·1	·0323	·044	—	—	·009	—	—	—	— 4·7	— 4·6	In this case $F_b = F_a$ throughout (see text).		— 4·6
			20	0·6	·1938	·050	—	—	·015	—	—	—	— 1·3	— 1·3			— 1·3
			60	1·8	·5814	·061	—	—	·026	—	—	—	— 0·8	— 0·7			— 0·7
			100	3·0	·969	·073	—	—	·038	—	—	—	— 0·7	— 0·7			— 0·7
			140	4·2	1·357	·089	—	—	·054	—	—	—	— 0·7	— 0·7			— 1·3

Direct-Current Meter "D."—Concordance of calculated and experimental load-error curves is shown in fig. 13. The earth's field may vary the net torque due to the friction-compensating series



A—calculated; B—experimental.

Fig. 12.—Error Curve, A.C. Meter "*g*." Variable cos ϕ.

coil by more than 30 per cent. on turning the meter through 180°. Since the compensating field has a great influence on the meter error at low speeds, it is highly important that the present type of meter be calibrated *in situ* or at least with the same disposition of the instrument, relatively to the earth's field, as will obtain in the subsequent use of the instrument.

TABLE III.—Moment of Inertia of Armature System (by "Coasting" and "Oscillation" Methods).

Meter.	Current and voltage as per cent. of normal. J_1	J_2	E	Error in mt. inertia by coasting test. (Taking κ by oscillation test to be correct).
c	6	0	20	— 3 %
	8	0		— 12 %
B	4	0	100	+ 9 %
	2	0		+ 10 %
	4	2		+ 8 %
C	5	0	100	— 25 %
	3	0		— 21 %
	6	0	100	— 2 %

Conclusions.—Modern A.C. meters of the Ferraris type show so small a total frictional resistance that the provision of a constant compensating torque adequately corrects error due to this cause.

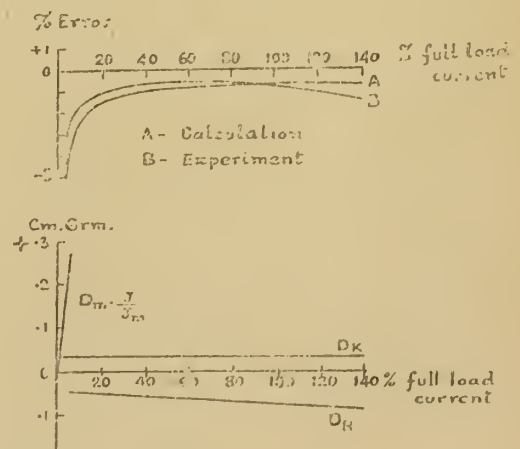


Fig. 13.—Error Curve, D.C. Meter "D." Variable Current.

Direct-current watt-hour meters are seriously affected by friction at low loads. Good compensation is possible, on constant-voltage circuits, by the provision of a constant correcting torque, but owing to the powerful influence of the earth's field, the total frictional torque should be as low as possible. Brush and clockwork friction are specially serious, bearing and windage friction vary with the armature speed and do not seriously affect the error curve. The constant frictional resistance in ampere-hour meters should be a minimum, its compensation being a complicated matter.

All meters with rotating armatures should have a low running speed; the fulfilment of this condition in A.C. meters reduces the damping error due to stray alternating fields.

TRADE STATISTICS OF HOLLAND.

The following figures, showing the imports of various goods into Holland in 1910, are taken from the recently issued annual trade statistics; the figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1909. Gulden.	1910. Gulden.	Increase or decrease. Gulden.
Machinery, steam, industrial and agricultural.—			
From Belgium	1,948,000	2,487,000	+ 539,000
„ Great Britain ...	5,676,000	5,779,000	+ 103,000
„ Hamburg	158,000	117,000	— 41,000
„ Germany	14,101,000	15,468,000	+1,367,000
„ United States ...	2,278,000	2,747,000	+ 469,000
„ Other countries ...	249,000	297,000	+ 48,000
Total ...	24,410,000	26,895,000	+2,485,000
Gutta-percha, raw.—			
From France	173,000	103,000	— 70,000
„ Great Britain ...	12,000	202,000	+ 190,000
„ Dutch Guiana ...	882,000	655,000	— 227,000
„ Java	1,598,000	5,077,000	+3,479,000
„ Other countries ...	286,000	410,000	+ 124,000
Total ...	2,951,000	6,447,000	+3,496,000
Gutta-percha manufactures.—			
From Belgium	525,000	477,000	— 48,000
„ Great Britain ...	446,000	515,000	+ 69,000
„ Germany	497,000	608,000	+ 111,000
„ Other countries ...	10,000	156,000	+ 146,000
Total ...	1,478,000	1,756,000	+ 278,000
Iron wire.—			
From Belgium	3,003,000	3,197,000	+ 194 000
„ Great Britain ...	3,000	25,000	+ 22,000
„ Germany	21,759,000	20,279,000	—1,480,000
„ Sweden	136,000	166,000	+ 30,000
„ Other countries ...	3,000	52,000	+ 49,000
Total ...	24,904,000	23,719,000	—1,185,000
Instruments, physical, chemical, &c.—			
From Belgium	587,000	532,000	— 55,000
„ Great Britain ...	379,000	484,000	+ 105,000
„ Hamburg	84.000	39,000	— 45,000
„ Germany	3,753,000	4,554,000	+ 801,000
„ Other countries ...	83,000	99,000	+ 16,000
Total ...	4,886,000	5,708,000	+ 822,000
Copper wire.—			
From Belgium	186,000	123,000	— 63,000
„ Great Britain ...	104,000	96,000	— 8,000
„ Hamburg ...	417,000	154,000	— 263,000
„ Germany	2,679,000	2,494,000	— 185,000
„ Other countries ...	22,000	68,000	+ 46,000
Total ...	3,408,000	2,935,000	— 473,000
Steel wire.—			
From Belgium	1,922,000	446,000	—1,476.000
„ Great Britain ...	447,000	644,000	+ 197,000
„ Germany	2,399,000	1,595,000	— 804,000
„ Other countries ...	22,000	21,000	— 1,000
Total ...	4,790,000	2,706,000	—2,084,000
India-rubber manufactures.—			
From Belgium	199,000	238,000	+ 39,000
„ Great Britain ...	1,379,000	2,083,000	+ 704,000
„ Germany	1,274,000	1,981,000	+ 707,000
„ United States ...	15,000	20,000	+ 5,000
„ Other countries ...	17,000	70,000	+ 53,000
Total ...	2,884,000	4,392,000	+1,508,000
Glass manufactures.—			
From Belgium	245,000	271,000	+ 26,000
„ Great Britain ...	97,000	103,000	+ 6.000
„ Germany	1,653,000	1,902,000	+ 249,000
„ Other countries ...	9,000	13,000	+ 4,000
Total ...	2,004,000	2,289,000	+ 285,000
Porcelain.—			
From Belgium	141,000	151,000	+ 10,000
„ Great Britain ...	52,000	48,000	— 4,000
„ Germany	987,000	1,104,000	+ 117,000
„ Other countries ...	36,000	49,000	+ 13,000
Total ...	1,216,000	1,352,000	+ 136,000

Note : Gulden = 1s. 8d.

THE JUNIOR INSTITUTION OF ENGINEERS: SUMMER MEETING IN EAST ANGLIA.

It was hut natural that with Sir J. J. Thomson, Professor of Experimental Physics at the University of Cambridge, as President, the summer meeting of the progressive Junior Engineers should, this year, have had its setting in East Anglia, with visits to the Laboratories of Physics and Engineering at Cambridge as the gem of the week so to speak.

In accordance with usual custom, the members foregathered at a place where the week-end previous to the opening of the meeting could he spent in quite a holiday fashion. Thus it came about that on Saturday, July 29th, the Felix Hotel at Felixstowe opened its hospitable portals to the Institution, and was constituted the headquarters of the party until the following Monday morning, by which time the introduction period had been well got over, and the greatest possihle good fellowship prevailed throughout. The Cinderalla dance at the hotel on the Saturday evening provided most opportunely the occasion for the ladies of the party to enter into acquaintanceship, and appeared to be fully appreciated.

Ipswich was the first town of call, and was reached by a pleasant steamer trip from Felixstowe up the River Orwell. On arriving, the directors of Messrs. Ransomes & Rapier met the members and conducted them over the well-known Waterside Ironworks, while the ladies were appropriately shown round the corset manufactory belonging to Messrs. W. Pretty & Sons. At the former works the application of electrical power was well illustrated. The generating station consists of separate engine room and hoiler-house. There are three direct-coupled, steam-driven sets, two of which have an output of 100 kw. each, and the other set 200 kw., at 230 volts. A testing set of variable voltage and current for use in the testing of electric cranes was examined with great interest. For running the generating plant, steam at a pressure of 150 lb. per sq. in. is supplied from three boilers fitted with an economiser. The manner in which the final erection and testing of cranes in the yard is carried out by means of various travelling steam cranes was shown.

After their morning's perambulation, the members and their fair friends were entertained at the Crown and Anchor Hotel by Messrs. Ransomes & Rapier, Ltd., the chairman and managing director, Mr. Wilfrid Stokes, M.Inst.C.E., presiding at the luncheon. The occasion was marked hy the presence of the Mayor of Ipswich, Mr. P. W. Cohhold, the borough engineer, and other gentlemen.

Mr. H. S. Jefferies, M.I.Mech.E., of Messrs. Ransomes, Sims and Jefferies, then took the party in hand for the afternoon, conducting them to the Orwell Works, where were seen in course of production numerous traction engines, road locomotives, portable and stationary engines, electric overhead traversing cranes, &c.

While the members were thus occupied, the ladies were engaged in inspecting some of the historic places of interest for which Ipswich is celehrated, afterwards joining the members for afternoon tea at the Crown and Anchor Hotel, as guests of Messrs. Ransomes, Sims & Jefferies. The acknowledgments of the Institution having heen expressed to them for opening their works for visiting, the party suhsequently joined the 6.28 p.m. Cromer express from Ipswich for Norwich, where the old-fashioned and interesting Maid's Hotel became headquarters.

On the following morning (Tuesday), Mr. Thomas Glover, M.Inst.C.E., the engineer and general manager of the Norwich works of the British Gas Light Co., acted as cicerone over his works, the annual production of which exceeds 420 million cb. ft. The *pièce de résistance* here proved to he the De Brouwer combined charging and discharging machine, an ingenious apparatus, the invention of M. de Brouwer, engineer in charge of the gasworks at Bruges. Electrical engineers present did not fail to note how electricity had been brought into service in the working of this machine. All the motors are of the enclosed type. Their position on the machine is arranged as far away from the retort hench as possihle, and the projector motor is enclosed in a hox. The current is supplied from a 37-kw. generator, of Messrs. Laurence, Scott & Co.'s construction, the same generator also supplying the motors which drive the coke conveyors.

The current is conveyed to, and returned from, the machine by overhead hare cables and trolley arms at 220 volts pressure. It passes from the overhead positive cahles by way of the trolley arms to vertical cahles within the framework of the machine. Contact is made with these vertical cables as the hanging frame is raised and lowered, by means of other contact arms provided with rollers, as on the overhead trolley arms. The current next passes through a circuit-breaker, which acts as a safeguard for all motors on the machine. After passing through the circuit-breaker the current goes to the various controllers and motors and back to the negative overhead cable.

Within the framework of the machine a hanging frame is suspended upon suitahle chains, which framework is capable of being raised and lowered to suit the various tiers of retorts to he charged. The charging drum is fitted within this frame, and is 40 in. diameter × 15 in. across, the periphery heing grooved 8 in. × 3½ in. The rubber belt on which the coal falls, and hy means of which it is projected into the retorts, passes round pulleys and partly round the drums. The top pulley is capable of heing raised to maintain the tension and to take up the stretch. The discharging part of the machine works alongside the charging apparatus, and consists of two steel channels telescoping one within the other. The whole discharger is capahle of heing lifted and lowered to suit the varying tiers of retorts in the same way as the position of the charging portion is adjusted.

The programme for the ladies during the members' inspection of these works consisted of a series of visits by motor-car to places of civic interest. They afterwards assembled with the members to partake of refreshments offered by the chairman and directors of the British Gas Light Co. The whole party then proceeded to Norwich Castle to visit the well-known museum, &c., and the cathedral, where the afternoon service was attended.

Wednesday was given up entirely to "a day on the Broads," and a very enjoyable day everyone pronounced it to be. The Horse Shoes Hotel, picturesquely situated on the river at Wroxham, proved an excellent place of embarkation, its cuisine for luncheon and afternoon tea leaving nothing to be desired.

On the following morning the Carrow Works of Messrs. J. & J. Colman, where the mustard, starch and blue come from, provided means for the examination of numerous processes in which electrical, mechanical and other species of the genus engineer could not fail to be deeply interested, as well as those having proclivities towards the study of the social condition of workers in large factories. A call was made at the company's Club House—a long building standing in a neatly cultivated garden. There is a fine central hall accommodating 500 persons, billiard room, gymnasium, &c., so that the social needs of the employés are well considered. The party then made their way to the Criterion Restaurant for luncheon as the guests of Messrs. J. & J. Colman. At 5 o'clock the party left Norwich for Cambridge, arriving there in time for dinner at the University Arms Hotel, the final headquarters for the week.

Friday's proceedings will long be remembered, for the reason that the party spent most of the day in the company of the President, Sir J. J. Thomson. The memory of his kindness and friendliness to everyone will be cherished by all who had the privilege of being present. On arriving at the Hopkinson Laboratory in the morning the President introduced Prof. Bertram Hopkinson, Professor of Mechanism and Applied Mechanics in the University of Cambridge, who showed the party over his department, after which the President conducted some striking experiments in the physical laboratory, including demonstrations of the action of liquid air, and of high-tension electric currents. The laboratories are fully equipped with apparatus and appliances of all kinds, the operation and uses of which were exhaustively explained, for which both the President and Prof. Hopkinson were warmly thanked before the visitors left.

The Council Chamber of the Guildhall was the next rendezvous, where the party were entertained to luncheon by the Mayor, an organ recital following.

In the afternoon all the beauty and capacity of expression of the organ, for which Trinity Chapel is so noted, was exemplified in a special recital given in honour of the Institution's visit, by Dr. Alan Gray. It was a remarkable performance, and gave real pleasure to all, especially those devotees of music, of whom there are not a few in the ranks of the Institution. Afterwards followed, under escort of the President, visits to Trinity Dining Hall and Library, and to several of the colleges. The unaccompanied service in King's was attended as the concluding item of the afternoon's programme.

The Institution's summer dinner was held at the University Arms Hotel in the evening, Sir J. J. Thomson presiding. Amongst the guests were Sir Joseph Larmor, M.P., the Mayor of Cambridge, Dr. Alan Gray and Prof. M'Lennan, Professor of Engineering in the University of Toronto. After observing the loyal toasts, that of "The University and Town of Cambridge, and the Proprietors of the Works, &c., opened to the Visit of the Institution during its Summer Meeting in East Anglia," was proposed by Mr. S. Bylander, and was acknowledged by Sir Joseph Larmor, the Mayor of Cambridge, and Mr. Thomas Glover, of Norwich. "The Universities of our Dominions Beyond the Seas" was proposed by the President, who spoke in eulogistic terms of all that was being done in the Colonies for students of engineering. Prof. M'Lennan, in responding, admitted that they were very proud of their engineering school at Toronto, but said there were matters on the practical side of engineering to which they might give more attention. One was in respect of the ventilation of their buildings, in which Great Britain was far ahead of them. Another was the finish and permanence of their works. They had much to learn as to the supply of water to their large cities. Typhoid fever was prevalent in the large towns, and at Toronto, whilst they were on the banks of a lake 200 miles long and 40 miles broad, the public water supply was so bad that they had to drink distilled water. The concluding toast, "The Institution," was given by Mr. J. W. Auchterlonie, and was replied to by Mr. B. E. Dunbar Kilburn. The toasts were interspersed with musical selections given by the Chorister Glee Singers.

The works of the Cambridge Scientific Instrument Co. were visited on the following morning. Here were seen various types of pyrometers, thermometers and mechanical and electrical instruments in course of construction, including the Duddell oscillograph, the Einthoven galvanometer, and the Duddell thermo-galvanometer.

A garden party was given in the afternoon by the President and Lady Thomson at their home in West Road, forming a most agreeable termination to a week full of technical interest and social enjoyment, which the Junior Engineers seem to have the faculty of so happily blending in all they undertake.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Sign Projector.

A recent issue of the *Central Station Engineer* describes an electric sign projector which is exceedingly simple in construction. Its essential features are a powerful little lamp, three lenses and a stencil containing the advertisement.

The lamp, which is a 100-C.P. of the glower type, operates on the regular lighting circuit, either A.C. or D.C.

The lenses, the glower and the stencil are contained in a metal tube, 14 in. long and 2⅝ in. in diameter.

The tube is separated at the end occupied by the lamp so as to provide for the insertion of a small globe, which makes the light available for illuminating the window in which the sign projector is placed. The pedestal for the tube to rest upon completes the outfit, which is illustrated in fig. 1.



Fig. 1.—Electric Sign Projector.

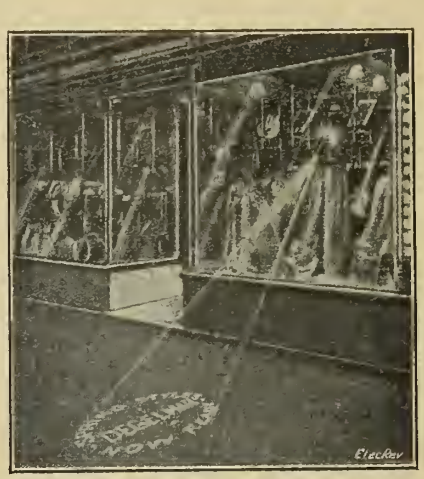


Fig. 2.—The Projector in Use.

It can be placed on a bracket or attached directly to the ceiling, in the window, above the door, or in any convenient place. The tube may be adjusted to suit the position and height, being capable of adjustment to any angle. It is focused like an opera glass.

The advertisement as it appears on the pavement is not round as shown on the stencil, but slightly elliptical (fig. 2). It varies from 3½ ft. longest diameter upwards, according to the distance of the projector above the sidewalk.

While primarily intended for pavement advertising, the projector may be used for throwing advertisements on walls and ceilings as well. It has been effectively used by department stores as a wall sign to call attention to special sales.

This sign projector is manufactured by the Pittsburg Electric Specialties Co.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"A. J. H." writes:—"A person owns a house, and has a right of way thereto. However, the railway company owns the roadway and footway by which the house is approached. Has the owner of the house necessarily a right to open the footway or roadway for the purpose of having drains, water, gas or electric services laid or repaired? It seems to me that if a person purchases property with a right of way thereto, it is only reasonable to assume that he has the right to lay the necessary services to be able to enjoy his property.

"Also, if he cannot break the surface, would he have the right to swing service wires or pipes overhead?"

*** A right of way imports nothing more than the words intend. It confers no property in the soil. The public have a right of way along a high road—that is to say, they may pass and repass; but they may not camp out on the road, or tear up the surface, or suspend wires over or across it. A private right of way confers no greater privileges. The right to uproot and lay drains, &c., is vested in the owner of the soil, unless, of course, there is a right to drain as well. In the circumstances, it appears that the person referred to by "A. J. H." cannot have the necessary services.

Llanelly Tramways. — One hundred tramway men struck work on the 21st inst., demanding recognition of the union.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,748. "Electric resistance grids." Electric and Ordnance Accessories Co., Ltd., and M. R. H. Mueller. December 11th.

27,801. "Electric current-limiting devices." H. B. E. Nordfeldt. December 11th. (Complete.)

27,808. "Dynamo-electric machines." P. Taylor-Batten. December 11th.

27,817. "Self-regulating arc lamps." Physikalisches Laboratorium Mechanische-Technische Werkstatte Hans Thoma G.m.b.H. (Convention date, December 12th, 1910, Germany.) December 11th. (Complete.)

27,826. "Electric safety lamp." H. Sefton-Jones. (Electric Exporte Werke G.m.b.H., Germany.) December 11th. (Complete.)

27,840. "Means for transmitting rotary motion." Jandus Arc Lamp and Electric Co., Ltd., and A. D. Jones. December 11th.

27,843. "Electrically heated thermal accumulator." A. Rittershaussen. December 11th. (Complete.)

27,848. "Electric motor-generators." Electric and Ordnance Accessories Co., Ltd., and H. V. Bowen. December 11th.

27,862. "Series systems of incandescent lamp lighting." E. Booth and N. R. Booth. December 12th.

27,869. "Miners' safety lamps and ignition devices in connection therewith." E. A. Hailwood. (Addition to 14,914/1909.) December 12th.

27,883. "Electrical heating of service or dinner lifts." F. Hodgson. December 12th. (Complete.)

27,884. "Manufacture of electric metallic-filament lamps." G. Midgley and A. R. Crossley. December 12th.

27,902. "Process and apparatus for electrically decomposing fluids." L. G. Fixen. December 12th. (Complete.)

27,910. "Electric safety lamps." K. G. H. Von Sladen Vogelsberger. December 12th.

27,931. "Processes of separation by aid of electro-osmosis." G. B. Schwerin. (Convention date, January 25th, 1911, Germany. Addition to 3,364/1911.) December 12th. (Complete.)

27,932. "Distributing system for explosion engines." Itala Fabbrica di Automoili. (Addition to 19,455 of 1911. Convention date, June 17th, 1911, Italy.) December 12th. (Complete.)

27,951. "Method and apparatus for producing a gaseous reaction by a silent discharge." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 12th.

27,953. "Telephone relays." S. G. Brown. December 12th.

27,974. "Apparatus for indicating at the power station a fault or leakage of current and its particular location in a series of electric mains or conductors." R. Hacking. December 13th.

27,978. "Apparatus for photometrically testing burners for gas or electricity." W. Gordon. December 13th.

29,988. "Electric alternating current or voltage measuring or detecting instruments." C. E. K. Mees and A. F. C. Pollard. December 13th.

27,995. "Electric fuse handles." Sykes & Sugden, Ltd., and A. Sugden. December 13th.

28,007. "Enumeration of telephone calls." S. D. Williams. December 13th.

28,023. "X-ray apparatus." H. A. C. Donnithorne and W. Hampson. December 13th.

28,054. "Electric miners' lamps." W. Cross. (Dr. Zodzislav Stanecki, Fabryka akummulaturow i przyrzadow elektrycznych, Spolka z ograniczona odpowiedzialnoscia Lwow, Austria.) December 13th. (Complete.)

28,080. "Portable lamps for electric lighting." E. Murrle. December 13th.

28,137. "Dynamo-electric machines for use in electric generative systems of motor vehicles." B. Brooks and W. Holt. December 14th.

28,165. "Intercommunicating telephone systems." W. Fairweather. (K. M. Turner, U.S.) December 14th. (Complete.)

28,185. "Electro-osmotic processes." Ges. Fur Elektro Osmose m.b.H. (Convention date, September 28th, 1911, Germany.) December 14th. (Complete.)

28,199. "Electric circuit protective devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 14th.

28,209. "Mechanism for striking and controlling the electric arc." H. E. Crocker. December 14th.

28,221. "Step-by-step motion for electric controller, rheostats, and similar devices." F. Greenhalgh. December 15th.

28,236. "Electric pendulum or revolving wheel." A. Schmidt. December 15th.

28,263. "Arrangement for working in parallel of synchronous and asynchronous alternating-current generators." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H. Germany.) December 15th. (Complete.)

28,281. "Means for generating electricity." L. Ducellier. December 15th.

28,285. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 15th.

28,321. "Devices for giving a signal and indicating the number of calls on telephones." H. Wilkins. December 16th.

28,351. "Production and ... less transmission of electrical oscillations." H. Heinicke and M. Jasper. ... cember 16th.

28,383. "Dynamo-electri ... uction and like machinery." Akt.-Ges. Boveri et Cie. (Conventic ... ate, December 16th, 1910, Germany.) December 16th. (Complete.)

28,391. "Electric distribution systems." J. Bijor. (Convention date, December 21st, 1910, United States.) December 16th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Method of Production and Utilisation of Hyper-Ultra-Violet Radiations having Waves of Short Length for Sterilisation Purposes. R. Lillon Daguerre. 24,025. October 25th. (October 18th, 1909.)

Means of Carrying Brushes for Electric Machines and Holding them up to their work in their Electrical Connections. Electrical Construction Co. and N. Pensabene. 27,205. November 23rd.

Electrical Current Generators. A. E. R. Bottono. 28,611. December 8th.

Crossings and like Fittings for Electrical Conductors. F. M. Munro and Railless Electric Traction Co. 29,706. December 21st.

Electrically-Driven Clocks and other Electrically-Driven Running Mechanisms. A. M. Lowne and Lowne Electric Clock and Appliances Co. 27,293. November 23rd.

Miners' Electric Safety Lamps. O. Oldham. 27,641. November 28th.

Coolings for Trolley Wires and other Electrical Conductors. A. Mather and R. Barlow. 27,711. November 29th.

Method of Synchronising Electric or other Motors for use on Cranes, Hoists, Gun Turrets, or other Machinery. Sir W. G. Armstrong, Whitworth & Co. and F. Harlow. 27,814. November 30th.

Electric Heaters. H. J. Read. 27,954. December 1st.

Electrically-Insulating Compound and Process of Preparing the same. O. V. Thomas. 28,069. December 2nd.

Reversible Variable-Speed Dynamo. J. Mould. 28,807. December 7th.

Apparatus for Controlling Gas-Cocks and Electric Light Switches. B. Scheidemann. 29,125. December 15th.

Bayonet Joint Fastenings for Electric Lampholders and for other purposes. E. Cheadle. 29,425. December 19th.

1911.

Electrodes for Electric Arc Lamps. S. Conradty and B. Conradty. 14,729. June 25th.

Driving of Rotary Field Induction Motors. Siemens-Schuckertwerke Ges. 17,768. August 4th. (August 4th, 1910.)

Telephone Receivers. Western Electric Co. (Western Electric Co.) 17,875. August 5th.

Electrical Transformers. E. Haefely. 20,524. September 16th.

Apparatus for the Purification of Electrolytic Gases. A. E. Knowles. 21,600. September 30th.

Apparatus for Sterilising Liquids by Ultra-Violet Rays. A. Helbronner and A. von Recklinghausen. 21,629. October 30th. (Divided application on No. 23,078 of 1910. May 1st, 1911.)

Electrical Purification of Gases and Apparatus therefor. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) 60. January 2nd.

Electric Circuit Controlling Devices. British Thomson-Houston Co. (General Electric Co.) 178. January 3rd.

Controllers for Electrically-Driven Motor Vehicles. A. Pieper. 1,776. January 24th. (January 25th, 1910.)

Electrical Influence Machines, or Machines for Producing Static Electricity. Morris & Lister, Ltd., D. K. Morris and F. A. Watson. 2,591. February 1st.

Current-Collectors for Electrically-Propelled Vehicles. F. M. Munro and Railless Electric Traction Co. 2,889. February 4th.

Smelting Furnace with Electric Refining Hearths Connected thereto. A. Helfenstein. 5,140. March 1st. (March 10th, 1910.)

Automatic Arc Lamp for Light Projections. A. Blondel. 5,502. March 4th.

Electrical Switches and Controllers. F. Garside. 5,856. March 8th.

Control of Electrically-Operated Switches. British Thomson-Houston Co. (General Electric Co.) 6,663. March 16th.

Speed Control of Electric Motors. Siemens Bros. Dynamo Works, Ltd., and N. Lydall. 8,591. April 4th.

Impedance Coil for Telephony and like Systems. E. A. Graham and W. J. Rickets. 10,045. April 25th.

Static Frequency Converter. O. Imray (administrator of the estate of M. L. Joly, deceased). 11,526. May 12th. (May 17th, 1910.)

Telephone and other Mouthpieces. L. Steinberger. 13,641. June 7th. (June 13th, 1910.)

Telephone Receiver Holders. C. S. Bann. 13,948. June 12th.

Terminals for Insulated Electric Wires. A. Morgan. 15,091. June 28th.

Electric Safety Fuses. R. Kallmann. 15,646. July 7th. (Divided application on No. 16,258 of 1910, October 18th.)

Clutch Mechanism for the Detachable Attachment of an Arc Lamp or other Appliance to a Post or high-up Support or Suspender. N. Worsley. 15,862. July 8th.

Electrocuting Trap. H. Hertzberg, A. A. Low and W. J. Wohl. 16,065. July 11th.

Fuses for Electric Circuits. E. A. Graham. 16,228. July 13th.

Electrical Secondary or Storage Batteries. W. Bayer and B. Hubbard. 16,859. July 22nd.

Manufacture of Magnetic Electrodes. Chemische Fabrik Buckau. 16,902. July 2 th. (July 22nd, 1910.)

Method of and Device for Locking the High-Tension Chamber of Electrically-Driven Vehicles. Allgemeine Elektricitäts-Ges. 17,301. July 28th. (August 18th, 1910.)

Circuit Arrangements for Railway Points and Signals. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 18,293. August 12th.

Mountings for Wall-Telephone Sets. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 18,462. August 15th.

Railway or like Signals. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 18,776. August 21st.

Safety Support for Electric Overhead Wires. G. Gottschalk. 548. January 9th.

Arc Lamp Electrodes. British Thomson-Houston Co. (General Electric Co.) 710. January 10th.

Factory Buildings Sales.—In their review of Factory and Commercial Property Sales during 1911, Messrs. Leopold Farmer & Sons report better results than in 1910 in the disposal of factory property, wharves, land, &c. There is a migratory movement amongst manufacturers to districts outside large towns where the lowest possible cost of manufacture can be obtained. It is difficult to say which branch of any particular manufacture more than any other has progressed in the year 1911; one, however, perhaps being very noticeable, is the manufacture of electric metal-filament lamps, and several companies interested in the business have acquired factories and are carrying on large businesses. Development has taken place in the motor and rubber trades, factories having been opened in consequence for manufacturing purposes. The acquiring of factories, &c., and building of works, consequent on reorganisation and extension in many trades, are always in progress; such operations in the engineering, milling, chemical and spinning trades having been well to the front in the year under review. The areas most sought after are those which offer the best facilities for manufacture on the lowest possible basis of cost of production. The effects of the Patents and Designs Act continue to be well to the front, foreign holders of English patents still being on the look out for factory property to comply with its requirements.

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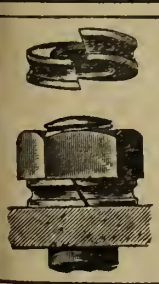
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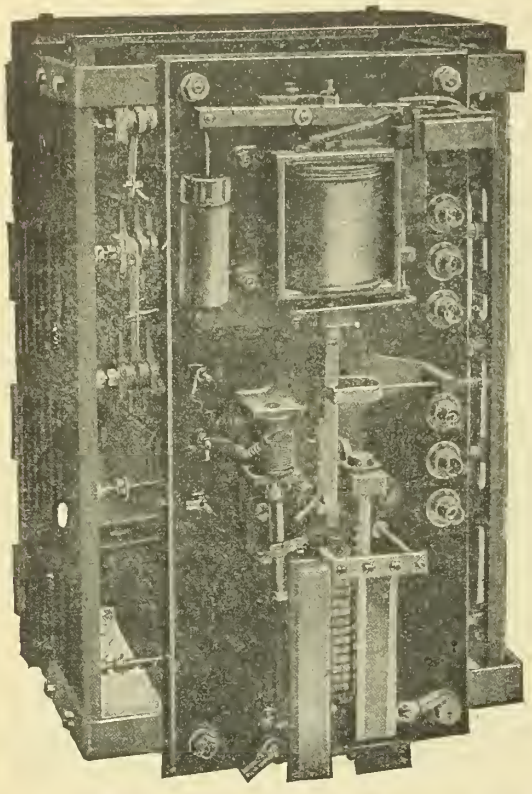
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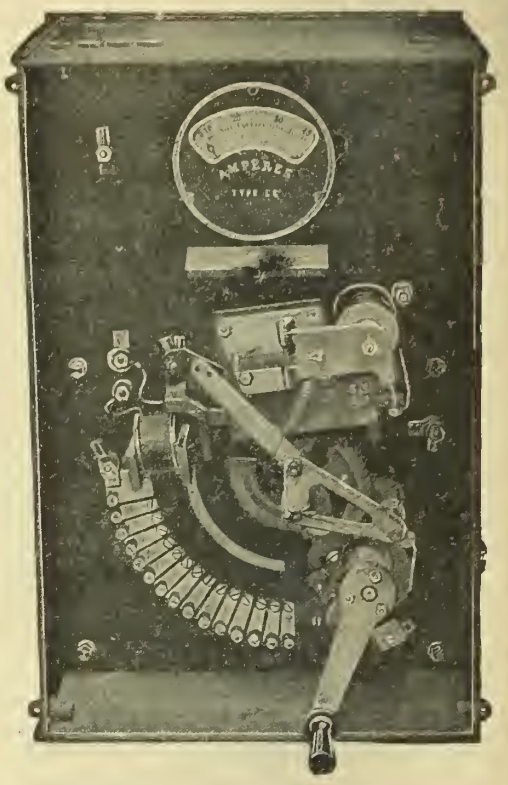


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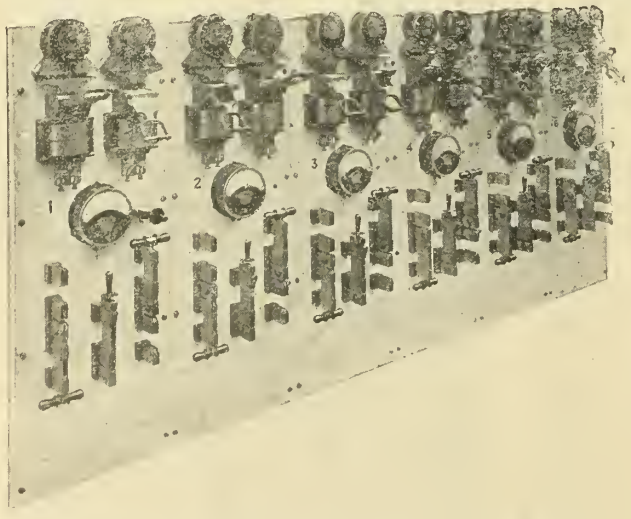
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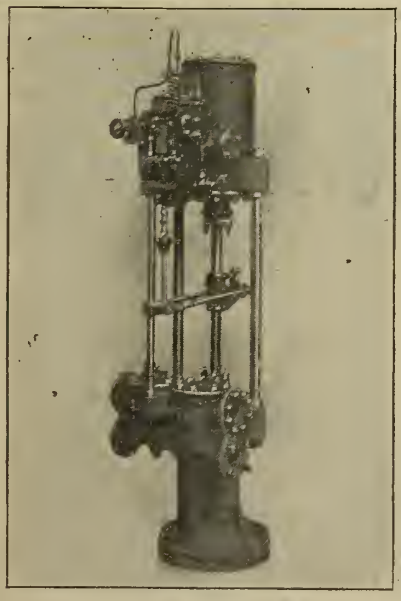
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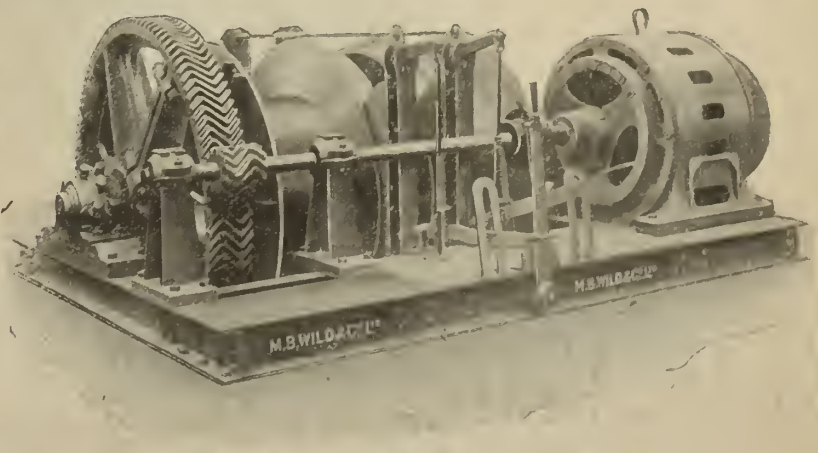
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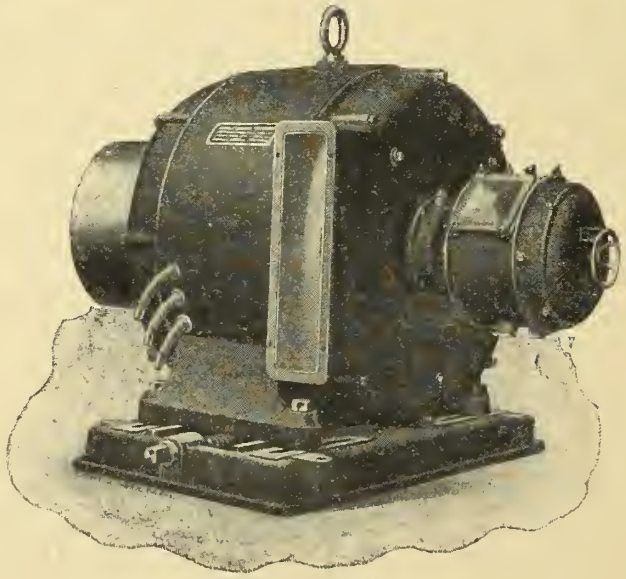
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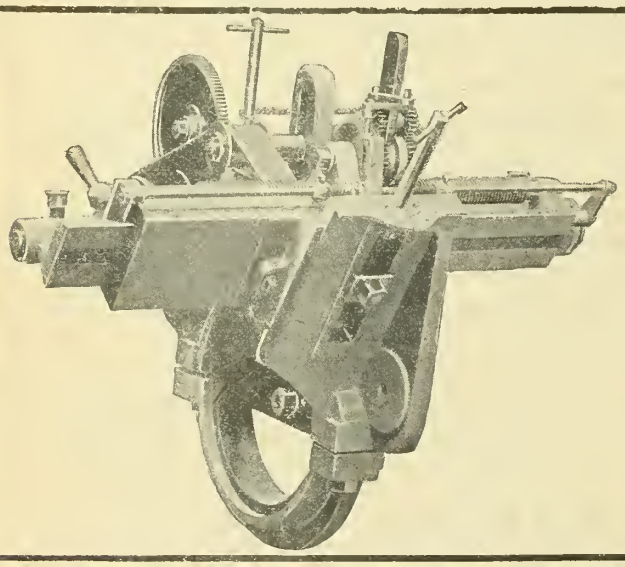
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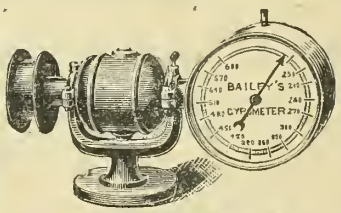
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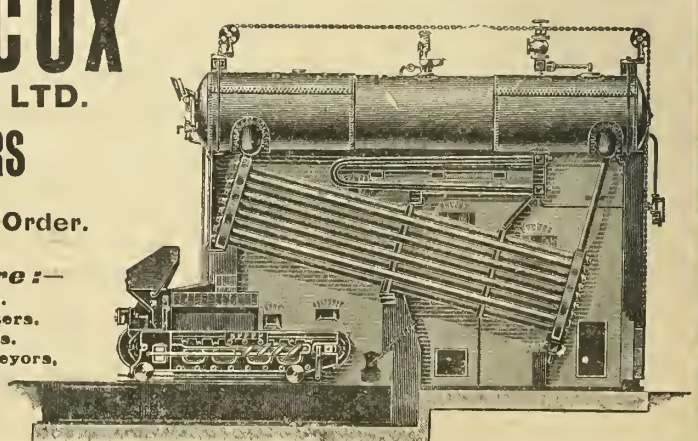
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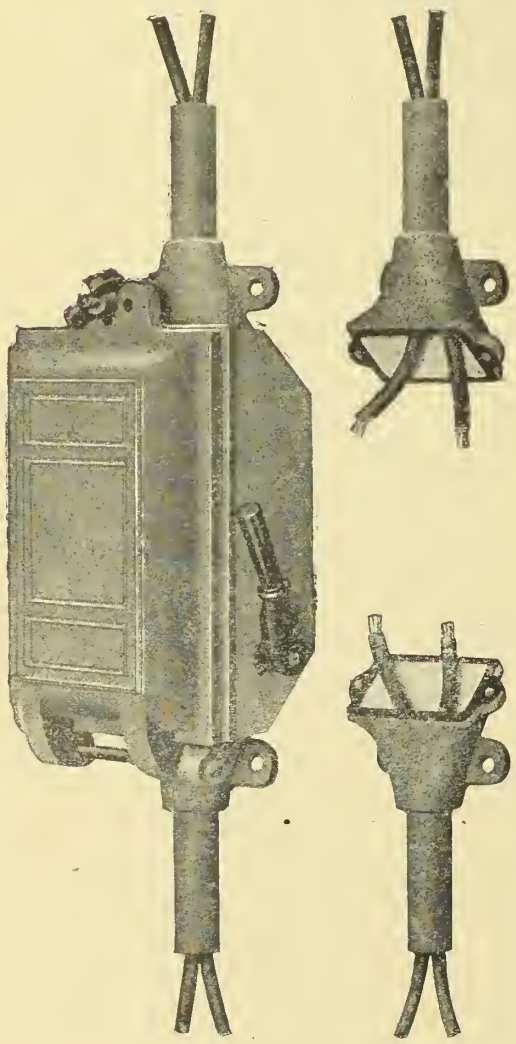
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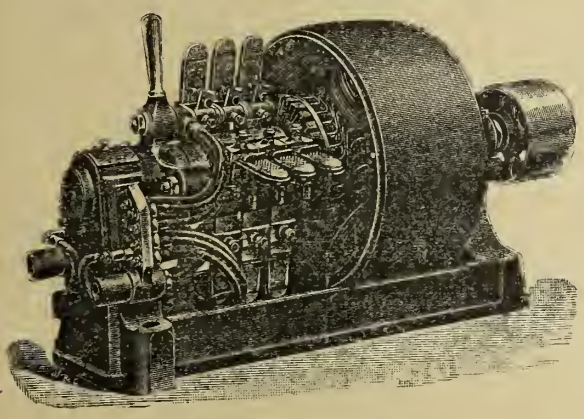
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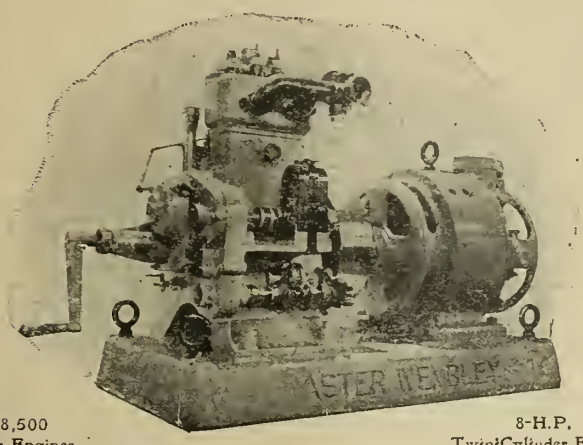
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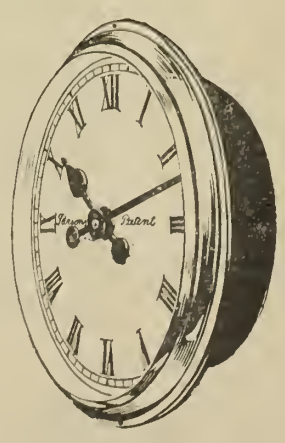
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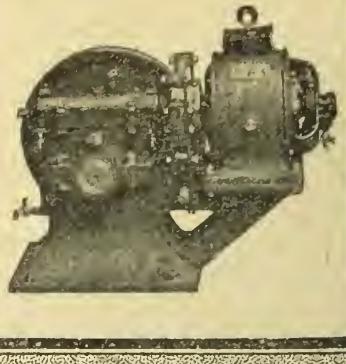
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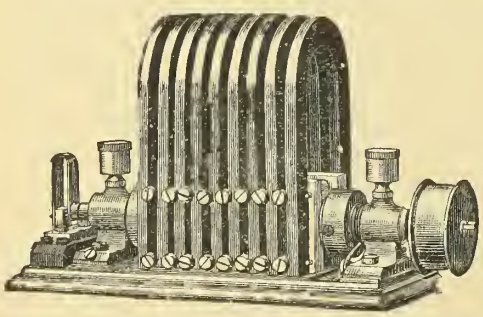
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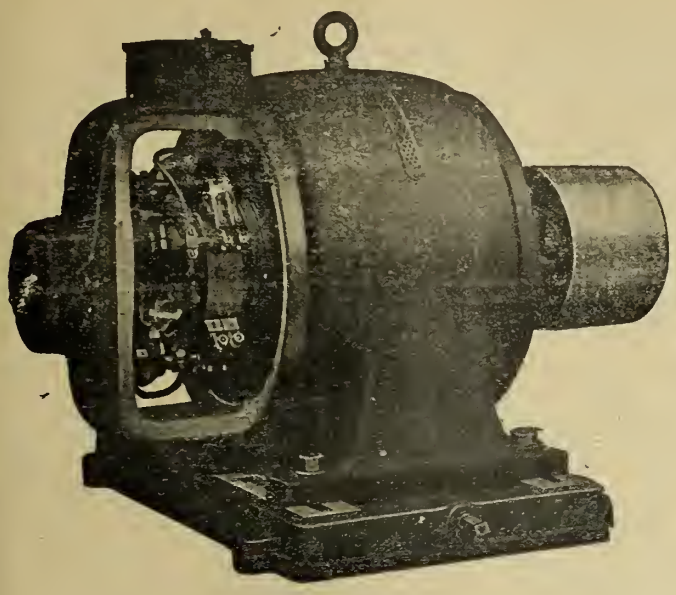
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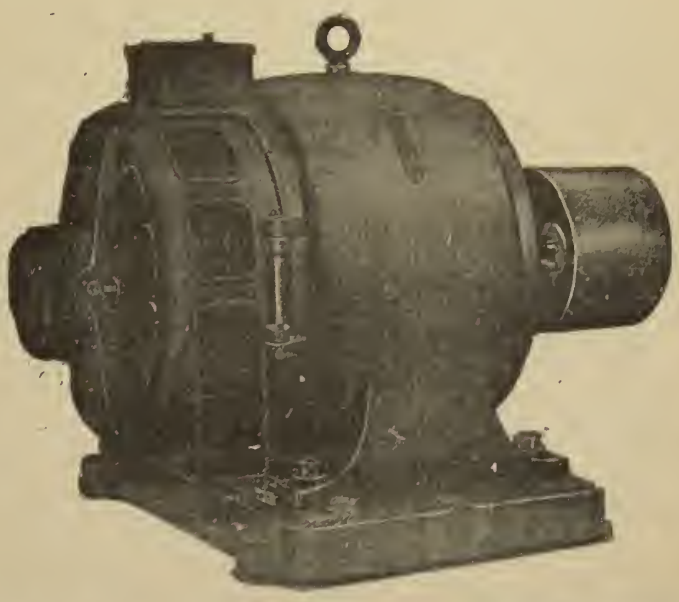
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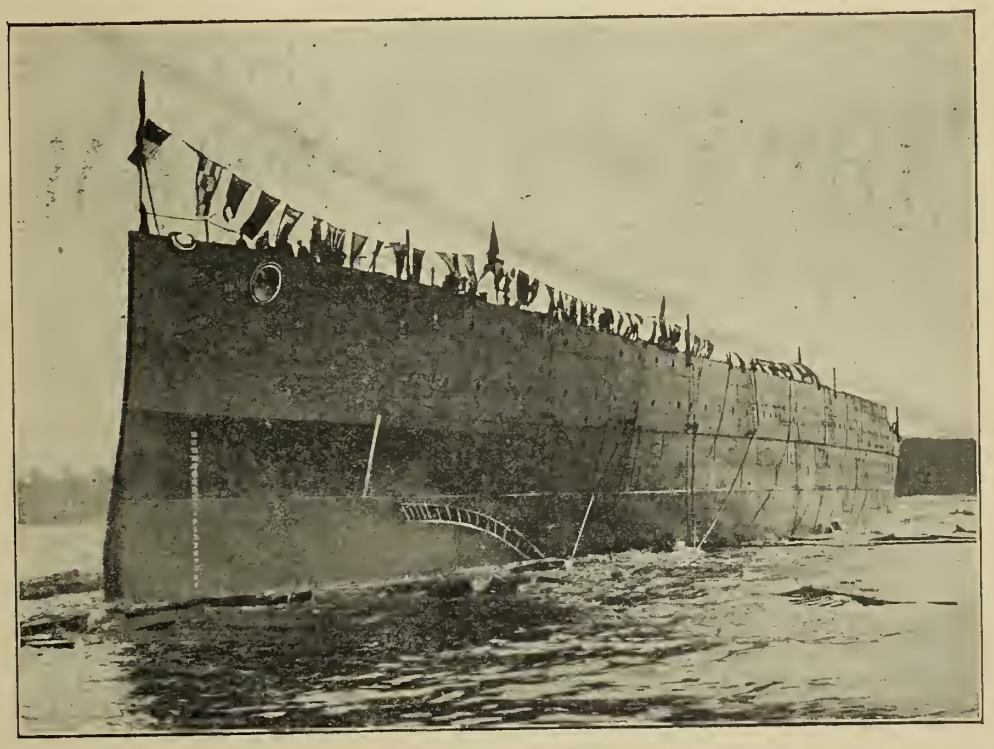
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CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERTILLERY.—Extensive waterworks scheme for the Abertillery and District Water Board; B. Latham, engineer, Westminster.

ADDINGHAM (near SKIPTON).—Proposed Primitive Methodist Chapel; Trustees.

ALLOA.—Extensions for J. Paton & Sons, yarn manufacturers, Alloa.

ASHTON-UNDER-LYNE.—Proposed premises for accommodation of refuse plant; Borough Surveyor.

BARMBOROUGH (near DONCASTER).—Proposed Primitive Methodist Church; Trustees.

BARNSLEY.—Proposed additions at the Old Town School; Secretary, Education Committee.

BELFAST.—Motor works for V. H. Robb & Co., Chichester Street.

BENTLEY (near DONCASTER).—Contemplated Primitive Methodist Church.

BEXHILL.—Three detached houses, Cooden Sea Road, and three bungalows, Cooden Drive; Tubbs & Messer, architects, Woking. Detached house, Penland Road; Piggott & Oxley, architects, Hastings. Detached house, Manor Road; J. H. Lye, architect, Station Road, Bexhill. Addition to "Haslingfield," Penland Road; J. B. Wall, architect, Devonshire Road, Bexhill. Pair of semi-detached houses, Arthur Road; G. E. Maynard, architect, Collington Avenue, Bexhill.

BIRMINGHAM.—Improvements at New Street Station, with electric lighting (£100,000); Secretary, L. & N.-W. Railway Co.

BOLTON.—Contemplated extensions at the Church Institute; Rev. J. E. Kent, Principal.

CARCROFT (near DONCASTER).—Proposed Primitive Methodist Church; Trustees.

CARMARTHEN.—Electric theatre, for L. Vint, theatre proprietor, Neath and Llanelly.

CHAPEL-EN-LE-FRITH.—Waterworks scheme at Dove Holes; Clerk to U.D.C.

CLAYTON (near BARNSLEY).—Proposed new Wesleyan Church at Clayton West; Rev. W. H. Lowry, superintendent, Denby Dale Wesleyan Circuit.

CONISBOROUGH.—Contemplated additional hospital accommodation; Clerk to the Mexbro' and Doncaster Joint Hospital Board.

COVENTRY.—Elementary school, Centaur Road (1,148 children); F. Foster, architect, Masonic Buildings, Coventry.

CROYDON.—Motor garage, stores and offices, Selhurst Road, South Norwood; D. Kennedy, Pembury Road, South Norwood. Disinfecting works and one house, Factory Lane; Borough Surveyor.

CUPAR (FIFE).—Proposed alterations and additions to Monimail U.F. Church; Clerk, Cupar U.F. Presbytery.

DARLINGTON.—Extensions, &c., contemplated; Darlington Co-operative Society.

DARWEN.—Proposed waterworks; Borough Engineer.

DEWSBURY.—Sewage works extension, &c. (about £50,000); Borough Surveyor.

DUBLIN.—New Registry of Titles office, Four Courts, for H.M. Board of Works.

DUNDEE.—Alterations on Ancrum Road School; Clerk, School Board. Alterations on property in High Street and Overgate, for W. Patterson. Alterations on and additions to property, 268-270, Hill Town, for J. Young. Garage, for W. Scott, Perth Road. Warehouses and workshop in South Road and Millar's Lane, for East Bros., Ltd.

DURHAM.—Building scheme in connection with the Blue Coat School; Managers.

ECCLES.—Contemplated new school in Monton and Winton district; Secretary to the Education Committee.

EDLINGTON (near DONCASTER).—Proposed Primitive Methodist Church; Trustees.

ELLESMERE PORT (near BIRKENHEAD).—New Wesleyan Church; A. Brocklehurst, architect, Manchester.

FARNWORTH (near BOLTON).—Proposed new infant school; Rev. A. C. Sinclair, curate-in-charge, All Saints' Church.

FIFE.—Additional hospital accommodation for Fife and Kinross; Gillespie and Scott, architects, St. Andrews.

GARSTON (near LIVERPOOL).—Proposed Sir Alfred Jones Memorial Hospital on Lightbody Estate (£24,500); Executive Committee.

GLOUCESTER.—New factory, Hempsted Lane (negotiations for site carried out by Bruton, Knowles & Co.).

GOLCAR.—Business premises and house, James Street; A. Shaw, architect, Golcar.

GRINGLEY (near OAINSBOROUGH).—Proposed restoration and enlargement of the church (£3,000); Vicar.

HALIFAX.—Proposed new church at Siddal; Vicar of St. Marks.

HASTINGS.—New business premises for laundry, York Road, Silverhill, St. Leonards; Jeffery & Son, architects, Havelock Road, Hastings. Alterations and additions to Hazlebree, St. Saviour's Road, St. Leonards; T. W. Elworthy, architect, London Road, Hastings. Alterations and additions to 14 and 15, Kenilworth Road, St. Leonards; F. G. Hatton, owner, Kenilworth Road. Alterations to 239, London Road, St. Leonards; H. Ward, architect, Bank Buildings, Hastings. Alterations to Assembly Rooms, Sedlescombe Road, St. Leonards; F. Plowman, architect, Havelock Road, Hastings.

HATHERSAGE (near SHEFFIELD).—E.L. installation at Brookfield Manor, for Mr. Dobbs, Ranmoor, Sheffield.

HUDDERSFIELD.—Proposed new Church at Grimscar; Rev. M. Richardson, vicar of St. John's.

HULL.—New school, Sauer Street, for the T.C.; J. H. Hirst, City Architect, Town Hall.

HUTTON (near PRESTON).—New dairy and hostel at the County Council farm (£10,000); H. Littler, County Architect, 16, Ribblesdale Place, Preston.

KILMACOLM.—Church halls for the Parish Church; J. J. Burnet, architect, Glasgow.

KIRKBURTON (near HUDDERSFIELD).—Contemplated parish hall; Rev. Canon Phipps, vicar.

KNOTTINGLEY (near PONTEFRACT).—Contemplated parish room; Rev. J. Hyndson, vicar of Christ Church.

LANCASTER.—Proposed new mission; Pastor, Independent Methodist Mission, Wolsey Street.

LEICESTER.—Rebuilding St. George's Church (£16,200); W. D. Caröe, architect, 3, Great College Street, Westminster, S.W.

LIVERPOOL.—Proposed new elementary school in Barlow's Lane, Fazakerley (900 places); J. G. Legge, Director of Education, Education Offices, St. Thomas Street, Liverpool. New schools, Grosvenor Street, for St. Joseph's Roman Catholic Church; Rev. Father W. Griffiths, rector. Revised scheme for Picrhead Baths (£40,000); City Architect.

LOCKWOOD (near HUDDERSFIELD).—Weaving shed, &c.; Lunn & Kaye, architects, Huddersfield.

LONDON (SHOREDITCH, N.E.).—Dispatch room and stores at Dorset Works, East Road; Proprietors.

(DEPTFORD, S.E.).—Model dwellings (over £11,000); W. J. Burton, builder, St. Peter's Road, Broadstairs.

(ACTON, W.).—Extensions to Acton Sanitary Laundry; W. L. Cook, Stafford Road, South Acton. Eight villa residences, Lynton Road; A. Welford, Lynton Road. Premises at Stanley Gardens, for the Acton Plating Co.

(EALING, W.).—Alterations and extensions at 220 and 222, Uxbridge Road; J. Schofield, 220, Uxbridge Road.

(W.C.).—Laboratory buildings for the University of London (£6,000); Prof. F. M. Simpson, architect, 88, Gower Street, W.C.

LONGFORD.—Contemplated addition to St. Mel's College (£3,000).

MACCLESFIELD.—Renovation scheme at the Infirmary; Clerk to the Infirmary Board.

MEXBOROUGH (near ROTHERHAM).—Proposed Primitive Methodist Church; Trustees.

MORECAMBE.—Proposed additional school accommodation at United Methodist Church, Clarence Street; Rev. M. de J. Lark, pastor.

NAIRN (N.B.).—Extension of the harbour (£17,000); Burgh Surveyor.

NEWPORT (I.W.).—Additions to Fernside, Shide; G. F. Quinton, builder, 1, Carisbrooke Road, Newport.

OSSETT (near DEWSBURY).—Structural alterations at Flushdyke Bethel Independent School; Pastor.

OXFORD.—School (£7,000); A. Castles, City Estate Offices, City Hall, Oxford.

PADGATE (near WARRINGTON).—Contemplated sewage scheme; Clerk to the Poulton-with-Fearnhead P.C.

PADIHAM.—Proposed new church at Hapton; Rev. T. W. Hodson, curate-in-charge. Headquarters for the East Lancs. Territorial Force Association; Secretary, National Buildings, St. Mary's Parsonage, Manchester.

PLYMOUTH.—Alterations to the Workhouse, for the B.G.; Thornely, Rooke and Barron, architects, 11, The Crescent, Plymouth.

PORTADOWN.—Electric theatre, Bridge Street, for Irish Provincial Theatres Co.; P. Cahill, architect, Dundalk.

PRESTON.—Proposed new churches in Deepdale and Frenchwood districts; Rev. C. M. Clarke, Vicar of Christ Church.

PURTON (WILTS.).—New vicarage (over £2,000); the Vicar.

RICHMOND-ON-THAMES.—Extension of music warehouse, Red Lion Street, and houses, Leybourne Park; Brewer, Smith and Brewer, architects, Richmond. Workshops, showrooms, &c., Church Terrace; E. J. Partridge, architect, George Street. Alterations and additions to Brynderwen, Mortlake Road; E. K. Purchase, architect, 20, Maddox Street, W.

ROCHDALE.—Rebuilding portion of Fieldhouse Mills, after fire, for J. Bright and Co.

ROTHWELL (near WAKEFIELD).—Further additions at the National schools (£900); Rev. E. G. Wa Bence, vicar.

RUSHALL (near WALSALL).—Proposed Infant school in High Heath Road; Secretary to the Staffs. Education Committee.

SEVEN SISTERS (near NEATH).—Vicarage; J. C. Rees, architect, Parade Chambers, Neath.

SHEFFIELD.—Proposed new school for the deaf; G. S. Baxter, Secretary to the Education Committee.

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TULLAMORE.—Projected new Town Hall and Technical Institute (£3,600); Mr. M'Namara, architect.

TYNEMOUTH.—Proposed additional school accommodation; Secretary to the Education Committee.

WAKEFIELD.—Proposed church at New Scarbro'; Rev. J. T. Levens, Vicar of St. Paul's.

WALKDEN.—Developments (surface and below) at various collieries; Earl of Ellesmere.

WARRINGTON.—Proposed new Congregational Church in Padgate Lane (£2,500); Pastor, Wickliffe Congregational Church.

WEDNESBURY.—Proposed metallurgical and engineering institute (£12,000); Secretary to the Staffs. Education Committee.

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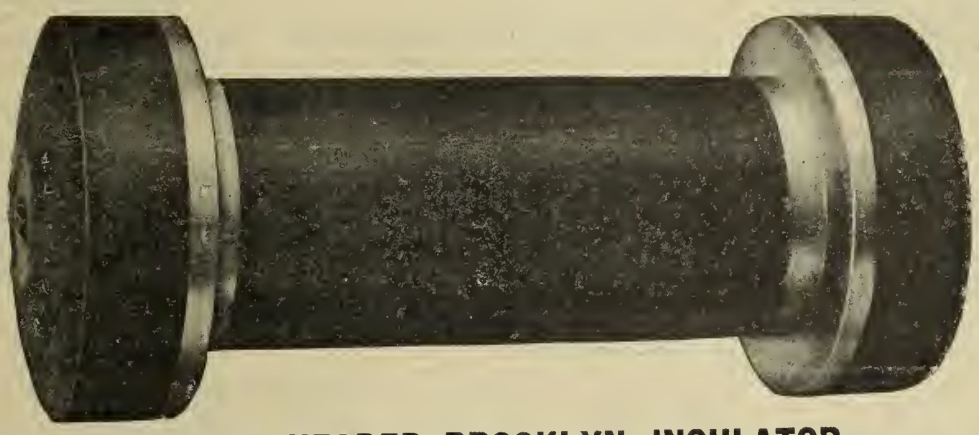
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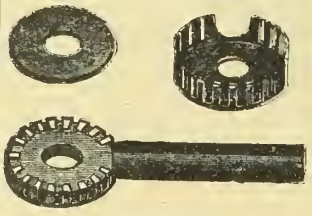




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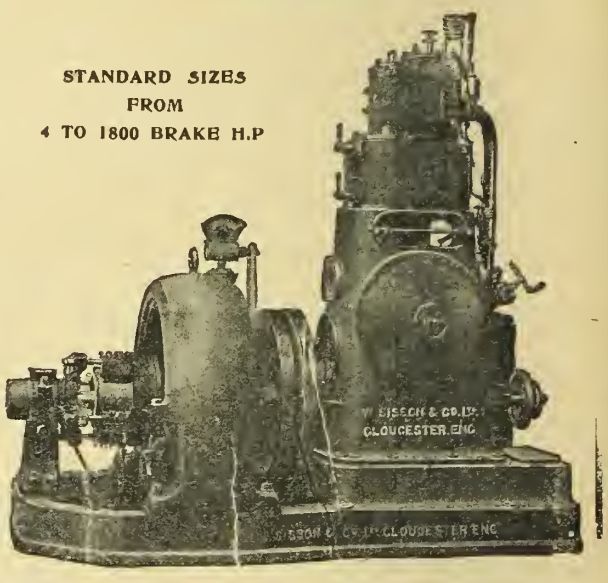
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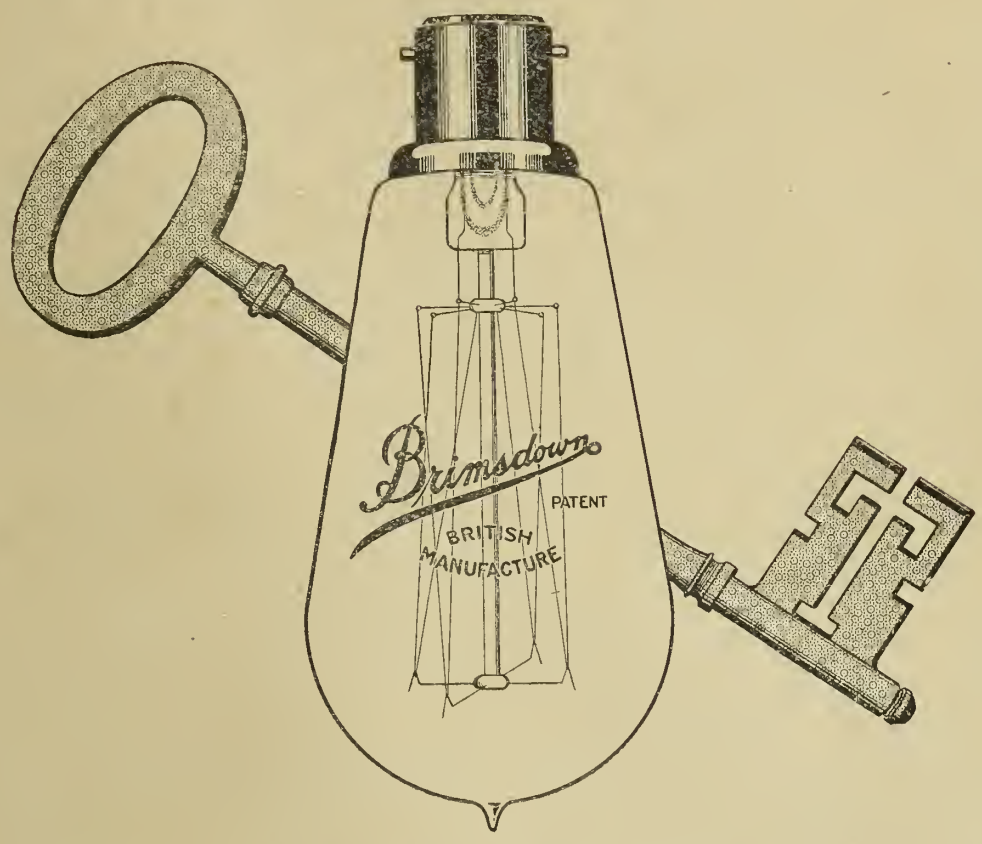
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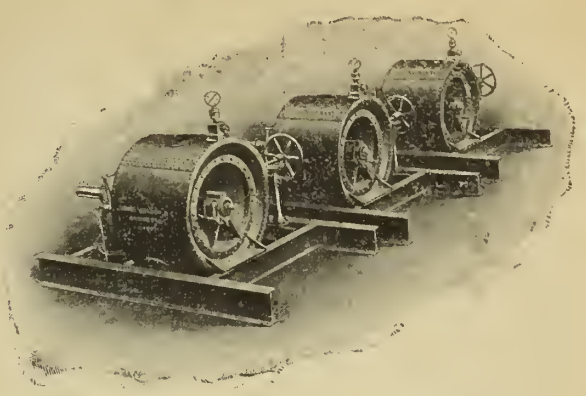
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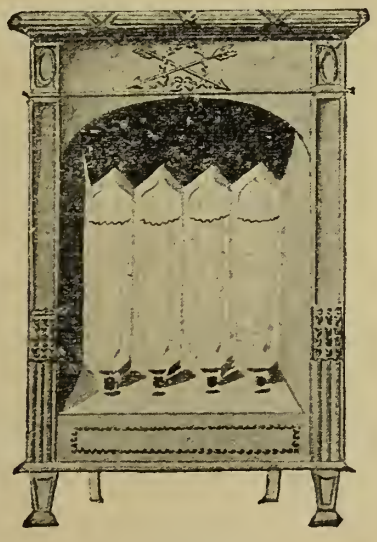
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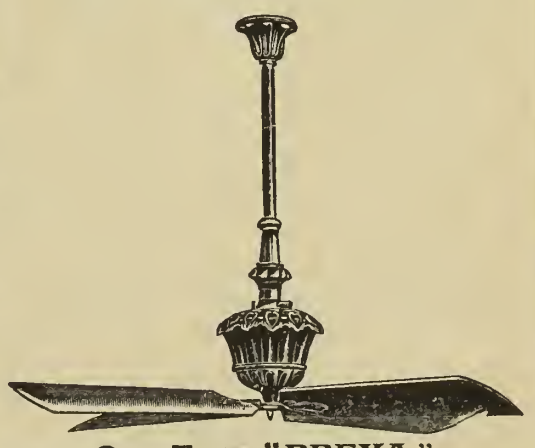
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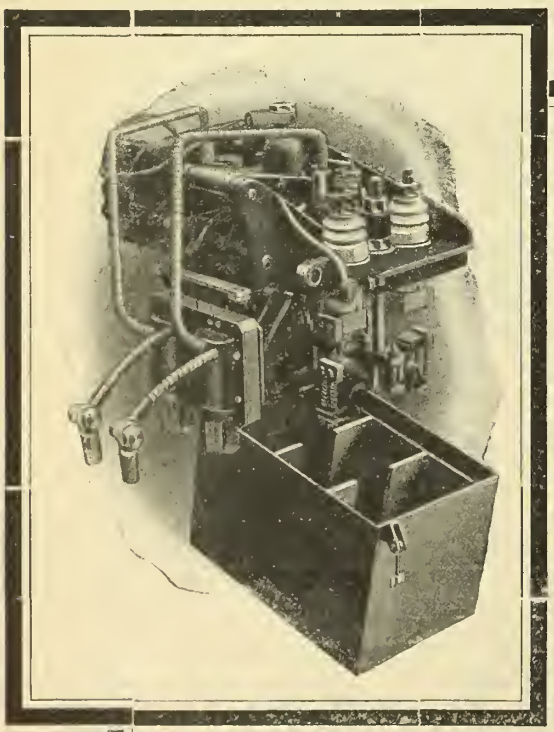
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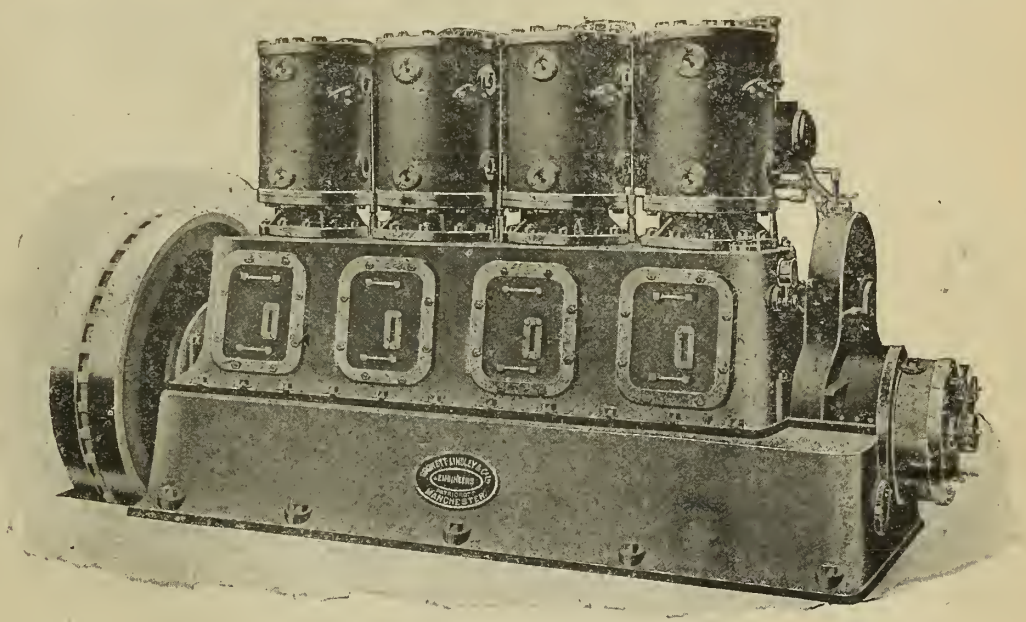
Massive Contacts
Metal and Mica
Insulation

WESTINGHOUSE
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Browett-Lindley

VERTICAL GAS ENGINES

50 to 1000 B.H.P.



400 H.P. ENGINE.

BROWETT, LINDLEY & CO., LTD., PATRICROFT, MANCHESTER, and Amberley House, Norfolk Street, STRAND, LONDON.

FOR SALE

The D.C. Switchboard illustrated, controlled the generators and supply to the British Section of the recent

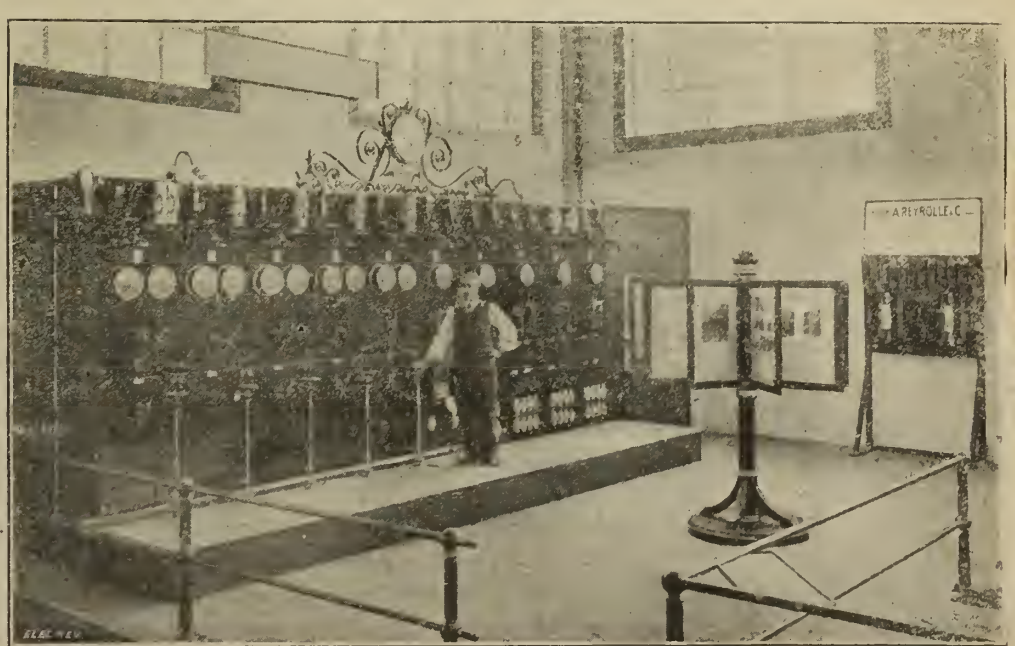
TURIN EXHIBITION,

and was awarded the

GRAND PRIX.

It is now For Sale, either as it stands or in parts to suit customer's requirements.

Full particulars and specification on request.



A. REYROLLE & CO., Ltd.,
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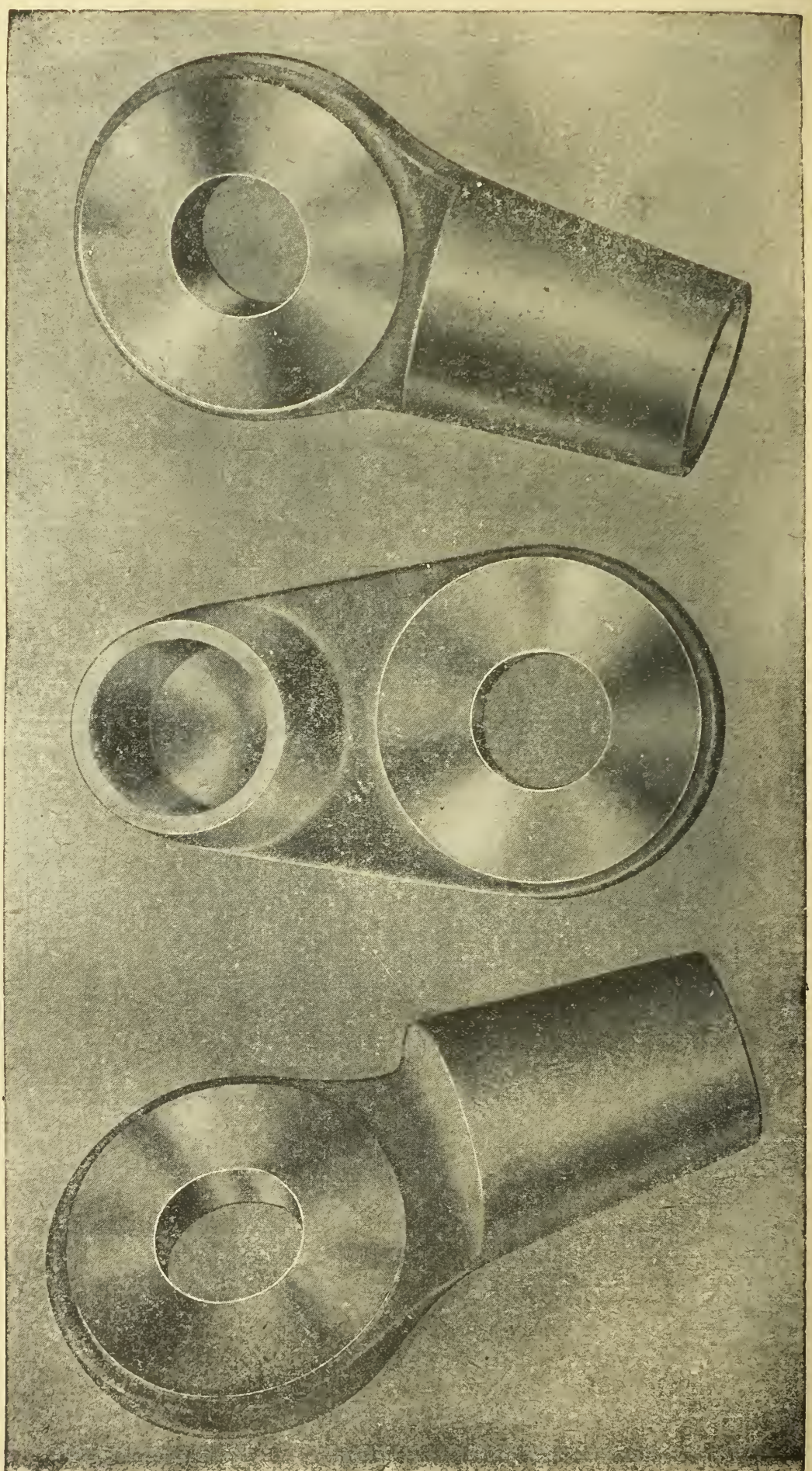
Screw Manufacturers and Metal Merchants,

YORK ROAD, KING'S CROSS & WOOD GREEN, LONDON, N.

Telephone: 11,070 CENTRAL. Telegraphic Address: "CONDUCTIVITY, LONDON."

STANDARD CABLE ENDS.

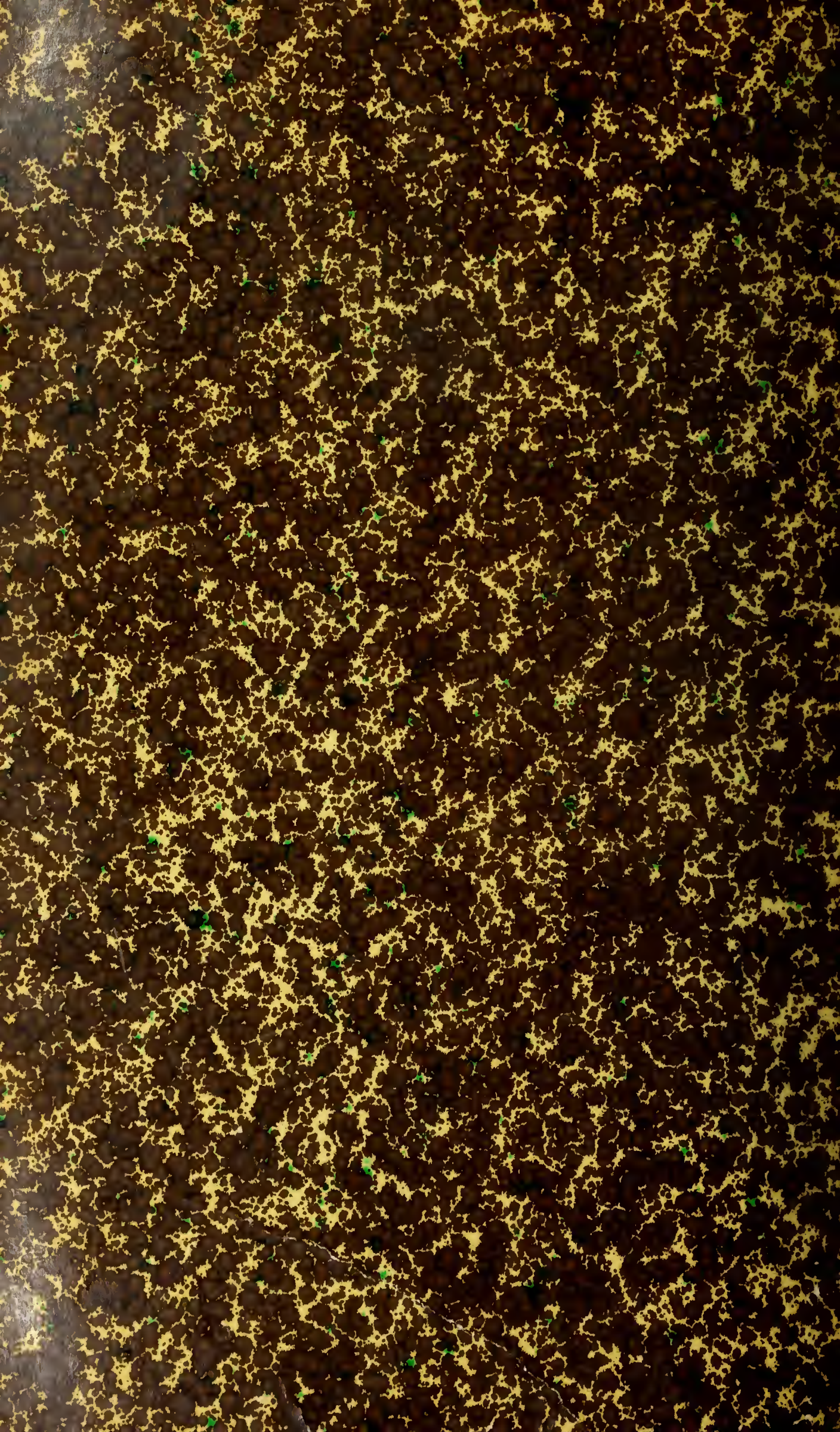
All these Goods are shown Full Size and kept in Stock.

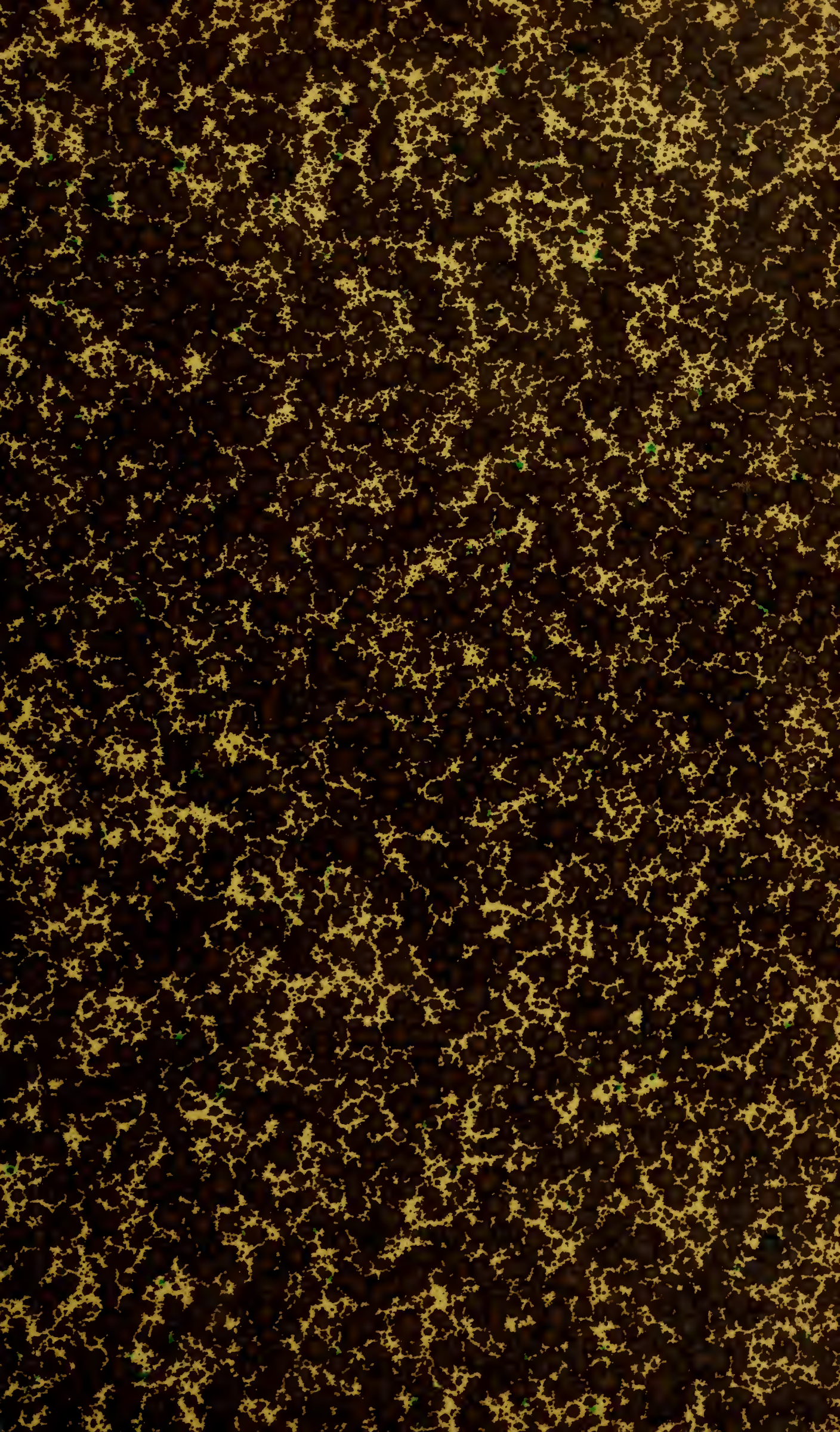


Machined both sides of bolt hole, thereby ensuring good contact.

STANDARD CABLE ENDS.

Carrying Capacity in Amperes	10	25	50	100	150	200	300	400	500	600
For Size of Cable	7/20	7/18	19/17	19/14	37/15	37/·092	37/·110	61/ 101	61/·118	91/17





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